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Navigation in Foggy Weather

ONE important aspect of the findings of the Commissioners appointed to enquire into the loss of the *Empress of Ireland* is that attributing the disaster to human error. The Court has found that the collision was caused by the handling of the *Storstad* at the time, and it states that the evidence makes it plain that there was no risk of a collision if both vessels had held the course they were on when in sight of each other before the fog shut them out. This is putting an enormous responsibility on commanding officers, and it makes it all the more necessary to instal some appliance which will help the navigator to fix the position at any moment of ships in the vicinity when his view is obstructed by fog.

The only audible method universally adopted up to the present for conveying information from one ship to others is the use of steam whistles and syrens, which are unsatisfactory in fog, just at the time when they are most needed.

The evidence in this case, as in a great many others, demonstrates how easy it is to misinterpret such signals, and it is obvious that another method must be sought for enabling ships to hear one another when their "sight" fails.

Wireless telegraphy offers the most hopeful solution of the problem, and the remarkable results recently obtained with installations of the new Marconi-Bellini-Tosi Wireless Direction Finder on the R.M.S. *Eskimo* and the Canadian liner *Royal George* justify the hopes placed on this apparatus.

The wireless direction-finder, which is quite simple, does not need the attention of a skilled wireless operator, and enables the captain to determine his position without the aid of the compass or sextant if he is within a radius of about 60 miles from a fixed wireless station or, what is just as important, if he is within a similar radius of another vessel fitted with wireless apparatus.

During the last voyage of the *Royal George*, Captain F. H. Thompson, R.N.R., her commander, states that the instrument was wonderfully accurate in determining the compass direction both of shore stations and stations on other vessels. They had, for instance, been able to ascertain the compass bearing of Cape Race, Cape Ray, Father Point, and ss. *Columbia*, the ss. *Calgarian*, and the ss. *Sicilian*. The *Columbia* was 68 miles distant, the *Sicilian* 18, and the *Calgarian* 53. The fact that there was a fog at Cape Race seemed to have made no difference, and Captain Thompson believes there are great possibilities for the system, especially in the event of going to the rescue of a ship sending out the S.O.S. call. When a steamer is in distress it is necessary for her to give another ship her position in degrees of latitude and longitude, and the navigating officer of the latter ship, assuming it is not equipped with this new apparatus, must know his own position before he can head his ship towards the calling vessel. But with the aid of this new appliance, even though the position of neither ship is known to him, he can steer directly to the rescue, and thus arrive at the scene of the accident much sooner than he could otherwise.

MR. H. J. NIERSTRASZ

Personalities in the Wireless World

H. J. NIERSTRASZ

Chief of the Technical Staff of the Wireless Department of Holland

MANY there are who are not averse to following the lead of adventurous spirits and "taking up" a new idea, but they must be satisfied that theirs is no insignificant minority, for only in numbers do they find sufficient moral support for their actions. Such men, however, are a negligible quantity in the world's assets; it is left to the bolder individual, the man with character, intelligence, and grit to supply the force which assists in rolling the world a little further along its appointed course. If we may alter an accepted quotation to fit a new purpose we would assert that "Man is born to progress as the sparks fly upward, and it is to those who do not hesitate to make the first step forward that their fellow-men afford priority of consideration."

Every age brings to the fore these men of enterprise, and especially is this the case when an epoch such as the decade just passed away is marked by some great discovery or invention. Consequently the discovery of wireless telegraphy has "selected" for its devotees many of the foremost spirits of our time. Such pioneers have from time to time been the subjects of portrait-sketches in THE WIRELESS WORLD, and to these is now added Mr. H. J. Nierstrasz.

For several years Mr. Nierstrasz has ably fulfilled the important post of Chief of the Technical Wireless Staff of the Dutch Government. But now his course is relatively "plain-sailing," he is an acknowledged authority on his subject, and he has only to maintain the ideas and principles which he has so successfully demonstrated to secure for himself a name "more lasting than brass," as the man who set in order the wireless system of Holland.

It is to the earlier chapters of his career that we must turn for the more striking interests of his life, because it is there that we see him as a young man devoting his unflagging energy to the science of telegraphy with such success that at the early age of twenty he obtained a position on the staff of the Dutch Telegraph Department. Not many years after the new wonder of wireless telegraphy attracts his attention and he determines to test its efficiency. To this end he obtains Government permission to conduct experiments between The Hague and Rotterdam. That was in 1900, and though from the point of view of discovery the experiments were unimportant they sufficiently demonstrated the usefulness of the invention. Thus was Mr. Nierstrasz encouraged to continue his investigations, and soon he proved the value of his knowledge to his Government. As a result they appointed him in 1906 to his present position as Chief of the Technical Service of the Wireless Department. In his official capacity Mr. Nierstrasz was a delegate at the International Radiotelegraph Conferences of London and Berlin, and was also present at the conference for the Safety of Life at Sea which was held in London last year.

He is now fifty years of age, for he was born in Roermond on April 11th, 1864.

A "Wireless" Anniversary

Scheveningen-Harbour Station

By A. WALRAVE

HOLLAND can justly pride itself upon being one of the first countries to consummate the practical advantages of wireless telegraphy, for shortly after Mr. Marconi's success in establishing wireless communication across the Straits of Dover, between Wimereux, near Boulogne, and the South Foreland Lighthouse, the Dutch Government appointed a Commission to examine the possibility of wireless communication between the lightship *Maas* and the Hook of Holland—a distance of about 15 kilometres (about 9⅓ miles).

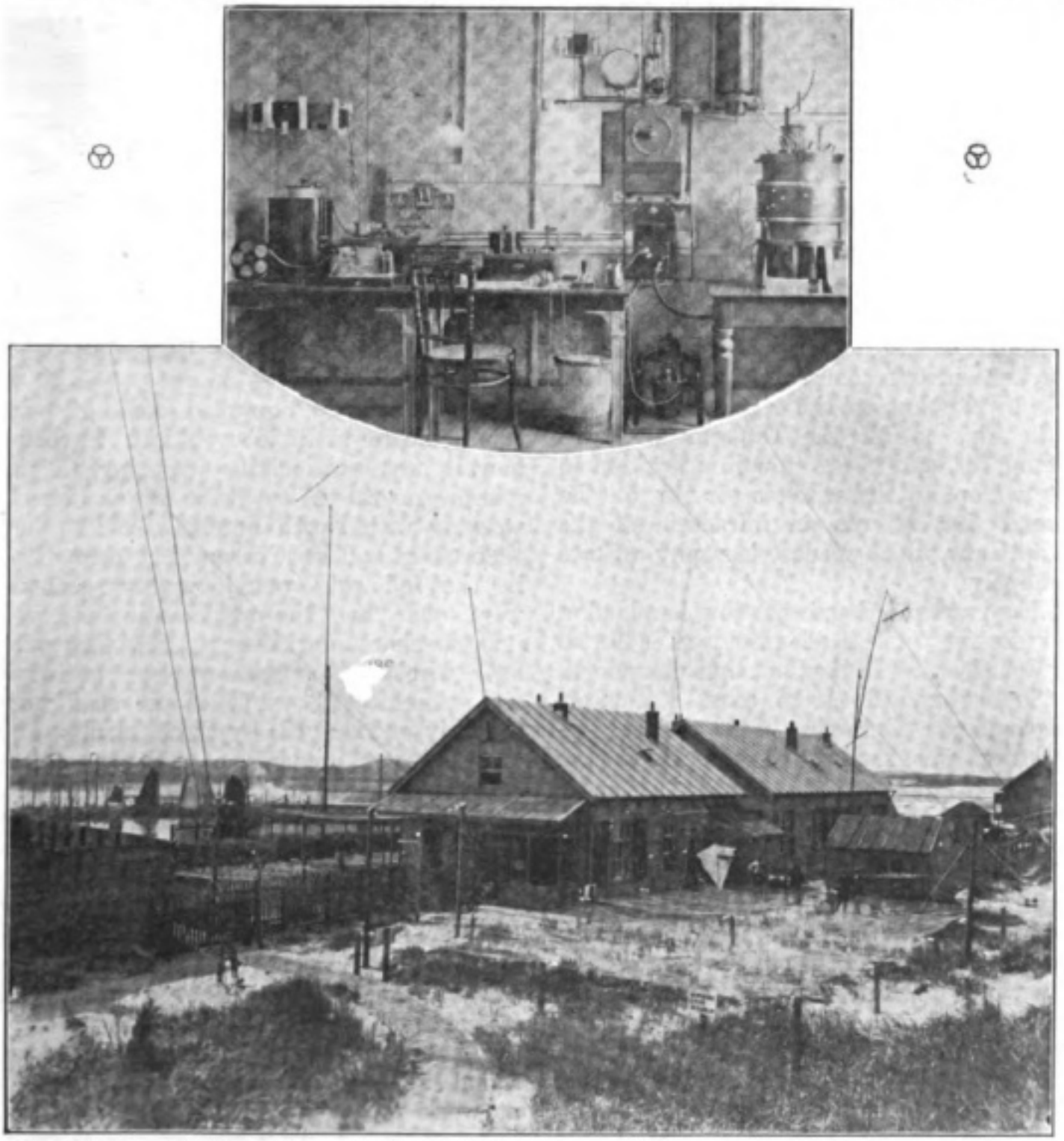
The Original Station at Scheveningen.

In these days, when the achievements of long-distance wireless telegraphy are of such common occurrence as to pass without comment among the regular daily affairs of the world, the early effort to which I have just referred does not seem a very formidable one. But its significance lies in the fact that the Dutch Government realised the possibilities, even though they appeared limited, before a long series of successful experiments demonstrated the practicability of wireless telegraphy. The Telegraph Department, the Naval Authorities and the Royal Engineers conducted an extended series of tests, and they were rewarded by the successful establishment of communication in 1902.

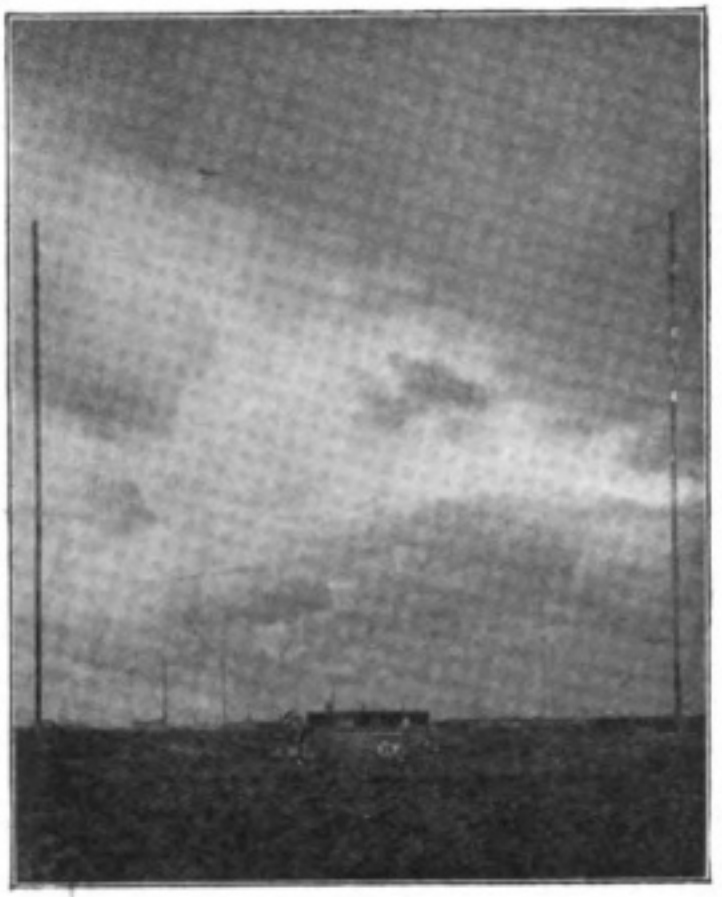
This success led to another and more notable success, one which stands out as a star in the journalistic firmament, for it signalises the first Press service conducted by means of wireless telegraphy. The service was not sanctioned by the British or Dutch Postal authorities, and after about twelve months working it had to be brought to a close when at last the Dutch Postal Authorities were able to obtain indisputable proofs that the messages were really sent by wireless. But it stands on record as a tribute to the Marconi system, even in those early days, and to the enterprise of the editor of the *Algemeen Handelsblad*, one of the leading papers in Amsterdam, by whom the service was employed. In 1903 the Marconi Company agreed to transmit through their stations at Broomfield, in Essex, and Amsterdam, the daily newsletter of the London correspondent of the *Handelsblad*—comprising about one thousand words. The messages were expressed from London to Chelmsford and delivered by a cyclist to the Broomfield wireless station, whence they were transmitted at a speed varying from 25 to 30 words per minute. The language used was Dutch, and although the operators at both the stations were English, without any knowledge of the language in which they were telegraphing, they performed their duties with perfect accuracy, except for the curious misreading of the letters *ij* which occurred in Dutch words for *y*. In the manuscript *ij* was accurately written, but invariably transmitted as *y*, yet never was the error reproduced in the *Handelsblad*.

In spite of the continued success of this service, there existed some faint suspicion that things were not quite as they appeared to be, and that the daily articles in the *Handelsblad* headed "By Wireless," possibly reached Amsterdam by some other means. The Dutch Government wanted absolute proof that the communications were, in fact, transmitted by wireless, and efforts were made to "tap" the signals in order to establish this proof, but for a long time without success. The duty of endeavouring to intercept the Broomfield signals was allotted to a special committee, but no success attended their efforts. On February 16th, 1904, an engineer from the Telegraph Department was sent to the *Maas* Lightship station with a view to bringing back the proofs that were needed to justify interference by the Department. I accompanied him on this occasion in order to read the Morse signals sent out by the station at Bromfield. The day was cold and the sea running mountains high, but the object of our quest had eluded us, and we were not sorry to return to the shore.

Then it was that the present chief of the Technical Service of the Wireless Telegraph Department, Mr. H. J. Nierstrasz, stepped in, and was able to prove to the Government that the Marconi service was a reality. At the Hook of Holland station, where he was



The Station at Scheveningen Harbour before it was rebuilt. (*Inset, the Instrument Room.*)



The present Station at Scheveningen Harbour.

assisted by Mr. W. P. de Klerizenaar (who is now at Scheveningen Harbour), Mr. Nierstrasz was unremitting in his labours, and on March 9th, 1904, he succeeded for the first time in overhearing the London letter sent by wireless to the *Algemeen Handelsblad*. This is all the Government were waiting for, and it was now in a position to put a stop to the wireless service on the ground that it was an infraction of the Postal Law, which made telegraphy a State monopoly.

This practical demonstration heralded a new era for wireless telegraphy in Holland. To the Hook of Holland station was added, in September, 1904, the coast station at Scheveningen Harbour. The original installation was rather primitive in design, and the results were not such as to cause enthusiasm. Alterations were made from time to time, however, and a change for the better set in gradually. But at first, such vessels as were equipped with wireless generally fought shy of the Scheveningen Harbour station. In those days the receipt of a wireless telegraph was an event of outstanding importance, and brought the whole of the station staff into action. Messages to ships always occasioned the station staff much anxiety; often messages destined for a radius of within 100 kilometres would occupy several hours in transmission, and would entail an enormous expenditure of energy. But not even these efforts would ensure messages reaching their destination! Times have changed very considerably since then, but anyone who has been indentified with the service since its somewhat crude beginnings cannot fail to look back upon the trials of those early days with emotion.

The first ship with which we established communication was the German steamer *Cap Blanco*, and through the dark hours between November 23rd and 24th, 1904, many wireless messages were exchanged between Scheveningen station and that steamer. Even to-day there is a feeling of affection among the station staff for the *Cap Blanco*, and these take a special pleasure in "speaking" to that vessel when she passes. But, alas, she appears sometimes to have forgotten her old friend, and passes her traffic through another station!

Slowly the volume of business through Scheveningen Harbour mounted up. Marconi stations were installed on Dutch vessels, and the *Noordam*, of the Holland-America Line, was the first of the "Flying Dutchmen" to sail from Rotterdam with a Marconi installation—on July 30th, 1904. Dutch vessels so equipped did not then communicate with Scheveningen Harbour, and it was particularly irritating to the station operators to hear Dutch vessels working with North Foreland, whilst they themselves had little or nothing to do. But in the following year new arrangements were made, and the coast station received its due share of traffic; during that year 2,011 wireless telegrams were cleared through the station. The whole of the staff were mightily encouraged by these results, and the engineers, under the guidance of Mr. Nierstrasz, vied with the members of the Administrative staff in their enthusiasm for their work. When at 1.40 a.m. on February 21st, 1908, signals were heard from the *Kaiser Wilhelm der Grosse*, 800 miles west of the Lizard, it was considered a well-merited achievement on the part of the station. Since that time signals have frequently been heard over long distances.

Up to two years ago the well-known signal . . . - - - - was often heard by operators at work with ships in the Mediterranean. Some operators, more particularly those at

coast stations, have been heard to grumble at alleged interference by this station, but there can be set against this the advantages claimed by many operators who have found it of service. Indeed, Scheveningen Harbour has had many regular customers who used to send their messages during the night, and in recalling those old friends, the name of Harold E. Watterson comes back vividly to the mind. I am writing of the time when he was operator on board the *Caronia*, and the staff here still remember with pleasure the amusing expressions which came through in broken Dutch, when each evening the *Caronia* was heard, sometimes over distances exceeding 1,000 miles.

The fame of the Scheveningen Harbour began to spread, and the visit paid to the station by Mr. Marconi, in company with Mr. W. W. Bradfield and Mr. A. Gray, caused a great deal of satisfaction.

In view of the extensions and improvements that were made from time to time, the station accommodation became too small to accommodate the machinery and apparatus installed, therefore a site was acquired and more commodious buildings erected. These were opened on July 4th, 1910. The new buildings provide all the accommodation that is now required, and the wooden masts, 82 metres in height, which were designed by Mr. Nierstrasz, enable communications to be heard over long distances.

Since the London Convention in 1912, Scheveningen Harbour no longer uses the old call letters, and to many of us the loss of this distinctive call, which has often penetrated into the far Atlantic and Mediterranean—a tribute to the ability of Dutch operators—was keenly felt.

Ten years have elapsed since the opening of the Scheveningen Harbour station. That period has been one of continuous progress and development until to-day the station stands at the zenith of its fame. The next ten years may witness many changes, but, with Mr. Nierstrasz and his diligent staff in charge, Scheveningen Harbour may be trusted to maintain the high reputation which it has gained.

The Interior of the Operating Room.

Terrestrial Magnetism

Its Probable Origin and Possible Influence on Wireless Telegraphy.

By ARTHUR E. COTTERELL.

TELEGRAPHISTS are well acquainted with the existence of what are known as "earth currents," which reach a state of exceptional vehemence somewhere about every eleven years, when the electrical currents so arising cause considerable dislocation in the working of ordinary telegraphic circuits in all parts of our globe simultaneously. Wireless telegraphy is so recent an achievement, however, that there has been little opportunity for observing the effect thereon.

As we are rapidly approaching a period when another magnetic storm may be anticipated, it seems opportune to draw attention to the phenomenon as a possible occasion for extending our knowledge of wireless physics, and, perhaps, adding to such data as we possess on the subjects of "Terrestrial Magnetism" and "Electric Earth Currents."

Apart from the analogy which may be drawn between "electric waves" and "light waves," there is also the well-known fact that wireless telegraphy loses in its efficiency when operated in daylight as compared with its greater range in the night time.

The magnetic storm which occurred on October 31st, 1903, was approximately about its periodic time, and it is reasonable to anticipate that the next visitation may possibly occur during the present year, 1914. It may be mentioned that these storms more frequently occur in the night, and usually, though not always, somewhere about the equinoctial periods of the year.

In 1903 wireless telegraphy was not in the advanced stage of development that it is now, and it is not surprising, therefore, that any effects, if effects there were, arising from the "magnetic storm" in that year would scarcely receive the attention which they might deserve. There was also a "magnetic storm" on September 25th, 1909, which, it may be here remarked, was associated with a period of solar activity when sunspots might usually be supposed to be at their *minima*. These circumstances, like other occasional outbreaks, will probably not affect the recognised eleven year period.

It is true that these storms arise suddenly, but they are often of several hours' duration. In view of a possibly imminent visitation, intending observers would do well to formulate the scope of their investigations.

A little thought will suggest various lines of research, but it may not be amiss to suggest the following as two primary heads, viz. :—

(1) Do magnetic storms affect wireless signals? If so, in what way?

(2) Is the interference, if any, during daylight and dark in any degree at variance?

During the course of a magnetic storm it would appear to be desirable that careful notice should be taken to ascertain whether the ordinary wireless signals are subjected to any interference of an unusual character, and if so the duration and extent of the interference.

In such event any record giving date, time, and nature of disturbance may prove useful in any subsequent consideration of the question.

With regard to the general question of terrestrial magnetism and magnetic storms, the causes of which are so imperfectly understood, if it should really be that electric waves from the sun play an important part then it is conceivable that something of these may be detected, and perhaps to some extent analysed during the occasion of a magnetic storm by observers who may be provided with receiving apparatus capable

of wide, quick, and ready adjustment to varying time periods of oscillations.

Turning now to the unsolved problem of "terrestrial magnetism," there are probably only two main schools of thought which need be considered. One of these suggests that lines of magnetic force radiating from the sun produce magnetism in the earth; the various diurnal and other changes resulting from the earth's movements of rotation and revolution; whilst magnetic storms are probably occasioned by solar disturbances, causing the ejection of electrons towards and around the earth or by the propagation of electro-magnetic waves.

The other proposition contemplates an almost entirely electric influence in which the earth magnetism is thought to have been initiated by streams of electrons from the sun, and that variations and magnetic storms are due to various phases of this cause at sunspot periods.

Whether the effects are brought about by magnetic or electric agencies it seems clear that the atmosphere and the ether of space must be pervaded by magnetic or electric vibrations. Given, then, a sufficient amplitude of range and sensitiveness of the means of reception, some effects may possibly be noted on wireless apparatus.

Sunspots of a character likely to be associated with a magnetic storm are sometimes sufficiently visible to the naked eye when the sun is slightly covered in mist, looking through smoked glass only. Their association with magnetic storms usually arises when they cross the central meridian of the sun. Sometimes the spots are too far north or south on the solar sphere to have any important effect. In the case of the 1903 storms the sunspot area was some 155,000 miles across. On the last occasion of magnetic storm (September 25th, 1909), the sunspot area was some 30,000 miles in diameter and covered an area of about 700,000,000 square miles.

It is interesting to recall that this magnetic storm lasted for about 9 or 10 hours. Another point of interest arises from the fact that Auroras were vivid at both the Northern and Southern Poles, which phenomena displayed a large proportion of violet light rays.

It may now be well to recall some of the interesting features of terrestrial magnetism. The known existence of huge quantities of iron in the constitution of the earth offers a broad basis for the presence of magnetic condition, and the assumption that this magnetism may find its origin in some celestial radiation of magnetic lines of force is exemplified by the fact that any upright iron structure upon this earth becomes magnetic, after it has been *in situ* for a short while, as a consequence of the magnetic lines of force which radiate from the terrestrial magnetic poles.

This primary terrestrial magnetism seems to be extremely simple, but we are concerned with quite a number of movements, which may be briefly summed up as follows:—

(1) Hourly variations in the westerly declination, the variation amounting to some 3 minutes of arc in winter and 9 to 10 minutes in summer.

(2) A variation in the extent of the westerly declination as between winter and summer amounting to about 7 minutes of arc.

(3) A movement of perhaps a more striking character, whereby the magnetic direction is varied over a larger area in the course of years. In 1912 the compass needle pointed in a direction which was 15° 24′·3 west of the geographical North Pole. In 1580 it was 11° east. Subsequent to this earliest record it travelled westward, coinciding with the geographical pole in 1657 and reaching a westerly maximum of 24° 41′ in 1818, since when it has receded in an easterly direction to the present time, and is still following that direction. The present rate of movement, based on observations of the last seventy-one years, gives an easterly progression averaging 6′·39 per annum.

(4) Fluctuations due to magnetic storms about every eleven years with occasional intermediate storms.

At an earlier stage reference was made to two main schools of thought. Since neither hypothesis seems to afford an adequate explanation, we will now consider the apparent objections.

It may simplify matters if we take proposition 2 first. The suggestion is that the earth, containing large quantities of iron, has been magnetised by electrons ejected from the sun which have circulated around our globe. Such a proposition, however, appears to be open to objection. As is well known, the axis around which the earth

rotates is situated approximately at an angle of 23° 27′ to the pole of the ecliptic.

Fig. 1 reminds us that the poles are reversed in their relative positions as to the

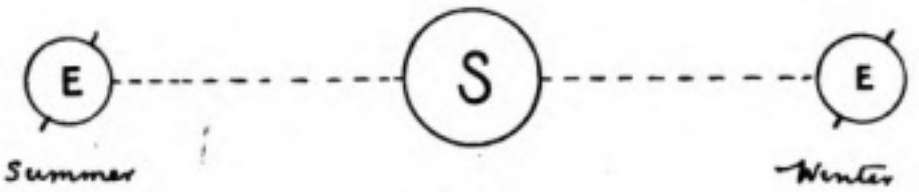


Fig. 1.

sun at summer and winter to the extent of about 47°.

If then we are to regard the magnetism of the earth as the result of such solar electric action, we might naturally conclude that the direction of such effect would be found to be perpendicular to the plane of the ecliptic or alternatively at the geographical poles as a result of the electrons following the earth's rotative direction. In 1831, however, the magnetic North Pole was found in lat. 70° 5′ N. long. 96° 46′ W., whilst in January, 1909, the South magnetic pole was discovered in 72° 25′ S. lat. 155° 16′ E. long.

These facts seem to debar the acceptance of the proposition that the earth's magnetism is due to solar electric effects, but does not necessarily debar the supposition contained in the second part of the hypothesis.

We will now consider the other proposition of a solar magnetic cause. If we assume that the sun is hugely magnetic, it is seen that powerful lines of force must radiate through space and pass through the earth in a more or less midway position of their sweep, as shown in Fig. 2.

We must not overlook, however, two serious objections: (*a*) the sun is a centre of tremendous heat. Heat is inimical to magnetism. How then can we regard our great governing orb as being magnetic? (*b*) Whilst terrestrial magnetism has coincidence with these suggested solar magnetic lines of force at a certain time of the day, we have to remember that the earth makes a complete rotation once in 24 hours, carrying the north magnetic focus around in a circle of 15½ per cent. radius at the present time. It is true that each day the declination of the compass needle varies, but the variation is small, the greatest normal extent of which is merely some 9 minutes of arc.

The matter is, undoubtedly, best considered from actual records, and for this purpose it is proposed to take the published magnetical observations recorded at the Greenwich Observatory for the year 1902. That year, selected quite haphazard, is a good one for our purpose because it was very free from magnetic storm and vehement solar disturbances.

From Table 2 of the Greenwich records (Fig. 3), which shows the "monthly mean diurnal inequality of magnetic declination west," we observe a rise and fall at certain hours of the day and night, the highest reading occurring at 1 p.m. and the lowest between 7 and 8 a.m. We also observe that there is a variation in the amplitude of this movement which increases in the summer months.

It has been considered sufficient for the

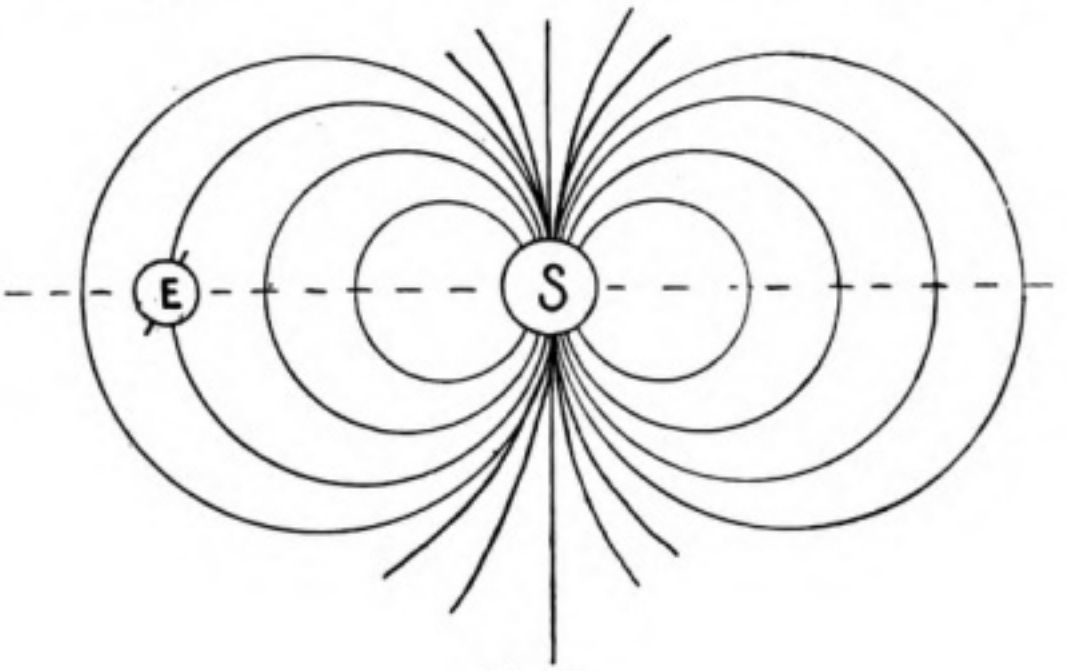


Fig. 2.

purpose to illustrate the curves for the four months which include the summer and winter solstices and the equinoxes, viz., June, December, March, and September.

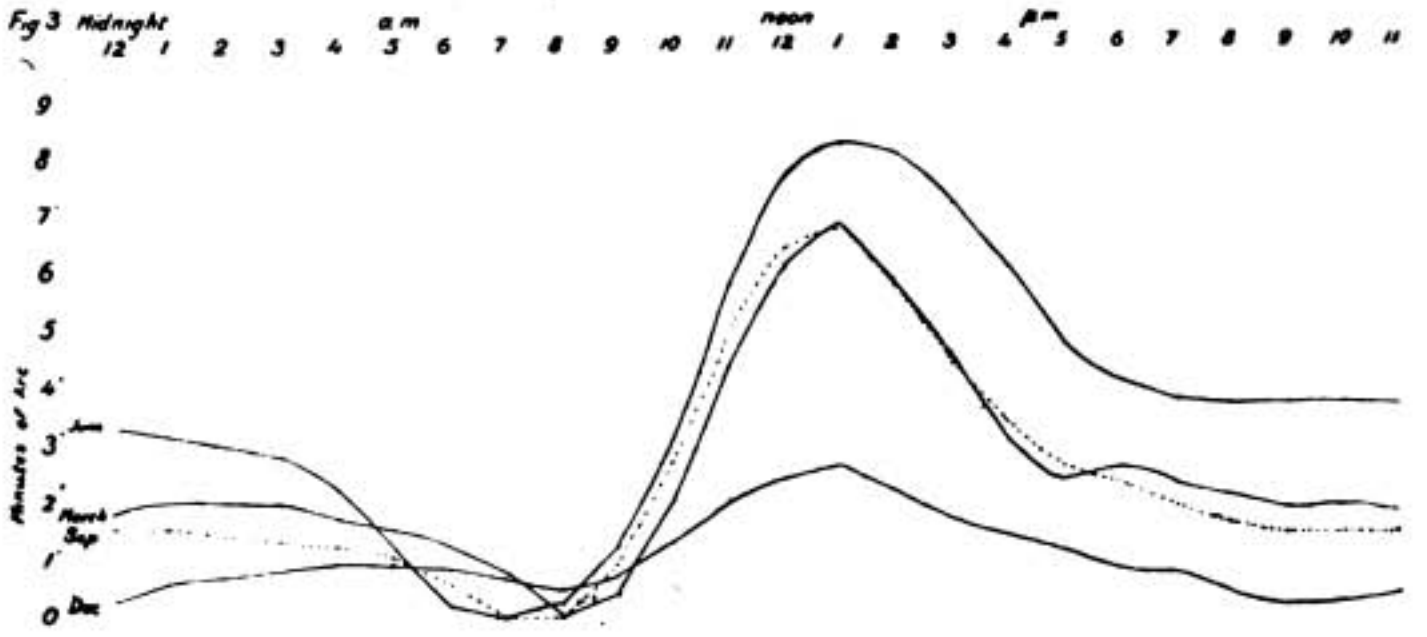


Fig. 3.

Coincidence with the seasons is shown in an interesting manner if we compare the mean monthly inequality (from the same Greenwich record) with the distance between the earth and the sun for one year. Fig. 4 illustrates this.

Notwithstanding certain anomalies, it seems imposible to doubt that the sun does affect terrestrial magnetism. There are, however, other irregularities to be accounted for, and if we are to seek them in the solar system, we must naturally consider the planets. At first it appeared that on an entirely magnetic basis the intervention of large bodies, which probably have considerable magnetism of their own, must cause diversion of any lines of force emanating from the sun. A brief study of them, however, in which their dimensions and distances were tested by calculations based on magnetic laws, seems to show that any disturbances would be of comparatively minor consequence.

The writer recently examined the 1902 magnetic records in connection with the earth-moon distances, and the varying declinations and movements which were suggestive of a fruitful field, but although these investigations were extended over the records for the greater part of a year, they offered no striking indications.

If, then, investigations rather point to a

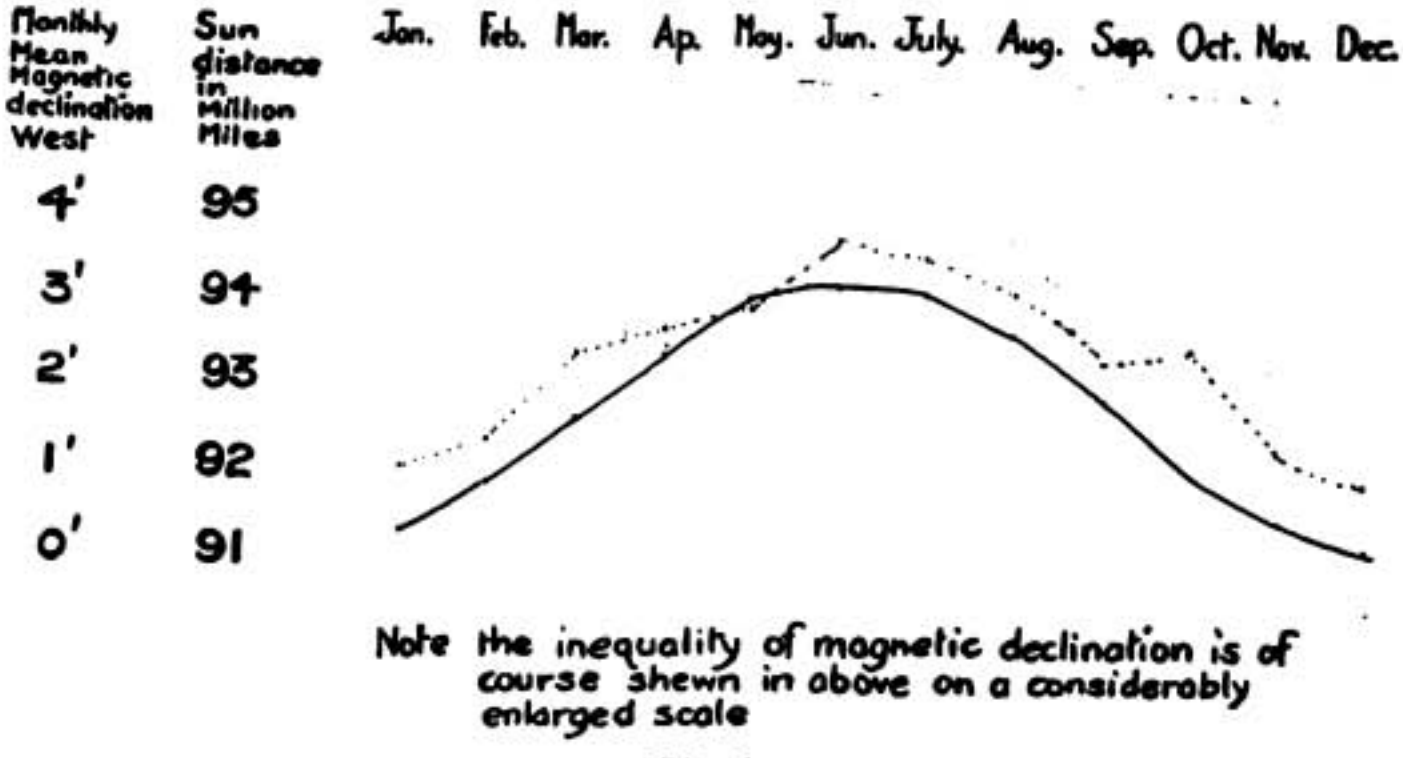


Fig. 4.

solar magnetic theory subject to variation as a result of sunspots, why cannot we accept these phenomena as a complete explanation of terrestrial magnetism? The negative answer is forced on us with no uncertain power. We have to explain two fundamental conditions of supreme importance.

(1) The origin of the general direction of the earth's magnetism.

(2) The reason why that direction makes so wide a migration in the course of years.

Let us consider what the earth-solar conditions are.

The earth, as is well known, rotates on its axis once in 24 hours. The earth revolves in a year around the sun in an orbital journey, slightly elliptical in shape, and having a major axis of some 186,000,000 miles.

These movements are merely suggestive of what takes place hour by hour, day by day, and season by season.

We ask ourselves whether there are any other important movements. There are some, which we will now discuss. They are:

(*a*) The precession of the earth's axis;

(*b*) Nutation;

(*c*) Variation in the eccentricity of the earth's orbit;

(*d*) The solar movement through space.

The precession of the earth's axis being a movement of considerable magnitude, we give that first consideration.

Briefly described, the earth not only rotates round its polar axis, but there is a polar movement which describes a circle around the pole of the ecliptic.

The period occupied in making one complete circle is 25,695 years. So important a movement is highly suggestive until we come to inquire more closely into the relative facts. The constant of precession is only 50·3514 seconds of arc, and therefore it is clear that any effect so produced could only form a small part in the annual magnetic migration, which amounts to nearly 7 minutes of arc.

The effect of lunar nutation is to superpose a smaller movement upon the greater one of precession, so that the circle described by the latter is converted into a slightly wavy line, a complete cycle being performed in 18⅔ years. The constant of this movement, however, is only about 9¼ seconds of arc.

We come now to the question of the eccentricity of the earth's orbit, which latter describes an elliptical path, the eccentricity from a circle being only about 0·01677 or nearly $\frac{1}{60}$. This eccentricity varies between limits of 0·0747 and 0·0047. At present the eccentricity is diminishing, but will not reach its minimum value for manythousand years.

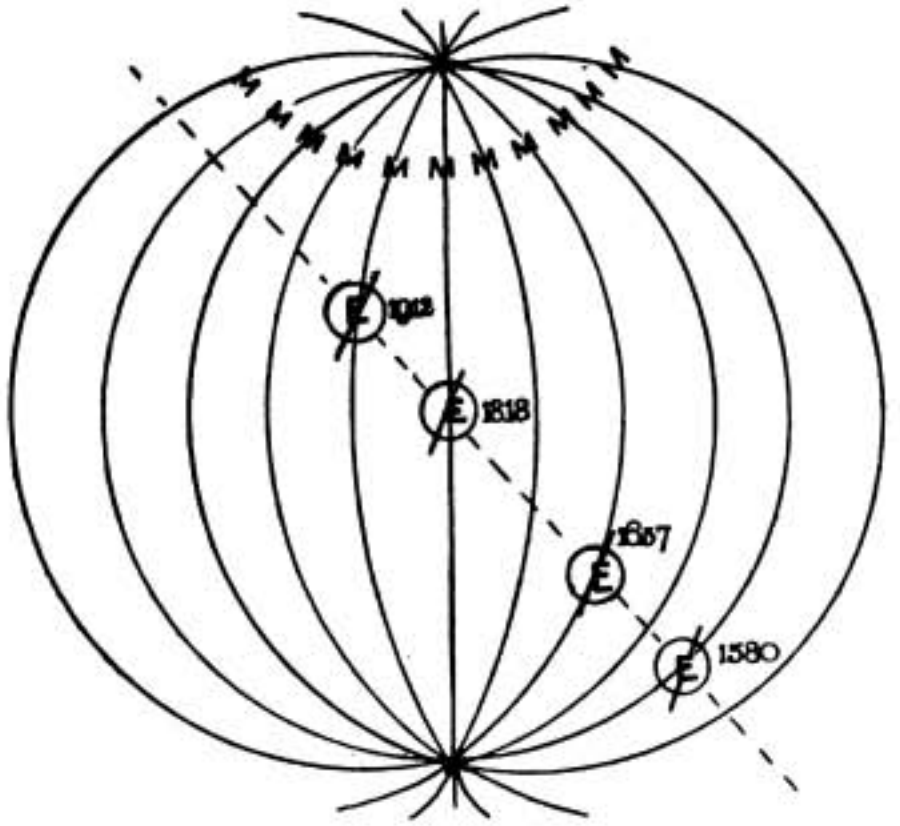


Fig. 5.

Lastly, it is estimated that the sun is moving through space at the rate of some 150,000,000 miles each year carrying in its train the whole solar system.

During the 334 years (1580-1914) in respect of which we have records of magnetic declination, the earth has been carried, with the rest of the solar system, a stupendous journey of some 50,100,000,000 miles through space. If now we can contemplate an etherial magnetic system pervading the comparatively small solar system, it is impossible to resist a wider conclusion that magnetism may permeate the universe, its directive tendencies affecting the various

planetary bodies, of which our earth is one, according to the positions which they occupy within the general lines of magnetic force.

If it be true that there are such magnetic lines of force, it must be remembered that they would be propagated in curves, and therefore any such moving body as our earth would intersect them at different angles in the course of its motion. This may perhaps be best shown in a diagram such as Fig. 5.

Let M M M represent lines of magnetic force pervading space and E E E E the earth at varying positions in its mighty journey through space. In 1580 we notice that the magnetic line intersects the earth on the eastward side. At 1657 the magnetic line coincides with the geographical poles. In the year 1818 the magnetic line is at its greatest westward position, whilst in 1912 it is occupying a less westerly direction, and obviously, as the earth pursues the same path, the magnetic line will continue to recede from its westerly direction. All these phases coincide with the observed magnetic declination, and though, of course, the suggested positions are purely imaginary, and the relative dimensions of both the earth and of the magnetic lines of force are out of proportion, it appears to the writer that an explanation of the migration of the declination needle seems likely to be found only as a result of investigation in the direction described.

It seems probable that when the full story of terrestrial magnetism comes to be written, the origin and principal motions will be found to have a far wider significance than is usually attached to them. When we consider the electro-magnetic influences of violet rays we open up wide vistas of speculation. The question will, no doubt, arise, "How then can it be explained that there is so much coincidence between solar phenomena and the effects observed on the earth?" A possible explanation may be forthcoming. A magnetic sun would necessarily affect the wider influences, or, alternatively, can it be that the effects which are observed are not the result of solar magnetic properties, but rather of an anti-magnetic character?

We know that heat is destructive to magnetism, a fact which introduces no inconsiderable difficulty in the conception of a solar magnetic theory, but which, alternatively, may supply ground for a theory of interference.

It is quite inconceivable that the solar system is the "Be all and end all" of the various phenomena which we observe on our comparatively small planet, and remembering how vast are the dimensions of other bodies and other systems throughout the universe, it is surely reasonable to assume that the realms of space, the superb vault of the Heavens, is blent into one harmonious whole, and that amongst the many and mighty wonders magnetism springs forth and pervades all things terrestrial and celestial.

INTERNATIONAL RESEARCH.

The International Commission for Radio-Telegraphic Research, which was inaugurated at a meeting in Brussels in April last, has held a further meeting, at which its constitution has been adopted in definite form. Mr. W. Duddell is President, Prof. Wien, Vice-President; Dr. R. Goldschmidt, General Secretary; and Mr. R. Braillard, Assistant Secretary. National Committees have been formed in Belgium, France, and Great Britain. A large number of technical matters were brought up at the meeting. Dr. Goldschmidt described the latest improvements at the Laeken station, and it was decided that a small high-frequency alternator be acquired. Reports were also read by Prof. Schmidt (Halle) on observations by a barreter and galvanometer; by Mr. Vollmer and Prof. Wien (Jena), Dr. Marchant (Liverpool), Mr. Lucas (Namur), and Mr. Wulf (Volkenburg), on photographic registration of signals; by Mr. Bonndorf (Graz) on reception of signals from Brussels at a distance of 2,000 km. by a detector and galvanometer; and by Prof. Howe (London) on the determination of the energy received from Brussels and Paris. In the discussion on these the Commission expressed the wish that experimenters would send in with their results characteristics of their antennæ, and that wherever possible should employ photographic registration. Mr. Duddell also read a paper on methods to be employed, and suggested the employment of a closed receiving circuit at the control station similar to that used by Dr. Braun.

The Imperial Aspect of Wireless Telegraphy

The Future of the Wireless Telephone

POSSIBILITIES of wireless telegraphy and telephony were touched upon by Mr. Godfrey C. Isaacs, managing Director of Marconi's Wireless Telegraph Co., Ltd., in the course of his evidence before the Dominions Royal Commission on July 1st, of which we reproduce the following report from the *Morning Post*:—

NEW ANGLO-AMERICAN STATIONS.

Mr. Godfrey Isaacs said that very shortly his company would be opening new wireless stations between Carnarvon, in Wales, and Belmar, near New York, which would have four times the power of the present wireless installation between Ireland and Canada, and would, therefore, enable them to despatch and receive messages at a greater speed than had been possible under past conditions. They contemplated being able to transmit and receive 100 words per minute automatically for a considerable proportion of the time they were working, which was about twice the rate at which submarine cables were operated. Mr. Marconi assured him that he saw no reason why, when certain mechanical apparatus, which had nothing to do with the wireless telegraphy itself but was applicable to wireless, had been perfected they should not be able to send 300 words per minute. This did not necessarily mean that these high-speed messages should be sent at night only, because they had found in their Atlantic experience that the day was just as favourable as the night for wireless telegraphy; in fact, it was sometimes more favourable. The new Carnarvon-Belmar stations were now being adjusted, and he hoped they would be available in about a month or so. The opening of those stations would mark an epoch in wireless telegraphy.

IMPERIAL TELEGRAMS.

At present the Atlantic rate for wireless telegraphy was 8d. per word, as compared with 1s. per word for submarine telegraphy, but that was by no means a fixed proportion. When they had developed the successful use of certain mechanical inventions which would enable them to carry a heavier "load" and had established a chain of high-power stations on certain lines of telegraphic traffic that would be equal to this increased "load," and would give them the "wave-lengths" they required, increased traffic would be carried at such a slightly-increased cost that the rate per word would go on being reduced to such a low denomination that it would be brought within the range of practically general use. "In my view," said Mr. Isaacs, "the development of wireless telegraphy must bring about universal cheap telegraphic communication. But I do not contemplate that the telegraphic services of the British Dominions will be conducted by private companies. It seems to me to be so clearly in Imperial interests that communication between one part of the Empire and another should be made cheap and efficient that the State will not be content to depend upon private control, but must insist upon Government control. No private company ought to be expected to conduct an Imperial telegraphic service at cost price, but the State could do so. Inasmuch as the cost of wireless telegraphy is going to be so cheap, I see no reason why it should not be universal throughout the British Empire. And not only universal, but so cheap, owing to its universal use and the low cost of establishing and extending the system, that it is quite possible, and indeed probable, that Sir Henniker Heaton's proposal for a universal Imperial telegraphic rate of 1d. per word will be introduced in practical form."

SECRECY AND CERTAINTY.

Mr. Isaacs assured the Commission that he had no doubt that wireless telegraphy would be conducted with the same certainty

and secrecy as submarine telegraphy, with greater speed, and at greatly reduced rates. When they possessed high-power stations they would be able to send out long wave lengths that could not be intercepted except by similar high-powered stations. As to the question of certainty, it had already been demonstrated that a single wireless service was far less liable to interruption than a submarine service dependent upon a single cable. When they had two services between this country and North America, as they would have shortly, the risk of uncertain communication would be reduced so low that it could hardly be a matter of serious consideration.

With regard to the Imperial aspect of the question, Mr. Isaacs said that one of the objects of the Marconi Company was to establish an Imperial system of telegraphy on British territory, managed and worked by British officials and free from foreign control. Only that morning he had had a conference with the heads of departments in the Marconi Company with a view to organising a Press service between this country and Canada, designed to supply news to both the Canadian and British Press at one half-penny per word. He had no doubt that as new stations were constructed other parts of the Empire would be brought within the range of a correspondingly cheap Imperial service.

WIRELESS TELEPHONY.

In reply to Sir Rider Haggard, a member of the Commission, Mr. Isaacs said the work which was now being done with wireless telephony clearly showed that it was only a question of the power of a machine which governed the distance over which one might telephone.

He anticipated and hoped that Mr. Marconi would telephone to New York before the end of this year. And if he telephoned to New York, when the stations were built between Buenos Aires and this country he should not hesitate to express the opinion that Mr. Marconi would at the same time that he telegraphed also telephone to Buenos Aires.

"You anticipate the time when a subscriber can have a telephone in his house by which he can telephone all over the world?"

"I would not like to go as far as that. I can see difficulties would have to be got over before that condition of things can come about. I think it will be possible to go to a particular station in London and telephone to New York, but I do not think it would be easy to telephone from your office to New York."

"The wireless business stands at present on the threshold of unrevealed things?"

"Yes. I feel there are great things to be revealed."

Sir Rider Haggard further inquired if it would be possible for the telephone subscriber speaking from his office to be connected with the wireless apparatus at the central station and thus speak direct to New York.

Mr. Isaacs: "So far as I can see, I do not think it will be possible for you to telephone from your office to New York and that the words which you use will be heard in New York, and that you will receive a reply from New York in your office."

"You do not think it would be possible to link up a call so that your actual words will be transmitted?"

"I do not say it will not be possible; but so far as I at present see, I do not see the prospect of that being immediately practicable."

"Do you know if it is being considered?"

"I think it is. I certainly think there is no reason why it should not come as a matter of development."

"Marconi wireless telegraphy installed" is one of the inducements offered to would-be purchasers of a big Sussex estate now in the market.

* * *

As the result of an interview with Mr. Arnold Kruckman, who is organising the round-the-world flight in connection with the San Francisco Exposition, Mr. Marconi has promised to place the wireless system along the line of route at the service of the competitors and officials. Mr. Kruckman states this will be a wonderful help in carrying out the race.

Aerials and their Radiation Waveforms. IV.

By H. M. DOWSETT.

THE electrostatic field of an air condenser (Fig. 1) is often taken as a model for drawing the field of electric strain of an umbrella aerial, such as is shown in Fig. 2.

Fig. 2 is a careful copy of Fig. 136, p. 150, from *Lietfaden der Drahtlosen Telegraphie*, 1909, by Prof. J. Zenneck. The distribution of the strain lines under the aerial in this diagram is open to criticism, but the lines shown leaving the top of the aerial for the earth—corresponding to the external field of the air condenser, Fig. 1, are what we are immediately concerned with. In the author's opinion they do not exist. If they exist, then these lines show that the top of the wave in its expansion will completely fill the space above the aerial. If they do not exist, there will be a fairly large space above the aerial, having the shape of an inverted cone, which will be completely free from wave disturbance.

The question is of more importance than it would at first appear. It would decide, for instance, whether an air craft immediately above the aerial could receive signals from it.

An air condenser has no external field because the conducting surfaces are continuous and the air on one side of each metal plate is divided from the air on the other side. But an aerial is not a continuous surface—it is a mesh; and the strain lines in the air, terminating on all parts of the aerial wire surfaces—whether above or below the aerial—all ultimately bend down between the wires so as to reach the earth below the aerial, as in Fig. 3. They do this because they always tend to take the shortest path to earth consistent with their mutual repulsion.

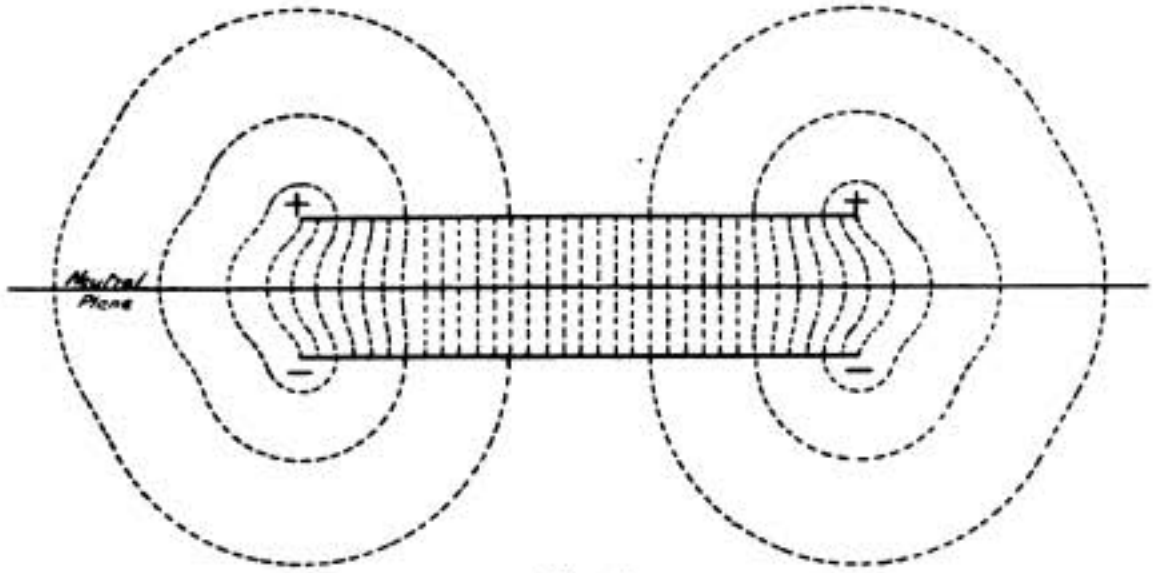


Fig. 1.

Fig. 4 represents an umbrella aerial as near as possible in type to the air condenser, Fig. 1, the horizontal part being a continuous sheet of metal and the vertical part being separated from the earth by a spark-gap not shown.

The density of the strain lines is shown approximately proportional to the electric intensity at the various parts of the air dielectric between aerial and earth, and is such as would be obtained by charging the whole of it to the same potential as is the

The previous articles by Mr. Dowsett appeared in THE WIRELESS WORLD for April, May, and June.

case in plain aerial transmission. The broken lines indicate that they begin on the aerial where shown, but end on the earth in another sectional plane. As in this case the potential is the same at all parts of the ærial, the density of the lines is also proportional to the capacity.

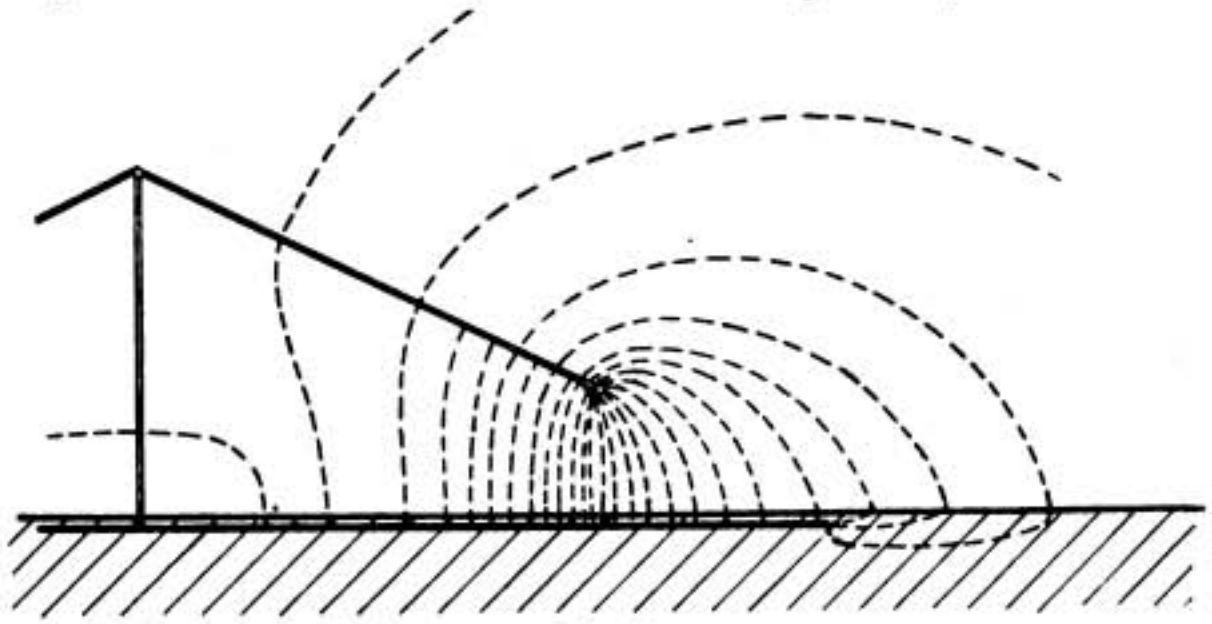


Fig. 2.

The actual flow of the charging current is indicated by arrows. The current has to double back on itself to provide the strain lines leaving the top of the aerial, and this tends to reduce the total flow in the plate.

In practice, the additional capacity obtained from the top of the aerial, if it were made of continuous sheet metal, would be of little use. There would be some radiation immediately above the aerial, but it would be weak, and the potential curve along the earth shown in Fig. 5 would have a more pronounced peak, due to the potential gradient of the part of the wave thrown off from the top of the aerial being less than the gradient of the part thrown off from under the end of the aerial.

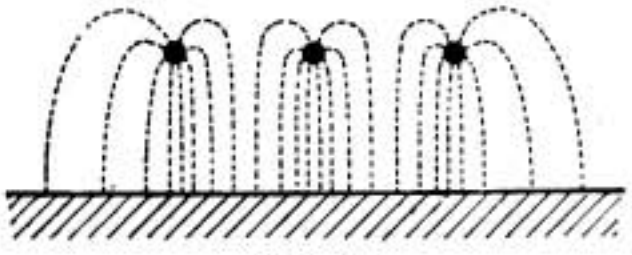


Fig. 3.

The umbrella type is generally used with lowered extensions. The extensions require to be long enough to ensure that the natural wave of the aerial is considerably greater than that of the supporting central metal mast, to keep down the amount of energy absorbed by the mast, which is unavoidably close to the vertical part of the aerial.

The main characteristics of this aerial are :—

1. It requires only one tall central mast, the extensions being supported by shorter masts or long stays.
2. It is economical of ground space for a given aerial capacity.
3. It radiates equally in all directions.
4. It has less radiation damping than a vertical or bent aerial.
5. Due to (4) it is well suited to quenched-spark circuits.
6. It does not radiate so high into space as the vertical or bent aerials, and it screens the ether immediately above it from the waves it itself sends off.
7. Its wave volume is less, it has not so much energy in reserve for travelling over distance as the waves from the two aerials mentioned, but its wave intensity is greater.
8. The potential wave immediately above the earth's surface, and which therefore affects the receiving aerial, is not a sine wave. The wavefront, Fig. 5, travels along normal to the earth and does not enter the earth. Therefore, if decrement be neglected, it maintains the same potential between its peak and base as it expands outwards. The waveback, however, radiates part into the earth, the proportion of waveback unabsorbed to waveback absorbed being in the same proportion as the capacity of the vertical part of the aerial to the capacity of the whole.

Thus, the potential due to the waveback, Fig 5, will be only one-third that due to the wavefront, if two-thirds of the back has been absorbed by the earth. The potential between one waveback and the succeeding wavefront follows a straight line rise.

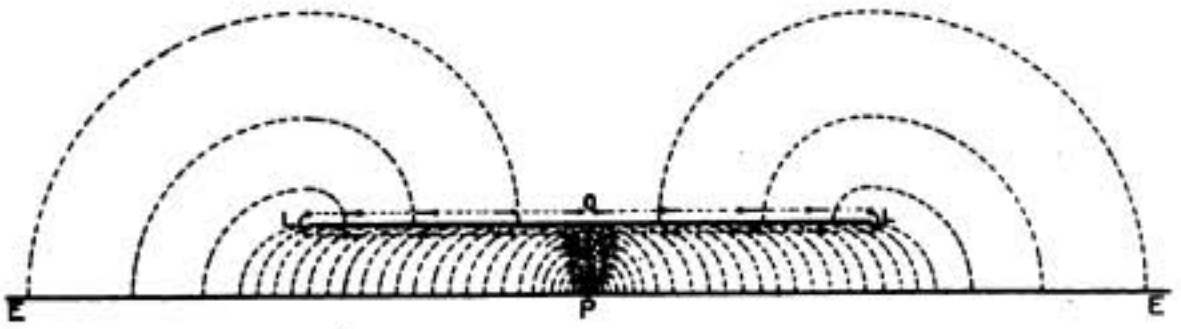


Fig. 4.

NATIONAL PHYSICAL LABORATORY.

THE Annual Report of the Director of the National Physical Laboratory at Teddington gives an epitome of the work carried on in the many departments of that Institution. In General Electric Measurements, the experiments on the dielectric losses in condensers have now been extended to high frequencies up to at least 1,000,000 ~ per second, in fact covering the range which has so much practical importance in wireless telegraphy. The investigations are not yet nearly complete, but some very interesting results have already been obtained. For example, with well-dried castor oil as dielectric, the power factor at a frequency of 800 ~ per second is about 0·0005, but at 1,000,000 ~ per second it is enormously larger, being about 0·038, with intermediate values at lower frequencies. Now, castor oil, from its high specific inductive capacity and good insulating properties, is very convenient for making small condensers, but the magnitude of the lower losses at the higher frequencies makes it a quite undesirable dielectric for condensers used in wireless telegraphy. It has also another objectionable property : the capacity of a castor oil condenser has a very considerable temperature coefficient, about —0·3 per cent. per degree C. On the other hand, well-dried petroleum behaves well, both as regards dielectric loss at high frequencies and temperature coefficient. Mica condensers also give very good results. In a certain high-class mica condenser tested from 5° C. up to 30° C. it was found that the temperature coefficient, although very small, was by no means constant between these limits of temperature, the rate of change being much greater at 25° C. than at 10° C.

A considerable amount of work was done in connection with decrement measurement and high-frequency resistance. The measurement of decrement is of fundamental importance in wireless telegraphy, as the determination of efficiency is so largely dependent upon it. A number of tests were made on coils, some wound with solid, and others with highly stranded wire. The effective resistances at high frequencies were tested by direct determination of the power spent in the coil by a given current.

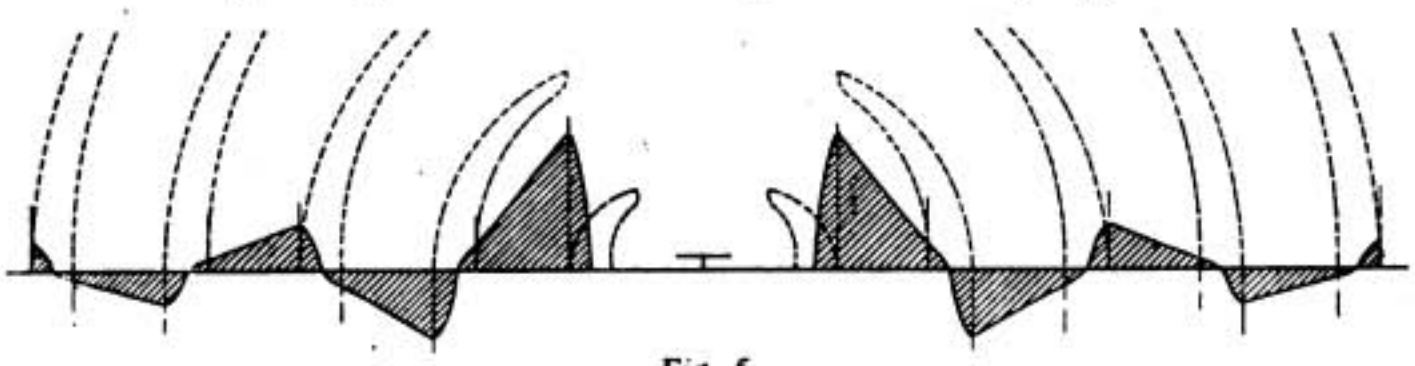


Fig. 5.

This direct system of measurement was found to corroborate Lindemann's interesting discovery that at certain frequencies a solid conductor behaves better than a stranded one.

Digest of Wireless Literature

ABSTRACTS OF IMPORTANT ORIGINAL ARTICLES DEALING WITH WIRELESS TELEGRAPHY AND COMMUNICATIONS READ BEFORE SCIENTIFIC SOCIETIES.

Resistance Measurements in High-Frequency Circuits.—

In discussing in the *Jahrbuch der Drahtlosen Telegraphie und Telephonie* the accuracy attainable in measuring resistance in high-frequency circuits, S. Loewe describes two methods: one in which continuous waves are used, produced by means of a Poulsen arc; and the other, in which the high-frequency current is obtained by discharge across a spark-gap. In both cases the deflection of a thermo-galvanometer placed in an inductively-coupled circuit was observed—first, when the resistance to be measured was in circuit; and secondly, when a known resistance had been added to the circuit. Expressions are obtained giving the value of the resistance sought in terms of the known resistance. The various sources of error are discussed, and the conditions are given under which the greatest percentage of accuracy can be obtained. With the Poulsen arc the most serious error is due to uncontrollable variations of frequency, which are continually occurring, and which may be a sudden change, and may last for long or for short periods. Several examples are given, showing that the probable error is about 1 per cent. for both methods so long as the wave-length is over 1,000 metres.

Aerial Radiation.—

H. de Bellescize contributes a lengthy article to *La Lumière Electrique* in which he discusses methods of calculating the area of radiation from an antenna. Hertz's theory indicates that at any point in the equatorial plane of an antenna the instantaneous values E_o, H_o of the electric and magnetic fields vary with the area formed by a curve having the vertical portion of the antenna as base and the instantaneous total value of the current in the antenna at different points as ordinates. In order to test this, de Bellescize had set up transmitting and receiving aerials at a distance apart of over 16 miles. The theoretical areas were calculated and their squares compared with the indications of the measuring instruments. The results show that the assumptions made, that the horizontal portion of the antenna is a pure capacity and the loading coil a pure inductance, are sound. It is possible to compare the radiation of antennæ having a vertical wire and any type of capacity area at the top. The method allows also of comparison of energy radiated by the same antenna at different wave-lengths. The necessary data for purposes of calculation are: fundamental wave-length; current at foot of antenna.

Sphere-Gap Discharge Voltages.—

Mr. J. Cameron Clark and Mr. Harris J. Ryan presented a paper before the American Institute of Electrical Engineers on "Sphere-Gap Discharge Voltages at High Frequencies," in which they described a series of experiments made by them to determine the values of steady, high-frequency, high voltages required to discharge between 7-in. copper spheres, in air, at ordinary temperatures and barometric pressures. A 15-kw. arc generator was used as a source of high-frequency sustained high voltage. The apparatus used in securing and measuring currents from 85,000 cycles to 612,500 cycles is described in detail. The sphere-gap standard consisted of electrolytic copper spheres mounted on the ends of brass tubes in treated wood frames. Gap lengths were determined by means of calipers and micrometer screw or steel scales. The 123,000-cycle values locate a right-line relation for sphere gaps and discharge voltages, which when produced passes through the origin. The authors give the mathematical relation existing between the root-mean-square kilovolts and the gap length for frequencies between 123,000 cycles and 255,000 cycles.

High-Voltage Measurements with the Sphere-Gap.—In a paper read before the American Institute of Electrical Engineers, Mr. F. W. Peek, jun., declared that a gap method of measuring high voltage is desirable in certain tests, since the gap measures the maximum point of the voltage wave. At high voltages the needle gap is unreliable, inconvenient, and seriously affected by humidity. The sphere gap is free from complicated corrections and the curve is subject to calculation. The correction for air density—that is, altitude and temperature—which has to be made wherever voltage is measured by a gap has been made for the sphere gap over an air-density range equivalent to that from sea level to 18,000 feet elevation. A spacing three times the radius may be used without appreciable corona. An equation is given for calculating the sphere spark-over curves for various spacings, radii, air density, etc. The apparent surface gradient at spark-over, in the non-grounded case, increases with decreasing radius of sphere. Tables are given showing the spark-over voltages for different-sized spheres and different spacings, at sea level and a temperature of 25 degrees C. These give a standard curve which may be made to apply to any given altitude by means of a correction factor. Curves are given showing how well the measured values check with the calculated values. Curves should be calculated, it is emphasised, only when standard measured curves cannot be obtained. Over commercial range there is no variation due to frequency. The author believes that local over-voltage and not high frequency causes destruction of insulation. A non-inductive resistance should be placed in series with the gap to prevent oscillations and to limit the current discharge.

Mast Construction.—In a Paper published in the *Journal* of the Institution of Electrical Engineers, Mr. C. G. Roach describes the erection of masts at the Post Office Land's End Station, which was opened for traffic on December 1st last.

There are two lattice steel masts, each 205 ft. 6 in. in height and fitted with three sets of four stays. Originally it was intended that they should stand on porcelain feet, but owing to the high cost of such massive insulators, which would have had to be specially made, it was decided to substitute concrete feet. The diameter of each block is 36 in. The blocks stand 18 in. high and are 36 in. in diameter, and there are three for each mast. The stay anchorages are formed of T-shaped blocks of concrete reinforced with ¼-in. iron rods. Each block is estimated to weigh 18 tons. Running through the concrete at an angle of 45 degrees is a 1½-in. iron rod, 9 ft. in length, threaded through a 6-ft. length of channel iron 4½ in. by 2 in. by ½ in. at the lower end, and fitted with a 6-in. ring at the upper end to take the stay attachments. The stays are made of 2½-in. steel rope. The topgallant stays have three block porcelain insulators, and the topmast and mainmast stays to each. The stays terminate at the ground anchors with a short length of crane chain and a special clamp, which admits of a fine adjustment by nuts and of a coarse adjustment by taking up a half link or a number of links in the chain. The masts are of triangular section, and will maintain their stability when subjected to a wind having a velocity of 80 miles per hour. The main members are composed of bent steel plates of uniform thickness and are connected end to end by suitable fish-plates. The braces are of 2 in. by 2 in. by ¼ in. angle iron, and are fitted to the vertical members by two rivets at each end. Their lengths are: for the mainmast 5 ft. 11½ in., topgallant mast, 4 ft. ⅜ in. Owing to the extreme length of the sections, 70 ft. 10 in. main, 65 ft. 7¼ in. topmast, and 66 ft. 5¼ in. topgallant-mast, they were sent down in half-sections, each half-section being nested together for convenience of transport and erection. The moving derrick method was employed for the erection of the first mast, but in the case of the second mast this method was abandoned, and quadruple blocks taking a 4-in. manila rope were used instead. The masts will doubtless do all that is expected of them, but the cost of carriage and erection will probably prevent the perpetuation of that particular design.

High Speed Wireless Telegraphy.—In connection with the contract placed by the Post Office with the Marconi Company for erecting at Stonehaven a wireless telegraph station, which among other functions will

serve for communication at a speed of 100 words per minute with a similar equipment to be installed by the Company at Cullercoats Wireless Station, an interesting demonstration was recently given, with marked success, under the supervision of the Engineering Department of the Post Office. The matter has already been referred to in THE WIRELESS WORLD, but in the July number of the *Post Office Electrical Engineers' Journal* there is an interesting summary of the results of the demonstration. The stations chosen for the demonstration were Chelmsford and Letterfrack, in County Galway, a distance of approximately 550 miles. For fast-speed communication Chelmsford served as the transmitting station and Letterfrack as the receiving station; no transmitting apparatus being installed at Letterfrack.

The method adopted for the demonstration was as follows: Dummy messages were prepared and Wheatstone slips punched from them by the Department; the slips were run through a Creed translator, thus giving typed copies of the messages corresponding in all particulars with the slips. The typed copies were taken to Letterfrack, where all checking was performed. The checking of speeds was, of course, done at Chelmsford. The messages were average commercial messages, with the usual proportion of plain language, figure, code and cypher. Over prearranged times Chelmsford at first ran through slips for fourteen-minute periods, separated by intervals of fifteen-minute rests. Early in the demonstration such good results were obtained, however, that these working and rest periods were altered to thirty minutes and five minutes respectively. This condition, under which the major part of the demonstration was conducted, was much more onerous than that first adopted, and constitutes probably the most thorough and severe working test ever applied to wireless telegraphy.

At Letterfrack cylinders or parts of cylinders bearing the received signals were chosen for transcription as soon as they were taken off the machine, the object being to have written up about 25 per cent. of the messages transmitted and to distribute over the whole of the cylinders the messages chosen for writing up under conditions approximating to those which would be experienced in actual working. The demonstration was spread over a period of four days; the traffic particulars for the separate days are as follows:—

	Messages received.	Messages written up.	Individual errors.	Messages mutilated	Messages lost.
1st day	190	47	13	3	2
2nd day	588	153	1	1	—
3rd day	459	95	7	1	—
4th day	290	64	—	—	—
Grand Total ...	1527	359	21	5	2

The only marked variation in receiving conditions observed during the demonstration occurred on the first day. At times the signals would fall rapidly in strength and as rapidly rise to their normal strength again. The variation was not traced to any particular cause, but was probably due to some abnormal atmospheric condition about which little is known at present, and which affects generally all wireless systems. It will be seen that most of the faults occurred during this time. The grand totals compare not unfavourably with those obtained in ordinary line communication; eliminating the first day's traffic, the results are remarkably good, and to those hitherto unacquainted with recent developments in wireless will come as a surprise.

Further short trials at higher speeds were made, of which particulars are as follows:—

Speed, words per minute.	Messages received.	Messages written up.	Individual errors.	Messages mutilated.	Messages lost.
125	38	38	1	—	—
140	20	5	—	—	—

It will therefore be seen that the system promises to be capable of maintaining speeds much higher than 100 words per minute. The possibility of actuating the transmitting apparatus from a distance will be obvious to all engineers, and when it is added that the Company has further demonstrated that the received signals can be relayed over a considerable distance, the flexibility of the system will be recognised. It would be a rash individual who would attempt to predict the final outcome of this, the Marconi Company's latest development in wireless transmission; it may mark an epoch in the history of telegraphic communication.

C

The ENGINEERS Note Book

[Under this heading we propose to publish each month communications from our readers dealing with general engineering matters of various kinds in their application to wireless telegraphy, and we would welcome criticisms, remarks and questions relating to the matter published under this heading. We do not hold ourselves responsible for the opinions and statements of our contributors.]

The Micrometer Screw Gauge and Thickness Gauge.—II.

By M. V. R.

In any kind of internal combustion engine, if some idea of the temperature of the valve spindle can be estimated, and as the length of the spindle can be measured, then it is quite an easy matter to calculate the clearance to be given to any particular engine.

As an example, take the case of an exhaust valve spindle whose length is 5 in. and whose temperature when the engine is running is 280° F. Suppose the surrounding atmosphere is at a temperature of 80° F. Then, taking the coefficient of linear expansion of steel at 0·000006 per degree F. the amount the valve spindle would lengthen will be :—

$$200 \times 5 \times 0{\cdot}000006 \text{ in.} — 6/1000 \text{ in.}$$

So that the clearance to give in this case would be 6/1000 in. The exhaust valve is only taken as an example, it being equally important that the inlet valve should have the right amount of clearance, from an economical point of view if not as regards power. Some practical clearances are given below for internal and external valve spindles of different lengths.

Length of spindle in ins.	Clearance. Internal.	External.
3	5/1,000 in.	4/1,000 in.
4	6/1,000 in.	5/1,000 in.
5	7/1,000 in.	6/1,000 in.
6	8/1,000 in.	7/1,000 in.
8	10/1,000 in.	9/1,000 in.

The ordinary thickness gauge would become rather cumbersome if it were constructed so that measurements could be made of, say, distances of over 1/16 in. with single gauges.

For measurements over the above the thickness gauge is made in the form of a long tapered wedge and graduated on one side from 1/16 in. to ¼ in.

Supposing a foundation has been laid down and it is required to level up the machine resting on it. The machine is first levelled up on three packing pieces, two at one end, one under each corner of the bedplate, and one at the other end underneath the middle of the bedplate. The machine is then levelled up with a spirit level in the usual manner.

The thickness gauge is now inserted at various points and the various thicknesses of the packing pieces can be ascertained. These are driven in so that they do not lift the machine off the three levelling packing pieces. In this manner the first level is kept, whereas in the ordinary method packing pieces are driven in at various points, and the machine will perhaps have been lifted ½ in. before a proper level is obtained, to say nothing of the number of times the level would have to be checked as the packing pieces are driven in.

This thickness gauge is also very useful where two steam pipe flanges come together. It is essential that the two faces of the flanges shall come up square to each other before they are bolted together. With the thickness gauge the gap is very easily measured, as it can just be inserted and withdrawn and the distance read right off, whereas with an ordinary rule it would take

some considerable time to go all round the flange and measure the gap at various points.

In conclusion, the following hints on the use and care of the measuring instruments may be found of value.

The micrometer screw gauge when not in use should be kept in a suitable case. A small washleather bag is excellent for this purpose.

Care should be taken that the gauge is never under any circumstances screwed up tightly, and if it is of the type provided with a locking ring it is best to lock the spindle after use in such a position as to leave a small gap between it and the anvil.

The gauge should always be kept smeared over with a thin coating of oil.

To obtain accurate results it is essential that both the faces of the gauge and their points of contact on the part being measured should be perfectly free from dirt, dust, congealed oil, etc. This latter point applies with equal force when using the ordinary thickness gauge.

The above notes have been written, not with the intention of showing the full uses of the micrometer screw and thickness gauges, but simply to point out that these two instruments might be used more with advantage by engineers who are not in workshops, and also to show that small distances can be measured equally as well with a micrometer screw gauge as larger distances can be measured with a 12-in. rule.

A New Division of the Inch.

New denominations of standards, being equivalents to or multiples or aliquot parts of the imperial measure of an inch, have been made and verified by the Board of Trade, and it is notified in the *London Gazette* that they will become standards under the Weights and Measures Act, 1878, on and after November 1 next.

According to the schedule of the new denominations the descriptive number of the equivalent of an inch is 15/0 B.G. (Birmingham gauge). The new numbers proceed by units down to 1/0 B.G., which equals ·3964 in., diminishing thereafter from 1 B.G. (·3532 in.) by units to 52 B.G. (·00095 in.).

Wet Steam in Boilers.

A fault frequently met with in steam boilers is the carrying over of water mechanically mixed with the steam, which water not only takes away heat without any useful effect, but when present in any marked quantity, itself becomes a source of danger and of serious loss in the engine. If steam rises from a surface of water faster than about 2 feet 6 inches to 3 feet per second, it carries water with it in the form of spray; and when a fine spray is once formed in steam it does not readily settle against a rising current of very low velocity, as a current of 1 foot per second will carry with it a globule of water one-thousandth of an inch in diameter.

The cause of priming may be either impure water, too much water, or improper proportions in the boiler. When a boiler is found to form wet steam with good water, carried at a proper height, it is a proof of wrong design.

The amount of priming in different boilers varies greatly, and as yet there is not sufficient data to establish any definite ratio for boilers in ordinary use. The experiments of M. Hirn, at Mulhouse, showed an average of at least 5 per cent.; Zeuner sets it down as approximately from 7½ to 15 per cent.

The colour of a jet of steam near the orifice whence it is escaping is blue when it contains less than 2 per cent. of moisture, and white when it contains more. To determine quantity of water in steam, calorimeters are used.

STRAY LEAVES.

Simplicity in construction is the real touchstone of successful designing.

* * *

Learn to measure your days by the work accomplished rather than by the hours put in.

* * *

A man's education should depend on his individual job.

* * *

Application of that which is really observed is the pathway to opportunity for the mechanic, and once he starts on the pathway, he will be surprised to find how elastic opportunity is.

The Wireless Press, Limited.

LET us explain without any preamble that the name which figures at the head of this paragraph is now that of the Company formerly known as the Marconi Press Agency, Limited. To many of our friends the continuous expansion of THE WIRELESS WORLD has been an outward and visible sign of the development of the business of the Marconi Press Agency, and that expansion alone would have warranted the step which has just been taken. But this magazine by no means absorbs the whole of the energies of the Company, which, for some time past, has concerned itself with the task of making clear to the average layman, through the medium of sound, inexpensive books, the underlying principles of wireless telegraphy and their applications.

In view of these developments it was felt that the name of the Company should more accurately reflect its many-sided activities, and arrangements have accordingly been made to change the name to the "Wireless Press, Limited." The capital of the Company is being increased and the accommodation at Marconi House has been enlarged by the acquisition of spacious premises on the ground floor, facing Aldwych, which are utilised as a publishing office and sale shop for the publications of the Wireless Press, Limited, including THE WIRELESS WORLD, *The Year Book of Wireless Telegraphy and Telephony*, *Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead, *The Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, *The Wireless Map of the World*, Morse Code Cards, etc. Here visitors will be cordially welcomed and information will readily be given concerning all publications dealing with wireless telegraphy and telephony.

Marconi Company and the Chinese Government.

THE statements which have appeared in the Press to the effect that a contract with the Chinese Government had been actually signed have led to erroneous statements being published in the Pekin newspapers that the Chairman of the Marconi Company had stated that he had no knowledge of any contract whatever with the Chinese Government. This situation has given rise to some confusion in both countries. The Marconi Company therefore think it desirable to publish the following information:

Negotiations have been pending between the Chinese Government and the Company for some time past for the erection of a number of wireless stations in China for internal and external telegraph services. On April 8th last the Chinese Government sent an official letter agreeing to authorise the Marconi Company to issue two million sterling five per cent. Chinese Bonds in payment of the proposed stations. This document was filed at the British Legation at Pekin, and the formal contract has been sent forward for approval and signature. The Company has every confidence that in due course the agreement will be signed and all mutual obligations fulfilled.

The Marconi Wireless Telegraph Company of Canada, Limited, have found it necessary to increase their office accommodation, and the address of the Company is now Room 507, Shaughnessy Building, 137, McGill Street, Montreal.

The Company's manufacturing business has also outgrown its accommodation, and new works have been acquired in Rodney Street, comprising a three-storey brick factory building, which will provide excellent accommodation for the staff.

The Kingston Station, Buildings and Mast.

The Canadian Wireless Chain

A New Link

WITH the installation of a wireless station at Kingston, modern science and the inspiration of a bygone day have taken up their habitation in one of the most famous cities of Western Canada. This "City of Limestone," as it has been called owing to the fact that its buildings are constructed of the beautiful rock on which their foundations rest, is situated on the slope of a promontory at the junction of Lake Ontario with the mighty St. Lawrence River. Very splendid it looks with its terraces of fine houses and public buildings which reach down to the water's edge, and the history of the city is as splendid as its appearance.

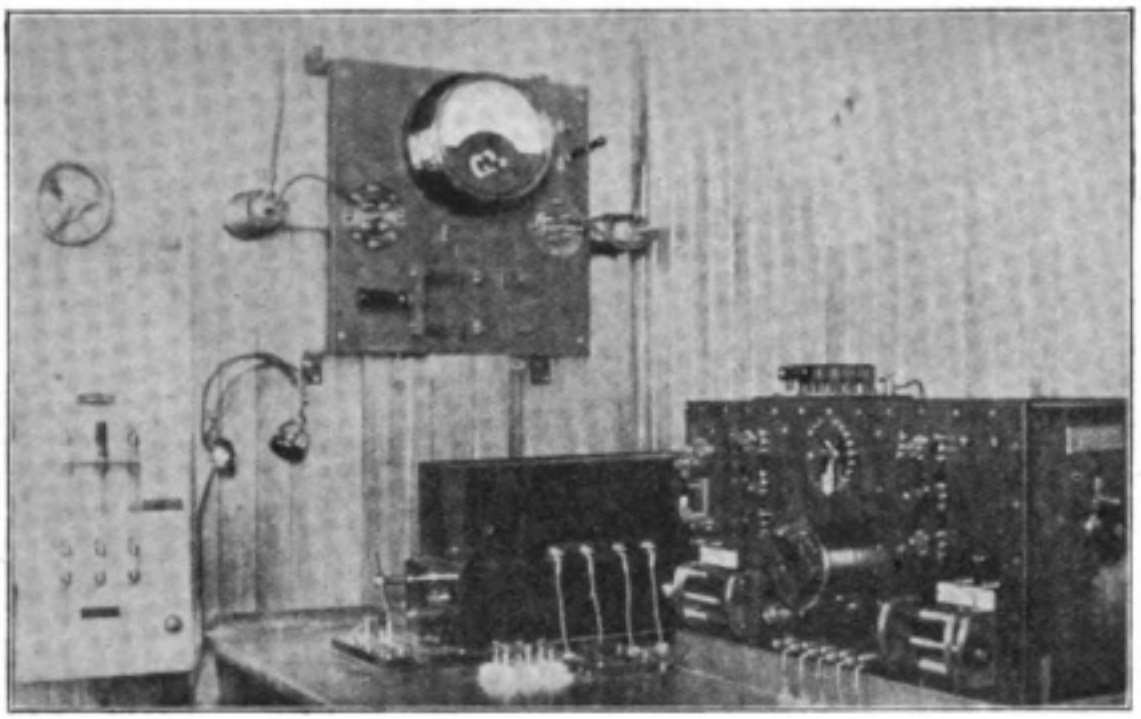
Its foundation dates from the seventeenth century and was due to the efforts of that little courageous band of French, who, inspired with a loyalty which was nothing less than devotion to their Mother Country and to their king, the crafty, avaricious Louis Quatorze, determined to make the continent of America a province of France.

At this time Montreal was nothing more than a stockaded post, but about the year 1670 General de Fontenac, the French Generalissimo and Governor of Canada, decided to make it a permanent fur depôt and secure its defence by erecting a stockaded fort at Katarakoui.

In 1673 his scheme was carried into effect, four days sufficing to build the necessary log fort, which was known as Fort Fontenac but renamed Kingston on its occupation by the English.

This did not take place immediately; for eighty-five years the French held it in possession, and during their occupation it progressed from a mere outwork to Montreal to be in itself a considerable township. Indeed it was worth taking when, in 1758, the British General Abercrombie marched across the Canadian frontiers and commissioned Colonel Bradstreet to take the place by assault. On August 25th this was successfully accomplished and 70 of the defenders, with M. de Moyan, the commander of the town, were made prisoners.

For many years the outpost of Fort Fontenac remained forsaken, as it was only at the close of the American War of Independence that a party of American loyalist refugees chose to make a settlement there rather than repudiate their allegiance to Great Britain. Henceforth the township was known as Kingston, and considering the occasion of its establishment no better name could have been chosen. Ever since the town has upheld its ancient heritage of loyalty and reverence for established custom.



The Operating Room at Kingston.

Kingston now began to enlarge its borders; it rapidly developed into a flourishing city, more as a commercial than as a military centre, although the old site of Fort Fontenac was set apart as a military outpost. A few years later Lord Dorchester conceived the idea that the town should be thoroughly fortified with bastions, ramparts, and towers, and should be made the capital of Upper Canada. The fulfilment of the plan did not take place till many years later; not, in fact, until the war of 1812 had depleted the inhabitants of New York and Toronto and practically wiped out the city of Niagara.

As a result refugees poured into Kingston until the city's population was almost doubled; then a new fort, constructed of logs, was erected and named Fort Henry. Twenty years later the city defences were strengthened with stone bastions and Martello towers. These are standing to-day and are excellently well preserved.

The greatest blow to the prosperity of the city was the decision in 1840 to remove the seat of Government to Montreal, but Kingston had already acquired fame as a centre of commerce and society sufficient to outstay the fleeting pomp of governmental power.

In 1846 she became an incorporated community; but despite this outward and visible sign of aggrandisement, her state was one of splendid isolation, for Montreal to the east and Toronto to the west are both over a hundred and seventy miles distant, and the only means of communication was in summertime by steamboat and in winter by stage coach, for the railroad was not completed till several years later.

Now railway, telegraph, and, latest of all, wireless, have brought her into touch with outside affairs and she can continue her *rôle* as one of the most important cities of Canada. Her University is one of the finest in the Dominion. It was established by Royal Charter in 1844, and was named Queen's University, in acknowledgment of the Royal foundress. Kingston also boasts a Royal Military College, which is housed in a fine Norman structure which links together Fort Henry and Fort Fontenac.

A feature of the town is its vast shipbuilding yards, which are the outcome of an industry originating in the yet struggling township; for it was here that in 1812 the first Canadian steamboat was built and launched.

The wireless station just completed by the Canadian Marconi Co. for the Government is of the standard 5·5 kw. type. A site has been found for it at Fort Henry: the masts are of the three section wood type, 185 ft. high, with a cross arm shackled aloft. The aerial has a natural wave-length of 600 metres when in series with the secondary of the oscillation transformer, and earth system. The earth system consists of a number of zinc plates buried edgewise for a depth of 3 ft., and form a continuous circle

whose diameter is 65 ft., also a capacity earth is provided which consists of 2,000 ft. of copper netting. The Bradfield insulator is led into the transmitting room through a special porcelain bushing, this being necessary on account of the peculiar climatic conditions that exist. The machines are of the standard 5·5 kw. disc type of the Canadian Marconi Co. The generators are belt-driven from two 8 h.p. gasoline engines. The gasoline tanks are outside the building, and sometimes the weather is so cold—for a thermometer reading of 30 degrees below zero is no uncommon experience at Kingston—that even within the building the pipes conveying the gasoline to the engines have been found within a few moments of use covered with ice to a thickness of over a quarter of an inch. The transmission wavelengths vary from 600 to 1,600 metres, and the receiving from 300 to 3,000. The magnetic detector is used as a stand-by, while the carborundum crystal has been found to be very efficient. Two oscillating transformers, so admirably designed that telephone transformer and battery find a place within the instrument itself, have been provided in case of necessity. The one has a range of from 300 to 1,600 metres, the other from 1,600 to 3,000 metres.

The opening up of this station completes another link in a great wireless scheme, for as soon as the stations at Montreal and Quebec have been rebuilt—and already work on them has been commenced—one of the longest chain of wireless stations in the world will have been completed, and it will be possible to send a wireless message from Port Arthur to the other side of the Atlantic.

Ottawa receives Time Signals from Washington.

Listening to the seconds ticked off from Washington through the wireless telegraph apparatus recently installed at the Dominion Observatory was a feature of the meeting of the Royal Astronomical Society at Ottawa on April 23rd. Shortly before 10 p.m. the Arlington town signals could be distinctly heard throughout the hall through the gramophone which was connected with the wireless receiving instrument at the Observatory. At five seconds to ten the ticking ceased, and at ten o'clock a long stroke gave the striking of the hour. This corresponds almost exactly with the hour at the Observatory. The lecture was given by Mr. C. P. Edwards, superintendent of radio telegraphy for the Dominion, who delivered an interesting address, and many experiments demonstrating the modern use and value of wireless telegraphy.

Erecting the Kingston Station Building.

NOTES OF THE MONTH

TELEPATHY is now generally admitted, but the conditions which govern it are still a mystery. In her lecture on "Sleep and Dreams," Dr. Lipinska makes the ingenious suggestion that it belongs to the same category in the psychic world as wireless telegraphy does in the material world. The hypothesis that telepathy only occurs between two brains which have been "tuned" to one another's would appear to indicate the possibility of "tuning" artificially the brains of people who desired to hold communication with one another at a distance. It is worth recalling that in the early days of wireless telegraphy the sending of messages without wires induced some people to say "Now we can begin to believe in telepathy," but we can have no doubt that there is absolutely no connection between them. We do not profess to understand the process of telepathy, but so far as we can see it does not appear to be conducted by a physical medium.

* * *

The Committee for Radiotelegraphic Investigation of the British Association, and the Committee recently appointed by the Commission Internationale de T.S.F. have now agreed upon a programme of emission on the day of the solar eclipse on August 21st under which unique opportunities will be afforded for the investigation of strays and for the measurement of the strength of signals. According to this scheme, Bobrouisk (2,500 metres), Paris (2,200 metres), Norddeich (1,670 metres), St. Petersburg (5,000 metres), and Nauen (9,400 metres) will each emit for two minutes in the order named from 10 h. 0 m. to 15 h. 30 m. Each station will emit once every twenty minutes from 10 h. to 11 h. 40 m., and from 13 h. 20 m. to 15 h. 30 m. During the period of totality, *i.e.*, from 11 h. 40 m. to 13 h. 20 m., they will each emit once every ten minutes. The signal for these will consist of the slow transmission of a characteristic letter for 10 seconds, followed at intervals of 10 seconds by a continuous dash of 10 seconds duration.

St. Petersburg is situated to the east of the central line of shadow, and during totality will emit a special system of continuous signals, in addition to those described above. For one minute the same characteristic letter will be sent at every 10th second. During the next minute another series of a characteristic letter will be sent at every 10th second, and so on.

The adoption of a system of characteristic letters, for which ingenious arrangement Dr. W. H. Eccles is responsible, renders it unnecessary for observers themselves to record the time. Any two consecutive letters received automatically record the accurate time. Measurements by apparatus of precision will be made by observers from the Commission Internationale. The observations made under the auspices of the Research Committee of the British Association will consist of the rough estimation of signal strength—for the most part by ear, and of the registration of strays by the method of graphic record. The complete programme of emissions will be executed by all the stations on the day preceding the eclipse, and, in the case of St. Petersburg, possibly also on the day succeeding.

* * *

Bombay, like all the principal ports in the world, is now fully served with wireless telegraphy equipment to meet present requirements, and this has been demonstrated in the work that has been carried out at the new wireless station on Butcher Island.

When wireless facilities were first given to Bombay it was in the form of a low-power station at Back Bay, and as the apparatus had a radius of only 200 miles the value of the station was not sufficient to induce a great deal of business. If a steamer approaching Bombay, for instance, wished to communicate with the station this could only be done when the vessel was within a comparatively few hours of land, but with the new station on Butcher Island a message can be sent to Bombay by a passenger on a steamer when she is almost two days' journey from Bombay. A little over 600 miles is the furthest distance at which Butcher Island has been able to "pick up" a steamer, but at Karachi there is also a wireless station with a radius of 600 miles, and as a steamer coming from home to Bombay enters the zone of the Karachi waves first, time may be gained by sending Bombay messages through Karachi. All these improved conditions have tended to increase the volume of "wireless business" transacted at Bombay, and at the present time an average of thirty inward and outward messages are dealt with per day. The principal source of business comes from passengers on the passenger steamers travelling to and from Bombay, and business usually reaches its most brisk stage when a home steamer is in touch by wireless. Although the Butcher Island station is further away from the point of receiving and despatching messages—the Bombay Telegraph Office—than the old station at Back Bay was, no appreciable time is lost in dealing with messages, as the station and the Bombay office are connected by cable.

* * *

The Butcher Island Station is under the control of the Indian Telegraph Department, but the officers stationed there are military officials. In accordance with a scheme decided upon some time ago to station military officials at all the wireless stations in India the change was first made at Bombay, and now three other wireless stations in India have been similarly dealt with. This fact precludes any particulars of what tests may be made at the Butcher Island station being given to the public, but it is understood that the work which is carried out day and night with the apparatus has resulted in some good distances being obtained, and the usefulness of the station has been fully established. The wireless station in these latitudes which has the longest range is that at Colombo, but of the chain of ten stations which have recently been established in India, Bombay and Karachi are the most powerful. The other wireless stations in India are at Calcutta, Diamond Island, Jask Mergui, Port Blair, Sandheads, Table Island and Victoria Point.

* * *

The efforts to solve for the vision the problem or problems of space which the telephone has solved for the ear bears a close enough resemblance to some of the problems in the wireless field to permit us to follow with sympathetic interest the endeavours which scientists are making to reach a practical solution. Hopeful results were foreshadowed in a communication made during the past month to the Academy of Sciences in Paris by Professor Lippmann on behalf of M. Georges Rignoux, who has devoted himself to this subject for many years. M. Rignoux has now devised an improved apparatus to which he has given the name of Telephote, and which is just a scale of shade and light. There is a transmitting and receiving apparatus connected by two wires. At the transmitting station a concave mirror throws the rays of a 200 candle-power Nernst lamp upon the object which is to be reproduced at the other end of the wire. Each point thus illuminated is shown through a magnifying glass upon a screen composed of cells of selenium metal, of which the electric resistance varies in accordance with the intensity of the light thrown upon it. An electric current is passed through this screen, and, thanks to the peculiar properties of selenium, is transmitted in varying strength according to the amount of light on each portion of the screen. The currents are transmitted over a wire to the receiver, which emits through a Nicol prism rays of light corresponding in intensity with the current received. These rays are cast through a lens upon a revolving mirror, which reflects upon a screen a picture of the light and shade of the object at the other end of the wire, drawn in small rays of light. M. Rignoux claims to have succeeded in his laboratory in thus producing letters of the alphabet, and he is hopeful of further progress.

Maritime Wireless Telegraphy

IT is a popular belief that the harvest of ocean disaster and shipwreck takes place more particularly during the winter months, and it is in accord with our prevailing suppositions of great storms and billows heaving mountains high to imagine that with the equinoctial gales the danger period of sea voyaging commences. But the reader of the daily Press has had enough evidence placed before him during the last month or so to disillusion him of this maritime fallacy, for it is rarely that so lengthy a catalogue of greater and less disasters has been placed on record.

* * *

The peril which the mariner probably fears most is that of the white floating mists which blot out the vision and subdue the sound, so that a vessel driving through a belt of fog is, as it were, a creature without ears and eyes. It was not to be supposed that this peril would be allowed to hinder maritime progress, and two recent inventions have helped very much to minimise difficulties of this nature. One is the Marconi Distant Control Apparatus, described in the June number of THE WIRELESS WORLD, so there is no need to dwell upon it here. The other is the Marconi-Bellini-Tosi Wireless Direction Finder. Only recently the *Royal George* arrived at Quebec from Avonmouth and reported that it had found this instrument of great advantage in enabling compass bearings to be taken of passing ships whose positions were determined within a few degrees, while the chief stations of Cape Race, Cape Ray and Father Point were located exactly. To illustrate how great is the need for such apparatus, it is only necessary to glance over the shipping intelligence for the last month or so, when it will be seen that several mishaps recorded would have been in all probability averted if the new apparatus had been more generally used.

* * *

From Sydney news was received that the *Waipara*, a steamship belonging to the British India Company, with 350 emigrants on board for Australia, had gone ashore on Hannibal reef, Torres Straits. The steamer *Cyrena*, bound from Sydney to Singapore, first received the call for assistance, and without delay went to the rescue of the distressed vessel. She was followed by H.M. surveying ship, *Fantome*, which already was in touch with wireless, and in response to the appeal of Captain Hutchinson, of the *Waipara*, took with her a quantity of potatoes and other provisions of which the passengers were greatly in need. Eventually passengers and crew were rescued by these and other vessels which were brought into service by means of wireless.

* * *

A few days later the *Royal Edward* transmitted information by wireless that she had struck an iceberg some 100 miles east of Cape Race, but she is a big liner, and at the time of the collision was making little headway owing to fog. Later she was able to report that, though damaged, she could still hold her own, and was in no need of assistance. Under careful seamanship she duly arrived in port. Information of this nature, it will be readily understood, is greatly appreciated both by the liner's owners and by all who are interested in the welfare of the vessel. The underwriters are reassured, for the conflicting rumours, which would otherwise certainly have been circulated, are avoided.

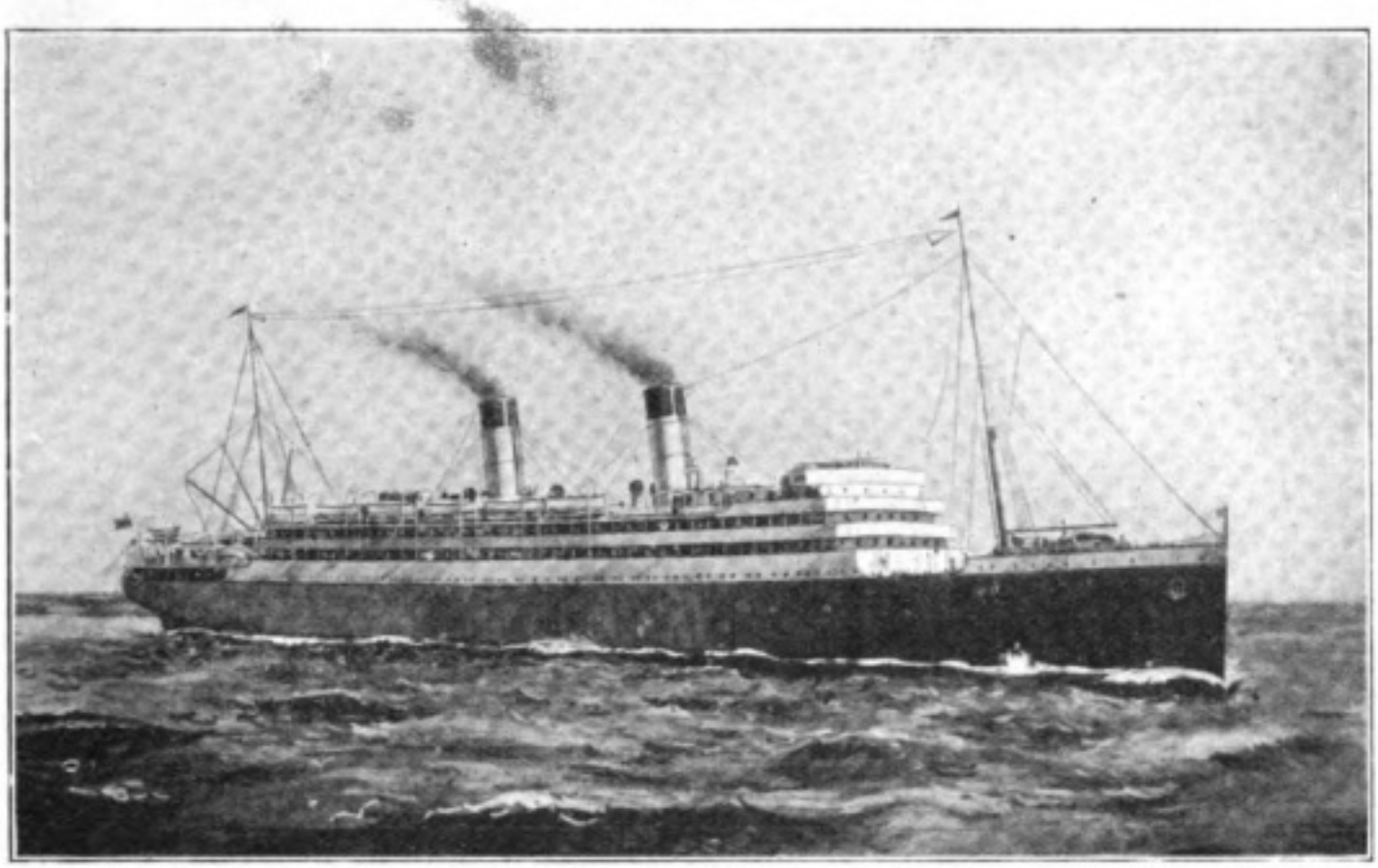
* * *

The Admiralty hospital ship *Maine* ran aground on June 17th, in foggy weather, on a rock at the south end of the Isle of Mull, which is some 24 miles from Oban. News of the accident was sent by wireless from Malin to Rosyth, and thence by telephone to Oban. When the intelligence reached Oban, the *Princess Louise*, an Oban excursion steamer, at once set out for Mull to render any assistance necessary. On arrival she found several destroyers from the North of Ireland and a cruiser standing by, and was signalled that her services were not required, and she returned to Oban.

On June 18th the North German Lloyd liner *Kaiser Wilhelm II.* came into collision with the *Incemore*, a Liverpool cargo steamer, while navigating the Channel, and a serious disaster was narrowly averted. The liner was struck amidships, and holed below the water-line. As soon as the accident occurred prompt action was taken by the commander. The boats were swung out, but were not used as, on examination, it was found that the damaged vessel was capable of returning to port under her own steam, and the captain immediately sent out a wireless message notifying the fact of the collision, and at the same time stating that the safety neither of the ship nor of the passengers was imperilled. The *Incemore* also despatched messages on her own part to the same effect, and later in the day both vessels were berthed in Southampton.

* * *

A mishap of a more serious nature was that which befell the Red Star liner *Gothland* as she was making a voyage from Montreal to Rotterdam. She struck the rocks near Bishop Lighthouse, Isles of Scilly, in the afternoon of Tuesday, June 23rd, and was badly holed forward abaft the bridge. But worse than that, her position on this dangerous reef was one of extreme peril. She carried 84 passengers and a crew of 131. Immediately the distress signal was sent out, and the St. Mary's and St. Agnes lifeboats went to her assistance. Two other liners, which were warned by wireless of the accident, were later informed that their services would not be required as the R.M.S. *Lyonesse* and the two lifeboats were in attendance. The work of rescue was not easy, for a dense fog blotted out everything a few yards off, and the only thing to do was to grope about in the hopes of coming in touch with the wrecked vessel.



The R.M.S. "Royal George," which has recently been equipped with the Marconi-Bellini-Tosi Wireless Direction Finder.

Captain McColl, of the *Lyonesse*, in his account of the disaster, makes one remarkable statement, to the effect that, though both rescue and distressed vessels were within a mile of Bishop's Rock Lighthouse, they could not hear the fog signal. This supports our contention that sound becomes, to the same degree, inaudible in a fog as the vision is restricted. But wireless fog signals and the Wireless Direction Finder are proof against the disturbing influences of fog and other adverse weather conditions, and so offer a safeguard which no mariner can afford to overlook.

CARTOON OF THE MONTH

Wireless Worries

What it feels like when you pass for the P.M.G. certificate.

Cingaleana

By H. E. PENROSE.

The Author has been a Marconi Operator for many years and has seen an infinite variety of life in many climes. He has besides the rare gifts of imagination and a facile pen, so that anything he has to write of his experiences makes interesting reading. Here he gives a few impressions of life in Ceylon.

SPLASH! and with a rattle accompanied by the shrilling of pipes and hoarse commands the anchor is cast in the outer harbour of Colombo. The big red light at the end of the breakwater casts a lurid glow over the white decks. Behind twinkles the tower light winking out the name of the town and the degree of latitude in measured periods of brief illumination. For an hour or so it is pitch dark, then, with the suddenness of a theatrical effect, the gorgeous Eastern morning breaks and the rise of the sun sweeps away the velvety shades and breaks through the lingering haze with darts of splendour. Out of the mist echoes the sound of a distant thug, thug, thug, heralding the approach of the company's launch, which comes into view with the house flag flying at her staff. All of the ship's company who are able take advantage of her coming to go ashore. The new comers are resolved to go sight-seeing, but to the "old stagers" the prospect of an idle day in a Madeira chair is the more inviting. To my mind for sheer lazy enjoyment Colombo is without rival. Settled in the shade of a low verandah with nothing to do but to watch the comings and goings on the high road before you, there is ample opportunity to indulge your fancy, whether fantastic or artistic. Eastern life, with all its charm of colour and variety, is displayed on the high road. The blazing sun makes the solar topee and white ducks of the European who chances to be abroad gleam out in striking contrast to the bronze skins of the natives and their variegated clothing. Perhaps the most prominent passers by, on account of their numbers, are the rickshaw-wallahs. The rickshaw-wallah is ubiquitous and in his way energetic. Invariably he reminds me of that delightful character in "Midshipman Easy" who was "all zeal." Many a time have I been a sufferer from this zeal. He always knows better than his employer what to do and where to go. Protests are in vain. If there is any particular spot in the district which appeals to him he will take you there willy-nilly. For instance, on one occasion I hired a man who on half-days and holidays was wont to attend with his family a certain local place of worship. On my hiring his services for a ride I suggested that a visit to Lavinia would be pleasant, but he immediately nipped my programme in the bud and carried me whither I would not, namely, to the detestable little bamboo hovel of his worship.

Western civilisation has been a bad thing for the rickshaw-wallah in introducing him to the effervescing delights of ginger beer. He has cultivated an infinite capacity for the beverage—at least, so it would appear from his constant request for "baksheesh" to procure himself this harmless drink. But my faith in him and his volubly expressed partiality for non-inebriating drinks has been on more than one occasion severely shaken. Notably when I, with a party of friends, were constrained, by pure kindness of heart, to make our wallahs a donation for purposes of refreshment. They disappeared and we waited patiently in the heat. After a quarter of an hour's strolling about we expected to find them returned to their posts so that we could resume our interrupted journey, but they were nowhere to be seen; nevertheless, we stood by in readiness. Immediately we were assailed by a swarm of itinerant merchants, photographers, post-card sellers, seers, and the like. They swarmed upon us like bees round a honey-pot, and as there were only three of us we were unable to relieve our

feelings by kicking them, while our Cingalese vocabulary was not sufficiently extensive to enable us to emphasise our feelings. Presently we could stand it no longer, so we went in search of the truants and found them befuddled in a bhang shop. They were not too incapacitated to walk, but it was an unsteady little procession of rickshaws that continued the journey. Talking about merchants reminds me of the great product of the Colombo market. It is the Cingalese elephant, which is sempiternal. The Cingalee carves him in all sizes and various materials. You can buy him for the watch-chain or you can procure a magnificent two-foot specimen in ivory for the drawing-room, but if you do this you had better buy your specimen immediately on setting foot in Colombo, otherwise, before a week is out you will be so sick of the sight of the creature that you will never wish to be reminded of his existence. Of course, the Cingalee won't understand your feelings at all, for he considers you are created to buy elephants, and so firm is he in his belief that, if you should be handicapped with only a slight knowledge of the language and should find yourself in the bazaar at any time, the oily shopkeepers will understand promptly that you wish to purchase an elephant, and they will crowd around you elegant little trinkets on silver chains, great trumpeters on ivory pedestals, and tray after tray of them in assorted sizes.

Unlike the majority of Eastern towns, Colombo has no official bazaar. Instead, there is the Pettah or native quarter, where the narrow streets are lined on either side with rows of low open-fronted booths. All day long a motley crowd surges through this Mecca of merchandise. People of all types and creeds, men, women, and children, jostling each other as they pass on from stall to stall. Here you will see Tamils and Mahratti from the South, Madrasees and fawning Bengali, and occasionally a man of finer physique and lighter colour indicating a visitor from Northern India. The aristocratic Brahmin passes the lowly Hindoo without deigning to notice his existence, such are the rigours of caste. The stalls of fruit are always of interest to me. They contain such a weird medley of uncommon delicacies. There are mangoes and mangisteins, bread-fruit and pampoi, cocoanuts and bananas, and almost invariably there is a chattie filled with the juice of limes hanging up by the door-post to keep cool. Progress in these crowded ways is very slow, however, and anon you are brought to a halt by some little naked youngster running up to claim baksheesh, or attempting to soften the heart of the good-natured Englishman by his shrill piping of "Ta ra ra boom de ay," to which he contributes something in the nature of a loud pedal or big drum accompaniment by thumping his fat little sides with clenched fists.

The brass-worker is sure to have a stall in the market. He is usually a sedate and hoary citizen very prone to a conversation with his fellows. You will see him gravely salute his comrade, then, with all the solemnity in the world proceed to prepare a betel chew. For this purpose he will produce a leaf, and on it, after careful calculation, spread lime, betel, and perhaps a little spice. This is skilfully rolled together very much in the same way as a Spaniard rolls a cigarette, and then, the preliminnaries of hospitality having been observed, the two will squat down together and discuss the questions of the day with much wagging of the head and hand gesture. All around, a perfect babel of sound continues without interruption. High-pitched voices, bargaining and chattering; hawkers of all descriptions plying their wares; the ringing of rickshaw bells and the shouts of their drivers, with now and again the dull rumble of ponderous native carts drawn by teams of oxen, which make their laborious way through the crowd and leave in their wake clouds of terra-cotta dust. Over all hangs the glare of an Eastern sun which pierces the shade of the palm trees, while the hot air is redolent of spices and garlic.

Delightful, however, as these glimpses of Eastern life may be, they become intolerable when continued day after day; so that the operator is as glad to leave them behind him on his call to the ship and to the sweet invigorating breezes of the sea as he was to have the opportunity of the experience.

Among the Operators

[*This section is devoted to recording items of particular interest to wireless telegraph operators.*]

We regret to record the death of Patrick Joseph Coffey, who was drowned in the Sabine River, Texas, on June 7th. It appears that about one hour before the vessel on which he was serving, the *San Gregorio*, was due to leave Sabine, Coffey obtained permission to visit the British ship *Astrakhan* in order to purchase some cigarettes, accompanied in a small boat by the bosun and carpenter. The party boarded the *Astrakhan*, and while Coffey was making his purchase his comrades visited another part of the ship, and within a few minutes heard a cry. They hastened to the side of the ship, and a life-preserver was thrown overboard, but Coffey was not seen again. From the fact that some tins of cigarettes were seen

H. E. Jensen. *P. J. Coffey.*

in the water near the gangway it is surmised that in stepping down the gangway the operator accidentally slipped and so lost his life.

Unfortunately the hand of death has been busy among operators lately, and has carried off two members of the staff of the Société Anonyme Internationale de Télégraphie sans Fil, of Brussels; H. E. Jensen, of Aalborg, Denmark, who died at sea on board the s.s. *United States* after being operated upon for appendicitis, and R. T. Jenssen. The first named was still in his teens, and had been only twelve days in the Company's service. Jenssen was assistant operator on the s.s. *Kristianiafjord*, and he died at the Norwegian Hospital, New York, on June 15th. He joined the S.A.I.T. in May, 1912, and had seen service on Dutch, Austrian, Portuguese, and Norwegian ships. His work and character were highly appreciated by all with whom he came into contact, and to whom the sad news of his untimely end has come as a great shock.

* * *

We wish to draw attention to the regulations published on another page relating to the enrolment of wireless telegraph operators in the Royal Naval Reserve. British subjects between the ages of 21 and 30 who hold certificates as wireless telegraph operators, and who pass a certain physical standard are eligible for enrolment, which must be for a period of five years with the option of renewing for further service at the end of that period, during which an annual retainer of £10 per annum will be paid. After completing 20 years' service a gratuity of £50 will be granted in lieu of pension. There will be special pay for the men when they undergo their annual training, or when called out for service in the Fleet; the kit will be supplied gratuitously and inducements will be offered to the men to keep it complete and in good condition. The Admiralty's offer is one which should appeal to wireless telegraph operators from many points of view, and we expect a ready response on the part of the latter.

* * *

Of the average Marconi operator we can justly say, as the High Sheriff of Surrey said of the late Jack Phillips: he keeps no ledger account with duty, he draws up no moral balance sheet with its nicely calculated less or more. This is a truth which is brought home to us by an incident on board the s.s. *San Valerio*, in which the Marconi operator, Mr. W. B. Goodsell, figured with no small credit to himself. While the vessel was lying at Tuxpan loading oil for Galveston, water was noticed in the fore peak. As this could not be pumped out several members of the ship's company proceeded to the peak and unscrewed the manhole door with a view of ascertaining whether the strum-box was clear. All who descended the hole were unfortunately overcome by asphyxiation. A smoke-helmet was procured and Mr. Goodsell courageously descended the peak with the smoke helmet over his head. But those in charge of life lines were not satisfied as to his safety and they hauled him up. On reaching the surface again he said that he had tried to sling one of the bodies but had found it too much for him. A fireman named Hyde then took his place and slung all the bodies, which were brought up to the surface in a remarkably short time before Hyde himself appeared. By that time medical aid was at hand, but the efforts to bring the victims back to life proved unavailing, and their bodies were solemnly laid to rest the following morning. Of the dead, all that we need to say is that each man laid down his life in the heroic though vain attempt to save the life of a comrade, and their heroism makes the greater appeal to our admiration when we remember that they descended to an almost certain death without waiting to don the smoke helmet.

Contract News

Orders have been received to equip the following vessels with Marconi Apparatus:—

Name.	Owners.	Installation.
N.W. Miller	Norfolk and North American S.S. Co., Ltd.	1½ kw. and emergency
S.W. Miller	" " " "	" "
Dominion Miller	" " " "	" "
Obnasei	Elder Dempster Line	" "
Campanella	The Uranium Steamship Co., Ltd.	" "
Uranium	" "	" "
Principella	" "	" "
Herschel	Lamport and Holt, Ltd.	" "
Holbein	" "	" "
Euripides	G. Thompson & Co., Ltd.	" "
Glengyle	The Glen Line	" "
Gleniffer	" "	" "
Glenlogan	" "	" "
Mapacho	Cia Sud Americana de Vapores	" "
Maipo	" "	" "
Cachapoal	" "	" "
Lebu	" "	" "
Tena	" "	" "
Maniatee	Messrs. Elders and Fyffes, Ltd.	½ kw. and emergency.
Manzanares	" " "	" "
Tortuguera	" " "	" "
Miami	" " "	" "
Barranca	" " "	" "
Aracataca	" " "	" "
Chirripo	" " "	" "
Matina	" " "	" "
Nicoya	" " "	" "
Pacuare	" " "	" "
Reventazon	" " "	" "
Gent	" " "	" "
Changuinola	" " "	1½ kw. and emergency.
Motagua	" " "	" "
Carmarthenshire	Royal Mail Steam Packet Line	" "
Pembrokeshire	" " "	" "

The following Vessels have been fitted with Marconi Apparatus since the last issue of the "Wireless World."

Name.	Owners.	Installation.	Call Letters.
North Star	Mr. Vanderbilt	2 kw. and emergency	KYZ
Erin	Sir Thomas Lipton	1½ kw. and emergency	MUC
Socotra	Peninsular and Orient Line	" "	MSJ
Mount Temple	Canadian Pacific Railway	" " (refit)	MLQ
Wayfarer	Harrison Line	" "	GCI
Crown of Seville	Prentice Service and Henderson	" "	MTL
Rakaia	New Zealand Shipping Co., Ltd.	" "	MRO
San Nazario	The Eagle Oil Transport Co.	" "	MUH
Ormara	British India Steam Navigation Co., Ltd.	" "	MVD
City of Athens	The Ellerman City Line	" "	MVB
Para Lightship	The Brazilian Government	½ kw. set	—
City of Madrid	Ellerman and Bucknall Line.	½ kw. and emergency	MTM
Suicanee	Anglo-American Oil Co., Ltd.	" "	MIY
Potomac	" "	" " (refit)	GLQ
Sayonara	A. I. Drexell, Esq.	" "	MUG

The Marconi Wireless Telegraph Company of Canada have received orders to install wireless on three vessels—the S.S. *Sharon*, *Sheba*, and *Durley Chine*—which have been chartered by the Railway and Canals Department of the Dominion Government for service in Hudson Bay. They will be fitted at Halifax with 1.7 kw. sets.

Two wireless schools have during last month been fitted with 1½ kw. apparatus for experiment purposes, the one is the Birmingham Wireless School and the other the Belfast Wireless Training College.

PARLIAMENTARY DIARY

House of Commons, July 16th.

Merchant Shipping Bill.

Mr. John Burns informed Sir Henry Norman on July 6th that the Board of Trade, in consultation with the representatives of the shipowners, have for some time been negotiating with the Marconi Company with a view to an agreement which, in the event of the Merchant Shipping Convention Bill becoming law, will ensure that the shipowners who, under that measure, will be required to have their ships fitted with wireless installations will be able to obtain this service on reasonable terms. The agreement, which is nearing completion, will not, of course, impose on shipowners any obligation whatever to obtain their installation from this particular company. When the agreement is completed he proposes to lay it before Parliament.

* * *

In Committee.

The Committee stage of the Merchant Shipping Bill was reached on July 14th. Clause 5 provides that vessels receiving wireless distress calls shall proceed with all speed to the assistance of the persons in distress, unless they are informed from the ship in distress their assistance is not required, or it is "impracticable, unreasonable, or unnecessary in the special circumstances of the case" to proceed to render assistance.

Mr. Holt moved an amendment providing that any ship proceeding to the assistance of another vessel in compliance with this provision should be entitled to receive from the owners of the other vessel payment of all expenses incurred, including loss of time. He contended that otherwise there would be great danger of vessels calling other vessels for trivial purposes.

Mr. Burns said that till wireless was better known, till it was more generally adopted, till they had got a body of practice by means of which captains and others on the sea could have some guidance, it would be unwise to arrest in any way, for material reasons, the noble humanitarian impulse that had surrounded the introduction of wireless for the rescue of people in distress. He pointed out that the International Salvage Convention, held in Brussels in 1910, came to the decision, "No rescue, no pay." That was a wise decision, and he took a similar view in this case.

Mr. Holt withdrew the amendment.

* * *

Imperial Wireless Scheme.

Several questions were put to the Postmaster-General in the House of Commons during the early part of July with regard to the Imperial wireless telegraph scheme. The information elicited from Mr. Hobhouse was that several of the masts of the United Kingdom installation have been erected, and a considerable amount of material has been sent out to Egypt. Material is also on the point of being sent out to East Africa, India, and Singapore. The Post Office, however, was not at present in a position to undertake the work of erecting the three remaining stations.

The question was again raised on July 16th, when the Postmaster-General was asked whether he had read a statement of the directors of Marconi's Wireless Telegraph Company that the slow progress the company had been permitted to make seriously prejudiced their interests. Mr. Hobhouse admitted that delay had occurred in proceeding with the construction of the Imperial wireless stations through difficulties which could not be foreseen, but some further delay had been caused by proposals submitted by the company for an improvement in the working arrangements. These proposals, which had been made for the purpose of increasing the efficiency of the installations, had to be carefully examined, and this had occupied an appreciable time. The chief difficulties now, however, had been removed or were on the point of solution. The arrangement for establishing direct communication between Egypt and India which was explained to the House on March 2nd necessitated some delay in connection with the acquisition of fresh sites in Egypt and India. The new sites for the Indian station had not as yet been formally accepted by the company. Work had been proceeding for some time on the construction of the masts for the English station, and the construction of the foundations for masts of the Egyptian station was about to be commenced.

Practical Hints for Amateurs.

The Use of Trees for Aerial Masts.

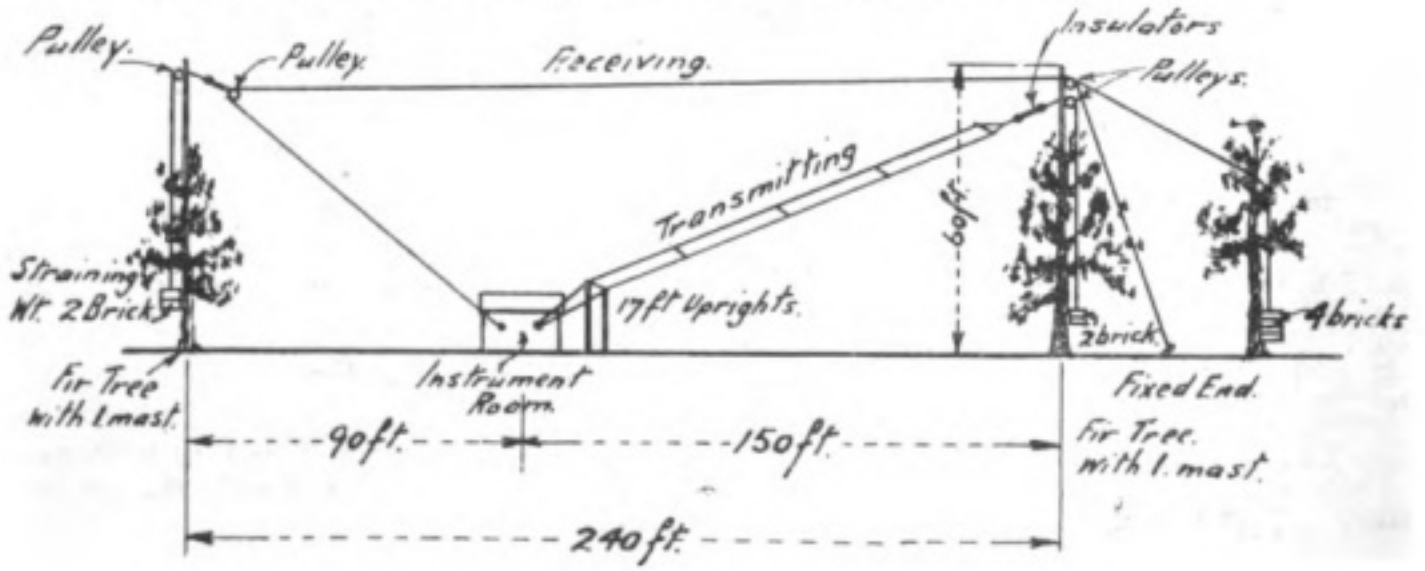
By SIR HANBURY BROWN.

THE use of poles fastened to trees, to serve as masts for a wireless aerial, may possibly not be uncommon among amateurs and those who operate with portable apparatus in the field. A description, therefore, of the arrangements which experience in breakdowns has taught me to adopt may be of service to others.

As high up the trunks of two fir trees as was possible I fixed ladder poles, 30 feet long, thus obtaining masts 60 feet high and 240 feet apart. The hoisting and fixing the masts up the trees was effected without difficulty by means of a couple of pulleys and a rope. It was a simple sapper's job. But the masts, when fixed, swayed with the tree tops in high winds to such an extent that the aerial wire, being of insufficient strength to stand the strain frequently broke, especially at the down-leads, in consequence of the alternate slackening and straining to which they were subjected whenever there was a high wind. To obviate this to some extent, the tree tops were stayed by iron wires to neighbouring tree trunks as far as possible, and a stronger wire was substituted for the original aerial, these being the obvious measures to take. But the storms of last winter being unusually severe, the force of the wind acting on the tree-tops impressed itself upon me, and I considered means of limiting the maximum strain to which the aerial wire could be subjected.

I decided not to fasten the halyards at the foot of both trees, but to fix only one of them and to fasten to the other a straining weight, so that the strain on the wire should never exceed that due to the straining weight *plus* friction, nor be less than the same weight *minus* friction. I also found it desirable to adopt this system for the stay from the top of one of the poles.

I have now two aerials—a single wire aerial for receiving, a double one for transmitting. The stay from the top of the pole opposes the strain produced by the two aerials. The straining weight of each aerial consists of a box with two bricks in it. The pole stay weight consists of a box with four bricks in it. The friction of the pulleys and of the halyards against the boughs that they touch prevents any unnecessary easing of the strain for *slight* swaying in every light breeze. The arrangement is as in the sketch herewith. The two aerials being in the same vertical plane with one another is, I know, a defective arrangement. Some day I may arrange for the transmitting aerial to have a mast of its own so placed that the transmitting wire may be set at right angles to the receiving aerial.



THE AMATEUR HANDYMAN.

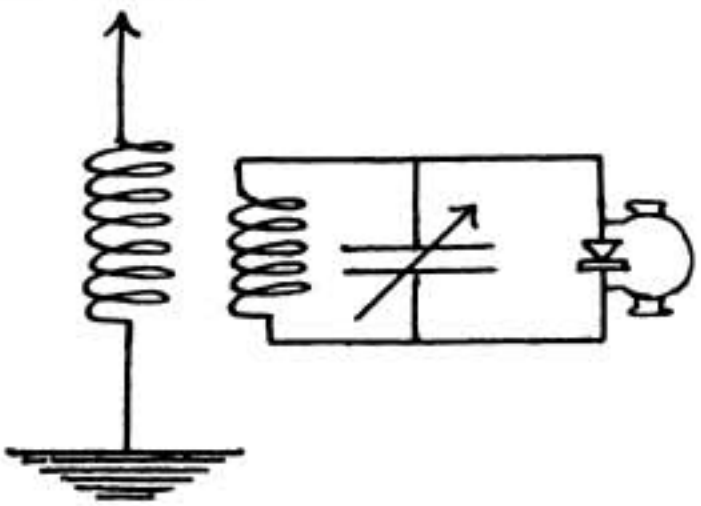
A Receiving Station.

By "RADIO"

THE aerial of my experimental receiving station is of the inverted L type, and consists of one No. 20 S.W.G. phosphor bronze wire, 350 ft. long and at an average height of 70 ft.

The receiving apparatus consists of an inductively coupled "jigger," secondary variable condenser, crystal detector and telephone. The primary of the "jigger" consists of 500 turns of No. 20 S.W.G. D.C.C. wire, wound on a cardboard tube 4 in. in diameter and well coated with shellac, contact being made by means of a slider on the bared portion of the wire. The secondary is 100 turns of the same gauge wire on a tube 3 in. in diameter. The secondary variable condenser is of the sliding type, consisting of zinc plates with whole-plate negative glass as the dielectric. A large number of detectors have been experimented with, but the type finally adopted is a silicon crystal with a blunt copper point lightly resting on it. This detector, used in conjunction with a double head telephone of 4,000Ω resistance, is extremely sensitive, but requires very careful adjustment.

The accompanying diagram shows the connections:



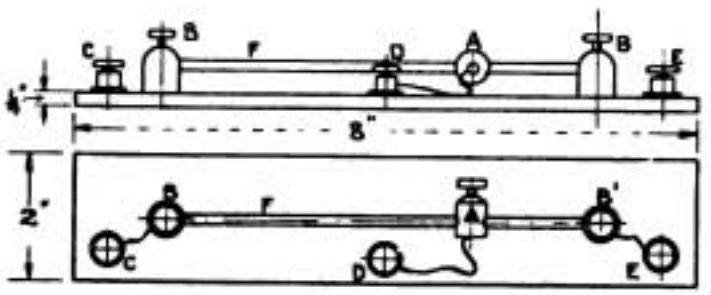
With this apparatus good results have been obtained: Paris, Norddeich, Poldhu, and Cleethorpes being exceptionally loud and clear, whilst numbers of ship stations and other stations as yet unidentified are heard every day. However, I think even better results could be obtained if a larger "jigger" secondary were used, so that only a small capacity would be necessary to put the secondary circuit in tune with the long wave stations, and a new "jigger" has already been designed embodying this feature, and also having one end of the secondary well away from the earthed primary.

How to make a Potentiometer.

By E. H. GARDNER.

MY experience with the potentiometer which I have just made prompts me to describe it in the WIRELESS WORLD for the benefit of those amateurs who have hitherto been denied, either by cost or difficulty of construction, the use of a potentiometer and cells.

The potentiometer described here is intended primarily for detectors, such as tellerium-zincite, bornite-zincite, and should be used in conjunction with a weak, dry or léclanché cell.



In the accompanying illustration, F is the graphite taken from an ordinary lead pencil and is held by the terminals BB of the "push in" variety. A is a third terminal of similar type with the wood screw removed. The graphite is passed through the hole in this terminal and the screw adjusted until it slides easily along it. C, D and E are three terminals. B is connected to C, and B′ to E. A is connected to D by means of a piece of gauge 34 to 40 copper wire, one end being soldered to the bottom of A. C and E then form the battery terminals, and D the variable. The graphite is obtained by soaking a lead pencil in boiling water for a few minutes; it will then come out easily. The terminals are screwed into a piece of wood measuring about 8 in. by 2 in. by ¼ in. The graphite must be scraped to make good contact with A.

I have found no difficulty in making this potentiometer at very little cost, and it has worked well.

Among the Wireless Societies

Birmingham. — *An Amalgamation.*— Arrangements have been completed for the amalgamation of the Birmingham Wireless Association with the Scientific Society of the Birmingham and Midland Institute. The subscription will date from October in each year and will be 10s. 6d. This amount includes full membership also of the Scientific Society—*i.e.*, the use of their rooms, scientific apparatus, photographic dark-room, workshop, etc., also admission to all lectures. An aerial has already been erected and the transmitting and receiving apparatus will be considerably augmented. A list of all members who are definitely known as willing to join under the new arrangement has been sent to the Midland Institute, so that membership cards can be issued. Members who are in doubt as to whether they have been included should consult the list at Mr. Beresford's, and if they have been omitted, notify him or the Secretary of the Wireless Association. The first official meeting of the joint societies will probably be held the first week in October, a further notice of which will be duly given.

* * *

Denstone College.—We are glad to welcome the club which has been formed among the students and masters of this college, which is known as the "Denstone College Wireless Club." The Club has its headquarters at Rochester, North Staffs, and membership is restricted to students at the College and masters, the control being in the hands of a committee consisting of four senior boys and the Head of the School Science Department. Every day, from 6 p.m. to 10 p.m., a member is in charge of the station, which is for receiving only, but it is hoped before very long to fit a transmitting station. The Hon. Secretary of the Club is Mr. S. G. Fillingham.

* * *

Derby.—*Visit to Sheffield.*—On the invitation of Mr. A. W. Ward, several members of the Derby Wireless Club journeyed to Sheffield on June 27th to inspect his experimental wireless station. Mr. Johnson's neat and compact station was first inspected, at which the signals even in daytime were quite loud and distinct. Mr. Johnson showed a compact pocket set, all contained in a small ebonite tube 1½ in. in diameter and 4 in. long. It will bring in Clifden's long wave as well as short wave stations. The set comprises a tuning coil, potentiometer, condenser, and detector and gave as loud signals as the larger set (all ebonite insulated) which Mr. Johnson has as his permanent station, but the little tuning coil is wound in a special manner, making use of variometer effects. A 4 in. coil, with special break, working from 12 volt accumulator, is employed for transmitting, and signals were interchanged with several local stations, a break-in system being employed by means of a special key. Mr. Johnson's "power station" attracted special attention, being constructed on the side of some steps, the last place one would think of looking for it.

The party then proceeded to Mr. Ward's station, where the first item of interest was the battleship mast, 126 ft. high, from which the aerial is suspended. The erection of the mast was not devoid of exciting incidents, and several greenhouses narrowly escaped total destruction, by the mast falling through a guy wire breaking.

Mr. Ward's instruments are all well made and his transmitting apparatus is particularly efficient. It consists of a transformer worked from the mains, a rotary gap, large oil condenser, and jigger. The key is provided with large silver contacts and an oil break. Mr. Ward's receiving range is an extensive one and Pola happened to be working vigorously while the visitors were listening in. Cleethorpes 10 p.m. weather report was overpoweringly loud and portions of it were read at a distance of 18 ft., the 'phones being laid on the table, and no magnifying devices being employed. A "Bassano" and another perikon detector were used in turn. A break-in system is not employed, but one movement of the change-over switch changes from transmitting to receiving, and at the same time

stops or starts the rotary gap. The same switch operates a Morse sounder, which has been adapted to cut out the detector when sending, which it does most effectively, all ill-effects on the detector while transmitting being avoided.

The address of the Derby Wireless Club has been changed from 47 Full Street to the Mechanics Institution.

* * *

Liverpool.—A meeting of the Liverpool Wireless Association was held on July 9th, when the subject under discussion was "Crystal Detectors" introduced by Mr. J. Bolton, who gave the results of some tests he had had made recently with various crystals, including tellurium. A member reported that he was obtaining excellent results from home-made variable condensers, consisting of two empty "tins," one sliding inside the other, each tin being previously dipped in insulating varnish, a wire being simply soldered to each tin for the connections. The question of the design of indoor aerials was also under consideration, and good results reported.

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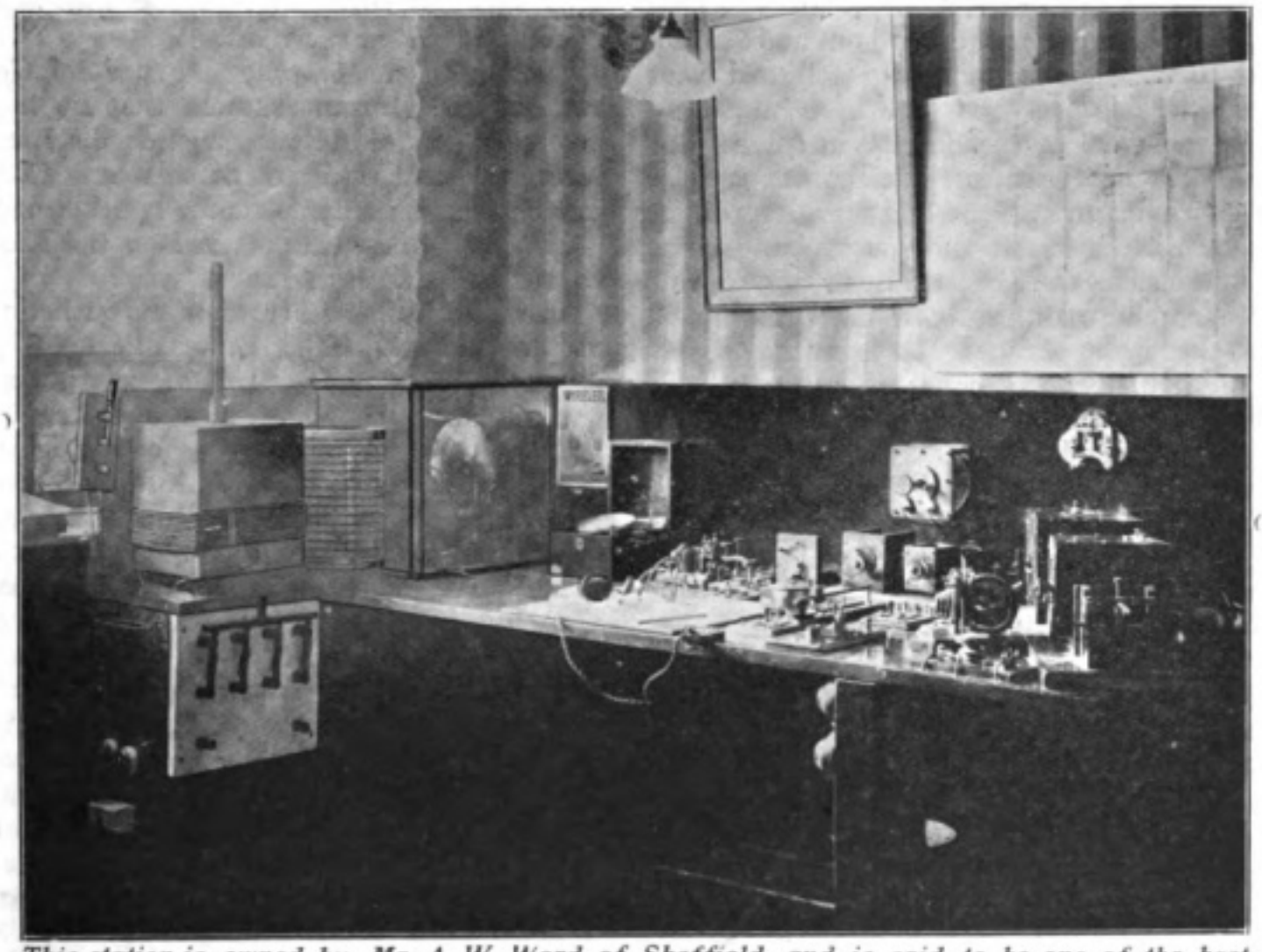
Newcastle-on-Tyne. — *Coupling and Syntony.*—Mr. A. W. Bridges delivered an interesting lecture on "Accumulators," at a recent meeting of the Newcastle and District Wireless Association, and at another meeting Mr. C. M. Denny dealt with the subject of "Coupling and Syntony." Taking as an analogy two pendulums suspended by a string and by frequent use of the blackboard his hearers had no difficulty in following his treatment of the subject. Later in the evening Mr. Denny also dealt with "Magnetism and Electricity" from an elementary standpoint for the benefit of the younger members of the Association.



This station is owned by Mr. A. W. Ward, of Sheffield, and is said to be one of the best equipped private stations in this country. The photograph was taken on the occasion of the visit of the members of the Derby Wireless Club. The familiar cover of the "Wireless World" is seen at the left of the operating table and the Wireless Map of the World is on the wall.

Newport.—*Coupling.*—At a meeting of the Newport and District Wireless Society, held recently, the aerial at Mr. T. K. Jenkin's station was temporarily led into the Garn School Room, and demonstrations were given of the efficiency of various types of coils, from which it was gathered that the loose coupling of the "cheese box" type gave far better results in distinctness of signals and sharper tuning than the other types experimented with. Coils wound by Messrs. Taylor, of Cardiff, Bufton of Llandrindod, and Bailey of Newport, gave good results in the order named. It was held from the experiments carried out and the discussion which subsequently followed that considerable progress had been made by the members of the Society in solving the problem of the most efficient coupler for use in amateur stations, and there is no doubt that as the result of this meeting some valuable ideas will be put into practice during the coming months, both in portable and stationary apparatus. It is interesting to note that the Garn School, where the meeting was held, is 1,200 feet above sea level, and no doubt the excellence of the results obtained was due in a large measure to this fact.

A visit was paid to the South Wales Wireless College on June 27th, at the invitation of Mr. J. R. Schofield, when the members inspected the apparatus installed there and listened to a lecture on Wireless telegraphy by the College instructor, Mr. H. E. Wright.

* * *

North Middlesex.—At a meeting of the North Middlesex Wireless Club held on July 6th, the chairman, Mr. R. J. Durrant, gave an interesting paper entitled "Leaves from an Amateur's Note-Book." In the early days, when amateur stations were few and far between, such a thing as jamming was unknown.

He had tried various kinds of detectors and found silicon and brass to be as good as any. At one time he had experimented with kite aerials, but although the results were good, this form of aerial was undoubtedly more trouble than it was worth.

He described how one night he and several other enthusiasts made their way to the top of Parliament Hill with 700 feet of 22 S.W.G. enamelled wire on a reel, and a large box-kite. They were eyed suspiciously by a policeman, but owing to the late hour were spared the attention of a curious crowd. After some time they had 700 feet of wire up and some severe shocks were felt on catching hold of the wire. The long wave stations were very loud, Norddeich particularly fairly shrieked in the 'phones. It was then decided to wind in some of the wire, and when some 200 feet were hauled in there was a sudden "click" and 500 feet of copper wire and a perfectly good box-kite disappeared in the darkness! This was not surprising, as the wire was much too thin for the work.

Coming to the transmitting part of the station, Mr. Durrant showed that he had got very good results as regards distance, having transmitted to St. Albans from Cricklewood on a large motor ignition coil.

Mr. F. Hilton next lectured on the Marconi ships 1½ k.w. set.

The Club held another successful gathering at Shaftesbury Hall, Bowes Park. The president, Mr. A. G. Arthur, was in the chair, and in opening the meeting remarked that he was gratified at the good progress the club had made since its inception, but that he would not be satisfied until the club numbered at least 100 members. He also mentioned that, being a young club, they were being watched, and their doings criticised, by the older clubs in the wireless world, and so he urged all members to at all times endeavour to uphold the dignity of the club, and when conducting their operations and experiments one with the other to use every precaution against interfering with other experimenters, and to act at all times as became members of the North Middlesex Wireless Club.

The Hon. Secretary of the club is Mr. E. M. Savage, Nithsdale, Eversley Park Road, Winchmore Hill, London.

* * *

Nottingham.—At a recent meeting of the Nottingham and District Wireless Society it was reported that permission had been obtained for the society to erect an aerial on the Mechanics Hall, Nottingham. The strength of the society is gradually growing, and all local amateurs who are not already members should communicate with Mr. J. H. Gill, 16 Premier Road, Gregory Boulevard, Nottingham.

QUESTIONS AND ANSWERS

Readers are invited to send questions on technical and general problems that arise in the course of their work or in their study to Mr. H. Dobell, 21 Maltese Road, Chelmsford. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered.

A. C. (Christiania).—If you will send us your full address we shall be pleased to send you a reply by post: your letter is too long to be answered in these columns.

J. G. C. (Leeds).—How can I make a telephone transformer for using low-resistance 'phones on a high-resistance combination detector (Zincite, Bornite)

Answer.—Buy a second-hand ignition coil such as is used for motors; the condition of the make-and-break does not matter, as this would be short-circuited, and even if the coil is broken down (so far as its ordinary use is concerned) the insulation may be quite good enough for use as a telephone transformer. You would, of course, use the thick-wire winding in your telephone-circuit, and the thin-wire secondary winding in the crystal circuit.

M. W. M. (Wandsworth).—Is there any technical reason for the micrometer gap on the multiple tuner having a left-hand thread?

Answer.—It is a common practice among instrument makers to make the thread of a fine adjustment left-handed. It is partly with the idea of making it "fool-proof." That is to say, if an unauthorised or careless person attacks such an adjustment, he will probably try to unscrew the lock-nut, with the result that it would "jam" more tightly, and the adjustment would remain unaltered. In any case, it "makes him think," and he is brought to realise that the adjustment is a fine one and an important one—for instance, in the micrometer gap, if the gap is accidentally shorted, important signals might be entirely missed.

A. L. (Canterbury).—I have three aerials, one pointing north, another east, and the third west; each are 85 ft. high and brought to one pole at the highest end, and about 200 ft. span. Each aerial, although about the same length, has a slightly different wave-length, but when all three are connected to the tuner much less inductance is required, and the signals are much louder than with each aerial separately. Would I get still louder signals if I made the capacity of each aerial exactly the same by more or less wire in air, or by small inductance on two of the aerials to make all three equal? Which is the better method?

Answer.—We recommend you to adjust the aerials themselves so that they all have the same wave-length, though if as they stand they do not differ by more than a very little, the improvement will not be marked. Naturally you get better signals and tune with less inductance when you join them all together, for you are adding greatly to the capacity of the aerial and reducing its inductance, so that the addition of a fixed amount of tuning inductance has a much greater effect on the wave-length. See numerous recent answers.

O. I. X. wants to know how he can arrange so that while transmitting (with the telephones on his head) he can listen to his signals as they leave his aerial, so as to be able to tell whether the note is clear and the signal steady and strong. He refers particularly to a ship-installation.

Answer.—We think it would be easy for him to rig up a little circuit (using, say, photo-negative plates as condenser) tuned to somewhere between the 600 and the 300 metre waves, so as to be about equally well in tune with whichever wave he was transmitting on, and to put a carborundum crystal across the condenser with a change-over switch, by which the telephones could be put in series with the crystal while he is sending. On the other hand, we fear he would be likely to get into trouble with the authorities if he did so, because one of the advantages of the "earth-arrester gap" is that the operator can be listening all the time for the other man to break in, whereas if the telephones were switched on to the circuit, as suggested, this would be impossible.

D. G. N. (Broughty Ferry).—(1) With an aerial 30 ft. high and 45 ft. long (twin wires) would I be able to receive up to 500 miles? (2) Do neighbouring trees seriously affect the aerial if they do not actually touch? (3) I propose having two leading-in wires coming perpendicularly from the aerial and joining each other at the foot of the mast. Will this be satisfactory? (4) Is a Post Office license necessary for a receiving set only?

Answers.—(1) All depends on the power of the station which is at 500 miles: or, rather, not "all," since much depends on your circuits, your detector, and your skill. It is wonderful what can be done with a tiny aerial if the most is made of it. We have received good signals from Canada on an aerial no bigger than the one you propose: we do not think you will do this, but you might certainly get your 500 miles. On the other hand, we strongly advise you to increase both height and length of your aerial if possible: things are made much easier by doing this, and it cannot fail to increase your range.

(2) Trees are apt to have a serious absorbing effect, especially at a time when they are full of sap.

(3) We are inclined to advise you to lead-in by the two wires from the *far* end of the aerial, so that the leading-in wires slope away from the mast and are longer than they would be if taken perpendicularly down.

(4) Certainly.

"Ion" (Devonport) has only known THE WIRELESS WORLD since last April, and on trying to get back numbers containing the Instructional Articles has failed to do so. He should write to the publishers at Marconi House, Strand, London, W.C., or he can buy the "Elementary Principles," which are an enlarged and revised form of the articles from the same source.

He wants to know: Using silicon-platinum detector, need he use a battery and potentiometer? No. Will a lamp-glass coated with tinfoil outside, with a sliding wooden plug coated with tinfoil, do for the variable condenser across secondary of jigger? Yes, if of the proper size: he can calculate the capacity roughly by the usual formula (see answer to C. F., in May, 1914, number), and likewise the inductance of his secondary (see answer to H. E. A., in same number), and then see if these combined give somewhere about the wave-lengths he wants to receive. Also, he wants to know if a dozen old quarter-plates interleaved with tinfoil will do for a blocking-condenser (which is really the telephone condenser). He had better arrange plugs so that he can put in 4, 8, or 12 plates as desired. He can get a 60-ft. aerial, 25 ft. high, and wants to know gauge of wire and how many wires; 3/22 stranded silicon-bronze would be good, or single No. 16 or 18 copper would do, but would not be nearly so strong. As he wants to get long-wave stations, he had better make it a 4-wire aerial.

V. H. K. (South Africa) gets ships over 1,000 miles off at times, and consistently gets them over 500 miles off, so it is evident that his apparatus is in working order. It is

connected up as in Fig. 69 of the "Elementary Principles." His one trouble is "atmospherics," and we fear they are likely to remain so—for they are always bad in hot climates. From his description, we gather that he has a series condenser in the aerial-circuit (as shown in the diagram mentioned), but on the other hand he says, "I use two variable condensers in parallel with primary and secondary": so we do not quite know which arrangement he has got. If he has got a series condenser, he should shunt this direct to earth by a long highly-inductive shunt, so as to keep his aerial discharged. He should go in for very accurate tuning, and use very loose coupling between primary and secondary. The "balancing" methods of which he has heard are hardly suitable for amateur use, but he might try one of them, consisting of two carborundum crystals connected in parallel, but in "opposition," so that if the atmospheric comes through both of them, it will produce much less noise in the telephones than it would ordinarily. But V. H. K. must understand the action of carborundum thoroughly before he tries this: he should read the "Elementary Principles" and also our reply to E. N. E. in the May, 1914, number. See also reply to R. S. W. in this present number.

L. H. (Chester) has a double-slide tuning coil 12 in. by 4½ in. of No. 24 wire, a silicon-gold detector, 1,500 ohm telephones, a good earth connection, various condensers, and an aerial about 35 ft. high: but as yet he has not even heard Paris. He suggests it is partly the fault of his aerial, which "comes back on itself" and goes to instruments only 8 ft. below the "free end," so that the two parts, go and return, are quite close to each other. This certainly is very bad, and L. H. should change it at once. If he wants to keep the instruments where they are, we advise him to lead in from the end above them, even though it makes the total length of aerial much smaller. But even with his present aerial we cannot help thinking there is something wrong somewhere else, if he cannot get Paris at all; for even if his aerial is inefficient, his tuning-coil is plenty for the purpose, and a properly tuned circuit will give Paris on a few feet of stair-rod. We suspect his detector and his connections—he gives us no clue as to the latter. Or—is he sure that his telephones are in working order? But the odds are that it is the silicon at fault. Answers to his other questions:—leave all the wires quite separate all the way (free end and all), till they join to lead in; don't worry about indoor aerial until you have got results with the outdoor; with the indoor aerial it would certainly improve signals to extend out of doors to opposite house; you might lead in about centre—at your instruments, say.

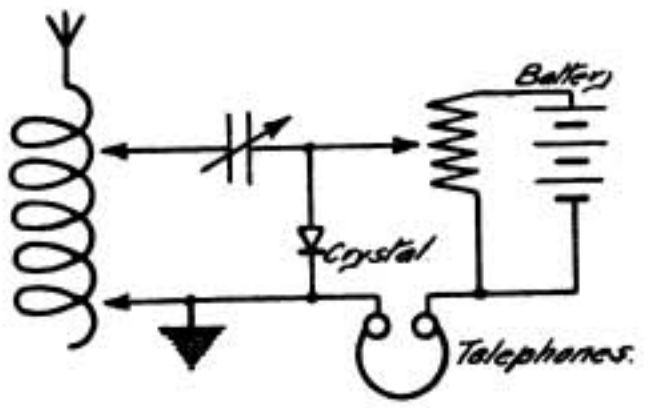
F. L. (Chipping Norton).—(1) I have made an oscillation transformer as described by Mr. A. L. Megson on page 104 of THE WIRELESS WORLD, but I do not get strong signals with it and fail to get the four-volt lamp to light up when placed in earth or aerial lead. The lamp burns brightly when in the primary. (2) I hear a station working every night at 8 to 8.20, and another with a very high note at 8.45 p.m. Can you tell me what stations they are?

Answers.—(1) The fact that your tuning-lamp fails to glow at all when in the earth-lead is an indication that your primary circuit is not properly in tune with your aerial-jigger-secondary-earth circuit. The fact that it glows brightly when put in the primary circuit is no indication of anything of interest, except that the lamp is in good order. The earth-lead is the correct place for it, since when you are in tune it is here that the greatest current flows.

(2) Quite impossible to say who these stations may be; why do you not know their call-letters and look them up in the "Year Book"? Perhaps you get them, and no others, because they happen to be very near or very powerful, and your receiving apparatus and aerials are only good enough for very strong signals. On the other hand, it may be that these are the only two stations which are sending on waves suitable in length to be tuned to by your apparatus. What about that iron building which you mentioned, and which we referred to in a previous number? Have you taken care that your aerial is not running too near metal-work?

C. F. has a two-wire aerial, 30 ft. high 20 ft. long, 6 ft. apart, of No. 14 bare copper wire, a carborundum detector with battery and potentiometer, telephones of 2,000 ohms resistance, a tuning-inductance on hardwood tube, 7 in. long, 3 in. diam., wound with No. 22, and a variable condenser of three movable and four fixed plates (copper) separated by glass. He asks us if his outfit is all right, and gives the following diagram of connections.

We have no fault to find with the aerial, or the detector,



or the telephones: he does not say the size of his condenser plates, so we cannot give an opinion as to what use it will be: his tuning inductance is too small to give him the long-wave stations, and the hardwood cylinder should be soaked in paraffin-wax. But most important of all, where did C. F. ever see us recommend a diagram of connections such as he gives? Or where can he find it recommended in, say, the "Elementary Principles?" If he looks at Fig. 66 of the latter, he will find a diagram somewhat like it (only a little worse), and he will see that its badness is explained just below it, and the good connections shown and explained.

J. C.—We have no time to work out your various problems: but we can give you some hints, with pleasure. In the first place, your telephones, of 250 ohms each, are enough to account for your comparative failure. You must either get a pair of high-resistance telephones specially designed—diaphragm and all—for crystal working, or you must use some kind of induction-coil (a motor-car ignition-coil would do) as a telephone-transformer for your low-resistance telephones. Now, as to tuning and your circuits generally. Your best plan to begin with is to adopt the connections shown in Fig. 6 of the article you refer to (Mr. Gantley's, in March, 1914, number) until you have managed to get various distant stations: then you can go on to more complicated circuits. The first thing you should do is to get your Paris signals and find out where he tunes on your coil. If his signals are so strong that it is difficult to say where the tuning-point is, you can shunt your telephones with a variable resistance, so as to weaken signals till you can only just hear them—then you will be able to see how they change as you alter the tuning. You must not expect to get sharp tuning from Paris, especially as he is so near: but still, these results will show you about how you stand with regard to the amount of aerial-tuning inductance—you will know that for other stations of the same wave-length you will require the same inductance, and so on. If you find Paris gets stronger and stronger as you put more and more of your 12 in. inductance in the aerial-earth circuit, then change to your 20 in. inductance. For the longest-wave stations you may even require to put both inductances in series. M. Corret is quite correct in saying that the use of a "loading coil" in a two-circuit receiver "loosens the coupling": you will see what he means if you read our answer to H. C., in the April, 1914, number. It is also true that a variable condenser "across the sliders of a two-slider inductance" has a somewhat similar effect

we do not recommend it, except when it is impossible to get enough inductance to tune the aerial-circuit without it, and even then we warn our readers that the arrangement is only a makeshift.

J. K. H. sends us particulars of his receiving station His apparatus seems quite well designed and well-connected —comprising a receiving jigger with a change-over switch in the aerial-circuit to put the aerial-tuning condenser either in series—to shorten the wave-length—or in parallel to lengthen it.

He asks us to estimate the wave-length which he may hope to tune to with his arrangement: the most important point is the range of the jigger-secondary, and here although he gives the condenser-value (maximum of ·002) he gives only the actual length of the secondary wire—130 ft. of No. 26. Now, unluckily, the inductance of this will vary greatly according to the size of the former on which it is wound, and he gives no indication as to what this may be. We advise him to work out the inductance by one of the usual formulæ, and then combining this with his known value of capacity, he can calculate the approximate maximum wave-length. He asks how the calculations are arrived at for putting condensers in series and parallel. This is a complicated matter, and in the first place it is pretty well certain that J. K. H. does not know what the capacity of his aerial itself is, and as the whole matter depends on this, we think he will have to depend on practical results.

His last question is why the coherer has fallen out of general use. This is because it is far less sensitive than modern receivers, and requires more expert adjustment: also, it is not well adapted to "sharp tuning" and does not work well on the modern highly-persistent waves: also, it cannot distinguish—as the human ear can—between atmospherics and the musical note of modern signals. Its one advantage is that it easily works a recording apparatus such as an Inker (of course, through a relay), whereas the various crystal and valve and magnetic detectors have to be helped by particularly sensitive relays before they can do this.

L. D. (Nice).—(1) What is the name of the station which sends in English almost every day at 11 a.m. a number of letters and figures followed by news? (2) With the receiving sets shown in Figs. 1 and 2, why do I always get the best signals in (1) with the largest possible capacity (with m.f. 0·04), and in (2) with the smallest capacity? (3) How can I get Clifden?

Answers.—(1) It is contrary to our custom to give this kind of information, for in many cases this might involve a breach of confidence, and we must make a definite rule. (2) In Fig. 2 you have the orthodox "jigger" connections, giving you a secondary circuit which is a closed oscillatory circuit with a variable inductance and a variable capacity:

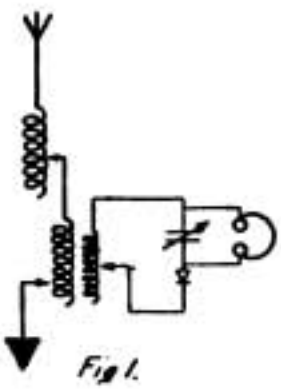


Fig. 1.

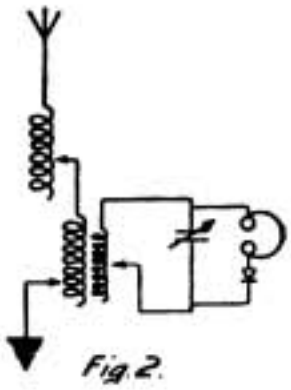


Fig. 2.

the crystal detector (in series with telephones) being merely shunted across the condenser. Thus the condenser, in this case, is part of your oscillatory circuit. Now, for a given amount of energy at your disposal, the smaller this condenser is the higher will be the voltage to which it is raised by the signals—taking for granted, of course, that as you reduce the condenser you adjust the inductance so as to keep in tune. The higher the voltage produced across your condenser by the signals, the louder will be the sound in the telephones, since the crystal may be looked on as a "potential-operated" detector. That is why a crystal jigger has a large inductance and a small variable condenser. In Fig. 1, on the other hand, you have *no* closed oscillatory circuit, for in series with your condenser you have put the high-resistance crystal, which puts too much resistance in the circuit to allow it to oscillate. Therefore the only true oscillating circuit is the open one formed by the inductance of your secondary coil and its self-capacity; your crystal (in series with telephones) is shunted across this open oscillatory circuit. Your condenser, in this case, becomes really a "telephone condenser" instead of a tuning condenser for your oscillatory circuit, and gives the best results at a value which depends on your telephones and on the spark-frequency of the transmitting station.

W. M. (Finchley).—I was interested in your reply to H. C. in April (*re* coupling), as my experience is exactly the reverse of his. I hear Paris loudly, and other stations, including Norddeich, very faintly, but all with coupling *quite loose* and condenser right out. Tightening the coupling, or putting in more capacity by the condensers, shuts out everything. Where am I wrong? In an article in the November WIRELESS WORLD it is laid down that "The maximum wave-length to which it (secondary) can be tuned will be about 2½ times the value of its minimum wave-length." Does that mean by varying the capacity only, or could a greater range be obtained by tapping? In other words, if I can get Paris with secondary as it is, should I want a separate and smaller one to get down to 600.

Answer.—In the first place, do you really "tune-up" to a station? That is to say, do you ever really get to such an adjustment that *any* alteration—increasing or decreasing a condenser, or increasing or decreasing an inductance—perceptibly weakens signals? If not, no logical advice or explanations apply to the results you get. For instance, you say you get all those stations "with condenser right out." In your sketch you have two condensers, one in parallel with your jigger-primary and one across your jigger-secondary. Presumably you mean that both of these are right out. But if you meant even one only, this would prove that you are not really properly tuned: your first step, instead of bothering about coupling-variations, should be to modify your gear so that you can "get on either side of the tuning-point." Otherwise you cannot be sure that you are not miles out of tune. Next, that plan of having a condenser across the jigger-primary is all very well if you have not enough tuning inductance to reach the required wave; but it is only a *pis aller*: you will get stronger signals if you tune up by adding enough inductance without any condenser. Try this, therefore, and it is quite possible that when you are properly tuned, both primary and secondary, you will find you can tighten your coupling and increase your signals to a certain point. In any case, we do not like the idea of your little 6 in.-long secondary buried right inside a 12 in.-long primary. Where is the "free high-potential end"?

As to your second question, tapping would be no good, for if you read the article in question carefully you will see that the trouble is the self-capacity of the coil, and the unused end of the coil (beyond the tapping-off point) has just as much capacity as if it were in the circuit. If you made a complete break at each tapping, joining up only as the various sections are required, you might get over the difficulty. But it is far best to have a separate and smaller jigger for short waves such as ship-waves; the diameters should be quite small.

HERBER (Dublin) asks why the modern 1½ kw. set, that is, with rotary spark wheel, is not arranged to have a natural

frequency equal to the frequency of supply. Until he read a reply to a question in our June number he was under the impression that the fixed gap 1½ kw. set was arranged so that a spark discharge took place at every half-cycle, viz.: at maximum voltage. He states that he has heard of sets being arranged to give sparks once in every 2½ cycles, but once in four, as mentioned in a previous reply (to G.M. in June), seems to him to be rather startling. "Doesn't Mr. Hawkhead's book tell us discharge takes place at every half-cycle?" he asks.

Answer.—In sets with a fixed spark-gap, such as the one referred to in the reply to G.M., to which you refer, the low-frequency charging circuit is tuned to the frequency of the alternating current. In sets with synchronous disc dischargers, where the number of studs is such as to give a spark at every half-cycle, the same kind of tuning holds good, and if the case you are considering were one of this type your estimate would be about right. But it is not one of this type: it has a spark frequency much in excess of the half-cycle frequency, owing to the large number of studs, and conditions are entirely changed. Tuning is no longer made with the alternating frequency, but with the average spark-frequency: hence the low transformer ratio and the small amount of external inductance. With regard to the second part of your letter, we do not quite see your difficulty; you say, "if the maximum voltage is 14,000, there must be a decent accumulation due to resonance effects at every fourth cycle." We have already said so, by saying that the discharge occurs at the fourth cycle and is produced by 14,000 volts, for it is obvious that, with the d.c. supply at 80 to 100 volts, nothing approaching this value could be obtained without a "decent accumulation due to resonance." Very often the spark is reduced slightly below 4 m/m, in which case, of course, the spark-frequency is higher and less swings are required. We should be glad if you would point out exactly *where* Mr. Hawkhead's book tells us what you say it does.

W. G. B. (Uppingham) recently constructed a jigger, the primary sliding inside the secondary. He describes the windings of these, but is not able to get Paris so well with it as with a double sliding inductance 8 inches long by 6 inches in diameter. He has tried a loading coil without any difference being noticed.

Answer.—It looks to us as if your secondary circuit was out of tune; we should know better if we knew the size of the plates of your condenser and what the dielectric is. You should have no difficulty in finding out the approximate maximum value of such a condenser if you read these columns; see, for instance, our reply to C.F. in the May, 1914 issue.

As a rough estimate, we should put the value of your secondary inductance at somewhere about 30,000 microhenries. Now, with this inductance, to tune to Paris you would only require a total capacity of about '00005. Your variable condenser itself probably has as much capacity as this, even at its minimum—they very rarely go actually to zero—to say nothing of the self-capacity of the coil; so that probably your secondary circuit is tuned to a wave far longer than Paris. You had better try disconnecting your condenser altogether; if this gives Paris stronger, or as strong, you will know that you should make a very much smaller variable condenser—from a glass test tube, for instance. First of all, however, get Paris signals; weaken your coupling till they nearly vanish, and then see if you can "get on both sides of the tuning point" both on primary and secondary. If you cannot, then you can be sure that something of the sort of mis-tuning we suggest is at the bottom of your trouble.

You must remember, though, that even when you are properly tuned you may very likely get signals a little weaker than on a "single-circuit" receiver, which is a very efficient one so far as *strength* of signals is concerned when working on long waves with short aerials (see innumerable past replies). The advantage of the jigger will come in when you want to cut out other stations, and atmospherics.

CAPTAIN H. (Fleetwood) sends us particulars of his amateur transmitting set, and asks how to use the Marconi wavemeter for tuning the set to 200 metres.

Answer.—After reading about his disappointing experience elsewhere, we hardly like to recommend him to buy a particular book when he turns to us for help; but certainly, if he wants to understand the construction and method of use of the wavemeter he had better spend a shilling on Bangay's *Elementary Principles*, which may be obtained from the publishers of this magazine. As for the particular application to his own set, let him proceed as follows:—Disconnect aerial and earth altogether. Get primary circuit connected up as if for working, and spark—not necessarily on full power. Walk about carrying wavemeter, with telephones on your head and a carborundum crystal between the clips, turning condenser backwards and forwards slowly so as to cover complete range of wavelengths. The coil, in the lid of the wavemeter, should be kept in a plane roughly parallel with your jigger-primary. If the wave given out, with primary circuit at its first adjustment, is anywhere on scale of wavemeter, when you get near enough to the primary you will find a noise in the telephones which gets loud at one particular point on condenser and decreases as this point is left. If you hear the noise "all the way round the wavemeter" you can be sure that your primary is giving a wave outside the range of latter, and you must alter the number of turns in the jigger-primary. If you find it tuning on wavemeter, then hold the latter quite still and turn condenser till you know the exact tuning point. To get the exact point you had better walk away from the primary until signals are weak, and then adjust wavemeter—so that you can just hear signals at the right point, but they vanish on either side of the particular condenser reading. Look in the chart and see what this reading corresponds to; if it is more than 200 metres, reduce the number of jigger-primary turns until the new tuning-point is exactly 200 metres. Then you know your primary circuit is tuned. Now for jigger-secondary and aerial. Put aerial on to some turn of jigger-secondary, and spark the other end of latter to earth. Quite a small spark will do, and any rough fixed gap will serve. Meanwhile, arrange your discharger so that your primary circuit doesn't spark across by induction. Listen in wavemeter to wave sent out by aerial—near the earth-lead is a good place to put wavemeter, and adjust turns of jigger-secondary until this wave also is exactly 200 metres. If necessary, add tuning helix you mention above the secondary. Now remove temporary spark-gap and put jigger-secondary straight to earth (unless you like to keep a very small gap always in series, to act as a lightning arrester). Get your primary working, now on full power, and listen on wavemeter near aerial or earth-lead. If your primary and secondary are far apart (loose coupling) you should hear one wave only—200 metres. If you tighten the coupling, you should hear two, one on either side of the 200. From the value of these two waves you can calculate your coupling (see the *Elementary Principles*). By the way, if you get no signals in wavemeter, try turning the crystal, so as to get a sensitive point. The place for the "tuning-lamp" (a little 4-volt carbon-filament lamp) is really shunted across a portion of the earth-lead, so that a small fraction of the current flows through the lamp; but with power so small as yours, you had better put the lamp actually *in series* with the earth, and so get all the current through it. Send on full power, but with a very loose coupling to start with—for fear you might burn out lamp—then tighten bit by bit until lamp *just* glows. If you are properly tuned (as described above) a small alteration of aerial-circuit, either increase or decrease, should make the glow vanish. If you have got the helix in series with aerial, vary this and not the jigger-secondary; if you must vary the latter, look out for false results due to fact that a considerable increase of secondary may increase the glow by tightening coupling although really mis-tuning. Don't forget that the fact the lamp *glows* is no indication that circuits are tuned—it must *decrease in glow* when the wave-length of one circuit is changed a little without corresponding change of the other.

MARCONI PATENTS.

Alleged Infringement.

THE action brought by Mr. Marconi and Marconi's Wireless Telegraph Company, Ltd., against the Helsby Wireless Telegraph Company, Ltd., for infringement of Patent No. 7777 of 1900 by the installation of wireless apparatus on board four London and North-Western Railway steamers came on for trial on June 24th before Mr. Justice Eve, with Professor Bertram Hopkinson, F.R.S., sitting as Assessor at the request of the defendants.

In opening the plaintiffs' case, Mr. Walter, K.C., said that the patent upon which they were suing was the same as that upon which they had sued in a previous action before Mr. Justice (now Lord) Parker, when a certificate of validity of the patent had been granted and infringement found. The defendants denied infringement and attacked the validity of the patent. Neither he nor his experts were able to see any material difference between the alleged infringing apparatus in this and in the previous case, nor were they able to see that the documents cited as anticipations, although a few of them were not cited in the previous case, showed any greater prior knowledge than had been shown before.

Mr. James Swinburne, F.R.S., was called on behalf of the plaintiffs. Examined by Mr. J. Hunter Gray, he said that the judgment of Mr. Justice Parker in the previous action contained a full and accurate statement of the history of the art of wireless telegraphy. The essential feature of Mr. Marconi's 1900 invention was the coupling of a persistently oscillating circuit to an open radiating circuit so as to get the advantages which Lodge had shown were incompatible in a single circuit. In his opinion, the invention was not described in any of the alleged anticipations, and the invention was useful and sufficiently described in the patent specification. He dealt with the differences between the defendants' apparatus in this and in the previous action, and stated that in his opinion they were immaterial, and that the defendants' system worked in accordance with the Marconi invention.

Cross-examined by Mr. Courtney Terrell, he explained the impulsive rush employed by Lodge to charge his aerial, and showed that Lodge had not two circuits tuned together. The defendants' apparatus did not work in accordance with Lodge. They had inserted an inductance in the aerial which made it impossible to employ the impulsive rush which consisted in the charging of the aerial capacity from a condenser through a circuit containing practically no inductance. The defendants' apparatus had spark-gaps in it which were not shown in Marconi's specification, but they made no material difference and could not quench the primary oscillations. Shown a photograph of the primary spark taken through a revolving mirror, he stated that it was not conclusive as to the number of oscillations in the primary circuit. Shown a diagram of primary and secondary oscillations in which the former ceased after 3½ swings, he stated that if this were a true representation of what took place in the defendants' apparatus, it would be a question of degree for the Judge to decide. The resonance curve obtained from the defendants' apparatus showed that they were using loosely coupled circuits or tightly coupled quenched spark circuits. It was perfectly obvious from a mere inspection of the apparatus that they were not using the latter. While it was easy for anyone with the knowledge of to-day to employ either Tesla's or Ducretet's apparatus in accordance with Marconi's invention, neither Tesla nor Ducretet had used their apparatus in this way, nor had they even realised the problem which Marconi's inventions solved.

Re-examined by Mr. Walter, he stated that with a loose coupling it was only possible to transfer a small amount of energy at each swing from the primary to the secondary circuit. Consequently the diagram showing only 3½ oscillations in the primary circuit was only consistent with very tight coupling or with enormously high damping in the primary circuit. The apparatus which he saw was not tightly coupled and there was nothing to cause any such damping. The deduction from the photograph of the primary spark was inconsistent with the apparatus. He had not had experience of photographing these sparks, but he thought there was chance of error, as each spark lasted only one-millionth of a second.

Mr. J. St. Vincent Pletts, examined by Mr. Hunter Gray, said that he had been fifteen years with the plaintiff company and was engaged on the erection of the first chain of wireless commercial stations in the world in 1900. He had examined the figures and calculations put in by the defendants as representing the performance of the examples given in the specification of patent No. 7777 of 1900. He found that the methods which had been employed for calculating the capacity of the aerial and for determining the mutual inductance, and from it the coupling of the two circuits, were wholly wrong, and resulted in errors varying from 30 per cent. to as much as 1000 per cent. He stated that the examples given in Marconi's specification were all practical examples of installations which had actually worked at that time. He had visited the defendants' installation at Holyhead with Mr. Swinburne and Mr. Clerk, and had taken a resonance curve from the aerial circuit of the ship. The curve which was produced was only consistent with loosely coupled circuits, or with tightly coupled circuits and a quenched spark. He admitted that the curve in itself was also consistent with a highly damped primary, but if this were the case the installation would be most inefficient and could not work a mile, since with the loose coupling employed less than 10 per cent. of the energy would be handed over to the aerial in the few swings shown in the diagram. Whilst the diagram was Marconi as far as it went, in his opinion it did not represent what took place in the defendants' apparatus. They must have had at least 20 or 25 complete oscillations in their primary.

Cross-examined by Mr. Courtney Terrell, he stated that Marconi had given ample directions in his specification to tune the two circuits together, and that the examples given were in fact tuned, and in almost every case gave peaky resonance curves similar to that obtained from the defendants' installation. In his opinion, the spark photograph was not satisfactory evidence of the number of sparks actually occurring. It was obvious that if the photograph were looked at through a piece

of smoked glass still fewer sparks would be visible. The resonance curve obtained at Holyhead was only consistent with loose coupling, or tight coupling and a quenched spark. The circuits were not tightly coupled, and the additional gaps were insufficient to quench. He had noticed that the gaps at Holyhead got quite hot. He had reconstructed the apparatus at Chelmsford and confirmed his opinion.

Re-examined by Mr. Hunter Gray, he stated that the quenching of a spark only occurs after the first half-beat—that is to say, when all the energy has been handed over from the primary to the secondary circuit, and that he knew of no quenching device which could stop the primary oscillations sooner. Certainly the defendants had no special quenching device which could have stopped the oscillations before the first half-beat.

Mr. Dugald Clerk, F.R.S., examined by Mr. Hunter Gray, said that he had accompanied Mr. Swinburne and Mr. Pletts to Holyhead, and that the defendants' apparatus was loose-coupled and tuned. The sharp peaky resonance curve that had been put in was taken in his presence. In his opinion the defendants' apparatus was the same as that in the previous action.

Cross-examined by Mr. Courtney Terrell, he stated that if the primary were cut off very quickly only a very small proportion of the energy of the condenser could be got into the aerial with the loose coupling employed. He had had considerable experience of photographing with the optical indicator and had found great difficulty in getting any trace on the photographic plate even at one five-thousandth of a second, and the fact that the photograph did not show more than six sparks was no proof that there were not any more. In his opinion, Ducretet, using Oudin's transformer, did not teach the world Marconi's invention.

Re-examined by Mr. Walter, he stated that, so far as he could see, the whole object of Ducretet was to tune his receiver to his transmitter, and that he gave no suggestion of using a primary and a secondary circuit.

In opening the defendants' case, Mr. Courtney Terrell said that the defence was confined to three points: first, that Marconi's patent was anticipated by the publications of Tesla and Ducretet. Secondly, that the defendants did not infringe because Mr. Justice Parker had stated, and all the witnesses had agreed, that the invention was for building up and maintaining oscillations in the aerial by means of a persistently oscillating primary circuit. Building up was one thing, and maintaining was another thing, and the photograph and diagram of the defendants' apparatus showed that while the oscillations in the primary circuit built up oscillations in the secondary circuit, they did not maintain them, and therefore the defendants had not got the essential feature of Marconi's invention. Thirdly, the apparatus shown by Tesla was exactly the same as the apparatus used by Marconi, so that Marconi had made no new manufacture, and even though his idea might have been a good and very valuable idea and one worthy of a Parliamentary grant, it could not be subject-matter for letters patent.

Dr. J. Erskine Murray, giving evidence on behalf of the defendants, was examined by Mr. Jaffé. He stated that in his opinion Marconi's patent was for building up and maintaining the oscillations in the aerial by means of the oscillations in the primary circuit, whereas in Lodge the primary circuit was cut off from the aerial as soon as the latter had been charged. In his opinion, the defendants' apparatus worked in the same way as Lodge. He considered the photographic method of determining the number of oscillations in the primary circuit to be the most direct, and that the additional gaps in the defendants' apparatus did in fact quench the spark. The rate of transference of energy from the primary to the secondary did not depend solely upon the coupling, and the greatest amount of energy was transferred in the first few swings. While two loosely coupled circuits could give a peaky curve, in his opinion that obtained on the ships was too peaky, and could only be consistent with a quenched spark. The photograph exhibited, which was an enlargement from the original, was the only justification for the short train of primary waves shown in the diagram. Mr. Swinburne's explanation of the way in which Lodge worked was erroneous.

Cross-examined by Mr. Walter, he admitted that the defendants' circuits were similar to the circuits described by Marconi. He further admitted that if there was a 2 per cent. coupling and 50 oscillations in the beat, and if the envelope of the oscillations was a sine curve, less than 10 per cent. of the total energy would be transferred from one circuit to the other in five swings. He stated that the substantial distinctions between the alleged infringements in this and in the previous action were the additional gaps and the through charging coil, and he thought the additional gaps increased the rate of energy transference from the primary to the secondary. A photograph taken through a revolving mirror of the sparks between two gaps, one having copper and the other cadmium electrodes, and placed in series in an oscillating circuit, was shown to the witness. He admitted that the spark from the cadmium electrodes showed a greater number of oscillations than the spark from the copper electrodes. Referring to the experiment which had been shown to the Judge, the Assessor, and the plaintiffs the previous afternoon at Lennox House, Dr. Murray stated that when the additional gaps were short-circuited and the through charging coil removed one could certainly see in the mirror beats or pulsations, although the mirror was not going sufficiently rapidly to allow the separate sparks to be seen. In his opinion, the spark when the gaps were in appeared to be a quarter or a fifth of the length when they were out. In his opinion, Tesla was the best anticipation of Marconi's invention, but he could not say that it taught the world Marconi's invention. Ducretet might teach the world Marconi's invention, but there were always the teacher and the taught.

Re-examined by Mr. Courtney Terrell, he stated that the defendants' apparatus was efficient, and he had seen it work 120 miles. Referring to the cadmium copper photograph, he did not think that any serious scientific statement could be based upon it, though he admitted that the cadmium spark showed a few more than the copper sparks.

Further cross-examined by Mr. Walter, he admitted that a curve shown in his book did

indicate that with a given decrement the rate of energy transference from the primary to the secondary increased with the coupling, while with a given coupling the rate of transference decreased with increase of either the primary or secondary decrement. The curves, however, were due to Drude, and much of Drude's work had afterwards been found to be incorrect.

Further re-examined by Mr. Courtney Terrell, he stated that the difference in the number of sparks from the copper and the cadmium gaps was about one in eight.

Mr. J. St. Vincent Pletts, recalled and further examined by Mr. Walter, said that the cadmium copper photograph was taken with the two sparks in series, so that any current that passed through one must necessarily have passed through the other, and that the photograph showed considerably more sparks from the cadmium than from the copper gap. Referring to the Lennox House experiment, he stated that he thought he had seen one and a half beats when the charging gaps were short-circuited. With a 3 per cent. coupling this meant that there must have been 45 oscillations, so that if the spark seen in the rotating mirror when the charging gaps were in use was half the length, and he did not think it was less than half the length, there must have been at least 22 oscillations in it.

Further cross-examined by Mr. Courtney Terrell, he stated that it was totally impossible to calculate the decrement from the resonance curve which had been obtained from the Lennox House apparatus, as the readings had not been made with the extreme accuracy that was necessary for this purpose.

Further re-examined by Mr. Walter, he explained that the formula for calculating the decrement from a resonance curve was such that an error of 1 per cent. in either of the two readings that had to be taken might easily produce an error of 50 per cent. in the decrement. From the curve shown it was possible to deduce any decrement from a very small one up to infinity. With an ordinary spark gap it was very difficult to get accurate results on curves of this kind, because the ammeter or other measuring instrument summed up the effect of a number of sparks, and unless the sparks followed each other at exactly the same period, a different reading would be obtained.

Mr. Jaffé, summing up the defendants' case, laid stress upon the difference between building up and maintaining the oscillations in the aerial, and held that while the defendants built up, they did not maintain the oscillations, and that they therefore could not infringe Marconi's patent, since the maintaining was an essential feature of the invention according to Mr. Justice Parker's interpretation and according to the evidence that had been given.

Mr. Walter, summing up the plaintiffs' case, said he ventured to think this was an undefended action. The documents that had been cited as anticipations disclosed nothing more than had been disclosed in the previous action. The highest that the defendants' witness could put it was that these disclosures might have taught the world Marconi's invention had the world been more intelligent than it actually was. The figures and calculations which the defendants had put in as representing the performance of the examples given in the specification had been subjected to a destructive criticism, and no evidence had been called to support them. In spite of this, the Court was asked to rely upon a diagram the only justification for which was a photograph. They had shown that a photograph of sparks occurring at this enormously high speed was at the best unreliable, and they had also shown that it was totally impossible to calculate the number of oscillations from the curve which had been produced, as it obviously was not taken with the extreme accuracy necessary for this purpose.

Mr. Hunter Gray followed, and stated that even if there were only 3½ oscillations in the primary circuit, nevertheless those oscillations were building up and maintaining oscillations in the secondary circuit whilst they lasted. He said that the defendants had utterly failed to prove their statement that there were only 3½ oscillations in the primary circuit. The photograph, which was their only justification for this statement, had been shown to be completely unreliable. He cared not whether the cadmium spark showed a few or a lot more oscillations than the copper spark. So long as it showed any sparks which the copper did not show it proved that the photograph taken from copper sparks did not tell the whole truth. It was, however, not enough for him to show that the defendants had not proved their statement. He had also to prove his case, and this he had amply done. The curve which had been obtained from the defendants' installation was only consistent with three things: (1) loosely coupled circuits, (2) tightly coupled circuits with a quenched spark, and (3) a highly damped primary circuit. It could not be the last, because the defendants' installation was admittedly an efficient installation and could communicate 120 miles. It could not be the second, because the defendants' installation was admittedly loose-coupled. It could therefore only be the first. He submitted that the alleged infringement was the same as the infringement in the previous action, and he asked his Lordship so to find.

Judgment was reserved.

The Unexpected Fiftieth.

At the close of the Annual Meeting of the Marconi International Marine Communication the following remarks were made with reference to the Merchant Shipping Bill now before Parliament.

The Managing Director: Merely conversationally, referring to what you, Sir, said just now of the introduction of this Bill into Parliament making it necessary or obligatory for ships carrying fifty persons or more to carry wireless telegraphy, there is one little thing which occurs to me which is rather interesting. As a matter of fact it occurred to Captain Sankey, my colleague, but I am going to repeat it, for as it has been raised by him it may be amusing to you. He wanted to know what is going to happen when a ship sails from port with forty-nine passengers and crew on board and a fiftieth is born on the voyage. (Laughter.) I do not know whether in that instance when it arrives in port it will have contravened the law for not having wireless telegraphy on board; certainly the absence of wireless telegraphy will have one disadvantage—it will not be able to advise friends at home of the welcome arrival of the addition to the family. (Laughter.)

A Visit to Eiffel

By FRANK H. WRIGHT, *President of the Northampton Wireless Club.*

MOST wireless amateurs will, I think, agree with me that among their earlier experience the most exciting was the first reception of the Eiffel's note. Even the recent recruit to the wonderful science, who finds ready for his use all the latest devices of apparatus with full instructions for use, experiences a thrill when for the first time the 'phones thrum with the dull boom! boom!! of the great French station, but to us who five years ago were rigging up our own wireless sets, it was a moment of glorious life when "Eiffel came," at last, after months and months of effort and failure after failure.

No wonder then that to the enthusiast Paris becomes a Mecca, and Eiffel the station above all stations that he desires to see. Day after day he has listened and learned to understand its language, till he has come to look upon it as a personal friend, a necessary luxury of life.

It was with such intimate feelings that the writer, as representative of the Northampton Wireless Club, accepted an invitation from Commandant Ferrié (who is one of the Association's Vice-Presidents) to visit Eiffel at 10 o'clock on Sunday morning, May 31st.

Even as we arrived the air was being stung by the sending of the International time signals, flung into space by the fan-like aerial overhead. Scores of visitors were enjoying the beauty of the grounds, but the majority were evidently at a loss to explain the sounds like mighty whip-lashes, and knew nothing of the strange work which was being carried on beneath their feet. Perhaps here and there was one who had some faint idea of the meaning of the mystery, the rest simply marvelled. Strangely enough the garden officials themselves were apparently in total ignorance of the whereabouts of the station, and it was only after some time spent in the search that we eventually came upon the very modest entrance hidden away in a quiet nook, absolutely devoid of any architectural significance, and almost buried under the shadow of large trees and shrubs. It leads to a subway, guarded by half-a-dozen soldiers, with the simple notice, "Station Télégraphie Militaire" halfway down the stairway. Our credentials were examined, and the corporal of the guard at once lead us to the passage below. "Keep quite in the middle of the carpet, Monsieur," were our injunctions, and the placard to be seen here and there "*Toucher est mort*" was quite enough to justify a remark previously made to us by a friend, "See Eiffel and die!" Commandant Ferrié received us in the kindest possible manner. The official was altogether merged into the polished French gentleman; and throughout our visit he was most painstaking in explaining the object and uses of the various apparatus under his care. It was evident that constant association had not dulled his enthusiasm. As a matter of fact, he seldom sleeps away from the station, and has a very simply furnished dormitory fitted up within the walls. We found that the various rooms were built round a central "pit," which, but for the wires of the aerial leading into it, was the only visible evidence in the open of the existence of the station, or of the wonderful work that was going on beneath the trim parterres of the Champ de Mars. The sound of our voices seemed strangely confined in the "vaults," covered as they were everywhere—ceiling, walls, and floor—with insulating material. There was no lack, however, of fresh air; and plenty of daylight was admitted from the "pit."

We passed through the motor and machine rooms, thence into the clock department, where several dials were giving the time in various parts of the world. Then we came to the laboratory, where experiments and repairs were evidently in full progress, and eventually into the room occupied by the generating machinery. The Commandant drew our attention to the special apparatus

by which the various notes (as heard in England) were produced, and was interested to know the names with which we had labelled them, "the rouffle," the "musicale," etc., and our reasons for so doing.

Lastly, we entered the transmitting and receiving room, where preparations had already been made by the assistants to send the 11.45 a.m. time signals and weather reports. Our attention was called to a large glass case on the wall, and it was explained to us that the instruments enclosed were in immediate connection with the Observatory, from whence the time signals were about to be despatched. Even as we looked the lever of one of them—very like a Morse tapper—was suddenly depressed, and at the same moment a "crasn," and a blinding flash from a small window in the corner of the room, separating us from the generating chamber, told us that work was begun. In quick succession came the dots and dashes of the signals, and the whole place seemed livid with electricity. Through the coloured glass came the flashes, at which we gazed spellbound, and the generating chamber looked more like the centre of a flaming meteor. "*Toucher est mort!*" The statement admitted of no argument!

In the course of conversation it had been mentioned to the Commandant that several members of the Northampton Wireless Club would probably be listening at their respective installations at home, on the off-chance of hearing any news of their president. Immediately, therefore, on the conclusion of transmitting the weather reports the assistant was ordered by the Commandant to send the brief intimation: "Here is Wright"—a very great courtesy indeed to the Club.

The general features of the Eiffel aerial are these:—

The six wires are suspended from insulators nearly at the summit of the south-east face of the Tower, possibly 950 feet high, from whence they descend obliquely and fan-like till they are about a hundred yards or more from the foot of the Tower. Here their continuity is broken by the insertion of another set of insulators, above which, from a height of about 100 feet, leading-in wires drop till they all meet above the "pit," from whence they are lead to the receiving room.

As regards the outside audibility of the messages from the aerial, the writer on several occasions received them quite clearly in the open grounds, and when on one occasion the experiment was in conjunction with a friend both messages were found to tally exactly. Even at so great a distance away as the platform of the Champ des Mars railway station—probably 400 yards—the signals were distinctly audible.

The following Coast Stations are advised by the Berne Bureau as having been opened recently:—

NAME.*	Call-Letters.	Normal range in nautical miles.	Wave-lengths in metres (normal is heavy type).	Nature of Service.*	Hours of Service.	Coast Charge	
						per word in francs	minimum in francs.
NEWFOUNDLAND					4 hours later than Greenwich time		
American Tickle	VOC	100	600	PG*	8 a.m. to 8 p.m.	0.60	6.00
Battle Harbour	VOA	150	**300**, 600	,,	,,	0.60	6.00
Cape Harrison	VOH	150	600	,,	,,	0.60	6.00
Domino	VOD	150	600	,,	,,	0.60	6.00
Fogo	VOJ	250	**300**, 600	,,	,,	0.85	8.50
Grady, Labrador ..	VOE	150	600	,,	,,	0.60	6.00
Holton, Labrador ..	VOG	150	600	,,	,,	0.60	6.00
Makkovik	VOI	150	600	,,	,,	0.60	6.00
Smokey Tickle	VOF	150	600	,,	,,	0.60	6.00
Venison Island	VOB	100½	600	,,	,,	0.60	6.00

* All the above stations, with the exception of Fogo, which is operated and controlled by the Marconi Wireless Telegraph Company of Canada, are operated and controlled by that Company on behalf of the Newfoundland Government. They are open only during the season of navigation, that is, from July to October, for public correspondence in the inland service.

INSTRUCTION IN WIRELESS TELEGRAPHY

(Second Course)

(IV) The Insulation of Aerials and the construction of Earths.

[The article in the March number completed the first course of instruction. The present is the fourth of a new series of articles, which will deal chiefly with the application of the principles of wireless telegraphy. Those who have not studied that series are advised to obtain a copy of "The Elementary Principles of Wireless Telegraphy," which is now published, price 1s. net, and to master the contents before taking up the course of instruction. An announcement concerning the second examination appears on page 333.]

723. The insulation of the aerial is a matter of the utmost importance.

Bad insulation means a leakage of current, and therefore a loss of power. That is to say, instead of radiating all of the energy in the form of ether waves, part of the energy will be lost in leakage during each oscillation. The effect on the oscillating current is to increase the "damping," so that in addition to loss of power we get flatter tuning, due to the more highly-damped waves produced.

It is obvious that the longer the energy remains in a leaky aerial the greater will be the loss due to leakage. It is also obvious that an aerial which is a good radiator will not retain the energy put into it for so long as an aerial which is a slow radiator. It follows, therefore, that the **slower an aerial radiates its energy the greater the loss of energy due to bad insulation.**

724. In addition to the rate at which an aerial radiates, there is another point to be considered, namely, the rate at which the energy is put into the aerial. Assuming that the faulty insulator acts as a conductor with a high resistance connected to earth, then the rate of leakage from the aerial will be proportional to the voltage of the aerial at the point of leakage, for the higher the voltage the greater will be the current passing through the resistance.

Taking the case of a transmitter in which a primary circuit is loosely coupled to the aerial circuit, the energy in the primary circuit is only slowly transferred to the aerial, so that the aerial will not attain its maximum voltage until, perhaps, the third or fourth oscillation, as shown in Fig. 1. But, since during these oscillations the aerial is radiating its energy, it follows that the maximum voltage it will attain will not be so high as if the two circuits were so closely coupled together that the whole of the energy were transferred to the aerial during the first oscillation. Consequently the **loss of energy**

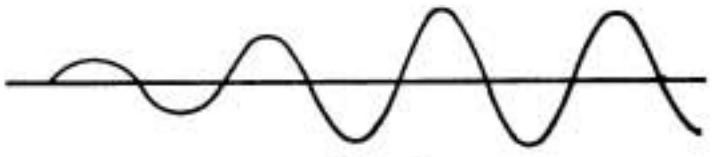


Fig. 1.

due to leakage will be less in the case of the loosely-coupled circuits than in the case of the closely-coupled circuits.

725. Although faulty insulation is bad even in the case of loosely-coupled circuits, inasmuch as it results in less power being radiated, it will not put the station completely out of action, for oscillatory currents will still be induced in the aerial, and therefore waves will be radiated, though the range of communication may be very much reduced.

It is for this reason that coupled transmitters have such a great advantage over "plain aerial." For, as the rise in voltage across the secondary of an induction coil when the primary circuit of the coil is interrupted takes some time, the charge in the aerial leaks away through the faulty insulators as fast as it is supplied by the induction coil, with the result that it is impossible to get a spark across the electrodes from aerial to earth. And, since the current in the aerial is not oscillatory until the spark takes place, no oscillating currents are produced, and therefore the aerial does not radiate waves.

AERIAL INSULATORS.

726. The first point to consider in connection with aerial insulators is the **dielectric**

strength of the material of which the insulator is made.

When an electric pressure is applied to an insulating material or dielectric, a mechanical strain is set up in the dielectric. Further, if the electric pressure is increased beyond a certain limit (depending upon the thickness and nature of the material), the dielectric is mechanically broken or punctured at its weakest point. If the dielectric be a liquid or a gas, the puncture is only momentary and heals up automatically as soon as the current ceases to flow through the path thus made, but in the case of solids the puncture remains, and the insulation is permanently broken down at this point. **The voltage at which the puncture takes place is called the dielectric strength of the insulating material,** and varies considerably with different materials.

The following table shows the comparative values of different substances in this respect.

Substance.	Voltage required to puncture 1 centimeter thickness of material.
Air	30,000
Oil	60,000 to 80,000
Ebonite	500,000
Soft indiarubber ..	450,000
Mica	1,000,000
Glass	250,000
Paraffin wax	170,000
Porcelain	100,000

The above figures are only approximate and vary considerably with different samples of the same material. In any case, in practice it is advisable to allow a factor of safety of at least 3, usually more.

727. The second point to consider in connection with aerial insulators is the **surface insulation.** Even when an insulator is perfectly dry, at high voltages electricity will creep over the surface far more readily than it will spark through an air gap. Thus, if a pressure of 30,000 volts be applied across two metal discs separated by 1·5 c/ms. of air, as shown in Fig. 2, no discharge will

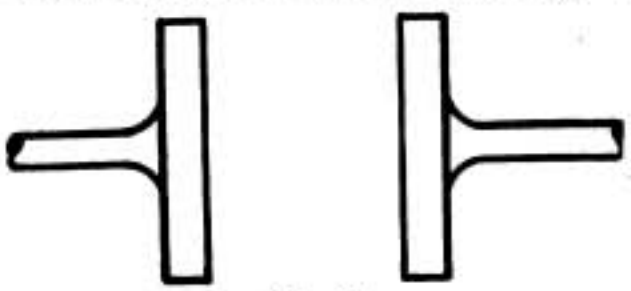


Fig. 2.

take place between them, but if the same space be filled with ebonite as shown in Fig. 3,

Fig. 3.

although the ebonite will not be punctured (see table of dielectric strengths in paragraph 726) the electricity will run along the surface of the ebonite between the two electrodes.

In order to increase the length of the path along the surface of the insulator without increasing the overall length of the insulator, it is usual to make the surface corrugated, as shown in Figs. 4 and 5, thereby doubling or trebling the length of the surface.

Fig. 4.

Fig. 5.

In the case of aerial insulators, however, the overall length is not a matter of great importance, so that corrugated insulators are not often used, the insulators being made sufficiently long in themselves.

728. The actual length of surface insulation to allow is a difficult matter to determine, as everything depends upon the nature and condition of the surface. Where a dry, clean surface is assured at all times, it will be quite safe to allow 4 c/ms. of surface to every 30,000 volts of potential. But

aerial insulators are exposed to all kinds of weather conditions, and if the surface of an insulator be allowed to get coated with a film of moisture or dirt, almost any length will be useless for the purpose of insulation.

In most cases dirt accumulates slowly, and trouble from this source can be avoided by a periodic inspection and cleaning of the insulators. The chief difficulty therefore is **how to keep the surface of the insulator dry.**

When the insulator occupies a more or less vertical position this is easily accomplished by fitting a cone over the insulator to act as a water shed, as shown in Fig. 6, but when the insulator occupies a horizontal position, as it would when supporting a horizontal aerial, this method would obviously be useless. In such cases it is usual to make the insulator of ample length and to paint its surface with a bitumastic varnish, so that any moisture settling on it will detach itself into separate drops instead of forming a continuous film of moisture over the whole of the surface.

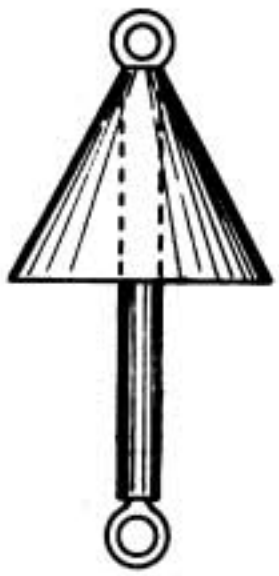


Fig. 6.

The surface of a porcelain or glass insulator has this property without being varnished, but these materials are unfortunately extremely brittle and therefore unsuitable, at all events, for portable stations.

729. One of the best insulators for general use is made up of a large number of strands of cotton, each strand saturated in rubber and the whole coated with a suitable thickness of vulcanised rubber, which is finally painted with a bitumastic varnish. Such insulators are very flexible and can be made to carry any desired load, the tensile strength being supplied by the cotton strands in the interior of the insulator.

An important point to bear in mind when insulating an aerial is to **use as few insulators in parallel as possible,** for each insulator thus used increases the total leakage from the aerial.

Thus an aerial insulated as illustrated in Fig. 7 will only have half the leakage as when insulated as shown in Fig. 8. Moreover, only half the number of insulators are required, and therefore it is less costly.

EARTHS.

730. A point of the utmost importance to the efficiency of communication is a good "earth" at both the transmitting and receiving stations.

"Earths" fall under two headings, namely (1) **Direct Earths;** (2) **Capacity Earths or "counterpoise."**

We have already shown in the article appearing in the July number that a node of current exists at the free end of the aerial and that a maximum of current flows at the earthed end of the aerial.

This current must flow through the earth connection from the aerial to the earth, and from the earth to the aerial. Therefore, any resistance in the earth connection will cause loss of power and damping of the oscillations.

In the case of ship stations the "earth" is a simple matter, as salt water is an excellent conductor of electricity, and it is therefore only necessary to attach a conducting wire to the metal hull of the ship. In the case of land stations it is usual to bury a number of plates of zinc, or other non-corrodible metal, at a sufficient depth to ensure their being surrounded by damp earth.

731. It is found better to use a number of long strips spreading radially under the soil than to use one large plate, as the former gives less resistance than the latter. The reason for this is that the effective resistance of a buried "earth" is reduced in proportion to the capacity of the earth plates. Thus, the **greater the capacity of the earth plates as a whole, the less the effective resistance of the "earth."**

The **most efficient earth where the resistance of the soil is high is made by burying a large number of wires below the aerial or burying them radially in all directions,** like an underground umbrella aerial.

732. It is not necessary, however, to have a direct electrical connection with the earth. What are known as "counterpoise" or "capacity earths" are frequently used even with comparatively high-power stations Such an "earth" usually consists of a large number of wires suspended above the

surface of the ground, and carefully insulated from it. It is important in this case that the capacity of the counterpoise should be at least equal to that of the aerial.

earth, while under other conditions, when the surface of the ground is dry, the "earth" acts as a counterpoise.

This form of earth, although not as

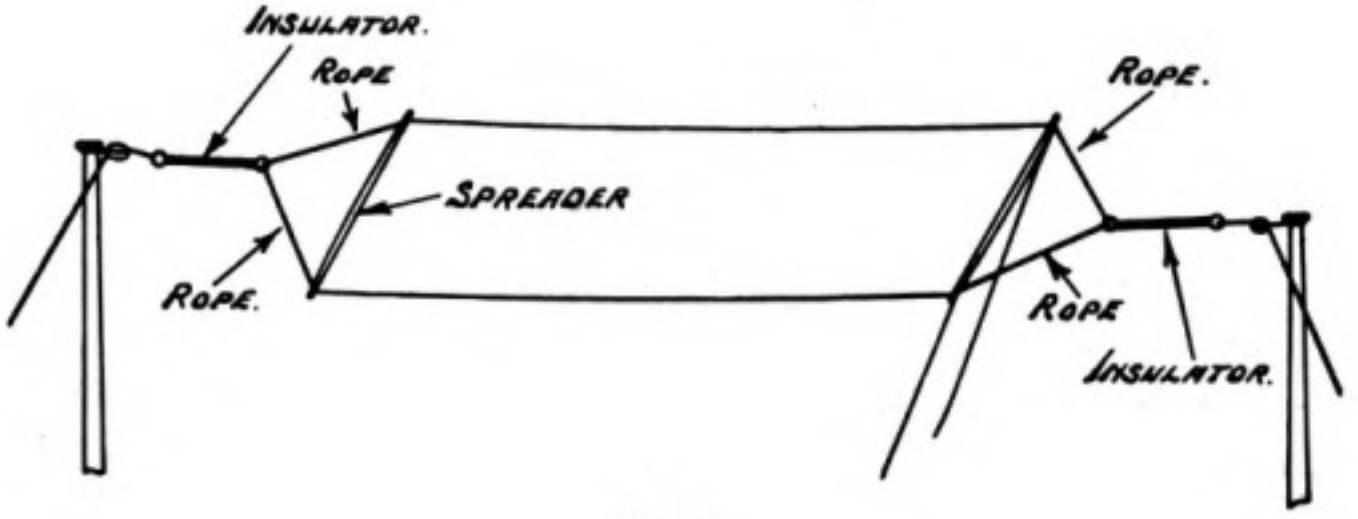


Fig. 7.

For portable Military Stations this form of "earth" is frequently employed, as it takes less time to erect than it does to dig deep trenches. For such stations, perhaps the most convenient form of earth

efficient under some conditions as a true counterpoise, has the great advantage of simplicity and ease of erection, and moreover does not interfere with the approach to the station. It will be readily

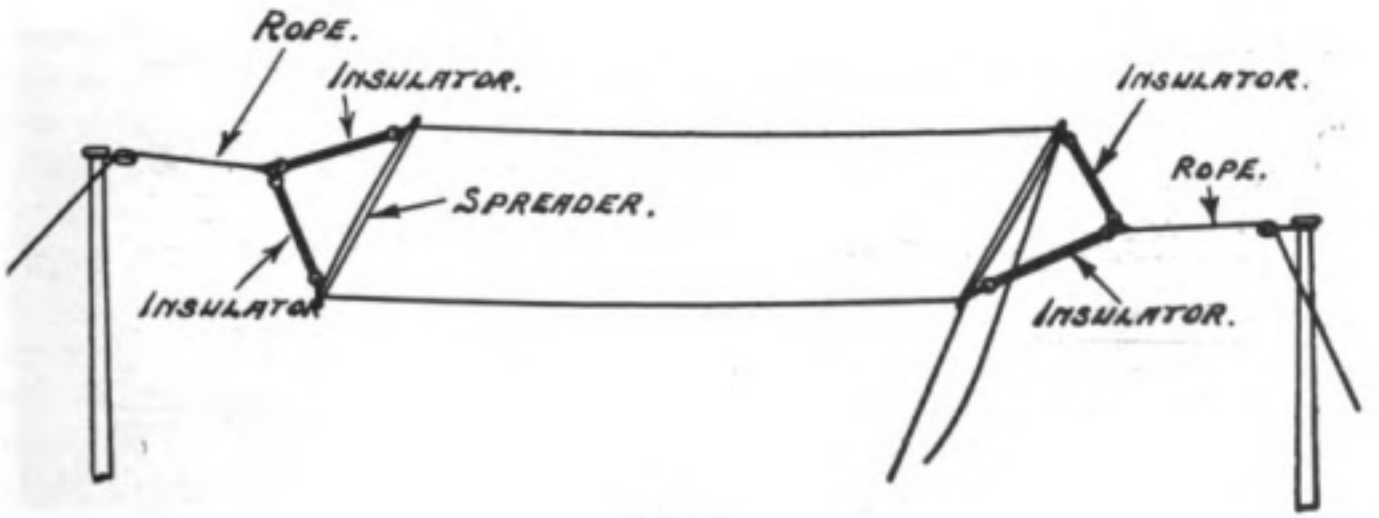


Fig. 8.

is a number of long narrow strips of wire netting, which can be laid on the ground star shaped, and can be rolled up into convenient rolls for transport purposes. Under some conditions, when the surface of the ground is wet and conductive, the "earth" acts as a direct connection to

understood that a number of wires suspended a short distance from the earth over a wide area round a station would be extremely inconvenient in a military camp, where a stray horse might easily become entangled with it at night, and perhaps do serious damage both to itself and the station.

Marconi's Wireless Telegraph Co. Ltd.

MARCONI HOUSE, STRAND, LONDON, W.C.

Senior Certificate in Wireless Telegraphy

This is to Certify that

Clifton Clague

was in May 1914 examined in the Elementary Principles of Wireless Telegraphy and qualified to receive this Certificate for proficiency in the subject and a prize of Ten Guineas

Dated this third day of July 1914

M Marconi Director

Henry W Allen Secretary

Facsimile of Certificate awarded to the successful candidates in the recent examinations.

Examinations in Wireless Telegraphy

Outline of New Scheme

THE award of the prizes and certificates to the successful candidates who entered for the examination recently conducted under the auspices of this magazine marks the completion of an experiment which has been well justified by the results. The percentage of "passes" was commendably high, 58 per cent. of Seniors and 61 per cent. of the Juniors having gained that distinction. But what affords us especial pleasure is the knowledge that the greater proportion of those who entered for the examination owe their introduction to the subject of wireless telegraphy, and certainly their knowledge of its theory, to the series of instructional articles upon which the questions were based. In support of this we have the testimony not only of the prize winners, but of those who were less fortunate in the results, and the general spirit of appreciation is admirably expressed by Mr. Clifton Clague, to whom belongs the honour of carrying off the first prize among the Seniors. "I feel quite proud of having won it," he writes. "I have not done any practical wireless and *didn't understand the theory until I read* THE WIRELESS WORLD, *in which the articles were very clear.*"

Our thoughts now turn to the future of these examinations, which we hope will become a regular institution, and that the numbers of those following our course of instruction will increase year by year.

The last examination was based upon the series of instructional articles appearing in THE WIRELESS WORLD from May 1913 to March 1914. Both the Seniors and the Juniors were examined upon the same series and they were grouped according to their ages, or to the classes to which they belonged.

An important change will be made in the examination to be held next year. Instead of framing the questions for Senior and Junior candidates upon the same course of instruction, as was the case at the last examination, the two sets of papers will be devised upon totally different courses. The examination for Juniors will be based upon the instruction given in the "Elementary Principles of Wireless Telegraphy,"* which is a revised and extended reprint in book form of the first series of articles appearing in THE WIRELESS WORLD, while the examination for Seniors will be based not only upon that course, but also upon the second series of instructional articles, of which the fourth appears this month. Successful candidates in the last Junior examination will be at liberty to sit next year for the Senior examination. Members of the Territorial Force or of the other organisations named may take which examination they prefer, and it is open to candidates to enter for the Senior examination without having passed the Junior examination.

Those competing for the prizes will be divided into five categories:

1. Members of Territorial units and recognised cadet battalions.

* "Elementary Principles of Wireless Telegraphy." By R. D. Bangay. London: The Wireless Press, Ltd., Marconi House, Strand, W.C. 1s. net.

2. Members of the Church Lads' Brigade, Boys' Brigade, and recognised cadet corps.
3. Members of Boy Scouts' Association.
4. Members of colonial companies of the Boy Scouts' Association resident in British Colonies and Dependencies.
5. Members of recognised amateur wireless clubs or societies.

In throwing open the examination to include colonial Boy Scouts we are only acceding to a widely expressed wish among our colonial readers.

To encourage the bona fide wireless amateur to pursue studies which may be useful, as well as interesting to him, we have decided to allow members of recognised wireless societies, clubs, or associations to enter for the examination and to compete for the prizes which we shall offer. This will enable the amateur to give a practical direction to his studies, and thus to feel in his hobby an interest which he could not possibly feel if he conducted his experiments in an aimless or desultory fashion.

We hope that those of our readers who are qualified to compete for the prizes to be offered will lose no time in applying themselves to the courses of study which we have provided, (*a*) the "Elementary Principles of Wireless Telegraphy" for Juniors, (*b*) that book and the series of articles now appearing in THE WIRELESS WORLD. Neither of the courses set are too difficult for the average wireless amateur to master, but they are sufficient to impart really useful knowledge to the student. The Questions and Answers pages in THE WIRELESS WORLD will be open to the explanation of difficulties that may arise, and we invite free use to be made of this facility.

* * *

Examination Papers, 1914.

Below we give the questions set to the candidates who sat in the examination for the Senior and Junior certificates. In our next issue we will publish a general criticism of the answers, and indicate the lines on which some of the questions should have been answered.

JUNIOR PAPER.

Questions.

1. What is meant by—
   (1) The length of a wave ?
   (2) The amplitude of a wave ?
   (3) The frequency of waves ?
2. Show how the frequency of an oscillatory circuit can be obtained if the length of the wave produced is known.
3. Write out the following sentence in the Morse alphabet :—The "quick brown fox" jumps over the lazy dog; the fox is chased, caught, and killed.
4. Make a diagram, using the usual symbols, showing a variable capacity connected in series with an inductance and in series with a variable resistance, all forming one closed circuit.
5. Why is it that an electric wave travels at a different speed to a sound wave ?
6. In a transmitter what purpose is served by—
   (1) An induction coil ?
   (2) A spark gap ?
7. What advantage is gained by exciting an aerial by means of a closed oscillatory circuit ?

   What conditions are necessary in order that the energy in the closed oscillatory circuit is transferred to the aerial ?
8. In a wireless telegraph receiver what purpose is served by a crystal ?
9. Draw a diagram of connections of any one form of a crystal receiver, showing a potentiometer connected in the circuit.
10. Why are high-resistance telephones used with crystal receivers ?
11. How can the fundamental wavelength of an aerial be increased ?
12. What are the main points of difference between a "closed" oscillatory circuit and an "open" oscillatory circuit ?

SENIOR PAPER.

Questions.

1. Show how the frequency of an oscillatory circuit can be obtained if the length of the wave produced is known.
2. On what two factors does the frequency of an oscillatory circuit depend ?

Describe how the frequency of the oscillatory circuit can be increased.

3. Make a diagram, using the usual symbols, showing a variable capacity connected in series with an inductance and in series with a variable resistance, all forming one closed circuit.

4. Make a diagrammatic sketch of an oscillatory circuit, showing how it is excited.

Explain how the energy which can be introduced into this circuit depends upon the capacity of the condenser and the voltage to which it is charged.

5. What advantage is gained by exciting an aerial by means of a closed oscillatory circuit ?

What conditions are necessary in order that the energy in the closed oscillatory circuit is transferred to the aerial ?

6. How can the coupling between two oscillatory circuits be measured ?

7. Make a diagram of the connections of a wave-meter and describe how it is used to measure the length of a wave produced by an oscillatory circuit.

8. Draw a diagram of the connections of any one form of crystal receiver, showing a potentiometer connected in the circuit.

9. Draw a curve illustrating the increase in current passing through a carborundum crystal, as the voltage across it is increased.

For what purpose is a potentiometer used ?

10. Draw a diagram of connections of a tuned buzzer and describe its action.

11. Draw any one form of aerial, showing the lengths of wires used, and estimate approximately what would be the fundamental wave-length of that aerial.

12. What are the main points of difference between a "closed" oscillatory circuit and an "open" oscillatory circuit ? Draw a diagram of each.

SOME OF THE PRIZEWINNERS, 1914.

D. E. Hooper
(Bristol University O.T.C.)

Clifton Clague
8th Batt. Manchester Regiment.

H. E. Evans
St. Peter's Co. Church Lads' Brigade, Wolverhampton.

P. W. Cunliffe.
Clitheroe Grammar School Troop (Boy Scouts).

A. E. Silver
St. Clement's Church Lads' Brigade, London.

R. A. Ford
44th S. London Troop (Boy Scouts).

J. W. Whiteside
Clitheroe Grammar School Troop (Boy Scouts).

Marconi's Wireless Telegraph

Company, Limited

REPORT OF THE DIRECTORS AND STATEMENT OF ACCOUNTS

For the year ending December 31st, 1913

Presented at the Annual Ordinary General Meeting of the Company, Grand Hall, Hotel Cecil, London, W.C., on Tuesday, July 21st, 1914

CAPITAL - - - - - - £1,500,000

Divided into 250,000 Seven per Cent. Cumulative Participating Preference Shares of £1 each and 1,250,000 Ordinary Shares of £1 each

DIRECTORS.

COMMENDATORE G. MARCONI, LL.D., D.Sc., Chairman.
GODFREY C. ISAACS, Esq., Managing Director.
SAMUEL GROGHEGAN, Esq.
ALFONSO MARCONI, Esq.
MAJOR S. FLOOD PAGE.
CAPTAIN H. RIALL SANKEY.
HENRY S. SAUNDERS, Esq.
COLONEL ALBERT THYS.

AUDITORS.

COOPER BROTHERS AND COMPANY.

SOLICITORS.

COWARD AND HAWKSLEY, SONS AND CHANCE.

SECRETARY AND OFFICES.

HENRY W. ALLEN, F.C.I.S., MARCONI HOUSE, STRAND, LONDON, W.C.

Report of Directors.

The Directors herewith submit the Balance Sheet with Profit and Loss Account for the year 1913.

As will be seen from the Profit and Loss Account, the gross profit for the year amounted to the sum of £245,583 13s., and the net profit carried to the Balance Sheet, to £122,323 9s. 8d.

It will be remembered that attention was drawn in the last Report to the fact that substantial profit had been realised for the year 1912 under exceptional circumstances, and that your Directors therefore deemed it prudent to avail themselves of the opportunity to establish a reserve account, and had appropriated £100,000 from these profits for that purpose. An effective comparison of the results of the two years cannot therefore be made. The Directors regret that the business of the past year should not have shown more immediate profits. The Company has nevertheless carried out a considerable amount of work, which should contribute large annual revenues in future years.

The financial conditions which have prevailed throughout the world for some time past have been responsible for many foreign Governments deferring to place orders which the Company expected to

receive. In other cases the Company has been unable to complete contracts within the year owing to delay on that portion of the work which had to be carried out by the Governments.

The Directors recommend the payment of a final dividend for the year 1913, of 10 per cent. on both classes of shares.

Summarised, the proposed appropriation of the available balance is as follows:

Preference Shares: Dividend of 17 per cent. for year ended December 31st, 1913, of which 7 per cent. was paid on October 1st, 1913	£42,500 0 0
Ordinary Shares: Dividend of 20 per cent. for year ended December 31st, 1913, of which 10 per cent. was paid on January 31st, 1914	150,000 0 0
Balance carried forward to next account	76,549 15 7
	£269,049 15 7

In the Balance Sheet "Shares in Associated Companies and Patents" are taken into account as usual at their cost price, viz., £1,298,743 13s. 6d., an increase over last year of £442,624 5s. 2d., the par value of the shares being £2,421,220 4s. 7d., showing an increase over last year of £826,636 12s. 4d. The amount shown in the Balance Sheet and the par value of the shares show substantial increases over the figures of last year, the Company having acquired additional interests which are calculated at cost. After careful consideration your Directors have resolved to discontinue publishing particulars of the shares held by the Company, it being in their opinion prejudicial to the interests of the Company that such information should be made public. Taking the prices quoted on June 30th last for such shares as are quoted on the London Stock Exchange, and placing a moderate valuation on those unquoted (taking into consideration the different elements which they now possess for such valuation), the total value so arrived at represents a sum in excess of the £1,298,743 13s. 6d. appearing in the Balance Sheet. This latter figure also includes the cost to the Company of the whole of its Patents and Patent Rights. The cost of Patent Renewals have been entirely written off from Profit and Loss Account, and no other figure appears in the Balance Sheet representing either Establishment Costs or Goodwill.

In October, 1913, the Capital of the Company was increased to £1,500,000 by the creation of 500,000 new Ordinary Shares of £1 each, ranking for dividends declared in respect of the period commencing January 1st, 1914, and in all other respects *pari passu* with the existing 750,000 Ordinary Shares of £1 each. 250,000 shares were forthwith offered to the Shareholders *pro rata* at £3 5s. per share and the whole of the issue was subscribed and duly allotted. Of the remaining 250,000 shares, 222,688 were issued for cash in December, 1913, in connection with the arrangements made with respect to the shares acquired in the Compagnie Universelle de Télégraphie et Téléphonie sans Fil.

The Share Premium Account has increased during the year by £511,958 4s. 4d., and now stands at £767,665 7s. 5d. Of this amount £397,057 15s. fell due in the early part of this year and has been received.

The Goldschmidt high-frequency alternator (continuous wave machine), in which the Company is interested through its shareholding in the Cie Universelle de Télégraphie et de Téléphonie sans Fil, particulars of which were given at the Extraordinary General Meeting held on October 3rd of last year, has been erected at a station in Germany and at another near New York. This latter station has been only recently completed and experimental work is being conducted between the two stations. It is yet too early to speak definitely as to the results. A demonstration has been given of the transmission of 3,000 words from America to Germany, when conditions were favourable, but tests from Germany to America on a similar scale have not yet been made. Given that they prove sufficiently promising, work will be proceeded with immediately with a view to making necessary changes and additions to equip both stations on a commercial basis. Some months, however, must be allowed for this work to be completed.

The contract entered into with His Majesty's Government for the erection of six high-power stations was ratified by Parliament on August 8th last, when your Directors contemplated proceeding immediately with the erection of all the stations simultaneously. Additional staff had been engaged and trained in anticipation at considerable expense, but nearly a year has passed, and the Board realises that the slow progress which the Company has been permitted to make seriously prejudices the Company's interests. Much work has been done by the Company, and a substantial sum of money has been expended, for which no return has been received during the past year. The Directors are giving this matter their serious consideration.

We have continued to do a substantial and remunerative business in Italy, and enjoy the confidence and support of the Italian Government.

The erection of the high-power station for the Norwegian Government is well advanced and should be completed by the autumn. A commercial telegraph service between Northern Europe and the United States of America is to be inaugurated, in which this Company will be interested to the extent of 10 per cent. of the gross receipts.

In December last the TRANS-OCEANIC WIRELESS TELEGRAPH COMPANY, LIMITED, was incorporated, with a capital of £200,000, for the purpose of conducting a wireless telegraph service between this country and the United States. That Company has acquired the new stations which have been erected in Wales for this purpose. These stations will be opened in the near future when for the first time a direct wireless

telegraph service between London and New York will be established. By this service messages will be automatically transmitted and received at the rate of one hundred words per minute, a speed considerably in excess of the fastest cable. This new service will be conducted by the Trans-Oceanic and American Marconi Companies without the intervention of landlines controlled by any other company. The issued capital of the Trans-Oceanic Company is held by this Company.

Telegraph offices will be opened in the City at No. 1 Fenchurch Street, which will be in direct communication by private line with the stations in Wales.

Licences have been obtained from the British and Spanish Governments for a direct wireless service between the two countries. For this purpose the Company's station at Poldhu has been enlarged, and a service to Spain and the Canary Islands will be inaugurated within a few weeks.

THE AMERICAN COMPANY.—Exceptional weather causing considerable difficulty and delay in transport of plant has caused the high-power stations to be longer in course of erection than was contemplated. Those, however, of San Francisco, Hawaii and Belmar (New York), are now practically complete, and will be opened for service in the near future. Difficulty was experienced in securing the services of a man with the knowledge and ability needed for the direction of the American Company, and the business of last year was therefore less profitable it is believed than it otherwise would have been. We are glad to be able to report that Mr. E. J. Nally, ex-Vice-President of the Postal Union Telegraph Company of America, has become the Vice-President and Manager of the American Company. Your Directors have had the advantage of receiving two visits from him, and are very hopeful that his business ability and experience in all matters concerning the cable and telegraph business, together with his energetic methods and organising powers, will soon make themselves markedly felt in the development of the American business. The patent actions in the American courts, to which the Chairman referred last year, have now been decided in the Company's favour and substantial results should be derived therefrom.

THE CANADIAN COMPANY has made progress during the year and steps which are in contemplation should markedly improve its position in the near future.

THE ARGENTINE COMPANY is proceeding with the construction of the high-power station for communication with Europe, which, so soon as the new transatlantic service is opened, will be pushed on with all speed.

THE BELGIAN COMPANY (Société Anonyme Internationale de Telegraphie sans Fil) has continued to earn satisfactory profits and is making substantial progress. For the year ending December 31st, 1913, a dividend at the rate of 7½ per cent. has been declared. This Company now owns and operates nearly 200 ship telegraph stations.

THE FRENCH COMPANY (Compagnie Française Maritime et Coloniale de Telegraphie sans Fil) has declared a dividend for the year 1913 at the rate of 10 per cent. on the Ordinary Shares, and 31.25 francs per share upon the Founders' Shares. This Company now owns and operates nearly 100 ship telegraph stations.

THE MARCONI INTERNATIONAL MARINE COMMUNICATION COMPANY, LIMITED, has shown an increase during the year 1913 of nearly 50 per cent. in its receipts. A final dividend of 5 per cent. has just been declared, making a total of 10 per cent. for the year. This Company now owns and operates some 873 ship telegraph stations as compared with 580 at the end of 1912. Our interest in the German Mercantile Marine continues to show excellent progress, and the Company receives satisfactory and improving returns therefrom.

THE RUSSIAN COMPANY (La Société Russe de Télégraphes et de Téléphones sans Fil) is making steady and satisfactory progress. It has declared a dividend for the year 1913 at the rate of 6 per cent. The contracts in hand show an increase over those of the preceding year, and the prospects of future business are highly encouraging.

THE SPANISH COMPANY (La Compania Naçional de Telegrafia sin Hilos) in which the Spanish and General Wireless Trust, Limited, have large interests, has not made the progress expected. The receipts from their stations, although increasing, are not satisfactory. The terms of their concession have been impaired by recent legislation, which it is considered entitles the Company to substantial compensation. Our Managing Director has recently paid a visit to Madrid, where he conferred with the Prime Minister and other Members of the Government, and informs us that he is encouraged in the beleif that the proposals which he has caused to be submitted to the Government will be accepted. In that event the Company's position will be distinctly improved, and a reasonable return upon its capital may be expected to follow.

THE BETULANDER AUTOMATIC TELEPHONE COMPANY, LIMITED, in which this Company holds a controlling interest, was incorporated on August 20th, 1913, to acquire from this Company the rights and patents in connection with the automatic telephone system invented by Mr. G. A. Betulander, of Stockholm. The business is being rapidly developed and the Directors are confident that it will show substantial and remunerative results.

During the past year this Company and its affiliated agents have entered into contracts and executed work for the Governments of the following countries: Great Britain, Dominion of Canada, Indian Empire, Union of South Africa, Bolivia, Brazil, Bulgaria, Chili, Greece, Italy, Norway, Portugal, Roumania, Russia, Servia, Spain, Turkey, and United States of America.

FIELD STATION DEPARTMENT.—Improvements have been made in some of the types of field station

apparatus, notably the lightest form of military apparatus, known as the Knapsack station, which has been entirely re-designed. The sales for 1913 are more than double those of the previous year, and during the early part of 1914 important orders have been received from foreign Governments.

Numerous additional patents, which are believed to be of great value were taken out during the year.

Rapid progress has been made in the development of wireless telephone apparatus, and the Company has recently introduced a practical and commercial set for moderate distances. Further important developments are proceeding and it is contemplated that apparatus will shortly be available for the transmission of speech over considerable distances. The development of this new means of communication should add considerably to the earning powers of the Company.

Marked progress has been made during the past year in the development of the Wireless Compass or Direction-finder, and Fog and Submarine Signalling apparatus. These instruments should add materially to the safety of life at sea, and it is hoped they will be universally adopted by the mercantile marine. An apparatus for use in lifeboats has also been recently introduced on the market, and is much appreciated by shipping companies.

An International Convention for Safety of Life at Sea was signed in London on January 20th, 1914, and a Bill to give effect thereto is now before Parliament. Under this Bill wireless telegraphy is rendered compulsory upon ships carrying fifty or more persons including crew. As similar provisions are to be enforced in all the principal countries of the world, increased business should result for all our subsidiary Companies which are operating wireless telegraphy on board ships.

In pursuance of the authority given to the Directors at the Annual General Meeting on July 9th, 1912, they have entered into a provisional agreement with the North British and Mercantile Insurance Company for the establishment of a Staff Superannuation Fund. An Extraordinary General Meeting will be held immediately after the Ordinary General Meeting to approve the necessary alteration to the Memorandum of Association authorising the Company to adopt the scheme.

The action brought by Mr. O. Locker Lampson, M.P., and Mr. P. E. Wright, referred to in the last annual report, is still pending. The Chairman will make a statement at the meeting.

M. Maurice Travailleur retired from the Board in May, 1914, owing to ill-health.

The Directors retiring at this meeting, although they would not in the ordinary course retire by rotation, are Commendatore G. Marconi and Mr. Godfrey C. Isaacs, who, being eligible, offer themselves for re-election.

The auditors, Messrs. Cooper Brothers & Co., also retire and offer themselves for re-appointment.

By Order of the Board,
HENRY W. ALLEN, *Secretary.*

Marconi House, Strand, London, W.C.
July 10th, 1914.

An EXTRAORDINARY GENERAL MEETING of the above-named Company was held at the conclusion of the Ordinary General Meeting for the purpose of considering and, if thought fit, passing as an extraordinary resolution the following resolution :—

"That the provisions of the Memorandum of Association of the Company be altered with respect to the objects of the Company by the insertion of the following provision in Clause 3 of the said Memorandum and that the objects of the Company be extended accordingly, that is to say :—

"Between sub-section (*x*) and the sub-section at present lettered (*y*) the following additional sub-section, namely :—

"'(*y*) To establish and support, or to aid in the establishment and support of associations, institutions, trusts, funds or conveniences calculated to benefit employees or ex-employees of the Company, or the dependents or connections of such persons, and to grant pensions and allowances, and to make payments towards insurance, and to subscribe or guarantee money for charitable or benevolent objects, or for any exhibition, or for any public, general, or useful object.'

"And that the sub-sections of Clause 3 or the said Memorandum at present lettered (*y*) and (*z*) be lettered (*z*) and (*za*) respectively."

Should the above resolution be passed by the requisite majority, it will be submitted for confirmation as a special resolution at a further Extraordinary General Meeting of the Company which will be subsequently convened.

Dr. BALANCE SHEET,

		£ s. d.	£ s. d.
To Capital—			
Authorised—			
1,250,000 Ordinary Shares of £1 each ...	£1,250,000 0 0		
250,000 7 per cent. Cumulative Participating Preference Shares of £1 each ...	250,000 0 0		
	£1,500,000 0 0		
Issued—			
994,771 Ordinary Shares of £1 each fully paid		994,771 0 0	
227,917 Ordinary Shares of £1 each on which £57,877 15s. paid and balance payable in 1914		227,917 0 0	
250,000 7 per cent. Cumulative Participating Preference Shares of £1 each, fully paid		250,000 0 0	
			1,472,688 0 0
,, Share Premium Account, of which £397,057 15s. payable in 1914, *less* Expenses of increase of Capital and New Issue			767,665 7 5
,, Bills Payable			17,962 7 2
,, Sundry Creditors			182,713 15 7
,, Reserve for Expenses Unpaid and Payments in Advance... ...			39,121 2 5
,, General Reserve Account			100,000 0 0
,, Profit and Loss Account—			
Balance as per last account, December 31st, 1912		439,147 3 8	
Deduct—			
Preference Dividends and Ordinary Dividends for 1912	£192,420 17 9		
General Reserve Account	100,000 0 0		
		292,420 17 9	
		146,726 5 11	
Profit for the year as per Account		122,323 9 8	
		269,049 15 7	
Deduct—			
7 per cent. Interim Dividend on Preference Shares paid October 1st, 1913		17,500 0 0	
			251,549 15 7
NOTE.—An interim dividend of 10 per cent. on 750,000 of the Ordinary Shares had been declared prior to December 31st, 1913, payable on January 31st, 1914.			
To Contingent Liability on Shares in Associated Companies	£50,862 10 0		
			£2,831,700 8 2

Dr. PROFIT AND LOSS ACCOUNT for

	£ s. d.
To Rents, Rates, Taxes, Travelling and General Expenses...	24,495 12 7
,, Salaries of Staff and Directors' Remuneration	45,077 11 9
,, Law Charges, Professional Fees and Patent Expenses	7,863 2 11
,, Depreciation of Plant, Machinery, Buildings and Furniture	19,562 17 5
,, Foreign Agencies Expenses	4,217 9 10
,, Station Expenses and Experimental Work	23,141 14 4
,, Balance being Profit for the Year carried to Balance Sheet	122,323 9 8
	£246,681 18 6

Report of the Auditors

We have audited the above Balance Sheet. The item, Shares in Associated Companies and Patents, par value of £1,246,788 10s. 2d., which are held in Brussels, Buenos Ayres, Madrid, Montreal, New York, this Company. This item also includes shares for which certificates have not been issued. We have properly drawn up so as to exhibit a true and correct view of the state of the Company's affairs according

LONDON, *July 9th*, 1914.

December 31st, 1913. Cr.

	£	s.	d.	£	s.	d.
By Cash at Bankers and in Hand				16,153	2	0
„ Share Premium due in 1914, since received				397,057	15	0
„ Calls on Shares due in 1914, since received				170,039	5	0
„ Sundry Debtors, Debit Balances and Expenditure on Foreign Developments				496,033	19	0
„ Stock at Cost or Under as certified by Officers of the Company ...				151,141	11	5
„ Freehold Works at Dalston	38,842	17	11			
Deduct Mortgage	14,611	12	4			
				24,231	5	7
„ Freehold Property at Chelmsford and Plant, Machinery and Buildings at Chelmsford and Genoa Works				106,080	13	2
„ Long Distance Stations in Ireland and Cornwall (including Stock of Stores) and Movable Plant at other places				141,859	17	7
„ Expenditure on Leasehold Premises, Marconi House, London, Office Furniture and Fittings at Head Office, Chelmsford and Foreign Agencies				30,359	5	11
„ Shares in Associated Companies and Patents				1,298,743	13	6

Shares held in Associated Companies are of a par value of £2,421,220 4s. 7d.

	£2,831,700 8 2

the Year ending December 31st, 1913. Cr.

	£	s.	d.
By Balance of Contracts, Sales and Trading Account	245,583	13	0
„ Transfer, Share Warrant and other Fees	1,098	5	6
	£246,681	18	6

to the Shareholders.

G. MARCONI, *Director.*
GODFREY C. ISAACS, *Director.*

includes shares without nominal value entered in the Balance Sheet at £23,585 13s. 8d. and shares of the Paris, St. Petersburg, and Sydney. We have seen letters stating that these shares are held on behalf of obtained all the information and explanations we have required. In our opinion such Balance Sheet is to the best of our information and the explanations given to us and as shown by the books of the Company.

COOPER BROTHERS & CO., *Auditors.*
Chartered Accountants.

Wireless Telegraphy on Ships at Sea

THE annual report of the Marconi International Marine Communication Company, Limited, which we summarised in the July issue of THE WIRELESS WORLD, was submitted at the fourteenth general meeting of the Company, held at the Whitehall Rooms in London on June 30th.

The Chairman, Commendatore G. Marconi, delivered an interesting review of the company's work in the speech which we publish below together with a report of the proceedings :—

CHAIRMAN'S SPEECH.

With your approval I propose to follow the usual course of taking the report as read. I feel sure that the accounts of the past year will have satisfied you, as they have satisfied your directors, that the company has continued to make sound and substantial progress. Comparing the figures with those of last year, it will be seen that the number of ships which we have fitted with wireless telegraph stations which we operate increased from 580 at the end of 1912 to 788 at the end of 1913, and that the same rate of progress continues, the number having become 873 at the date of the report. The receipts from ships' telegrams, news services, subsidies, rentals, &c., during the past year were £146,316, as compared with £100,322 of the preceding year, showing an increase in round figures of £46,000. On the other hand, the expenses, although necessarily higher, have not increased out of proportion. The principal item of increase is shown under station expenses, which of course rise with the number of stations, and likewise the amount of depreciation. Turning to the balance sheet, the only items to which I think I need make any reference are on the debit side, the issued capital, which has been increased to £306,084, and, on the credit side, to plant, apparatus, furniture, and stores, which has increased to £213,000, which, after making allowance for depreciation, shows an addition of £69,000, which is accounted for, of course, by the additional ships which have been fitted.

It is a matter of great satisfaction to your directors—and, if I may be allowed to say so, especially so to me—to see this company now soundly on its feet earning reasonable profits and paying a fair return to its shareholders, for I cannot forget that when this company was registered in the year 1900 it had for its object the introduction of wireless telegraphy upon ships at sea to save life and to save ships, but with very few exceptions we found very little disposition to take advantage of the valuable services which we offered. In these days, when many ships have been saved by means of wireless telegraphy and thousands of people owe their lives to the fact that installations are on board most of the important ships, it will be scarcely believable to those of our shareholders who have not been thoroughly acquainted with the development of the company that we expended something in the neighbourhood of £200,000 in creating and popularising our service before we were ever able to earn a profit. As a result, however, of the great energy of our staff and the hard work of every member of the company we are able this year, for the fourth successive year, to pay a reasonable dividend.

THE COMPANY'S "MONOPOLY": REPLY TO PARLIAMENTARY CRITICS.

I think I am warranted in saying that the nation at large, if not the whole civilised world, owes respect at least to this company for the untiring and patient work which it has done in causing loss of life at sea to be so much less than it otherwise would have been ; yet, notwithstanding, there are members of Parliament who never miss an opportunity of attacking our company and complaining of the monopoly which they allege we possess. I would ask them if they can contend that we have turned that monopoly to an improper account. Does the history of our company suggest anything of the kind ? Does the 10 per cent. dividend which we are now able to declare, after nine years without any return at all for the capital invested, savour of extortion ? Have they any knowledge or appreciation of our vast organisation ? Do they know that every young man serving with us as a telegraph operator on board ship—and there are now some 1,500 of them—has been taught by us without charge ; that not one of them has ever failed to do heroic duty, even to the sacrifice of his life, when circumstances have called upon him to do so ?

There has never been any evidence that a ship in distress fitted with a Marconi installation has ever yet called for assistance without receiving an answer. In every important port throughout the world there is a Marconi inspector ready to overhaul the wireless apparatus of every ship that calls, and they and the operators must work together under carefully considered rules, which have to be most rigorously adhered to by the company to ensure the magnificent discipline so essential to the public and which prevails throughout the service.

LORD MERSEY AND THE MARCONI OPERATORS.

Only a few days ago Lord Mersey, as President of the Court at present inquiring into the disaster which recently overtook the *Empress of Ireland*, complimented the Marconi operators, and stated that they were a credit to the service to which they belonged ; and innumerable are the letters of appreciation which are received by the company from all the important shipping companies throughout the country. I contend that it does not lie in the mouth of anybody to complain of the monopoly which this company possesses—if it

possesses one—for it owes it to the invention, to an organisation and a perfect discipline, which is essential and could not exist were the business in many hands, and to the important capital which it has invested, so providing a valuable, well-conducted and reliable service to the whole travelling public, which it is very probable would never have existed at all but for the company's own efforts.

In view of the Bill which has been introduced into Parliament to carry into effect the International Convention for the Safety of Life at Sea, under which wireless telegraphy becomes obligatory upon ships carrying fifty persons or more, including crew, your directors have consented to enter into an agreement with the Board of Trade to supply their installations in a similar way as they have done before wherever they may be called upon to do so. It is proposed that the remuneration which they are to receive shall be left to a referee. Having regard to the very reasonable terms which the company has been in the habit of charging, your directors see no objection to accepting these conditions.

A Superannuation Fund.

As mentioned in the report, the directors have established, subject to the approval of the shareholders, a superannuation fund, of which the North British and Mercantile Insurance Company will act as trustees. This fund is for the purpose of providing pensions for employees of the company when they eventually retire from work. Similar funds have been brought into existence in the other Marconi companies, and it is thought that it is highly desirable, now that this company has been placed on a sound profit-earning basis, to commence to make provision for employees upon their reaching the age of well-earned rest. The company and its employees will contribute jointly and in equal proportions to the fund, and your directors are of opinion that such a scheme is due to its staff, besides going a long way to encourage them to remain in the company's employ, and materially assisting therefore in maintaining the discipline which is of such pre-eminent importance in the responsible work which your company conducts.

It remains for me now only to assure you that your directors will continue to devote the same care and energy in the conduct of your business in the future as they have done in the past, and to offer to give any further information to shareholders if they have any questions which they desire to put to me. In the meantime I will propose:—"That the report of the directors submitted, together with the annexed statement of the company's accounts at December 31st, 1913, duly audited, be received, approved, and adopted." I call upon Mr. Godfrey Isaacs to second the motion.

The Managing Director (Mr. Godfrey Charles Isaacs): Ladies and gentlemen,—I have pleasure in seconding the resolution which the chairman has just submitted to you. There is nothing which I can usefully add to that which the chairman has already said to you.

The resolution was unanimously adopted without discussion.

The Managing Director: Ladies and gentlemen,—It is now my pleasure to move "That Commendatore Guglielmo Marconi and Mr. Maurice Travailleur, who retire by rotation, be re-elected to the Board." I do not think I need say anything to you—in fact, I know I need not say anything to you—about Mr. Marconi. As regards Mr. Travailleur, he is closely associated with an affiliated company on the Continent, and he is a most valuable member of the Board. I beg to move that they be re-elected.

Mr. Henry S. Saunders: I have the pleasure of seconding the motion.

The resolution was unanimously adopted.

Captain H. Riall Sankey, R.E.: Ladies and gentlemen,—A motion has been put into my hands which reads:—"That the remuneration of the directors for the year 1914 shall be the sum of £1,000, subject to such further sum, if any, as may be determined at the next general meeting of the company." This is the usual motion, and I do not think any words are necessary from me in proposing it.

Mr. Alfonso Marconi: I have very much pleasure in seconding Captain Sankey's motion.

The resolution was unanimously adopted.

The Chairman: I have now to move, "That a final dividend of 5 per cent., equal to 1s. per share, less income tax, upon the capital now issued and paid up, be and the same is hereby declared for the year ended December 31st, 1913; that the said dividend be payable on July 31st, 1914, to the shareholders registered on the books of the company at June 30th, 1914."

The Managing Director: I have pleasure in seconding the resolution.

The motion was passed unanimously.

Mr. C. A. Phillips: Mr. Chairman, gentlemen,—I have very much pleasure in moving "That Messrs. Cooper, Brothers and Co. be re-elected auditors for the ensuing year, and that their remuneration for auditing the accounts to December 31st, 1913, be 250 guineas." I move that formally, Sir.

Mr. W. W. Bradfield: I have much pleasure in seconding the motion.

The resolution was unanimously adopted.

Mr. Phillips: Perhaps it would not be out of order if at this juncture, as an opportunity is presented, I proposed an expression of our thanks to the chairman and his fellow-directors on the board of this company, with an expression of our pleasure and satisfaction that at this stage the company has reached a most satisfactory position, and that we are now receiving the dividends to which we have been looking forward for some time past. I am sure it is a matter of gratification to everyone, and we cannot help a feeling of great satisfaction that the work which the company is engaged upon is of a most beneficent and humanitarian character; it is helpful to the whole world and to civilisation. The only remarkable thing is that when the regulation was passed requiring vessels carrying fifty persons or more to be installed with the Marconi installation it was not made incumbent upon vessels of a smaller crew and passenger-bearing capacity also to comply with that regulation. Undoubtedly that is a thing which will follow later. I should like to move that our heartiest thanks be given to the chairman and his fellow-directors for their services during the past year.

The LIBRARY TABLE

"PRACTICAL USES OF THE WAVE-METER IN WIRELESS TELEGRAPHY. By Lieut. J. O. Mauborgne. McGraw-Hill Book Company, New York and London (6 Bouverie Street, E.C.). 74 pages, 42 illus. Price, $1.

This work was originally printed for use at the Army Signal School, Fort Leavenworth, Kan., and is now offered to a much wider public in a revised form. The author begins with a series of fundamental definitions and relations, and proceeds to describe the basic operation of all wave-meters of the resonance type. He also discusses in detail the types of instruments in use by the United States Signal Corps. The later chapters contain instructions for and examples of wave-meter measurements of open and closed circuit wave-length, coupling inductance, capacity, decrement, etc. Attention is given to the adjustments necessary to make transmitters comply with the various Federal regulations as to wave-length and radiation purity. The measurement of received wave-lengths is described, and a full-page chart which simplifies the calculation of frequencies and wave-lengths from inductance and capacity is added.

"STUDIES IN TERRESTRIAL MAGNETISM." By Dr. C. Chree, M.A., F.R.S. (London: Macmillan & Co., Ltd., St. Martin's Street, W.C. 5s. net.)

The study of the effect of daylight upon radio-telegraphic waves is of such wide interest that Dr. Chree's able volume should command a large number of readers who are interested in wireless telegraphy.

The subject of "Terrestrial Magnetism" is very large and ever increasing, and the author in the volume before us has contented himself with presenting a connected account of his own original work in that subject.

There is an absence ir the book before us of a definite theory as to the origin of the several magnetic changes. The author explains that his reason for refraining from laying down such a theory is that at the present stage theorising on the subject is less likely to be of substantial advantage than the existence of positive knowledge, and whilst the present volume deals almost entirely with facts or supposed facts. The phenomena of Terrestrial Magnetism are of a complicated nature. The so-called regular daily changes vary largely with the season of the year and from one year to the next; the so-called irregular changes are multitudinous. It can scarcely be hoped that in our time any general theory will present a satisfactory explanation of all observed facts, or enable us completely to forecast the future; for some time at least it is mainly to observation that we must look for detailed knowledge, and it is in any case to observation that we must turn as the touchstone by which to test theory. For this reason Dr. Chree's work is especially welcome, because of its originality, and it should serve as an excellent model for other investigators. The book is divided into seventeen chapters, and is well illustrated by means of clear diagrams.

COMPANY NOTICES.

Société Anonyme Internationale de Télégraphie Sans Fil.

The first Ordinary General Meeting of the Société Anonyme Internationale de Télégraphie sans Fil was held at Brussels on May 27th, General Thys presiding.

The Board were re-elected as follows: General Albert Thys, President; Doctor Adolf Franke and Godfrey C. Isaacs, Vice-Presidents; Maurice Travailleur, Gaston Perier, Count Georg von Arco, Hans Bredow, Felicien Cattier, Major S. Flood Page, Paul Mamroth, Commendatore Guglielmo Marconi, Captain H. Riall Sankey, Directors.

A dividend at the rate of 7½ per cent., or 37·50 francs per share, was declared payable on June 15th.

At December 31st, 1913, the Company was operating 165 wireless telegraph stations on board ships, which has increased to 190 at the present date.

* * *

Russian Company of Wireless Telegraphs and Telephones.

As we announced briefly in our last issue, the Annual General Meeting of the Russian Company of Wireless Telegraphs and Telephones was held in St. Petersburg on June 13th, Admiral Bostrem, chairman of the Company, presiding.

The Directors' Report shows that the business of the Company continues to develop satisfactorily, and the business in hand this year represents a very substantial increase over that of the preceding year, the Company having important contracts with the Russian Government. Owing to the growth of the Company's business it is proposed to enlarge the works.

The Company has declared a dividend of 6 per cent., payable on October 1st, which is at the same rate as for the previous year. The two retiring Directors, Commendatore G. Marconi and Mr. Adrian Simpson, were re-elected.

Share Market.

London, July 18th.

There have been considerable fluctuations in the various Marconi issues during the past month. The annual report, although showing decreased profits, is evidence of the great advance being made by wireless telegraphy all over the world, and an advance has taken place in the share values from the prices ruling before its publication, closing prices being: Marconi Ordinary, £2 5s.; Marconi Preference, £1 17s. 6d.; American Marconi, 11s. 3d.; Canadian Marconi, 6s.; Marconi International, £1 6s. 3d.

PATENT RECORD.

The following patents have been applied for since we went to press with the July number:

14,595. June 17th. Robert B. Goldschmidt. Mechanical selector for electro-magnetic waves applicable to wireless telegraph receiving apparatus. (Convention date, December 29th, 1913, Belgium.) (*Complete.*)

14884. June 20th. Emile Girardeau and Joseph Bethenod. Spark gaps for radio-telegraphy. (Convention date, June 23rd, 1913, Belgium.) (*Complete.*)

14891. June 20th. Sir Arthur Trevor Dawson and George T. Backhouse. Receivers for use with electrical apparatus for transmitting and receiving signals. (*Provisional.*)

15031. June 23rd. Emile Girardeau and Joseph Bethenod. Spark gaps for radio-telegraphy. (Addition to 14884/14. Convention date, February 23rd, 1914, Belgium.) (*Complete.*)

15082. June 23rd. Robert B. Goldschmidt. Mechanical selector for electro-magnetic waves applicable to wireless telegraph receiving apparatus. (Addition to 14595/14. Convention date, May 2nd, 1914, Belgium.) (*Complete.*)

15160. June 24th. T. William Stratford-Andrews and Galletti's Wireless Telegraph and Telephone Co., Ltd. Electric dischargers more particularly for use in wireless telegraphy and telephony. (*Provisional.*)

15182. June 24th. Lewis Claud Willcox, B. Hippisley and E. Russell Clarke. Wireless receiving apparatus. (*Provisional.*)

15388. July 1st. Bernard Starie. Detector for electro-magnetic waves or the like. (*Provisional.*)

15857. July 2nd. Percy Carr Bird. Wireless telegraphy. (*Provisional.*)

15881. July 2nd. Deutsche Telephonwerke Ges. m.b.h. Detector for electro-magnetic waves. (Convention date, January 24th, 1914, Germany.) (*Complete.*)

15981. July 4th. Raghunath Balkrishna Gupte. Alarm Marconi-bell for ships in fog at sea and for railway trains, air craft, and the like. (*Provisional.*)

16328. July 8th. John Hays Hammond, jun. System for the control of moving bodies at a distance by radiant energy. (Convention date, July 14th, 1913, United States.) (*Complete.*)

16380. July 9th. Roberto Clemens Galletti. Receiving apparatus for wireless telegraphy. (*Provisional.*)

Wireless Telegraph Operators in the Royal Naval Reserve

The following is a Copy of the Circular Issued by the Admiralty Relating to the Enrolment of Wireless Telegraph Operators in the Royal Naval Reserve.

Conditions of Service.

1. The Lords Commissioners of the Admiralty have approved of the formation of a Wireless Telegraph Branch of the Royal Naval Reserve, composed of Wireless Telegraph Operators of the Mercantile Marine. These ratings will be subject to the existing Regulations for the Royal Naval Reserve, so far as they are applicable, and will be required to qualify themselves by training in the Signal School, Portsmouth, or elsewhere as directed, for service in His Majesty's Fleet in time of emergency. When embarked for service and when under training they will be subject to the Naval Discipline Act.

(2) Candidates should apply personally or by letter to the Registrar of Royal Naval Reserve at any Mercantile Marine Office in the United Kingdom, or by letter to the Registrar-General of Shipping and Seamen, London.

Qualifications.

2. To be eligible for enrolment Candidates must be British subjects of high character, hold Certificates as Wireless Telegraph Operators (from recognised Wireless Telegraph Companies), and either be serving in the Mercantile Marine or be employed in Wireless Telegraphy where their efficiency as Wireless Operators will be maintained. Candidates *temporarily* out of employment will be eligible for enrolment, provided they can produce thoroughly satisfactory references from their last employers.

No man who is eligible for the Royal Fleet Reserve can be enrolled in the R.N.R.

Age for Entry.

3. The limits of age for entry are 21 to 30.

Physical Standard.

4. Candidates will be required to undergo a medical examination, and will only be accepted if they are of sound constitution and in good health, and free from grave physical defects, and have been vaccinated.

Chest measurement, 32 inches. Height, 5ft. 3 in., but the cases of specially desirable candidates who are below the general standard of height will be considered by the Admiralty.

Period of Enrolment.

5. They will enrol for a term of five years; and provided they remain in all respects fit, and their services are required, they will be allowed to re-enrol for successive periods of five years, but no Wireless Telegraph Operator will be allowed to re-enrol for further service after completing four periods of five years (*see also* par. 8).

Training.

6. They will be required to undergo fourteen days' training during the first year of enrolment, and subsequently seven days each year. As far as practicable they will be allowed to select their own time for this training, which will ordinarily be carried out at the Signal School, Portsmouth. They will be granted free railway warrants to and from the Signal School, and an allowance for subsistence while travelling at the rates authorised by the King's Regulations.

Annual Retainer.

7. The annual retainer will be £10 a year, payable so long as a man fulfils the conditions mentioned in paragraphs 6 and 14, and abides by the other conditions of his engagement.

The retainer will be paid by a Registrar of the Royal Naval Reserve at any Mercantile Marine Office, in four quarterly instalments of £2 10s. each. The quarters are to be considered as commencing on the 1st January, 1st April, 1st July, and 1st October in each year, and retainers are payable at the end of each quarter; thus the retainer for the quarter commencing 1st January is payable on and after 1st April.

The retainer will be due from the date of enrolment, but payment will be deferred until the first training has been satisfactorily completed, which must take place within the first year of service.

Payment of retainers for the second and subsequent years will also be dependent on the training for such years having first been satisfactorily performed.

Gratuity on Discharge after Completing 20 Years' Service.

8. A gratuity of £50 in lieu of pension, with release from all liability for active service, will be granted to Wireless Telegraph Operators, R.N.R., who complete 20 years' service and the requisite periods of training in the Reserve. Payment will, however, be deferred in the case of men under 45 years of age until they reach that age; such men will receive a Deferred Gratuity Certificate, and will be liable to be "called out" for service while holding this certificate.

No man, however, will be retained in the Reserve after attaining the age of 50 years.

Pensions, etc., for Injuries, and Care of Widows and Children.

9. Wireless Telegraph Operators, R.N.R., will be eligible for pension for wounds or injuries under the following conditions:—

If wounded or injured on service, or under training, they will be entitled to the same pension or gratuity to which a Chief Petty Officer of the Royal Navy would be eligible for a similar wound or injury; and if killed, slain, or drowned on service, or under training, their widows and children (if any) will be eligible for the same pensions and compassionate allowances as the widows and children of Chief Petty Officers of the Royal Navy.

Liability to Serve in Emergency.

10. Wireless Telegraph Operators, R.N.R., will be liable to serve in the Fleet when the Royal Naval Reserve is called out by Royal Proclamation in time of emergency, under the Regulations for the government of the Royal Naval Reserve. When so serving, and when under training, they will be considered in all respects as Chief Petty Officers of His Majesty's Fleet.

Pay and Victualling.

11. Whilst under training, or when called out for service in the Fleet, those with a higher Class Certificate will be paid 35s. to 42s. a week, and those with a lower Class Certificate 21s. to 28s. a week. If qualified and recommended by the Naval Authorities, men may be advanced from a lower to a higher Class Certificate with corresponding increase of pay. The recommendation by the Superintendent of Signal Schools must be entered on Form R.V. 58*e*, which should be forwarded to the Registrar-General of Shipping and Seamen with Certificate Book R.V. 2.

When under training they will be victualled on the same scale as the men of the Royal Navy.

Payment of retainers will be continued whilst a man is serving afloat.

The National Health Insurance contribution (both employer's and employee's) is paid from Naval Funds when a man is under training.

Uniform.

12. They will wear the same uniform as Royal Naval Chief Petty Officer Telegraphists, with a distinguishing Reserve mark.

They will also be allowed to wear a distinguishing badge on their M.M. Uniform denoting that they belong to the R.N.R.

Gratuitous Clothing.

13. The kit of Wireless Telegraph Operators, R.N.R., will be supplied gratuitously from the Royal Naval Depôts at Chatham, Portsmouth and Devonport. A self-measurement form (R.V. 1c. (3)) will be issued to each Wireless Telegraph Operator when he receives his Certificate Book R.V. 2. When filled in, the form will be forwarded by the local Registrar, R.N.R., to the Com-

modore of the Depôt to which his district is affiliated, with a request that the kit may be forwarded to him for issue as soon as possible.

Kit.

1 long jacket, double-breasted, cloth.
1 long jacket, single-breasted, serge.
2 drill tunics.
1 cloth waistcoat.
1 serge waistcoat.
1 pair trousers, cloth.
1 pair trousers, serge.
3 pairs trousers, duck.
2 white shirts.
6 white collars.
2 black silk ties.
*1 cap, cloth, with badge.
2 cap covers, white.
3 flannels.
2 pairs drawers.
2 blue check shirts.
2 blue check collars.
2 pairs of socks.
*1 pair boots.
1 pair braces.

(2) This will be the regulation kit, and whenever under training or "called out" by Royal Proclamation, they will be expected to have the above kit complete, and in good order.

(3) To assist them to keep it complete, and also as an inducement to them to take care of their kit, they will, on their second and every subsequent training, receive a sum equal to 2s. per month since the last training, but not exceeding a maximum of £7, on producing the kit properly marked and in good order, allowing for fair wear and tear. If the kit is deficient, it is to be completed on board, the value of any articles being charged on the ledger against the man, and only a proportion of the gratuity will be paid.

(4) If necessary, a Chief Petty Officer's chest for stowing the kit will be issued on loan on board the ship in which embarked.

(5) Marked bedding will be supplied on loan to the men on board the ships on which they are received for training.

(6) When called out by Royal Proclamation, the following further articles will be supplied gratuitously :—

1 bed.
1 blanket.
2 bedcovers.
1 hammock.
1 set of clews and lanyards.
1 lashing.

and in addition to the money grant of 2s. per month as above, they will be credited with a war clothing gratuity of £6, to enable them to complete their kit.

Discharge.

14. They will be eligible to remain in the Reserve, at the discretion of the Admiralty, only so long as they may continue to maintain a high character with their employers, remain fit for service at sea, and comply with the conditions as to training.

Should a Wireless Telegraph Operator, R.N.R., permanently abandon employment as a Wireless Operator or in a kindred capacity, before completing his third period of five years' service in the Reserve, he will be liable to have his retainers suspended, and to be discharged at the termination of his current period of enrolment.

Men adversely reported on by their Commanding Officer during or at the expiration of their training will be at once discharged from the Reserve.

Leave of Absence.

15. Men wishing to serve in any merchant ship, on any voyage the length of which will probably exceed six months, must apply to their Registrar, R.N.R., for special leave.

Failure to comply with the above will render men liable to forfeiture of retainers and discharge from the Royal Naval Reserve.

* Sizes of cap and boots required are to be stated.

A man was recently sentenced at Birmingham to six months' imprisonment for defrauding Messrs. T. Cook & Sons, Tourist Agents. He obtained the money by means of a telegram in which he had forged the code of the prosecutors, by whom he had been employed. He absconded to America, but was arrested on board ship through a wireless telegram.

Positions of Engineers

(July 13th, 1914.)

Gray, A., Chief Engineer, annual leave.
Anselmi, S. C., annual leave.
Barrington, R. N., annual leave.
Beatson, A., annual leave.
Benning, B. S., *en route* St. Kilda.
Blinkhorn, A. B., London.
Boome, G. J., Southampton.
Borghese, G. G., Letterfrack.
Boucicault, P., Carnarvon.
Boyle, C. W., Letterfrack.
Brown, W. H., *en route* Port Said.
Burrowes, F. E., Yacuiba, Bolivia.
Burrows, H. M., Carnarvon.
Casperd, C. C., Clifden.
Chevallier, J. C. E., Yacuiba, Bolivia.
Childs, H. B. T., returning from Egypt.
Clark, J. P., London.
Cole, W. B., Ferrol, Spain.
Cooke, R. R., India.
Croaker, P., Devizes.
Dalgairns, A., London.
Dashwood, S. L., annual leave.
Davis, W. J., Carnarvon.
Demont, R., Bolivia.
Densham, W., Chelmsford.
Dobell, H., Chelmsford.
Dockray, S. T., Punta Arenas, Chili.
Dowsett, H. M., Chelmsford.
Eisler, P., London.
Entwisle, G. H., London.
Entwistle, W. S., Carnarvon.
Ewen, H. A. E., London.
Fellowes, H. S., annual leave.
Fielding, W. F., Newcastle.
Flanagan, F., Clifden.
Flood-Page, A., Belfast.
Franklin, C. S., Carnarvon.
Gulster, J., Stavanger, Norway.
George, E., New Brunswick, America.
Gilmour, R. J., Liverpool.
Golland, E., London.
Green, E., Chelmsford.
Groser, S. R., Aranjuez.
Hill, L. D., Clifden.
Hobbs, T. E., London.
Hughes, C. H., Teneriffe.
Hunter, M. B., Poldhu.
Ichino, E., London.
James, C., Egypt.
Johnson, J. N., Vigo.
Jones, D. H., Devonport.
Jupe, A., Devonport.
Keith, C. H., sick leave.
Kemp, G. S., Haven.
Kent, A. D., Antwerp.
Kift, A. A., annual leave.
Kindersley, R. G., Constantinople, Turkey.
King, L. H., India.
Korber, F., Clifden.
Kos, S. F., London.
Lacy, T. S., Egypt.
Ladner, A. W., Poldhu.
Landon, G. H., annual leave.
Leary, J. J., London.
Linsell, A., Chelmsford.
Loveband, A. W., London.
MacCallum, H., Broomfield.
Marden, E. S. D., Egypt.
Mathias, E. L. A., Clifden.
Maunder, W. R., Carnarvon.
McKay, C. A., Glasgow.
McCullough, H., Riberalta, Bolivia.
McLellan, A., New Brunswick, America.
Meikle, G. C., Clifden.
Merriman, W. H., London.
Merton, H. F. J., Cowes.
Montague, E. C., London.
Moore, A. E., London.
Morris, A. J., Clifden.
Mott, W. F., Glasgow.
Newman, F., London.
Newstead, T. B. L., London.
Nicholls, H., Foreign Service leave *ex* Chili.
Paget, P. W., Chelmsford.
Payne, D. H., Carnarvon.
Persichetti, C. S., London.
Picken, W. J., New Brunswick, America
Pitcairn, R. F., London.
Pole, A. T., Riberalta, Bolivia.
Pontifex, B., Leafield.
Poyntz, J. M., annual leave.
Prince, C. E., Chelmsford.
Privett, P. E., Poldhu.
Quick, R. C., Barrow.
Rackstraw, N. C., Greece.
Rattray, C. G., London.
Rice, R. K., Barrow.
Richmond, H., Leafield.
Ridley, W. O., London.
Robinson, F. E., Broomfield.
Round, H. J., London.
Rust, N. M., Letterfrack.
Ryan, C. P., Chelmsford.
Sauve, H., on leave.
Savill, A. G., Brazil.
Shaw, H. E., Poldhu.
Sherborne, A. K., annual leave.
Smith, S. B., Towyn.
Stacey, F., London.
Strickland, R. H., on Foreign Service leave *ex* Chili.
Tisshaw, H. S., Towyn.
Topham, F. S., Letterfrack.
Tremellen, K., London.
Triggs, E., Glasgow.
Trost, O., Stavanger, Norway.
Turner, W. G. A., annual leave.
Tyler, E. G., London.
Venn, W. H., Lisbon.
Volter, E. F. W., Poldhu.
Vyvyan, R. N., London.
Wells, N., Poldhu.
White, J. D., London.
Whitmore, G. S., London.
Willis, M. F., Carnarvon.
Witt, B. J., Towyn.
Wood, W. H., Liverpool.
Woodward, P. J., Carnarvon.
Wright, G. M., Chelmsford.

Positions of Operators

(July 13th, 1914)

Abbott, S. H. V., on leave.
Adams, F. W., *Michigan*.
Adams, G. E., *St. Andrew*.
Adnitt, C. H. H., *Edinburgh Castle*.
Akehurst, C. J., *Highland Laird*.
Akerman, A. R., *La Negra*.
Albrow, H. V., *Arzila*.
Alderton, C. G., *Beacon Grange*.
Alchurch, H. P., *Devonian*.
Allison, W., sick leave.
Allnut, C. M., *City of London*.
Allott, N. E., Callao Depot
Alston, S. K., unattached.
Alton, H. F., *Mesaba*.
Alton, T. F., *Chaleur*.
Amber, P., *Mexico* (P.S.N.).
Amott, F., *Maryland*.
Anderson, G. D., *Elephanta*.
Anderson, L. N., *Saxonia*.
Andrews, A., *San Dunstano*.
Angill, A. C., *Irishman*.
Arbuckle, D., *Grampian*.
Aris, B. F., *Waipara*.
Arlaud, C., unattached.
Armstrong, C. C., *Oropesa*.
Armstrong, S., *Normannia*.
Arnold, A. C., *Crvic*.
Arrowsmith, G., *Appam*.
Ashbrook, J., *Arabic*.
Atkinson, J., *Corcovada*.
Atkinson, W. F., *La Correntina*.
Atkinson, W. H., *Narragansett*.
Auvache, J. E., *Medina*.
Avery, F., *Chaudiere*.
d'Avigdor, A. H. D., *City of Birmingham*.
Bailey, F. N., *Arabic*.
Bailey, H. H., unattached.
Bain, W. R., *Kelvinbank*.
Baker, A. E., *Highland Laddie*.
Baker, F. H., *Orteric*.
Baker, J. R., *Orissa*.
Balding, G., *Anglian*.
Balfour, G. W., Liverpool Depot.
Ballard, A. E. R., *Oruba*.
Bamford, E., on leave.
Bamford, J. R., *City of Vienna*.
Banbery, W. G., *Durham Castle*.
Band, H. J., *Star of Australia*.
Barber, C. E., *Highland Brae*.
Barber, W., *City of Poona*.
Barber, L. T., *Matura*.
Baron, C. E., *Huanchaco*.
Barrell, W. S., unattached.
Barron, T. G., *Baron Jedburgh*.
Bartlett, C. H., *Demosthenes*.
Baxter, B. O., *San Wilfrido*.
Beamon, T., *Ascot*.
Bean, H. H. W., *Englishman*.
Beardmore, G. A., *Caledonian* (Leyland).
Beatson, F., *Asturias*.
Beckett, G. N., *Panceras*.
Beckett, J., *Corinthian*.
Beilby, W., *Uranium*.
Belcher, H. F., *Armadale Castle*.

Bell, A., *Highland Laird.*
Bell, E., unattached.
Bell, J. A., *Raeburn.*
Bellhouse, G. L., *Benefactor.*
Bernard, R. A., *Malta.*
Berry, C., *Bovic.*
Bessell, B. W., *Namur.*
Beynon, A. R., *Kanawha.*
Biggins, J., *Dominion.*
Bilton, W. W., *Hantonia.*
Birch, A., *Huayna.*
Birtwistle, W., *Himalaya.*
Blake, E., *Macedonia.*
Blezard, J., *Cornishman.*
Blight, W. T., *Poona.*
Bliss, G. E., *Carnarvonshire.*
Blizzard, R. E., *Tara.*
Blow, A. G., *German.*
Bloxham, A. I. W. H., *Grantully Castle.*
Blundell, E. T., *Oxfordshire.*
Bolster, A., *Teesta.*
Bone, D. W., *Monmouthshire.*
Boon, N. A., *Bogota.*
Boorne, E. V., *Takada.*
Bower, A. B., sick leave.
Bowling, J. E. K., *China.*
Bowman, H. A., *Nigeria.*
Boxer, H. R., *Hurunui.*
Boylan, J. A., *San Bernado.*
Bradfield, T., *Mashobra.*
Bradley, F. A., *Chigneeto.*
Brain, R. L., unattached.
Bramley, J. R. C., *Italia.*
Bransby, A. H., *Highland Brigade.*
Branton, S. B., *Pera.*
Bremner, J., *Barranca.*
Brennan, J., *Empress of Britain.*
Brett, C. H., *Limerick.*
Brewer, C. H., *Pomeranian.*
Bridges, W., *Desna.*
Bright, A. E., *Massilia.*
Brindle, F., *Kathiawar.*
Brookes, J. F., *Ardeola.*
Brophy, M. J., *Drina.*
Brown, A. C., *Galician.*
Brown, A. H., *Demerara.*
Brown, A. R., *Motagua.*
Brown, J., *Potaro.*
Brown, J. A., unattached.
Brown, S. W., *San Edwardo.*
Brown, Stanley W., *Deserado.*
Browne, A., *Huasco.*
Browne, C. W., unattached.
Brough, F. G., *Sicilian.*
Brun, L. S., *Perugia.*
Bryan, H. F. B., *Sardinian.*
Bryant, P., *Varela.*
Bedge, J., *Quillota.*
Bull, J. G., *City of Madras.*
Burgess, A. F. T., *Ucayali.*
Burgham, G. M., *Ruapehu.*
Burke, M. M., *Jeane.*
Burnett, W. C., *La Blanca.*
Burnett, W. J. T., *City of Chester.*
Burrows, T. R., *Borda.*
Butler, J., *Ivernia.*
Butterworth, J. M., *Abosso.*
Buttle, J. G., *San Tirso.*
Caine, G., *Minneapolis.*
Caldwell, A. C., *Suevic.*
Caldwell, J., *City of Paris.*
Calver, F. N., *Aquitania.*
Calver, G. H., *Megantic.*
Cameron, R. S., *Pardo.*
Camfield, J., *Bohemian.*
Campbell, M. J., *San Urbano.*
Candy, W. H., *Montcalm.*
Carey, J. P., *Mashobra.*
Carnaby, N. E., *Berwick Castle.*
Carroll, J., *Arzila.*
Carruthers, G., *City of Rangoon.*
Carter, B. A., *Baroda.*
Carter, W., *Chagres.*
Cauvin, M. A. H.
Cavanagh, H. S., *Knight of the Garter.*
Chadwick, J. G., sick leave.
Chapman, G. G., *Mongolian.*
Chapman, T. J., *Elma.*
Chesterton, A. J., *Itapura.*
Cheyne, J., *California.*
Chick, C. A., *Trafford Hall.*
Chick, O., *San Melito.*
Chick, W. H., *Orotava.*
Child, L. J., *Guatemala.*
Church, G. R., *Minnehaha.*
Church, T. M., unattached.
Clark, F., *Star of India.*
Clark, J. W., *Burutu.*
Clark, J. W. A., *Patian.*
Clark, L. B., unattached.
Clark, P. S., *Assaye.*
Clarke, A. H., *Oceanic.*
Clarke, A. M., *San Francisco.*
Clarke, H. T., *Comrie Castle.*
Clarke, J. G., *Sagamore.*
Clarke, W. F., *Lancastrian.*
Clarke, W. J., *Victorian* (Leyland).
Clarkson, G., *Crown of Toledo.*
Cleary, L. B., *City of Glasgow.*
Cleaver, W. W., *Orama.*
Cleverley, E. S., *Amazon.*
Clifford, A. J., *City of Bombay.*
Cobham, A., *Franconia.*
Cocks, H., *Melford Hall.*
Coldwell, G. A., *El Cordobes.*
Coleman, T. H., *Gloucestershire.*
Collier, J. R., sick leave.
Condon, D., *Cornishman.*
Condon, W., unattached.
Connell, J., Liverpool Depot.
Cook, E. J., *Ricardo A. Mestres.*
Cook, F., *Georgian.*
Cook, G. E., *Athenic.*
Cookson, V., *Sachem.*
Cormack, D. R., *Scindia.*
Cormack, W. L., *Gujurat.*
Cottam, H. T., Lochboisdale Station.
Cousens, E. C., unattached.
Cousens, W. T., *Clearway.*
Cowhey, K. S., *Laconia.*
Cox, E. J., *Knight Templar.*
Cox, L. H., *Eupion.*
Cox, W. G., *Baltic.*
Coysh, W. D., *Mongolian.*
Craigie, J. A., *Campania.*
Craven, W. M., *Themistocles.*
Crawford, J. G., *Andorhina.*
Crofts, A., *City of Durham.*
Croke, L. G., *Mantua.*
Crookes, W. D., *Tyrolia.*
Crosby, S., *Asian.*
Cross, S. R., unattached.
Crossman, C. H. G., *Karina.*
Cruess Callaghan, S., *Koranna.*
Cryan, W. J., *Michigan.*
Cunningham, J., *Lucerie.*
Cutbush, H. E., *Karroo.*
Curd, D. A., *Canadian.*
Dale James, W. R., *Marmora.*
Daly, D. G., *Trent.*
Daly, R. H., *Walmer Castle.*
Damen, O. G., *Inanda.*
Daniels, J. H., *Missouri.*
Darby, P. T., *Francis.*
Darracott, R. B., *Alnwick Castle.*
Davey, A. W., *Erinpura.*
Davies, F., *Caronia.*
Davies, J. E., *Orduna.*
Davies, J. I., *Mimiro.*
Davies, W., Liverpool Depot.
Davis, A. C. J., *Gaika.*
Davis, G. E., *Desabla.*
Davy, W. H. G., *Karema.*
Dawson, B., *Canopic.*
Dawson, W., *Philadelphian.*
Day, E. J., on leave.
Dean, F. A. W., *Parana.*
Dean, J. J., *Botanist.*
Dennison, P., *Den of Cromhie.*
Dennis, F. L., *Minnewaska.*
Devereux, S. H., *Royal George.*
Dewey, G. H., *Vitruvia.*
Dewitt, D. T., unattached.
Dick, J., *Ausonia.*
Dicks, A. G., *Rangatira.*
Dickinson, A., *Peru.*
Dixson, E. W., on leave.
Dods, L. A., *Victorian* (Allan).
Docherty, P., *Moldavia.*
Donnan, W. J., *Indian.*
Donnegan, J. J., *Berwindmore.*
Dowling, R. J., *Marquette.*
Driscol, J. R., *Waimera.*
Drohan, J., sick leave.
Duff, J., *Corsican.*
Duncanson, J., *Banora.*
Durston, W. J., sick leave.
Dyer, E. W., *Obuasi.*
Earl, H. E., *Alcantara.*
Earl, W. F., *Highland Rover.*
Earle, H., *Huallaga.*
Ebbetts, F. T., *Ellore.*
Eccles, P. B., *Delphic.*
Eddington, D. F., *Oruba.*
Edwards, W. G., *Karamea.*
Egan, M. B., *City of Madrid.*
Elliott, B. S., *Empress of Asia.*
Emry, B. F., *Arnkola.*
Empson, T. L., *Bankura.*
Enthwistle, A. M., *Aragon.*
Erbach, E. W., *Matina.*
Evans, A. W. N., *City of Baroda.*
Evans, C. F., *Manxman.*
Evans, T. H., *Runic.*
Fagg, G. K., *Andes.*
Farman, A. H., *Zent.*
Farmery, J. C., *Calypso.*
Farrell, R. T., *Siwazi.*
Ferguson, R., unattached.
Findlay, J. N., *Whakarua.*
Firman, A. R., *La Rosarina.*
Firth, P. S., *Idaho.*
Fitton, F., *Ruthenia.*
Fitzgerald, J. M., *Potomac.*
Fletcher, L., *Carmania.*
Ford, H., *Stephen.*
Foreman, D. G., *Ionian.*
Foster, R. T., *Tagus.*
Fowler, W., *San Zeferano.*
Fox, L. C., *Paparoa.*
Fox, W., *Knight Companion.*
Foyle, H. R., *Kentucky.*
Fraser, R.
Freeman, H. T. E., *Pardo.*
Frost, E. T., *Guildford Castle.*
Fry, F. A., *Hubert.*
Gadd, W. C., *Thongwa.*
Gale, B., *Cedric.*
Gale, W., *Walmer Castle.*
Galagher, H. J., *Omrah.*
Garbutt, H. W., *Kia Ora.*
Gardner, F. T., *Candidate.*
Gardner, R. S., *Numidian.*
Garwood, F. W., *Akabo.*
Garner, G. J., *Minnewaska.*
Gascoyne, R. A., *Oriental.*
Gibbs, J., *Cufic.*
Gibson, A., *Orita.*
Giles, A. M. D., on leave.
Giles, R. W., *Changuinola.*
Gill, C. J. A., *Merion.*
Gillam, A. C., *Carpathia.*
Gillett, B. A., *Carribean.*
Golding, J. H., *Guildford Castle.*
Goodsell, W. B., *San Valerio.*
Gordon, C. S., *Kumera.*
Gornall, J., *Empress Queen.*
Graham, T., *Indralema.*
Grant, P. C., *Galician.*
Graves, D., *Vandyk.*
Graves, W. P., *Hypathia.*
Gray, F., *Uranium.*
Gray, J. H., *Canadian.*
Gray, W. F., *Tanda.*
Green, E. H., *Campanello.*
Greene, A. L., unattached.
Greenstreet, P., *Whakarua.*
Gregory, R. V., *Potaro.*
Gregson, A. J., *Caesarea.*
Gregson, E. A., *Numidian.*
Greig, A. F., unattached.
Gresham Barber, K., London Office.
Griffith, J. T. R., *Munster.*
Griffiths, A., *Vauban.*
Grover, A. F., *S.Y. Lysistrata.*
Gullen, F., *Mechanician.*
Haddock, R. B., *Kenilworth Castle.*
Hagon, W. R., *Manzanares.*
Hague, W. J., *Duendes.*
Haining, A. J., *Kildonan Castle.*
Hainsworth, *Corinthian.*
Halcrow, A., *San Jeronimo.*
Hall, H., *Caraquet.*
Halsall, T. H., *Hesperian.*
Hamlet, M. B. W., *Peru.*

Hancock, L. A., *Pulawan.*
Hannah, W., *Campanello.*
Hanson, A. E., *Poleric.*
Harding, R., sick leave.
Hardy, R. S., *Laurentic.*
Hardy, C. L., *Bovic.*
Harford, R., *Minneapolis.*
Harlow, E., *St. George.*
Harris, C., *Royal George.*
Harris, A. J., *Lake Michigan.*
Harrop, T., *Aragon.*
Hart, H. P. J., *Nyanza.*
Hartigan, M. J., *Sardinian.*
Harvey, D., *Cassandra.*
Hatfield, A. H., unattached.
Hathaway, A. D., *Rimutaka.*
Hawes, H., *Manchester City.*
Hawkes, G. E., *Letitia.*
Heath, W. H., *Garth Castle.*
Henderson, W. C., *Jose de Larrinaga.*
Hendry, A. O. R., *City of Naples.*
Henry, R. J., *Nicoya.*
Herbert, C. W., unattached.
Herbert, T., unattached.
Herd, H., *Corsican.*
Hewitt, S., *Milwaukee.*
Hickling, W., *Berbice.*
Hicks, W. J., *El Toro.*
Higgins, W. M., *Andania.*
Hill, A. E., *Otranto.*
Hill, A. G., *Invertay.*
Hill, E. G., *Tunisian.*
Hill, G. R., *Vauban.*
Hill, V. J., *German.*
Hilton, F., *Scotian.*
Hindle, T., *Victorian* (Leyland).
Hirkley, J. P., *Anglian.*
Hitchner, J. W., *Barpeta.*
Hoare, H. R., *Corinthic.*
Hobbs, H. R., unattached.
Hodge, T. H., *Aronda.*
Hodgson, W. H., *Chinkoa.*
Hodkinson, E. D., *Arvila.*
Holden, H., *Kandahar.*
Holden, T. F., *City of Karachi.*
Holker, N., *Saldanha.*
Holland, E. J., *Barjora.*
Holliday, P., *Demerara.*
Holman, C. G., *Empress of Britain.*
Holmes, T. B., *Historian.*
Hooley, T. E., *Berwindvale.*
Hood, J. A., *Ultonia.*
Hooper, P. H., *Galeka.*
Hoppe, R. G., *Nubia.*
Horne, T., *Lusitania.*
Horwood, H. J., on leave.
Hosking, L. G., unattached.
Houghton, H., *Teutonic.*
Howard, E., sick leave.
Howard, J. Q., unattached.
Howard, W., *Hermione.*
Howlett, W. J., *Manitou.*
Huggins, W. T., *Neuralia.*
Hughes, C. L., *Highland Harris.*
Hughes, C. K., *Magellan.*
Hughes, L. E., *Olympic.*
Hughes, W. J., *Adriatic.*
Hugo, V. S., *Minnetonka.*
Humphreys, E. H., *Chilka.*
Hunt, F. G., *South Point.*
Hunt, G., *Victoria.*
Hunt, H. B., *Ballarat.*
Hunter, A. E., *Parthenia.*
Hutchison, W. E., *Highland Corrie.*
Inder, W. W., *Cymric.*
Ingoll, G. W., *Indus.*
Iredale, J. J., *Canada.*
Ings, W. A., *Star of Australia.*
Isherwood, T. P., *Afric.*
Jacobs, H. E., *Ascanius.*
James, F., *City of Exeter.*
James, R. C., *Kasenga.*
James, R. H., *Royston Grange.*
Jamison, A. F., *Oronsa.*
Jeffries, A. H., *Ulster.*
Jefferies, F., *California* (Anchor).
John, W. J., *Syria.*
Johnson, F., *Denis.*
Johnson, W. A., *San Fraterno.*
Johnston, M., *Kasama.*
Jolly, E. E., *Briton.*
Jones, A. E., *India.*
Jones, A. V. G., *El Argentino.*
Jones, C. E., *Antillian.*
Jones, C. F., *Quillota.*
Jones, H., *Hydaspes.*
Jones, J. P., *Calgarian.*
Jones, O., *Osterley.*
Jones, R., *Columbia.*
Jones, R., *Antillian.*
Jones, Richard, *El Uruguayo*
Jones, T. G., *Arabic.*
Jones, W. A., sick leave.
Julius, A., *Orduna.*
Kean, O. P., *Manhattan.*
Keen, F. L., *Saxonia.*
Kelly, J. A., *Pomeranian.*
Kelly, K. C., *Sicilia.*
Kett, H. S., *Philadelphian.*
Kenworthy, H. D., *Goorkha.*
Kinder, F. V., *Westmeath.*
King, B., *Colorado.*
King, R. R., *British Sun.*
King, R. M., *Araguaya.*
Kingsbury, A., *Makarini.*
Kingsford, J. R., *S.Y. Sapphire.*
Kinipple, —., *Sagamore.*
Knapman, W. H., *Simla.*
Knox, T., *Ulysses.*
Kull, G. R., *Llandovery Castle.*
Lacock, T. J., *Scandinavian.*
Lambert, E.,
Lambert, G. H., *Circassian.*
Lambert, L. J., *Medic.*
Lang, H. K., *Athenia.*
Langham, A. E., *Charles E. Harwood.*
Langley, A., unattached.
Law, C., *Shenandoah.*
Law, S., *Pannonia.*
Lawson, A. L., *Araguaya.*
Lawton, A. H., *Flamenco.*
Lea, R. H., *Wayfarer.*
Learmon, E. E., *Anglian.*
Leche, W. J., *Ben My Chree.*
Ledward, T. A., *Aguila.*
Lee, G., *Musician.*
Lee, R. A. C., *S.Y. Cassandra.*
Lee, W., *Mexico (P.S.N.).*
Leech, H. S., *Cymric.*
Leeds, K. F. N., *Ellenga.*
Lees, E. A., *City of Winchester.*
Lees, J. H. D., *Nagoya.*
Lefebure, H. H. R. A. C., *Baron Napier.*
Leighton, L. H., *Narragansett*
Leith, R., *Aquitania.*
Leith, S. A., sick leave.
Lemon, S., *Alsatian.*
Leonard, D. P., *Lancastrian.*
Lever, G. H., *Marquette.*
Lewington, W. H., *Francisco.*
Lewis, W. T., *Laconia.*
Lewis, S. B., *Buffalo.*
Lewis, S. W., *Desna.*
Lightfoot, H. J., *Darro.*
Lillis, W., *C. A. Canfield.*
Lines, W. T., *Pannonia.*
Linnell, F. J., *Rotorua.*
Lister, C., *Carribean.*
Litchfield, C. P., *Den of Ruthven.*
Lithgow, W. H., *City of Colombo.*
Little, H. T., *Exmouth II.*
Lock, H. G. W., *Palermo.*
Longton, C. E., *Letitia.*
Lovelock, J. D., *Michigan.*
Lovett, F. J., *Melford Hall.*
Lovibond, R. A., *Parana.*
Lucey, J., *Candia.*
Lund, A. C., *Braemar Castle.*
Lush, J. K., *Nestor.*
Lynch, G., *Ghazee.*
Lyons, J., *Oronsa.*
Macdonald, J., *Marina.*
Machan, J. W., *City of Corinth.*
Mackenzie, C. F., sick leave.
Mackintosh, J., *Atahualpha.*
Macleod, S. E. S., *Hororata.*
Macnab, J. A., *Bohemian.*
Macrea, C., *Lusitania.*
Macrea, K., *Ingoma.*
Madgwick, G., *Mahrousa.*
Maltby, P. B., *City of Bristol.*
Mangan, D. D., *Chirropo.*
Mares, A. H., *Castalia.*
Marriott, J. E., *Dunluce Castle.*
Marsh, J. E., *Dominion.*
Marshall, W. P., *Scandinavian.*
Martin, P. B., *Olympia.*
Martin, S. F., *Melania.*
Martlieu, J. E., *Asturias.*
Massey, C. T., *Mesaba.*
Massey, W., *Dakar.*
Masters, C. E. E., *Euripides.*
Mather, J., *Andania.*
Matthews, E. N., *Niceto de Larrinaga.*
Matthews, W. C., *Eskimo.*
Mattinson, P. V., *Cassis.*
Mattock, P., *Oriana.*
Maudsley, C. B., *Caronia.*
Morris, J., *Den of Airlie.*
Mauro, O. G., *Junin.*
May, A. H., *Manitou.*
May, P. B., *Armadale Castle.*
Maycock, T. C. C., *Star of Scotland.*
Mayer, E. D., *Edinburgh Castle.*
McCarthy, C. P., *Oceanic.*
McCarthy, C. M. M., *Campania.*
McCarthy, C. J., *Isis.*
McCormack, D. C., *Sandon Hall.*
McCreath, R. V., *Drumlanrig.*
McCrohan, T., *Inca.*
McCrutcheon, W. J., *Reventazon.*
McEnery, T. C., *Ayrsn.*
McGhee, W. J., *Calgarian.*
McKenna, J. M., *Crofton Hall.*
McKierman, —., *Agadir.*
McLachlan, D., *Genesee.*
McLennan, R. F., *Gloucester Castle.*
McMillan, J., *Hesperides.*
Melling, H., *Denby Hall.*
Meredith, M. W., *Italia.*
Meyer, G. W., *Manhattan.*
Middleton, P. G., *Hilary.*
Miles, J. L., sick leave.
Miles, L. J., *Victorian* (Allan).
Miller, D., *Ballantia.*
Miller, W., *Persic.*
Miller, W. J., *Start Point.*
Mills, H. H. L., unattached.
Mills, L. C., unattached.
Mills, W. H., *Gaika.*
Mitchell, A. J. H., *Galway Castle.*
Mitchell, F., *Khyber.*
Mitchell, P. M., *Matatua.*
Mitchell, S. W., *Appalachee.*
Mole, H., *Custodian.*
Monsey, M., *Scotian.*
Montgomerye, J., *Prefcrian.*
Montgomery, B. H., *Chaleur.*
Moody, J., *Balmoral Castle.*
Moon, A. T., *Angora.*
Moore, J. J., *Quernmore.*
Moores, J. A., *Arankola.*
Morgans, R. H., *Tarquah.*
Moriarty, D. J., *Matoppo.*
Morris, P., *Cedric.*
Morris, C. E., *Kalomo.*
Morris, T. P., on leave.
Morrison, L. D. T., *Barala.*
Morrison, J. D., *Saturnia.*
Morse, W. S., *Vandyck.*
Moss, C. O., *Anthony.*
Mountain, R. H., *Drina.*
Mowe, F. H., *S.Y. Valiant.*
Mulhall, J. P., *Caraquet.*
Munro, H., *Saturnia.*
Murch, R. W. B., *Petuca.*
Murphy, D., *Wakatane.*
Murphy, E., *Mauretania.*
Murphy, H. P., *Ortega.*
Murphy, J., *Mantaro.*
Murray, T. W., *Aquitania.*
Muschamp, T., *King Orrie.*
Myron, G., *Tritonia.*
Naller, E. I. F., *Borderer.*
Nash, R. H., *Herefordshire.*
Naylor, A. T., *Gascon.*
Needs, W. A., *Nellore.*
Nelson, G. H., resigned.
Nethercote, J. K.,
Newby, F. W., *Shenandoah.*
Newman, W., *Highland Watch.*
Newman, L. S., *Canning.*
Nicholas, W. G., *Bolton Castle.*
Nichols, G. J. G., *Huntsman.*
Nicholson, A., *Taroba.*

Nicholson, J., *Winefredian.*
Nightingale, F., *Bandra*
Nixon, C. S. C., *Dewa.*
Noble, H., *Palma.*
Nolan, J. J., *San Hilario.*
Norwood, P. R., *Warwickshire.*
Nowlan, C. F., *Moto.*
Obey, W. C., *Avon.*
O'Brien, G. W., *Marere.*
O'Carroll, M. E., *Cassandra.*
O'Connor, A. W., *Highland Warrior.*
O'Connor, J., *Iroquois.*
O'Connor, P., *Principello.*
O'Connor, P. J., *Narragansett.*
O'Connor, T., *Montfort.*
O'Donnell, T. J., *Laurentic.*
O'Halloran, T., *Otaki.*
O'Keefe, P., *Vedamore.*
Oliver, C. A., *Maloja.*
Oliver, H., *Arcadia.*
O'Riordan, T., *Marengo.*
Osborne, A. J., *Tunisian.*
Osborne, A. E., *Sutherland Grange.*
Osborne, J. Edwin, *Cluny Castle.*
Osborne, R. F., *Trent.*
O'Sullivan, D., *Mount Temple.*
O'Sullivan, C. F., *Turcoman.*
O'Sullivan, J. P., unattached.
Overall, E., *Sablei* (Canadian Co.).
Owen, A. W., *Bogota.*
Owen, L. L., *El Toro.*
Owen, R. M., *Carpentaria.*
Owen, W., *Aaro.*
Owlett, R. A. J., *Ivernia.*
Packer, R. H., *S.Y. Iolanda.*
Pales, F. A., *Ascania.*
Palmer, H. M., *Remuera.*
Pannett, W. E., *Menominee.*
Parker, C. T., *Khiner.*
Parker, E. P., *Nevasa.*
Parkinson, W., *Kathlamba.*
Patrick, R. V., *Kildonan Castle.*
Payne, J. H., *Peshawur.*
Payne, T. A., *Minnehaha.*
Pavitt, H. J., *Ausonia.*
Pearson, D. E., sick leave.
Peever, F., *Tropic.*
Penketh, G., *Star of Ireland.*
Pennington, C. J., *Star of Victoria.*
Penrose, H. E., *Minnehaha.*
Pepper, G. F., *Llanstephen Castle.*
Perfect, A. E., sick leave.
Perkins, C. W., *Leicestershire.*
Perkins, H. J., *Haverford.*
Perlman, A., *Bloemfontein.*
Peterson, T. G., *Morea.*
Pettingill, W., *Orsova.*
Phelan, N. J., *Orita.*
Pink, Alfred, *City of York.*
Pitchford, G. R. J. W., *Lanfranc.*
Pitkeathly, W., *Garth Castle.*
Planterose, E. A., *Arabia.*
Pollard, F. G., *Arlanza.*
Ponsford, W. H., *Grantully Castle.*
Pope, H. W., *Crown Point.*
Porter, H. R., *Winifredian.*
Pott, G. M., *Grampian.*
Potts, A. S., *Mexico.*
Potts, J. W., *Naneric.*
Power, P. J., *Galeka.*
Power, R., *Rufford Hall.*
Preece, E., *Surat.*
Preston, M. A., on leave.
Pritchard, F., unattached.
Proughton, A. J., *Tonawanda.*
Quinlan, J. F., *Oreoma.*
Railton, N., *Marere.*
Ralphs, P. L., *San Isidoro.*
Rapsey, C., *Patia.*
Ratcliffe, L. G., *City of Calcutta.*
Ratcliffe, T. C., *Avon.*
Rattee, S. G., *City of Lahore.*
Raw, W., *Arawa.*
Rawsthorne, W., *Pacuare.*
Rea, J., *Aracataca.*
Read, C. A., *Sachem.*
Reid, H. S., *Highland Loch.*
Reid, S., *Haverford.*
Reid, W. H. W., Turkish "Dreadnought" *Sultan Osman I.*
Reidy, M., *Etonian.*
Renshaw, P. J., *Ultonia.*
Renshaw, R. W., *Celtic.*
Renwick, W. D. R., *Highland Heather*
Revell, J. L., *Geelong.*
Reynolds, A. J., *Galileo.*
Reynolds, F. W. J., *Carnarvonshire.*
Rhodes, T. C., *Ionian.*
Ricel, R. E., *Tainui.*
Rice, H. W., *Carmania.*
Rice, P. F., *Indrabarrah.*
Ridley, K. M., *Aeneas.*
Rivitt, F. W., *City of Edinburgh.*
Robb, T., *Toronto.*
Roberts, C. O., *Oropesa.*
Roberts, C., *City of Benares.*
Roberts, G., *Virginian.*
Roberts, M., North Point.
Robertson, C., *Goorkha.*
Robertson, D., *Cardiganshire.*
Robertson, J. K., *Cheyenne.*
Robinson, F. V., *Highland Piper.*
Robinson, L., *Glemetive.*
Robinson, S., *Suveric.*
Robson, E. W., *Cameronia.*
Rogers, T. J., *Minnetonka.*
Rookes, C. E., *Turcoman.*
Rooney, P. J., *City of Dunkirk.*
Ross, W. M., *Hesperian.*
Rowden, W. A., *Aidan.*
Rowlands, H., *Manistee.*
Rowlatt, F. W., *Viking.*
Rudderham, S. W., *West Point.*
Rundle, E. H., *Persia.*
Rushforth, A., *Potosi.*
Rushworth, F. B., *Sicilian.*
Rushton, F., *Carpathia.*
Russ, E., *Cretic.*
Ryan, J., *Hatumet.*
Ryan, L., *Mongolian.*
Ryan, V. A., *Hawkes Bay.*
Ryan, W. G., *Montreal.*
Saich, J. A., *Canopic.*
Salmon, J. B., *Highland Glen.*
Salmon, J. L., *Empress of Russia.*
Salter, T. H., *Asian.*
Salway, R. L., *Mongara.*
Saunders, C. T., *Arcadian.*
Sanderson, L. T. N., *Star of England.*
Sandison, J. L., *Baltic.*
Sandham, T. D., *City of Lincoln.*
Sandford, J., *Merion.*
Sandon, W. R., *Commonwealth.*
Sang, H. K., *Athenia.*
Santry, M., *Principello.*
Sayer, H. T., *Great City.*
Scales, C. W., *Atlantian.*
Schofield, A., *Guatemala.*
Scott, M., *Knight Bachelor.*
Scott, R. C., *Esmeraldas.*
Sculley, E., *Navahoe.*
Searl, C., *Empress of Asia.*
Seers, A. L., *Orissa.*
Sedding, N., sick leave.
Seddon, A., *Star of Scotland.*
Seddon, W., sick leave.
Seeney, H. W., *Berbice.*
Sellars, G. H., *Caledonia* (P. & O.).
Sequeira, H. C., *Turakina.*
Sharp, E. W., *Thongwa.*
Sharpe, C. H., *Ascania.*
Sharpe, F., *West Point.*
Sharpe, W. H., *Egypt.*
Sharples, E., *Katuna.*
Shatwell, E., *Walton Hall.*
Shaw, A. H. H., *Armenian.*
Shore, R. M., *Mamari.*
Shrimpton, E. T., *Kaipara.*
Silvester, W. H., Hull trawler *Columbian.*
Simmons, E. A., unattached.
Simmons, H. F., *Pachitea.*
Simmons, J. M., *Victoria.*
Simms, W. R., *Saxon.*
Simpson, J. C., *Arcadian.*
Simpson, T. A., Callao Depot.
Sinclair, D. H., *Herbert G. Wylie.*
Single, G., *Darro.*
Skinner, J. S., *Andes.*
Slater, F., *Iberian.*
Slockett, S. W., unattached.
Smith, A. C., *Canada.*
Smith, A. F., *Intaba.*
Smith, D. A., *Highland Heather.*
Smith, F. J., *Imperial.*
Smith, F. J. D. B., *Drumcliffe.*
Smith, H. F., *Berrimore.*
Smith, H. S., *Navara.*
Smith, L. J. G., *Arlanza.*
Smith, P. S., *Celtic.*
Smith, S., unattached.
Smith, W., *Salmo.*
Smith, W. H., *Inkosi.*
Smythe, G. W., *Malda.*
Snow, H. C., *Cretic.*
Snow, W. E., *Hyacinthus.*
Snowden, H., *Kingstonian.*
Soames, R. T., *Waimara.*
Soar, R. A., sick leave.
Salway, H. E., Canadian Company.
Sotheran, A. W., *Banca.*
Southan, R. W., *Otway.*
Spence, R. S., *Devonian.*
Spicer, S. W., on leave.
Spiers, J., *San Ricardo.*
Sproat, D. M., *City of Marseilles.*
Sprota, H., *Mexico.*
Spurgeon, W. P., *Sardinia.*
Standen, T. F., unattached.
Stanley, H. J., *Nore.*
Stannard, C. E., *City of Norwich.*
Stansbridge, S., *Adriatic.*
Stansfield, B. B., *Miltiades.*
Starky, J., *Kinfauns Castle.*
Stephen, A. K., *Gascon.*
Stephenson, J. A., *Highland Hope.*
Stevenson, A., *Druncree.*
Stevenson, P., *Niscaru.*
Stevenson, J. L., *Indrapura.*
Steward, E. H., *Karmala.*
Stewart, L. C., *Virginian.*
Stewart, W. M., *Calabria.*
Stickland, A. G., *Muritai.*
St. John, H. W., *Viking.*
Stocker, A., Canadian cruiser *Margaret.*
Stockton, S. A., unattached.
Stone, J. B., *Olympic.*
Strong, R., *Socotra.*
Stubbs, T. H., *Agadir.*
Studholme, J. J., *Patrician.*
Sturdy, H., *Quilpue.*
Styles, A. C., *Ionic.*
Summerlin, S. C., *S.Y. Alberta.*
Summers, E. B., *Calabria.*
Sutherland, D., *Cameronia.*
Sutherland, W. G., *Mauretania.*
Sweeny, W., *Caledonia.*
Sweetnam, R., *Delta.*
Syme, W. A., *Orvieto.*
Symes, J. L., *Walmer Castle.*
Taylor, C. G., *Durham Castle.*
Tamplin, L. H., *Danube.*
Tamplin, C. J., *Kingstonian.*
Tayler, G. R. W., *Kumeric.*
Taylor, A., *Tortuguero.*
Taylor, A., *Chignetto.*
Taylor, A. W., *Monmouth.*
Taylor, C. G., *Durham Castle.*
Taylor, H. W., *San Lorenzo.*
Taylor, R. F., *Seal.*
Taylor, W., *Osiris.*
Taylor, Wilfred, *Etonian.*
Taylor, W. G., *Palawan.*
Teahom, S., *Pretorian.*
Terraneau, E. G., *Nerehana.*
Thacker, G. H., *Cardiganshire.*
Thomas, G., *Cambrian.*
Thomas, G. H., *Edward L. Doheny.*
Thomas, H., *Hatinga.*
Thomas, W., *Alsatian.*
Thomas, W. H., *El Paraguayo.*
Thomasson, F., *Franconia.*
Thomasson, H., *Orotava.*
Thompson, A., *Mendi.*
Thompson, A. T., sick leave.
Thompson, W. J., *Nankin.*
Thompson, E. A., *Highland Seal.*
Thomson, G., *Salsette.*
Thomson, J., *Highland Watch.*
Thomson, J. R., *Mauretania.*
Thomson, H., *Cameronia.*
Thorpe, W. E., *Indralema.*
Threlkeld, T. G., *Worcestershire.*
Tilford, G. L., *City of York.*
Timperley, J. H., *Kelvinia.*
Tunbridge, T. G., *Crown of Seville.*

Tozer, E. C., *Colombia* (Anchor).
Turner, G. E., *Gloucester Castle.*
Turner, J., *Salamis.*
Turner, H., *Deseado.*
Tyler, G. R., *Teutonic.*
Tyler, W. E., *Sorata.*
Turner, A., *Balmoral Castle.*
Underwood, H. G., *Karonga.*
Utting, R. T., *Tongariro.*
Veale, R. G., *Orvina.*
Vincent, J., *Morea.*
Vincent, J. R., *Beltana.*
Wainwright, A. C. L., *Baron Erskine.*
Wakeling, G. P., *Elysia.*
Walker, H. B., Callao Depot.
Walker, S. S., *Duendes.*
Walker, S. R., *East Point.*
Walker, T. R., *Anchises.*
Wall, D. G., unattached.
Wallace, W. W., *Roseric.*
Wallworth, W. A., *Highland Enterprise.*
Walsh, L., Bayano.
Walsh, S. P., unattached.
Walsh, S. B., *Celtic.*
Ward, A., *Highland Harris.*
Ward, H., *Galway Castle.*
Ward, J. N., *Ceramic.*
Ware, W. R., *Montezuma.*
Warner, E. L., *Falaba.*
Warner, N. S., *San Antonio.*
Warren, H. G., *Keelung.*
Wasley, J. G., *Eagle Point.*
Waters, E. H., *Englishman.*
Waterworth, A., *Kahoura.*
Watkins, L., *Lake Manitoba.*
Watkinson, E. A., *Kenilworth Castle.*
Watson, G. H., *Athenia.*
Watts, B. O., unattached.
Webb, C. B. N., *Derbyshire.*
Webb, R. A., *Chile.*
Weller, C. A., *Ruahine.*
Weller, E. S., *City of Delhi.*
Wellington, C., *Ortega.*
Weselby, A., *Kabinga.*
Wheeler, N. B. W. M., *Saxon.*
Whittaker, C. H., *Highland Pride.*
White, A. C., *Kioto.*
White, V., *Den of Ogil.*
Whittaker, H. A., sick leave.
Whittred, H., *Chaudiere.*
Wickers, H. M., *Itacuera.*
Wignall, R. M., *Orcoma.*
Wilcox, A. E., *Perugia.*
Wilkins, A., *Hildebrand.*
Wilkins, J., unattached.
Wilkings, D. W., *Rappahannock.*
Wilkinson, E., *Amazon.*
Wilkinson, J., *Atlantian.*
Willett, F. W., *Kasembe.*
Williams, A. C., *Orontes.*
Williams, F. A., *Alcantara.*
Williams, D. F., *Tagus.*
Williams, G. V., *Digby.*
Williams, J., *Kansas.*
Williams, J. R. T., *Toko Maru.*
Williams, J. T., *Miami.*
Wills, H. C., *Malwa.*
Wedger, N. G., *Llanstephen Castle.*
Wilson, H. O., *Limbari.*
Wilson, N. J., *Caledonia.*
Wingrave, D. W., *Balantia.*
Winser, W. F., *Coronada.*
Wood, C. B., on leave.
Wood, C. E., *C.S. Restorer.*
Wood, D., *Ashtabula.*
Wood, T. A., *Osla.*
Woodhouse, W. A., *Norseman.*
Woods, F., *Swanmore.*
Woods, L. J., *Panama.*
Woodward, J.-E., *Commanchee.*
Woollam, M. W., unattached.
Woolley, L., *Kinfauns Castle.*
Woolway, C. J., *Statesman.*
Wright, E., *Rodstone.*
Wright, F. N., *Menominee.*
Wright, G. J., *Llandovery Castle.*
Wright, T. G., *Edavana.*
Wright, D., *Michigan.*
Wroughton, F. N. M., *Marathon.*
Wyard, L., *Quilpue.*
Wyatt, F. C., *Kenuta.*
Wyatt, R. G., *Borneo.*
Wyatt, A. W., *Mooltan.*
Yelding, A. T., *Kafue.*
Yelland, W. P., *Manora.*
Yorston, J. F., *Elmina.*
Young, F. E., *Empress of Russia.*
Young, J., *Galicia.*

Resignations

Charles, E. C., June 23rd.
Clarke, L. B., June 20th.
Herbert, T., July 1st.
Williams, G. H., June 23rd.

New Staff

Andrews, H.
Basson, J. W.
Brough, F. G.
Curtis, T.
Dawson, J. P.
Frost, E. T.
Green, J. W.
Greenough, H.
Greenwood, H. P.
Gregory, F.
Haddick, T. E.
Hall, P. E. W.
Hannah, W.
Hill, W. F.
Hodkinson, E. D.
Holmes, C. F.
Jagoe, J. S.
Mayne, T. E.
Norfolk, E.
Reeves, R. C.
Robinson, H.
Rogers, T. J.
Seaton, C. T.
Skidmore, C.
Steward, W. F.
Tamplin, C. J.
Thacker, G. H.
Turner, R. E.
Wilson, F. E.
Williams, S.

Transoceanic Operators

(June 15th.)

Anderson, G., School.
Brown, A. E., Towyn.
Brown, W. J., Telegraph Office.
Bisping, A., Telegraph Office.
Baker, W., School.
Boot, E., Telegraph Office.
Bentley, F. W., School.
Bentley, S. G., School.
Bush, J., School.
Bradbury, W. J., Towyn.
Bruton, A. E., Towyn.
Butler, S. J., Towyn.
Black, S., Clifden.
Belcher, H. J., Clifden.
Cole, G. H., Towyn.
Cotter, W. J., Clifden.
Charlton, W., School.
Clifton, G. F., School.
Dodd, C. S., Towyn.
Davey, W. M., Towyn.
Digby, —, Clifden.
Eggleston, J. W., School.
Gray, J. D., Telegraph Office.
Groves, W. G., Telegraph Office
Green, H. C., School.
Gillan, P., School.
Greenstock, E. W., School.
Gallivan, T., Clifden.
Hills, G., Telegraph Office.
Harvey, H., School.
Hurley, A. H., School.
Halliday, —, Carnarvon.
Hindson, G. E., Towyn.
Hardy, H. E., Clifden.
Hibbert, —, Poldhu.
Illman, W. T., School.
Jefferson, G. E., Towyn.
Jezzard, E., Clifden.
Kelsey, D. C., School.
Lackmaker, S., School.
Lipscombe, A., School.
Lyall, F., School.
Moore, A., Telegraph Office.
Macdonald, E. P., School.
Mushens, E. G., School.
Mallet, H. D., School.
Moodey, L. T., School.
Miles, F., Towyn.
Miller, O. G., Towyn.
Moore, F. H., Towyn.
Noakes, F. W., Telegraph Office.
Norris, C., Clifden.
Phillips, P., Telegraph Office.
Polly, A. J., School.
Phillips, A., School.
Parsons, S. G., School.
Picot, C., Towyn.
Phillips, S. C. Towyn.
Pain, —, Clifden.
Pettyfer, P. H., Clifden.
Reeves, G., Telegraph Office.
Rurden, F., School.
Richardson, L. F., Towyn.
Rogers, J., Clifden.
Smith, Seton, Telegraph Office.
Smith, J., Telegraph Office.
Stanbridge, A. S., Telegraph Office.
Skeggs, E. P., School.
Shepstone, S. E., School.
Soorn, P. S., Towyn.
Stevenson, J. B., Towyn.
Sutherland, W. G., Towyn.
Stickles, T., Telegraph Office.
Skeet, —, Clifden.
Smiddy, —, Clifden.
Taylor, R., School.
Treacy, P., Poldhu.
Webb, T., Clifden.
Whale, G. S., School.

Staff Notes.

Cricket.

The annual cricket fixture of the Marconi C.C. *v.* Marconi Works, Chelmsford, was held at Acton, on Saturday, July 11th. The match, which had some very exciting moments, resulted in a victory for the Works team by two wickets. The outstanding feature of the day's play was a brilliant innings of 42 by F. W. Bates for the Office team.

The glorious weather assisted in making the occasion a great success, attracting a large crowd, who enthusiastically followed the play.

An alfresco concert was carried out in the evening and items were contributed by members of the teams and their friends. Following this entertainment a few dances brought a most successful day to a close.

Marconi House Cricket Team.

Photo by] [*Mr. P. W. Harris.*

Back Row (left to right) : E. G. de Lange, E. Golland, F. Menaer, W. H. Smith, A. Soar. Front Row : R. J. Stokes, E. Morton, R. Williams, S. B. Balcombe, G. Ramage, F. W. Bates (in centre)

Swimming.

A variety of causes have interfered with several of the swimming matches arranged for July and August, so that these, perforce, have had to be postponed. Nevertheless, the members of the club actively continue their practices and turn up in full force on club nights. However, there is one fly in their ointment of content, for the baths of their patronage have become too popular this hot weather; crowds flock thither every evening and at times there is scarcely elbow room, much less swimming room, for the bather; or, as one member aptly remarked, "There is more body than water in the bath!"

Music.

The musical society takes a well-earned rest during the summer months, but not so the society's leaders; they are organising, planning and recruiting, and so pleased are they with the results of their labours that they are seriously considering a proposal to give during the autumn a rendering of some more important choral work than has hitherto been attempted. To do this they will require all the enthusiasm and wholehearted support that the members can afford them. Additional alto and soprano volunteers, too, would make the task of the organisers a lighter one.

Sports.

The second annual sports meeting of the Marconi Athletic Club has been fixed for Saturday, September 5th, and it is hoped that all members, by the support of themselves and their friends, will help to make the occasion a memorable one.

A number of contests have been arranged, of which the following is the official list:—(1) 100 yards Flat Handicap; (2) 220 yards Flat Handicap; (3) 440 yards Flat Handicap; (4) Mile Handicap; (5) Throwing the Cricket Ball; (6) High Jump; (7) Ladies' Egg and Spoon Race; (8) Boys' Hundred Yards Race; (9) Potato Race; (10) Sack Race; (11) Thread Needle Race; (12) Three-Legged Race; (13) One Mile Walking Handicap; (14) Departmental Relay Race; (15) Tilting the Bucket; (16) President and Vice-President's Race.

Personal.

Mr. B. E. Reinold has been appointed to H.M.S. *Marlborough* for torpedo and wireless telegraphy duties.