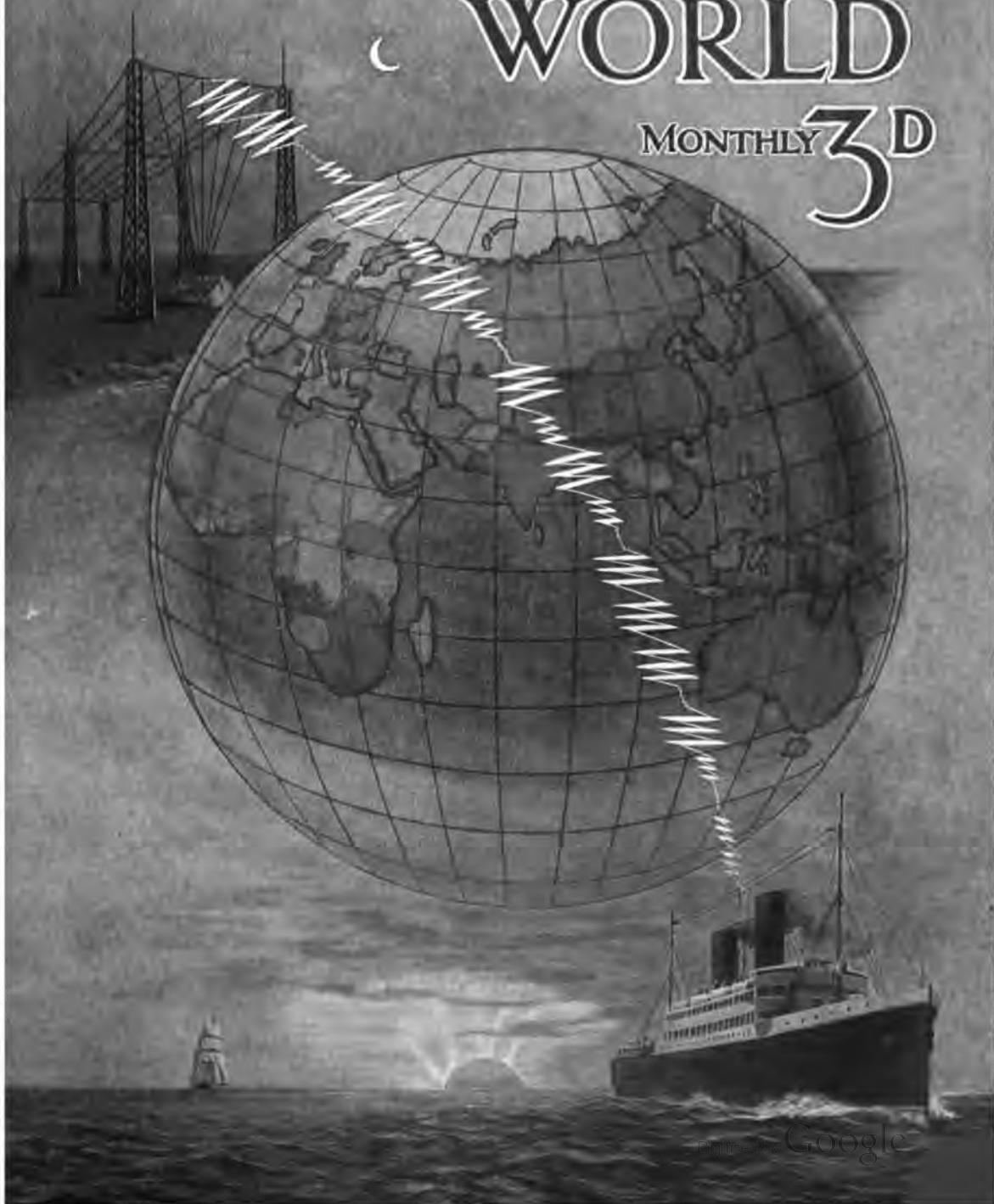


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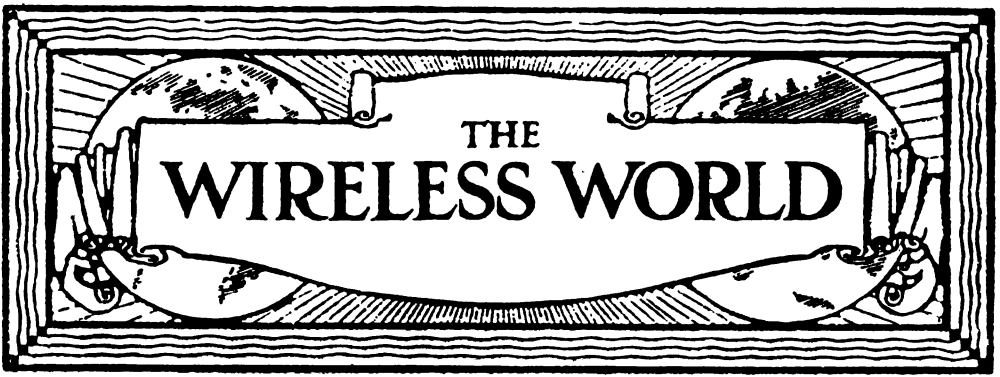
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A CROWDED YEAR

STRIDENT WARFARE AND SILENT WAVES.

WITHIN a few days of the date when this number comes into our readers' hands we shall reach the first anniversary of Britain's entry into the great world-war.

In the field of radio-telegraphy, one of the most fruitful for prophecy, incessant and ever-increasing activity reigns, providing a striking refutation of the idea previously so widely held, that "wireless" in war-time would be virtually useless, owing to deliberate and intentional interference on the part of the opposing nations. We were emphatically assured that each fleet would "jamb" the messages of the other, so that nothing of importance would get through. So far as we are allowed to judge, the reverse has actually occurred. Each side is trusting increasingly to its powers of wireless communication with its own fleet, and devoting less expenditure of energy to attempts for deliberately interfering with the enemy. Such interference has been attempted, but, as far as we can judge from available information, with little success.

On the field of battle in Flanders, in the plains and marshes of Galicia, on the Gallipoli Peninsula, on the sun-baked veldt, and in the steaming morasses of what was erst German South-West and East Africa respectively, wireless portable stations are carrying out useful work. We publish in this issue a note showing the important part played by "wireless" in General Botha's victorious progress, where vast areas combined with sparse population to render its aid invaluable.

Aeroplanes and airships daily use the medium of radio-telegraphy for trans-

mitting the results of their reconnoitring work, and even submarines utilise the æther-wave telegraph when cruising on the surface. With regard to the latter, however, Britishers are more concerned with "wireless" as a potent weapon of defence against German submarine piracy. Wireless calls for aid form the only weapon available to most British merchantmen, and in an astonishing number of cases this resource has proved the salvation of the craft, its personnel, and its passengers. Instances are so constantly multiplying that it has become almost monotonous to chronicle them in the pages we devote monthly to "Wireless and the War."

One of the most striking achievements was undoubtedly the severing, within four hours of the declaration of war, of the whole of Germany's submarine cables. As far as wired communication is concerned, that country has remained ever since virtually isolated. The only direct telegraphic communication possible between Germany and such neutral countries as do not border her boundaries has been effected by means of wireless telegraphy through the high-power stations at various points in the Fatherland.

Our ancestors with their poetic idealism used to picture the air as peopled by invisible spirit-strife contemporaneous with the struggles on the surface of the earth. The Valkyria of our northern ancestors form only typical instances of a widespread belief. To-day we have turned this poetic fiction into a reality, and perhaps it is hardly too much to say that the strife in the æther ranks only second to the titanic struggles beneath it.



MR. WILLIAM LLEWELLYN
PREECE,
M.I.C.E., M.I.E.E.

Personalities in the Wireless World

MR. WILLIAM LLEWELLYN PREECE,
M.I.C.E., M.I.E.E.

THE paper read recently by Mr. Preece before the Institution of Electrical Engineers on "Telephone Engineering in the Tropics," has brought our headlight more conspicuously before the public, if that be possible. Mr. Preece is the eldest son of the late Sir William Preece, K.C.B., F.R.S., and first saw the light at Southampton, on March 4th, 1866. He early developed a leaning towards science in its widest aspect, and in order to foster this interest he was sent to King's College School. After a preliminary education at that well-known foundation his parents deemed it advisable to send him to Switzerland and Germany, where his general education was completed. From the technical standpoint, however, his mind had only then commenced to broaden, and in order that his desires might be given full play he spent the year 1885 at the Electrical College, in Hanover Square, London. His special bent, however, appears to have been telegraphy and telephony, and in 1886 he joined the staff of the Midland Railway Telegraph Department at Derby under Mr. W. E. Langdon, the superintendent. Here his progress was so rapid that he became Telegraph Inspector in 1887, Electrical Light Assistant Engineer in 1888, and was appointed to fill the post of Chief Assistant to the Superintendent in 1892. After having satisfactorily discharged the duties imposed upon him by the railway company he decided to widen the scope of his activities and seek "fresh fields and pastures new." With this object in view he placed his resignation in the hands of the railway company, and retired from their service in 1898.

Turning his attention to the channels of commerce he took up a partnership in his father's firm, Preece & Cardew, consulting electrical engineers, the other directors of which were his father (the late Sir William Preece), Major Cardew, and Mr. A. H. Preece. Here he was entrusted with all telegraph and telephone matters with which his firm was

directly or indirectly concerned. This included telegraphs and telephones in all the Crown Colonies, South Africa, New Zealand, and, until the formation of the Commonwealth, the Australian Colonies.

Subsequently his name was brought before the Government of that day, and he acted as Consulting Engineer to the Colonial Office for the wireless telegraph stations erected at Aden, Somaliland, Fiji Islands, Ceylon, Accra, Gold Coast, Singapore, Penang, Hong Kong, Solomon Islands, Ocean Island, and, conjointly with Captain Brunot, represented the French Government in the New Hebrides. As a result of the British Government's decision to inspect the telegraphs and telephones in the East, he was in 1912 asked to undertake a tour in the Malay Peninsula and Ceylon and report on the systems of the various local Governments. In the same year sat the special Parliamentary Committee on the Contracts for the Imperial Wireless Scheme, and the valuable knowledge and clear insight into the technical problems connected with telegraphy and telephony, which Mr. Preece had perforce acquired, were requisitioned. In November of the same year he gave evidence before this special committee.

In 1914 Mr. Preece conceived the plan of entirely revising and partly re-writing the well-known text book on "Telegraphy," compiled by his late father and Sir J. Sive-wright. The energy necessarily expended in the revision of a book is great. Mr. Preece, however, set himself the laborious task, not only in the interests of science, but also as a labour of love in order to bring up to date the work of his eminent father. That this was necessary has been frequently demonstrated since the issue of the revised edition.

Mr. Preece has been admitted to full membership of the Institutions of Civil and Electrical Engineers, and we trust that he will long be spared to continue his notable work in the advancement of science and the propagation of its study.

The Physical and Electrical State of the Atmosphere

By H. M. DOWSETT.

SO much is spoken and written nowadays on the mechanism of wave propagation through the atmosphere, while the physical and electrical state of the atmosphere itself is still very imperfectly understood, that it may be useful here to shortly describe and discuss what is known of this groundwork on which all sound theory must be based.

Commencing with the earth's surface, we must first note that it is always negatively charged. The charge appears to increase with the growth of vegetation and to decrease when the sap in the trees ceases to rise.

The skin of air in contact with the earth is also negatively charged, but on fine days this skin is very thin, no more than a foot or so above ground level.

Extending for some few miles above the earth's surface is the "troposphere," or region of winds, of vapour and dust clouds, Fig. 1.

The height to which the winds are felt is not constant. In the temperate zone and over the same position on the earth it may vary from $4\frac{1}{2}$ to 7 miles. At the equator the winds travel higher than this, and at the poles they reach a much lower level.

The atmosphere from the earth upwards is normally positively charged, having a gradient of about $2\frac{1}{2}$ volts per inch, but under favourable conditions this may increase to 25 volts per inch. But this condition is frequently disturbed by the dust-laden winds which circulate over the earth's surface and sweep up in them a considerable negative charge. In consequence a fog of such negatively charged air may sometimes exist in patches extending from the earth's surface upwards. Under favourable conditions and in the presence of water vapour these patches may show themselves as mist. This wind-carried negative charge may, however, part company entirely with the earth, and by establishing an abrupt potential gradient may give rise to thunder clouds and lightning displays. Finally, near the top of the troposphere, where there is a scarcity of water vapour, it may exist as a negatively charged invisible cloud of air.

This would appear to be the case at an elevation of 5 miles and over, as the cirrus which float at this height do not show any lightning discharge, although in polar regions, where the cirrus float lower, they have sometimes been observed to glow to such an

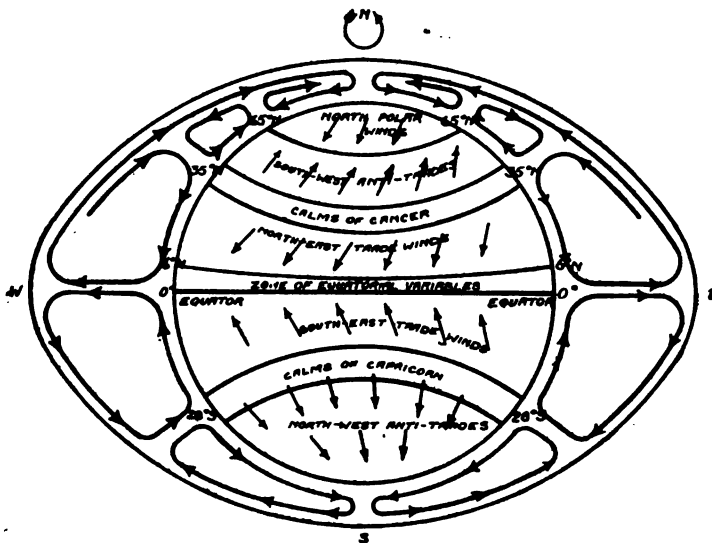


Fig. 1.—The Winds in the Troposphere.

extent as to be mistaken for aurora.

Above the cirrus the probability is that the air has still a positive charge although the potential gradient may be very small. Clouds become very infrequent and the temperature ceases to fall with increase of height, although there is sensible variation from day to night, and from day to day. There is no wind, and in consequence the chemical constituents which nearer the earth are kept in a well-mixed state now tend to sort themselves out in layers according to their densities.

The "troposphere" of the meteorologist is now succeeded by the "stratosphere," or the "lower atmosphere" of Dr. Eccles, by his "middle atmosphere." The upper limit of the "stratosphere" is placed at 45 to 50 miles above the earth (see Fig. 2) where the atmospheric strata are so tenuous that they cease to reflect light; but even as high as 54 miles up, "luminous night clouds" can sometimes be detected photographically, the composition of which can only be very vaguely surmised.

The "middle atmosphere" is the lower part of the stratosphere. It corresponds to Dr. Fleming's "diurnal layer," and is defined by Dr. Eccles as the region included between the 10 and 20 mile levels. Within these limits the air is supposed to become ionised by the sun rays in the daytime, and to return to its un-ionised condition at night. At the commencement of the ionised strata there must be a sudden change from the non-conducting to the badly conducting state, but there is no abrupt change from a non-conducting to a good conducting state.

According to Dr. Chree, "The intensity of the earth's vertical field is known from balloon experiments to diminish very rapidly as we rise in the lower atmosphere. At the 3-mile level it seems to be of the order of a tenth of what it is at ground level, and whether it has a finite value at

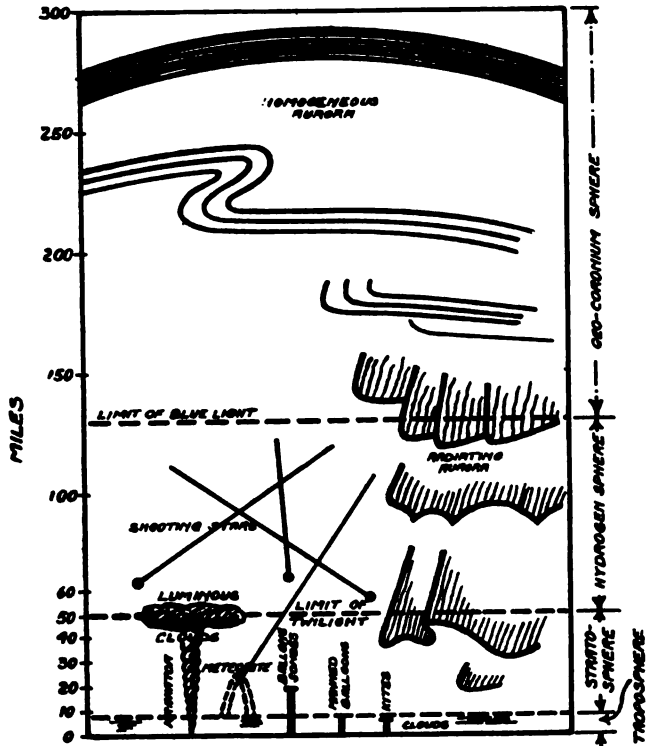


Fig. 2.—Cross Section of the Atmosphere (after Wegener).

"the 12-mile limit, is, at least, somewhat doubtful."*

It may, therefore, be more accurate to assume that at some level, say at 12 miles up, the potential gradient dies away to nothing—the air at this level has no charge at all. But this uncharged region in the daytime ends at an elevation of at least about 15 miles, where it takes on the character of the "diurnal layer."

Dr. Eccles's "upper atmosphere" extends from 20 miles upwards. We may assume it to commence at the 25-mile level to correspond with the correction suggested above for the lower limit of the middle atmosphere. Here the air is supposed to be strongly charged and permanently ionised, the ions to be of molecular size and to have long free paths.

The charge in the atmosphere is now preponderatingly negative, and this increases up to the 37-mile level, where it probably reaches a maximum.

* "The Marconigraph," Nov. 1912, p. 314.

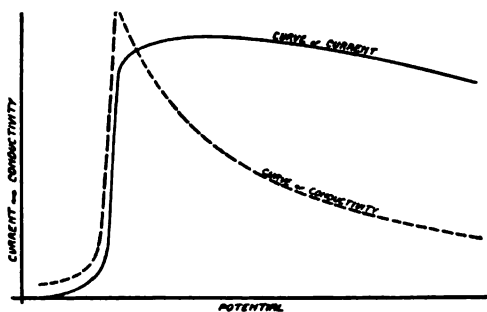


Fig. 3.—Curve showing change in Conductivity of Rarefied Gas with increase of Ionising Potential.

At this level the air pressure is reduced to about 1/760th of its value on the earth's surface when ionised air then has greatest conductivity. Un-ionised air at this pressure would still be an insulator.

Conductivity, however, depends very considerably on the strength of the ionising field, as we know from experiments with vacuum tubes (see Fig. 3). For weak values of field, the current which results is also weak consisting mainly of electrons, but as the field grows stronger and the gaseous ions themselves commence to carry the current, it begins to increase very quickly. Finally, when all the ions are in motion the current reaches an almost steady value, independent of any further increase in field. When it has reached this final state the whole gas glows; but the initial stages of conduction can exist without any glow. Evidently the belt at the 37-mile level is not highly conductive, as it does not glow, but it is no doubt the most conductive region in the whole atmosphere. Also there is no reason to suppose that there is any other than a gradual increase in conductivity from the badly conducting lower limit of the diurnal layer right up to the best conducting layer at the 37-mile level. At night time, however, when the diurnal layer has disappeared, the increase in conductivity should be less gradual.

The earth is a huge magnet with a complex field, having an axis which is neither straight nor rigid.

The greater part of this field is due to subterranean causes, possibly fluid currents. The free charges in the ionised layers come under the influence of the earth's field. The negative ions and electrons in the equatorial

belt are deflected and moved by this field in the direction of the earth's rotation, and the positive ions against the direction of the earth's rotation.

This probably constitutes the principal motion of the ions in the good conducting layer, and the resulting currents, creating a magnetic field of their own, give rise to the diurnal variations in magnetic field strength noted on the earth. The effective thickness of this revolving shell—the part which matters—may be tentatively said to extend from 25 miles up to 60 miles, the lower part of it moving slowly as it consists mainly of molecular ions, the upper part, consisting mainly of electrons moving much quicker, the greatest current intensity however being in the middle thickness. As whatever potential gradient exists is normal to the earth's surface, and in the equatorial belt this must be normal to the magnetic field, the magnetic field tends to break up the continuity of the ionic and electron currents, which is one reason why the conductivity of this belt remains low.

If we consider the motion of these ions at other latitudes instead of at the equator, there is reason to think that they tend to

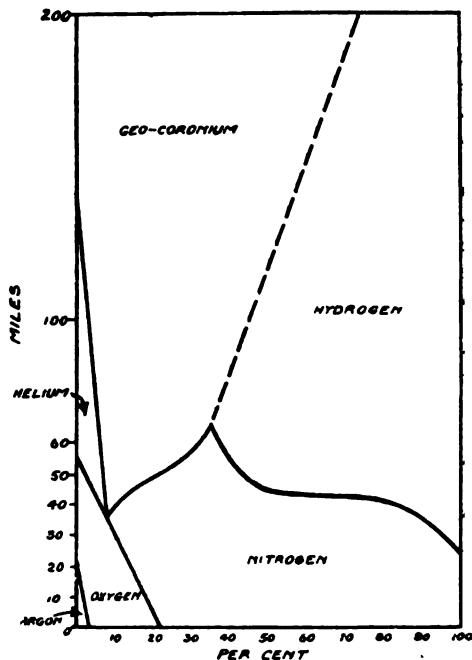


Fig. 4.—Percentage Composition of the Atmosphere at various heights (after Wegener).

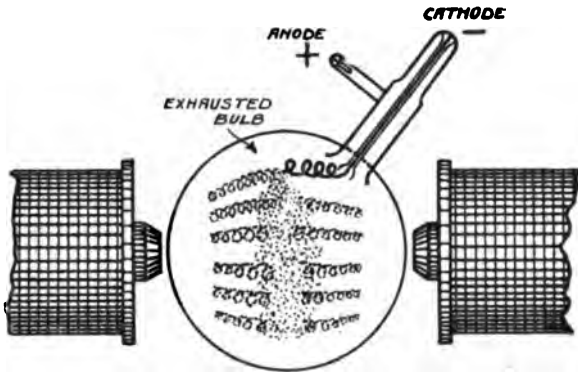


Fig. 5.—The Behaviour of Cathode Rays or Electrons when projected obliquely into a Magnetic Field.

have a spiral movement to and away from the poles. And near the poles where the lines of magnetic field coincide with the direction of the potential gradient, and the field therefore assists the discharge, the conductivity is so much increased that the belt glows, producing the well-known auroral drapery display.

But rarefied ionised air in the glowing state has been shown by Sir J. J. Thomson to act as a good screen for stopping electron discharge. This may explain why the aurora always ends some considerable distance above the earth,

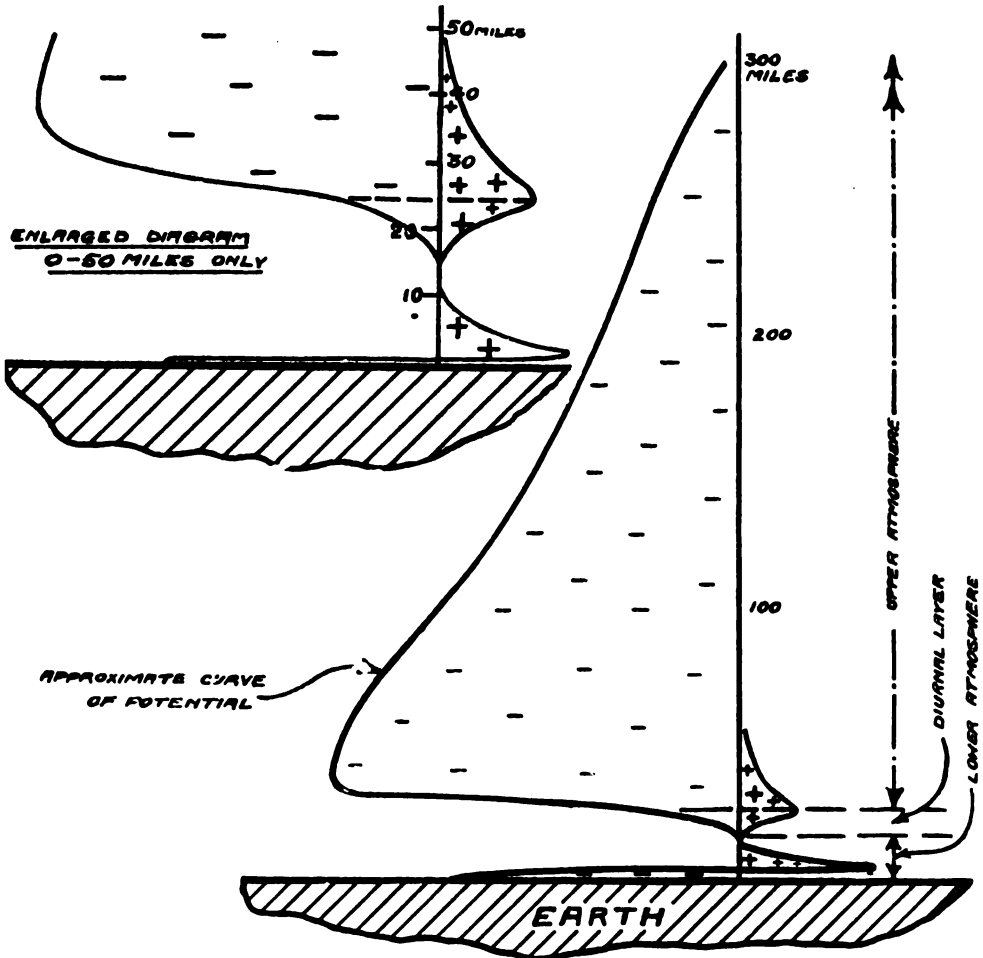


Fig. 6.—Rough representation of Electric Charge in Earth's Atmosphere at different elevations in Daylight.

and suggests a reason why the lower atmosphere does not become charged by electron diffusion from above.

From the 37-mile level upwards, the conductivity must fall off gradually, more gradually even than it increases to this level. Very useful information about the constitution of the upper atmosphere has been obtained from auroræ. The elevation of streamers and arches have been measured at different points by theodolite, and their light spectra have been analysed with the result that our knowledge of the gases composing the upper atmosphere has been much extended.

We know, for instance, as shown in Fig. 4, that hydrogen commences to make its appearance about 25 miles up, at 70 miles both nitrogen and oxygen cease to form part of the atmosphere, and at 100 miles above the earth where the auroral arch and crown are formed, and the atmospheric pressure has fallen to about $1/1,000,000,000$ th of what it is at sea level, the atmosphere consists mainly of hydrogen and an unknown gas—named by Dr. Wegener "Geo-coronium"—and a small percentage of helium.

Independent testimony that air still persists at this elevation is given by the appearance of meteors, which are set ablaze when travelling at a height even of 120 miles, although the air pressure at such a height cannot be more, and is probably less, than $1/250,000,000,000$ th of an atmosphere. Not only the resistance of the air, but its negative charge may have a good deal to do with the amount of light these meteors give out.

Artificial auroræ produced in the laboratory (see Fig. 5) confirm the view that the streamers are composed of electrons descend-

ing from the outer gaseous envelope of the earth sometimes from a height of 300 miles. They spiral down following the lines of magnetic force towards the poles, the spirals at the same time gradually closing up and decreasing in diameter as the field strength increases. The glow becomes brighter, due to this concentration and the improved conductivity which results—the combined effect of the magnetic and electric fields which are parallel at the poles also helping to increase the conductivity.

In the neighbourhood of the conducting layer the auroral streamers come to an end, as the electrons then return upon their paths and spiral up again.

No better proof of the negative charge of our atmosphere, or of its continuous character for at least some 270 miles, could be wished than that given by the existence and character of the northern and southern auroræ.

It must be of such an order as to exert a very considerable repulsive force on any negatively charged bodies the earth may meet on its journey through space. Fig. 6 is an attempt to show very approximately the distribution of charge at different elevations above the earth during the day-time. The effect of sunlight will be to add an equal amount of positive and negative ions to the atmosphere. In the diagram it is assumed that sunlight has little effect on the saturated outer envelope, some effect at the bottom on the permanently ionized layer and a marked effect in the region of the diurnal layer where its ionizing energy is completely used up. The maximum height of the atmosphere is shown as 300 miles, as at this elevation it must be so extremely tenuous that for all practical purposes it may be supposed to end.



Digest of Wireless Literature

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

WIRELESS TIME SIGNALS.

In a lecture before the British Astronomical Association recently, on latter developments in the applications of electricity to precision clocks for observatories, Mr. F. Hope-Jones, Chairman of the Wireless Society of London, spoke feelingly of the loss of the wireless time signals in war time. Throughout the year 1913, and until that fateful Saturday in August last, when all privately-owned wireless installations were dismantled by order of the Postmaster-General, the rhythmic signals were observed every night at 11.30, and by means of the "acoustic vernier" the rate of an astronomical regulator running on test was determined in 100ths of a second. Since then the old laborious method of testing and rating has had to be reverted to, requiring months instead of days.

Referring to the fight for freedom to listen to the international wireless time-service signals without taxation and its successful issue shortly before the war, he expressed the hope that these privileges would be restored in their entirety on declaration of peace. When that happy day arrived it might be necessary for the scientific world to act in consort, and present this claim with unanimity and force.

* * *

PROCEEDINGS OF THE INSTITUTE OF RADIO ENGINEERS.

Number 2 of the third volume of this excellent publication, just to hand, contains a number of exceedingly interesting papers which have been delivered before that Society, together with the discussions which have followed. First, in order of place, we find a paper by Dr. L. W. Austin on "Seasonal Variation in the Strength of Radiotelegraphic Signals." This is an account of results obtained from a series of experiments made by the Bureau of Standards

between the Philadelphia and Norfolk Navy Yards for the purpose of determining the variation of strength of signals at different times of the year. The conditions of the experiments were carefully arranged for constancy of wave-length, spark frequency and antenna current, and the method of measuring antenna current was that described in the Bureau of Standards Bulletin No. 7, page 295, 1910. From the results obtained certain conclusions can fairly be drawn. The seasonal variations seem to be different in different years, the minimum of 1912 being higher than that of 1913. The rise in the curves which were shown seems also to be steeper at some times than at others. It has not been possible definitely to connect the changes in foliage conditions with the strength of signals, although it is possible that these changes play an important part in the variations.

Mr. Henry E. Hallborg, who is well known to our readers by his recent contributions to THE WIRELESS WORLD, has next place in the "Proceedings" with a paper on "Resonance Phenomena in the Low Frequency Circuit of Radio-Transmitters." It is unnecessary to summarise the paper in question, as it was fully dealt with in the April and May issues of this magazine. In the discussion which followed the reading of the paper, Mr. Alfred S. Kuhn said that in some recent radio work with transformers the closed core type had been used by him, and it was found unnecessary to use external reactances in either the primary or secondary of the transformer. High efficiencies were therefore obtained. Results obtained by the use of such equipment, said Mr. Kuhn, warrant his objection to the author's statement that in the case of quenched gap sets "the choice naturally lies between a clear note with diminished efficiency and a 'medium' note with high efficiency." In Mr. Kuhn's experience im-

proving the note did not at all impair the efficiency, but rather augmented it.

Mr. Julian Barth next dealt with the mathematical side of the problem, and Mr. Alfred N. Goldsmith expressed the opinion that it is very desirable that the radio engineer should regard the complex audio or low frequency circuit (consisting of the alternator, choke coils, primary of the transformer, secondary of the transformer, and capacity load of the secondary) as an equivalent simple circuit. It is this equivalent circuit which is to be tuned to resonance, or rather, as Mr. Hallborg has explained, to a frequency somewhat different from that of the alternator. Mr. Goldsmith also asked what was, in Mr. Hallborg's experience, the effect of a resonance setting on sparking at the relay key contacts.

Mr. Hallborg, in dealing with the comments and criticisms, gave an interesting answer to this last question. He stated that he had found, in general, that there was less arcing when working above resonance, although it was difficult to draw general conclusions since the results are largely dependent on local conditions. He recalled an attempt to shunt a reactance across the relay key of the 100 kilowatt, 500 cycle, synchronous rotary gap set at Brant Rock, breaking about 400 amperes. It so happened that the reactance was accidentally of a value just sufficient to tune the generator-transformer circuit, and as a result a most violent arcing took place each time the contact was broken, accompanied by a noise almost as deafening as that of the spark itself. On replacing the reactance by a non-inductive water rheostat, excellent results were obtained. When the fixed and movable contacts had become burned into a good fit, satisfactory operation was obtained without a relay shunt of any kind.

Another paper of considerable interest to radio engineers bears the title "Design and Construction of Guy-Supported Towers for Radio Telegraphy." The author, Mr. Roy A. Weagant, states that the purpose of the paper is to develop methods of determining the stresses in the guy-supported type of radio-telegraph tower. The methods and their application are illustrated in a complete design of a 625-ft. structure of cylindrical form. The effects of the various strains upon the tower and guys are considered in

detail, and due consideration is given to the design of foundations and anchorages. Proceeding on the assumption that a guyed tower inclined bodily by the pressure of the wind should have the points of guy attachment remain in a straight line, methods are given for calculating the following quantities: guy tensions (for windward, leeward, and perpendicular guys), horizontal and vertical forces acting on the top section of the tower, stresses in the middle section, stresses in the bottom section due to bending, design of flat-topped and umbrella aerials, changes in stresses due to temperature variation, and dimensions of foundations and anchorages.

In the discussion following the delivery of the paper, Messrs. Hallborg, Louis Cohen, George S. Davis, and Alfred N. Goldsmith spoke of their experiences and dealt with several points of great practical importance.

Aerial supports are also dealt with in a paper by Mr. Cyril F. Elwell, entitled "Wooden Lattice Masts." The paper in question is not intended to cover all the various types of masts used in past and present radio installations, but rather to give details of the design and erection of one type developed by the author from the original design advanced by Professor C. B. Wing, of Stanford University, and many examples of which have been erected.

The author of the paper advocates the use of wooden guyed structures on the grounds that they are inexpensive and suited to the doubtful permanency of some stations. Photographs of several high masts constructed on the plan above mentioned accompany the paper, amongst them appearing one of the radio tower at Ballybunion, Ireland—a wooden lattice structure 492 ft. in height. Mr. George S. Davis, in the subsequent discussion, expressed the opinion that although wooden lattice masts may have certain advantages in certain localities, experience had shown that they were at times very unsafe. He instanced a fatal accident which occurred last year to some workmen who were dismantling a wooden structure at Colon. The masts of which the one being dismantled was a unit had been subjected to the unusual climatic conditions of the Tropics, and possibly to the ravages of insects, and for these reasons the use of

wooden structures in such countries appeared to be undesirable.

The final paper in the "Proceedings" is one by Mr. Haraden Pratt, on "Long Range Reception with Combined Crystal Detector and Audion Amplifier." It is stated by the author that if an audion bulb is used as an ordinary receiver, across the "stopping" condenser in series with a galena detector, an amplification of about ten times is attained. The audion bulb used, to be effective for this purpose, must have certain definite voltage-current characteristics. In the discussion which followed, Mr. Alfred N. Goldsmith said that those who have worked with the extremely sensitive receivers of the audion amplifier type will agree that the sensitiveness of the detector, at least for work in the summer months, cannot be profitably increased because atmospheric disturbances already produce sounds many times louder than the desired signals. Until we learn to overcome the problem of static, any further increase in detector sensitiveness is of no practical advantage.

* * *

NATIONAL PHYSICAL LABORATORY.

The following is extracted from the statement of the proposed work of the National Physical Laboratory for 1915-16.

Electricity.—The usual experiments will be carried out for the maintenance of the electrical standards.

In connection with the wave-meter and high-frequency work it is proposed to complete the series of current transformers so as to afford a good range of current measurement. It is hoped to finish the construction of the Poulsen arc lamp and to investigate methods of decrement measurements with continuous oscillations. Wattmeter methods may also be tried.

The constants of the standard wave-meter set at the laboratory were determined over a range of from 200 metres to 11,000 metres by the direct measurement of the frequency, using a photographic method. With a view to securing international agreement it is desirable to arrange for some inter-comparison of standard inductances and capacities, and probably to repeat some of the fundamental measurements on which the laboratory standard depends. Arrangements for this are under consideration.

It is proposed to continue the construction of a set of oil-cooled resistances for high-frequency work; also to construct several high resistances of very small but calculable self-inductance, consisting of long thin wires supported at a definite distance from one another and immersed in oil.

It is proposed to continue the research on the power factors of condensers of various dielectrics, both solid and liquid, at different temperatures and frequencies.

For very high and low ranges it is proposed to construct inductometers of more permanent form, similar to the models described in the report for 1913. Two marble cylinders have been obtained, on which it is hoped to wind standard single-layer inductance coils.

Electrotechnics.—Some investigations on micanite, which are at present in hand, will probably be concluded early in the year. The new dividing resistances capable of being used up to 40,000 volts, now in process of construction at the laboratory, have to be completed. These are of the woven-wire type, and their use on high voltages requires investigation, particularly in regard to their capacity currents to earth. The testing of such resistances for change of accuracy under different conditions of loading also requires investigation, which will, it is hoped, be undertaken.

If opportunity permits, an investigation will be made into the production of high-frequency currents for instrument testing by methods which may serve provisionally until a high-frequency generator set is available. Such a set is eminently desirable.

* * *

WIRELESS TELEGRAPHY AND SUBMARINES.

Considerable attention is at present focussed upon the activities of submarines, and the problems connected with their design and construction. Wireless telegraph apparatus is extensively installed on under-water craft, an aerial mast being erected when the vessel emerges on the surface. On first consideration it would seem a simple matter to arrange for this to be done, but it should be remembered that time is occupied in putting up and taking down such structures, and time is an extremely important consideration with

the submarine commander. Many extremely interesting points concerning submarines are brought out in a paper by Lieutenant C. N. Hinkamp, United States Navy, which recently appeared in the *Journal of the American Society of Naval Engineers*

It should be understood, says the writer, that there is nothing mysterious in the operation of a submarine. The orders used in the handling of the boat are few; they are made as comprehensive as possible and are so given as to eliminate any possible confusion. Preparing to submerge includes all preliminary work up to the closing of the conning-tower hatch. This comprises the stowing of the deck gear, taking down the bridge, unriggering the wireless telegraph gear, closing the hatches, unlocking the valve-operating mechanism, securing the engines; in fact, a clearing ship for action. The operation requires from two to twenty minutes, depending on the amount of rigging to be taken down.

The actual submerging of the boat can be done in two ways, one called the "static" dive, and the other the "running" dive. In the static dive, also known as "balancing," the boat is submerged but does not move except in the vertical plane. This dive may be accomplished in two ways: by trimming the boat and maintaining her trim by adjusting her ballast, or by dropping the anchor, trimming the boat to within a few hundred pounds positive buoyancy, and the heaving in or veering on the anchor cable. The latter way is the simpler method for easy control, and can be used where there is no current or only a small amount of current, if the sea is not too rough. Before submerging, the vessel is usually brought to a fore and aft trim, which will cause the boat to be level when submerged.

The running dive is made from the awash condition. In the awash condition the trimming tanks and auxiliary ballast tanks are flooded to the amount necessary for the proper trim when submerged; the main ballast tanks are empty. The running dive is used for all tactical purposes except balancing. The vessel being under way "awash," the order is given to submerge. All hands get into the boat, the engines are stopped, and the electric motors started. As soon as the engines are stopped the conning tower is closed, all ventilators

housed, and the main ballast tank flooded. Knowledge that the trim will be approximately correct when totally submerged renders careful adjustment of ballast unnecessary. The boat is inclined slightly, about one-half of a degree down by the head, and the inrush of the water controlled by manipulation of the valves. All this is done in the short period of from one to two minutes.

Submerging a submarine is distinctly a "one-man" job. The commanding officer must be thoroughly conversant with all the details of the actual submerging of the boat, and he must at all times be thoroughly informed as to existing conditions in the boat. None of the important features can be delegated to anyone else, as each condition or state of affairs has a distinct relation to every other condition.

Signalling while submerged is a subject of much interest. In the early days of submarine navigation signalling under water was done in a most crude manner, for which the hull of a vessel was found to be peculiarly adapted. Sending was accomplished by tapping on a rivet with a hammer, and receiving by holding the forehead to a frame of the boat. For several years inventors have investigated and experimented extensively, with the result that there are now in practical use in submarine signalling the submarine bell, the Fessenden oscillator, and the vibrating wire, by which it is possible to signal effectively at distances greater than five miles under favourable conditions. All these systems set up vibrations in the water, which are detected by microphones and heard through the ordinary telephone receiver. Inventors are now endeavouring to devise means for increasing the speed of transmission.

The primary object of a submarine is to fire torpedoes, and all other considerations must be subordinated to this as far as the tactical value of the vessel is concerned, but not to such an extent as to lose sight of the fact that the torpedoes cannot be fired at a target unless the vessel arrives on the scene of action. The efforts of the crew are aimed at one thing—sinking an enemy—and the placing of the boat in position to accomplish this end calls for the co-operation of all the departments in the boat.



Rubber Plantation on River Jurua.

Through South American Jungle-Land

Radio-telegraphy and the Brazil-Peru Boundary Commission

THE recent tour of ex-President Roosevelt through the chaotic wilderness of the Brazilian jungle, and his controversial claim to have discovered a new and large river running through the heart of that vast country, open up in the minds of most people an era of thought as to what secrets the virgin forest still holds. So vast an acreage does this tract of country comprise that more than a casual consideration of its mysteries appears desirable. Manifold are the attractions of exploration when undertaken voluntarily, but a less pleasing tone is rung when orders are given for the peregrination to be started at a particular stated time. Such in effect was the decision imposed upon a small party of three explorers by the Government of the Republic of Brazil. Its duty was to define and locate the boundary between the Republics of Brazil and Peru. To this end about 25 labourers were engaged by the Commission, a photograph and particulars of the members of which we reproduce here. Two wireless operators were deputed to accompany the expedition, as frequent use was expected to be made of Radio-

telegraphy in defining the boundary. To prove how valuable an asset wireless telegraphy can be, the experiments by the French Government to determine the geographical position of Timbuctoo may be cited. Similar trials have also been conducted between the Eiffel Tower Station and that located at Arlington, Va., U.S.A. Indeed, so successful were the discoveries that it was found that the city of Washington was actually situated about a mile from its previous mathematically-calculated position.

The Commission, fortified with all the paraphernalia of the explorer, set out on its journey. Very little was done until the Rubber Station at Santa Cruz was reached. Here the party established its headquarters and from this point conducted its investigations. A camp was formed, tents were erected, and in order that the members might be kept in touch with the outer world an aerial was "rigged up" between two tall palm trees, as seen in the illustration reproduced here, which was taken on the spot. It will be noticed that the palm trees to which the spreaders and aeri-als were attached offered a decided advantage to the height obtained from stems in the

immediate neighbourhood. It will not be out of place here to make allusion to the fact that these palms are found throughout tropical Brazil and are put to considerable use as telegraph and telephone poles by the authorities there. The Commission was provided with special Marconi receivers, and by this means time signals were received from the wireless stations at Manaos and Porto Velho, situated respectively 900 and 450 miles away. Through the high-power station at Iquitos in Peru the Commission was kept *au courant* with the doings of the world in general. Every night this station sent out a Press bulletin which was received by the temporary installation accompanying the explorers.

The fact that the members of the party had embarked on no light task may be gathered from the careworn expressions on their faces. Not only had they to contend with the ordinary hardships which necessarily accompany travel through an unknown land, but they were subject to special difficulties. In the low-lying basins of the tributaries of that mightiest of rivers, the Amazon, the germs of malarial disease did their deadly work, and several of the

labourers were temporarily placed *hors de combat*. But that was not all; their nights were rendered fearsome by the stealthy depredations of the wild beasts seeking their prey, and by the continual croaks of the reptiles, whilst the screeches of the night birds raised a din which was well-nigh unbearable. By dint of perseverance, however, progress was made, and each successive day added its quota to the work accomplished and saw the registration of further effort on the part of those who had "something attempted, something done."

The earliest attempts at providing wireless telegraph communication in the tropics brought the engineers face to face with a number of minor, but nevertheless important, problems. Not the least troublesome of these were the ravages of insects, which bored into the wooden portions of the apparatus, thus disintegrating its substance and causing the wood to crumble to dust. Ebonite parts also suffered from the effects of the constant variations in temperature which are so prevalent in tropical regions. This is caused by the great contrast between the unbearable heat of the day and the keen chilly mists of the



The Brazilian Commission



Operator receiving Time Signals from Manaos.

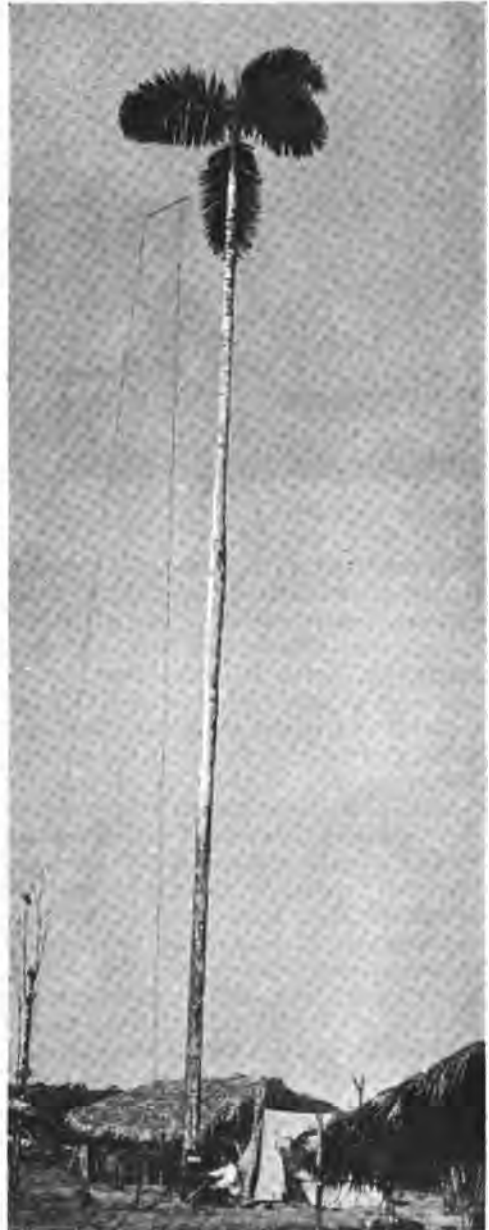
hours of darkness. From the human point of view it is these sudden changes which form the root evil of physical troubles experienced in the tropics.

The severest of all the troubles, however, was the difficulty of maintaining insulation, as the surface of the apparatus was perpetually covered with a film of moisture from the heavily-charged air drifting from the swampy regions of the jungle.

Apart from minor difficulties, some of which we have cited above, the major problem of how to work during the periods of intense electrical disturbance in the atmosphere always existed. Only those operators who have had occasion to work in equatorial and tropical regions can possibly realise the exasperating "static" interference through which wireless signals in these parts have to be sent and received practically throughout the whole year, but with a maximum intensity during the hottest seasons. The atmospheric noises almost drown every other wireless signal, and at times deafen the operator by their din and persistence. As a consequence the power used for transmission has to be many times greater than would be needed for effective

communication did these disturbances not exist.

As an instance we may quote the case of the two wireless stations erected by the Marconi Company for the Madeira-Marmore Railway. They are situated in the heart of



Aerial for Reception of Time Signals.



Camp in the Jungle.

the dense tropical jungle, one at Manaus and the other at Porto Velho. Although the distance between these places is but 400 miles, before effective day and night communication could be established it was necessary to instal apparatus of 70 kw. capacity. In recent years much has been done by way of improvement in the receiving apparatus, with the object of reducing "static" interference, and the invention of the "balanced" valve and crystal receiver marked a great advance in this direction. For the benefit of those who are not acquainted with this apparatus, we may mention that it works with two crystals or valves connected in parallel, but in opposition to one another, and adjusted so that the signals it is required to receive pass mostly through one of the valves or crystals whilst atmospheric and other interferences pass more or less equally through both, and thus counteract their own effect.

Amidst all the difficulties and troubles which we have related, the Commission succeeded in attaining its object. We can well imagine the pleasure with which the

news bulletins were received, and how they served to disperse the feeling of isolation which otherwise would have weighed heavily on the spirits of the whole party. But although the news bulletins were most welcome, it must not be forgotten that without the time signal from Manaus and Porto Velho the Commission could not have carried out its work with the accuracy and certainty which, from the beginning, was its sole aim.

THE PROGRESS OF RADIO-TELEGRAPHY.

The remarkable progress achieved by wireless telegraphy is exemplified by the following table of statistics compiled by the Berne International Telegraph Bureau. They represent the number of ship and shore stations of the world from the year 1908 to the year 1914 inclusive.

1908 ..	508	1911 ..	1,740
1909 ..	755	1912 ..	2,280
1910 ..	1,217	1913 ..	3,998
	1914 ..		5,277.

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.]

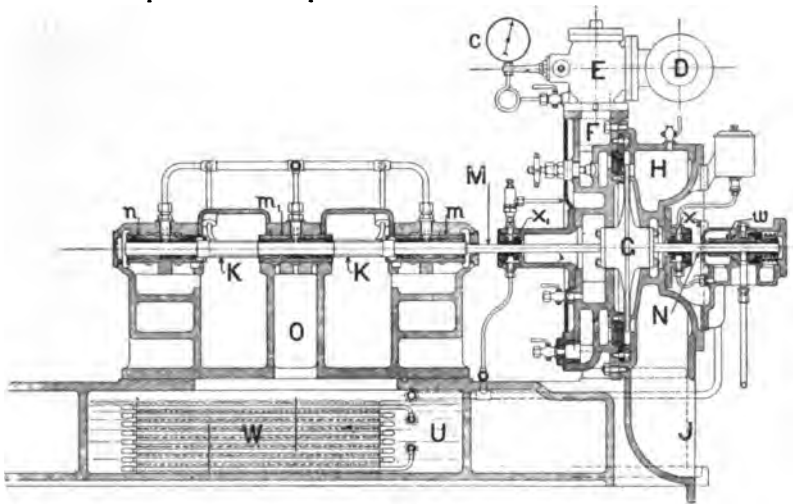


Fig. 1.

The De Laval Steam Turbine.

THE growing use of steam turbines for driving engineering plant of all kinds will perhaps warrant our devoting some space this month to a consideration of the De Laval Turbine, a machine which presents a number of interesting features. Our readers will remember that when the Poldhu station was reconstructed a year or two ago two De Laval turbines were installed, one of 110 h.p., coupled to an alternator, and the other of 15 h.p., driving a D.C. dynamo. At the Chelmsford works

of Marconi's Wireless Telegraph Company there are also two 225-h.p. (150 kw.) De Laval turbine dynamos and two 15 h.p. (10 kw.) sets, the latter being used for pilot lighting, testing, etc.

The De Laval turbine differs from others in having only one wheel and only one row of moving blades. The nozzles are so shaped

that the steam is fully expanded in them, to the pressure of the condenser. During this expansion the available Heat Energy of the steam is converted into Kinetic Energy, with the result that the blades are struck by steam of high velocity which drives the wheel round



Fig. 2.

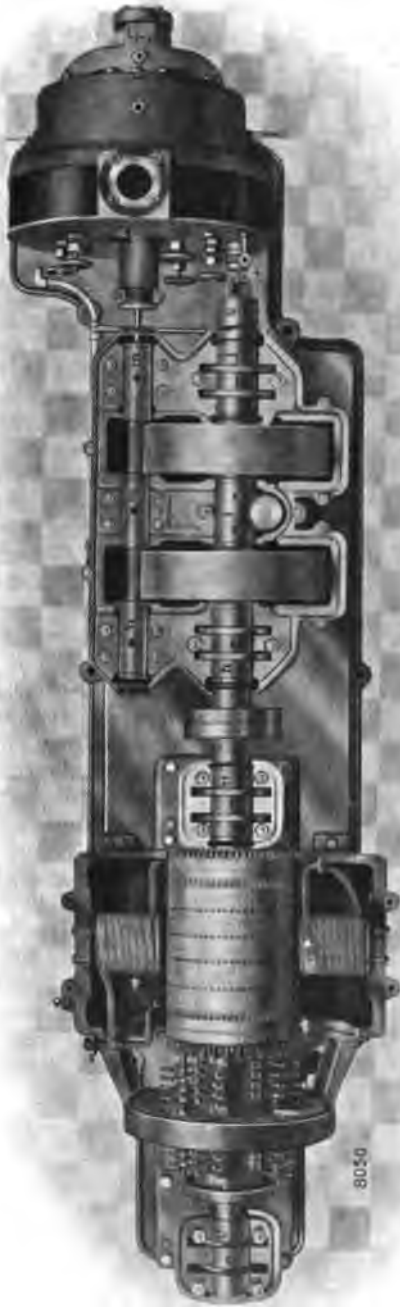


Fig. 3.

by its momentum. It will thus be seen that the De Laval is a pure *impulse* turbine.

It is a well-known fact that to obtain

efficiency with a steam turbine high speed of rotation is necessary. In many cases this high speed is a disadvantage, particularly on board ship, where it is difficult to design propellers to work at a high speed of rotation. The obvious solution of the difficulty is to gear down, but it was a long time before a satisfactory reducing gear was evolved. The difficulty was finally overcome, and now geared turbines are in common use.

In the turbine with which we are dealing a double helical gear reduces the speed to 1/10th or 1/12th of that of the blade wheel. (See Fig. 3.) The loss in the gearing is very slight.

Fig. 1 shows a large De Laval turbine in section. The steam when admitted by the stop valve passes through the strainer D, and is regulated by the governor valve E before it enters the steam chest F. In the older designs the steam passed through a few large nozzles, but in the latest type there is a ring in which a number of small nozzles are bored. The introduction of a larger number of small nozzles enables the blades of the turbine to be made much shorter, with the attendant advantages that the buckets are lightened and the stress in them due to centrifugal force reduced, and the windage of the wheel (an important point) is lessened.

The tightening bushes on all turbines of 55 h.p. and above are steam sealed, thus preventing oil getting into the exhaust steam and therefore into the boilers. This is an extremely important arrangement in a plant having surface condensers and water-tube boilers.

The De Laval turbine is largely used for driving dynamos and alternators, and in such cases the turbine and dynamo are mounted on a common bedplate—which acts as an oil reservoir—and are connected together by a flexible coupling.

Turbine alternators are standardised in sizes from 75 h.p. to 600 h.p. inclusive, but smaller machines can be made if required. Figure 2 shows a standard turbine alternator of the 300 kw. size.

We are indebted to Messrs. Greenwood and Batley, Ltd., of Leeds, the makers of the turbines above mentioned, for permission to reproduce the illustrations accompanying this article, and for many of the particulars which have been given.

Administrative Notes.

Italy.

THE Italian Government has issued a memorandum giving notice that on Italian or Italian-Colonial lines all telegrams and radio-telegrams, except those written exclusively in plain language (i.e., Italian, French or English), have been suspended. Registered addresses and signatures and telegrams without text are not allowed. It is to be understood that all telegrams or radio-telegrams are subject to censorship, and are only accepted at sender's risk. The Italian Government further states that all Italian or Italian-Colonial radio-telegraphic coast stations are closed to private service.

* * *

Panama.

Vessels intending to traverse the Panama Canal or finding themselves in its vicinity must conform to some new rules issued by the Hydrographic Office of the United States Navy. They read thus:—

1. "As soon as communication can be established with the Canal, vessels should report their name, nationality, length, draft, tonnage, whether or not they desire to pass through the Canal, require coal, provisions, supplies, repairs, to go alongside a wharf, the use of tugs, probable time of arrival, length of stay in port, or any other matters of importance or interest. If this information has been previously communicated through agents or otherwise to the captain of the port it will not be necessary to report by radio, but the probable time of arrival should always be sent."

2. "No radio tolls, either coast stations or forwarding, will be imposed against ships on radiograms transmitted by ships on Canal business. There will be no charge made against the Panama Canal by Canal Zone land lines or radio stations for the transmission of radiograms to ships on Canal business."

The Office advises that no charges will be exacted by the naval service on messages sent by masters of vessels to any Government official in the Canal Zone. If such

messages contain information as set forth in paragraph 1 they will be treated as Canal business. The Hydrographic Office, however, makes one request in order to facilitate accounting. It is that such messages be prefixed "CB," indicating that they are sent on Canal business.

* * *

In order to avoid confusion in sending wireless telegrams a general order has been issued by the authorities of the Panama Canal prohibiting the dispatch of long-distance messages by vessels whilst they are within the jurisdiction of the Canal.

* * *

United States.

It has long been realised that means of communication should exist between the little supply craft which regularly visit isolated lighthouses and lightships and the shore. Wireless telegraphy naturally suggests itself, and now we have to record that wireless apparatus is being manufactured for, and will shortly be installed on, the tenders *Columine*, *Cypress*, *Orchid*, *Sequoia* and *Manganita*, with a range varying from 100 to 300 miles. The apparatus is being made under the supervision of the Bureau of Standards of the United States.

* * *

It is announced that the naval authorities of the United States have decided to establish a wireless station at Cape Cod, specially equipped to guide vessels along the Atlantic coast in time of fog.

* * *

We are advised by the International Bureau at Berne as follows:—

Argentina.

Private radio-telegrams from, for, or in transit through the Argentine Republic coming from or addressed to Europe, Africa, Asia and Oceania are only accepted at sender's risk and are subject to censorship. Code telegrams are not permitted, and telegrams affecting the neutrality of Argentina will not be forwarded. Any language may

be employed, having due regard to the restrictions imposed by the country to which telegrams are addressed.

* * *

Australia.

The Commonwealth Administration will no longer accept on their telegraph lines, or those of their dependencies, telegrams either arriving, leaving, or in transit, except telegrams and radio-telegrams of foreign Governments written in plain language (English or French). They are subject to censorship, and should bear the signature of the sender at the end of the text. They will only be accepted at sender's risk and abbreviated addresses are not permitted.

* * *

British Honduras.

Radio-telegrams sent from or to the station at New Orleans during the interruption of the ordinary cable must be written in plain language with the complete address and signature and must bear the direction "via New Orleans." They are subject to censorship and are only accepted at sender's risk.

* * *

France.

The French Government only accepts in France, Algeria, French Colonies and Protectorates radio-telegrams written in plain language (French or English) and bearing the signature of the sender. They are only accepted at sender's risk, and no responsibility will be accepted by the French Government concerning them.

* * *

South Africa.

Radio-telegrams from or for the Union of South Africa, or in transit through that country, must be written in English, French, or Dutch, and bear the name of the sender. Radio-telegrams in plain language are only accepted at sender's risk. Abbreviated addresses are not permitted.

* * *

Spain.

Radio-telegrams in code, emanating from private persons, from ships of the Navy or Mercantile Marine, or from Consuls of any nationality are no longer accepted. Radio-telegrams, in plain language, must be written

in German, English, French, Italian or Spanish.

* * *

Sweden.

The use of code for private radio-telegrams is forbidden. Private radio-telegrams addressed to Sweden or emanating from that country must be written in plain language (Swedish, German, English, Danish, French, Norwegian, or Russian). Meteorological telegrams are not subject to this restriction.

* * *

United States.

We are advised that the Marconi station at Friday Harbour, Washington, U.S.A., was dismantled on May 27th, 1915.

"THE LOST WORD."

(With apologies.)

WORKING one night at the wireless,
In the Mediterranean Sea,
I was tapping a message crossly
From the operating key.
I forget to whom I was speaking,
But know he'd been trying to "Jamb,"
And I sent out a word in anger
Like the sound of a great, big D—.

It flashed through the troubled ether
With the speed of a ray of light ;
'Twas as if some evil spirit
Were bent on a mischievous flight.
It blotted out all other signals,
And smashed detectors galore ;
'Tis doubtful if ever receivers
Had been so shaken before.

It fused all tuning condensers
Into one solid piece,
And it made all aeriels vibrate
As if they would never cease.
I have sought, but I seek it vainly
That long-lost angry cuss,
Which leapt across the electrodes
And caused such a fearful fuss.

It may be that some other station
Will send out that word once more,
It may be that from Head Office
I shall hear of that swear I swore !

ALEC. BAGOT.

Correspondence

The Wireless Transmission of Photographs.

IN connection with the series of articles which have appeared in our pages on the above subject we have received from Mr. O. A. Zappulli of Lausanne the following letter, which is reproduced in full together with the accompanying diagram. The points raised are of considerable importance, and our readers will note with interest Mr. Martin's reply, which is also given below. We are always pleased to receive correspondence of this nature and to facilitate discussions on points of technical interest :

To the Editor of THE WIRELESS WORLD.

"I have read with great attention the interesting article on 'Wireless Transmission of Photographs' in THE WIRELESS WORLD. On the use of selenium cells suggested by Mr. Marcus J. Martin, in his last article (June issue of THE WIRELESS WORLD), I would like to make a few remarks. A few years ago, experimenting in connection with recording wireless telegrams, I conceived a similar arrangement, using an Einthoven galvanometer working with a selenium cell in series with a relay which closed the circuit of an ordinary Morse-inker, which in my experiments held the place of the 'Electrolytic receiver.'

"Matters worked well, but . . . terribly slowly, because, as I afterwards found out, selenium varies its resistance very irregu-

larly. As is shown in the curve, whilst the resistance rapidly decreases, it increases but very slowly after the light action has ceased. The result of my experiment was as follows :

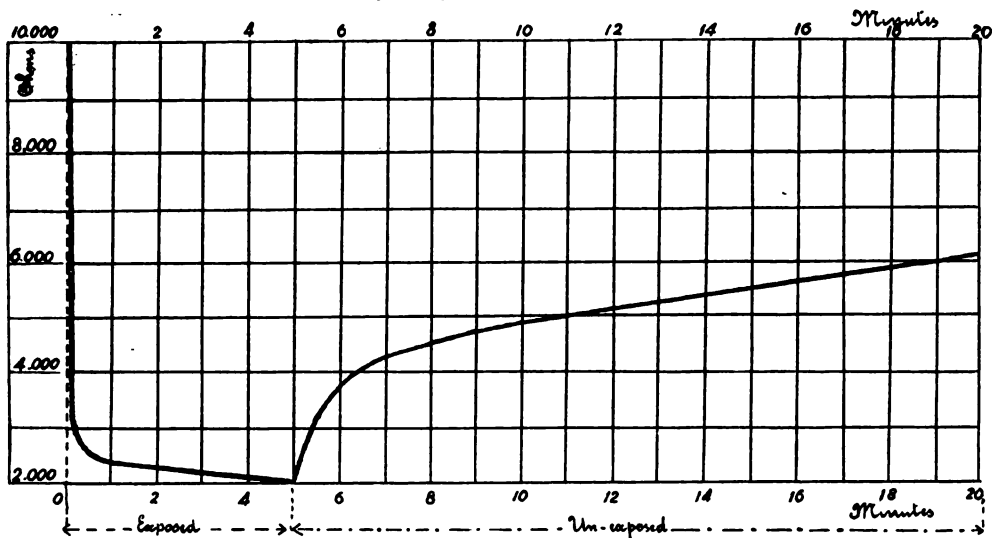
"When light fell on the cell resistance decreased relatively rapidly and sufficient current passed through the selenium to open the relay, but when the cell was left in darkness the resistance required so long a time for returning to the initial value that current passed through the cell and opened the relay even when the light action had ceased, with the result that a short galvanometer deflection, such as originated by a transmitted dot, was recorded on the inker as an immense dash. Consequently all possibility of practically applying this recording system was excluded. Therefore I think it would be useful to many readers if Mr. Marcus J. Martin would state what quality of selenium he uses in his system, in order to obtain a sufficient working speed. The annexed curve has been obtained experimenting by diffused daylight.

"(Sgd.) O. ARNOLDO ZAPPULLI."

MR. MARCUS J. MARTIN'S REPLY.

To the Editor of THE WIRELESS WORLD.

"In reply to Mr. Zappulli's letter, re the working of selenium cell, the difficulty



“ which he experiences is a very common one. “ Selenium cells vary very considerably as “ regards their quality as well as their electrical resistance. Thus it is possible to obtain “ cells of any resistance between 10 and “ 250,000 ohms, or even more, and also a “ cell may remain in good working condition for several months, while another may “ become useless in as many weeks. The “ ability of a cell to respond to very rapid “ changes in the illumination is determined largely upon its inertia, it being “ taken as a general rule that the higher the “ resistance the greater the sensitiveness. “ The sensitiveness of a cell is the ratio “ between its resistance in the dark and its “ resistance when illuminated. The majority “ of the cells have a ratio between 2 : 1 and “ 3 : 1, but Professor Korn has shown “ mathematically that by conforming to “ certain conditions regarding the construction the ratio of sensitiveness can be “ between 4 : 1 and 5 : 1. Take, for “ instance, a cell of $R = 125,000$ ohms. “ When exposed to a definite amount of “ illumination the resistance will be reduced, say one-fifth, almost instantly, but “ upon the illumination being discontinued the inertia interferes, and the “ resistance, instead of returning to its full “ value at once, only partially rises, and “ some time elapses, perhaps several “ seconds, before the cell returns to its “ normal condition. By continuing the “ illumination the resistance of the cell may “ be still further decreased, but the result “ would probably cause the cell to become “ ‘fatigued,’ in which case its sensitiveness “ gradually becomes less and the rate between its resistance when dark and its “ resistance when illuminated may be decreased by as much as 30 per cent. Excessive illumination will produce similar results.

“ This is plainly shown by the curve reproduced with Mr. Zappulli’s letter. It “ will be noticed that the resistance drops “ almost at once from 10,000 ohms to “ 6,600 ohms, but takes nearly five minutes “ to drop from 6,000 to 2,000 ohms. The “ cell from which the above curve was taken “ has been evidently over-illuminated, judging from the excessive time taken for the “ resistance to return to only half its “ original value.

“ Many attempts have been made to “ overcome the effects of inertia, the most “ successful being the method adopted by “ Professor Korn, by keeping the cell “ always sufficiently illuminated to overcome it so that any additional light acts very “ rapidly. Another method worked out and “ patented by Professor Korn and known as “ the ‘compensating cell’ method gives a “ practically dead beat action, the cell “ returning to its normal condition as soon “ as the illumination ceases. The arrangement is somewhat complicated and requires “ careful adjustment to get the best results. “ By enclosing the selenium cells in exhausted glass tubes it is claimed that their “ inertia can be greatly reduced and their “ life considerably prolonged.

“ The writer is preparing an article on “ selenium cells which he hopes to publish “ shortly, in which the Korn compensating “ method will be described. Yours, etc.,

“ (Sgd.) MARCUS J. MARTIN.”

With reference to the discussion at the Institute of Electrical Engineers on the “ Application of Electrical Engineering to Warfare,” an abstract of which we published on p. 10 of our April issue, we have received the following letter from “ T. O’R.” of Bombay, India :

To the Editor of THE WIRELESS WORLD.

“ With reference to an article in the “ April issue of THE WIRELESS WORLD, “ Mr. P. R. Coursey states :

“ ‘The Boer War furnishes us with the “ ‘first example of the use of the electric “ ‘telegraph for military purposes, although “ ‘it had not then the reliability that is “ ‘now regarded as essential.’ I should “ be pleased if you would inform him “ through your valued organ that a body “ of military telegraphists, numbering about “ 1,000, have been operating in all frontier “ wars and expeditions in India since the “ Indian Mutiny of ’57-8. We now man “ about 250 vessels sailing to all parts of “ the world where British interests are “ concerned ; moreover, we are represented “ in France, Belgium, and China by men “ who are working Wheatstone, Baudot, “ Field Telegraphy, and Wireless ; in short, “ practically all the latest known and up-to-date systems of wireless telegraphy, “ wire telegraphy, and telephony.”

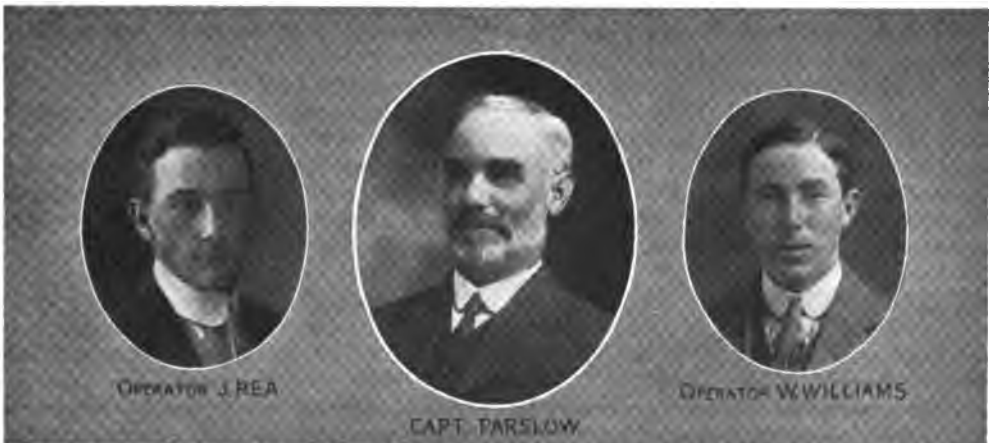
Wireless Telegraphy in the War

*A résumé of the work which is being accomplished
both on land and sea.*

IT is curious to contemplate how completely the modern engines of warfare have upset preconceived notions. It was always assumed in previous naval warfare that the most vital spot for the attack on a steamer was her engine room. That part of the ship was accordingly protected by heavier belts of armour. But from the date of the advent of submarines there is a feature which, from the standpoint of the attacking under-water craft, is more vitally dangerous even than the machinery which may drive the attacked vessel on top of it. This is the wireless apparatus, which—if allowed to work undisturbed—is certain sooner or later to summon aid, and foil his attempt, if it does not bring about his destruction.

We have this point very eloquently exemplified in the story of the London steamer *Anglo-California*, whose record of heroic endurance under fire has justly gone home to the minds of all who can appreciate true courage. On a Sunday morning at 8 o'clock, when folk ashore were attending or preparing to attend their places of worship, a German submarine pirate,

steaming awash, in vain summoned the gallant Captain Parslow to heave to. On his refusal she started circling round the vessel, endeavouring to get into a position suitable for launching a torpedo. All the time the wireless operator was radiating his calls for help. This was the only weapon which the peaceful British trader possessed. The captain was obliged to stand, without the slightest hope of "hitting back," the hail of shot and shell which his "brave" enemy poured in upon him and his shipmates. For four long hours this continued, the captain manœuvring in such a way as to ward off the deadly blow of his enemy's fatal weapon. But the ship was seriously damaged, the unfortunate captain blown off the bridge with terrible wounds, eight members of the crew killed, and seven others seriously injured. Still the wireless operator sent out his call for help. After his father's death, second mate Parslow took up the task; and finally assistance arrived, the pirate foe was forced to relinquish his prey, and the *Anglo-California* steamed into Queenstown Harbour. It forms a stirring



The Captain and Wireless Operators of the "Anglo-California."



Senator Marconi on Active War-service.

narrative of British pluck and tenacity under adverse circumstances; but why had nobody on board a rifle to send at least one of the German bullies to his last account?

* * *

One of our contemporaries recently published an amusing paragraph in connection with a telegram from Rome announcing the appointment of Senator Marconi to a Lieutenancy in the Engineers. Our contemporary appears to regard the matter rather from the characteristically English standpoint of Gilbertianism. Those, however, who know the spirit animating the great Italian inventor will recognise that he has been true to himself in subordinating all personal considerations to those of how best he can serve his country. After all, the mere insignia of rank matter very little, it is the service itself which counts. Our picture shows Senator Marconi as the Chief of the Wireless Department. He is leaving headquarters on a tour of inspection.

* * *

A Liverpool journal, in an interesting article entitled "War in the Woods," describes an adventure of a journalist with the army in the Argonne. "One of the most useful functions performed by the Air Service is that of sending wireless

"messages from a height of thousands of feet in the air." In this manner the narrator starts one of his most interesting paragraphs before proceeding to describe how he witnessed the starting of one of these wonderful new machines at work.

We extract his concluding paragraph:

"We saw this machine rise and become a speck in the air, and then we were taken to the wireless station in the woods. It was simply a little wooden hut, so small that we had to stand outside while the General talked to the operator. The latter explained the nature of his work. When the machine went up to direct artillery fire he was warned by telephone to be on the look-out for messages. 'Do you get any of the communiqués?' asked the General. 'Yes; we always look out for the French communiqué from the Eiffel Tower, and occasionally we intercept German fairy tales from the Norddeich and Nauen stations, but up till now we have never managed to pick up a Turkish communiqué.' 'Can you tell where the message comes from?' 'Yes, we can distinguish them as a rule by their varying power. For example, this morning early we intercepted a message from Madrid.' It was curious.

“to think that this little hut in the woods
“was able to gather the world’s news
“before it was known to the cities.”

* * *

We reproduce an interesting photograph of a field wireless outfit which accompanied General Botha’s force during its triumphant conquest of German South-West Africa. In this respect the General-Premier of the British Colony was quite as up-to-date as the enemy. The utility of “wireless” was amply demonstrated throughout the campaign; the field apparatus enabling the Anglo-Boer forces to keep in touch over wide expanses of country. We have previously referred to the importance of the British success which resulted in the occupation of Windhoek, with its valuable German high-power station. So sensible was the enemy of the value of this station, that all particulars thereof had been kept as a State secret. General Botha’s strategy was worked out as mathematically as von Moltke’s campaign of 1870. The British Commander had on the one hand the disadvantage of difficulties of transport,

absence of roads, scarcity of water, and vast expanse of sparsely-populated country as the field of his operations. But, on the other hand, he had the advantage over the Danish Master of War, who led the German forces in 1870, that he possessed in his wireless field apparatus a means of securing the co-ordination of scattered units, which was not available 45 years ago. The following forms a record of the principal stages in the advance into the enemy’s territory and illustrates, if followed on a good map, the points referred to in our paragraph :

January 14th	...	Swakopmund occupied.
February 22nd	...	Garub occupied.
March 20th	...	Battle of Pforteberg.
April 1st	...	Aus occupied.
April 3rd	...	Warmbad occupied.
April 5th	...	Kolkfontein occupied.
April 18th	...	Seeheim occupied.
April 20th	...	Keetmanshoop occupied.
April 26th	...	Battle of Trekkopies.
April 28th	...	Battle of Gibeon.
May 1st	...	Kubas occupied.
May 2nd	...	Otjimbingwe occupied.
May 5th	...	Karibib occupied.
May 12th	...	Windhoek occupied.
July 2nd	...	Otavi captured.
July 8th	...	Tsumeb occupied.



Field Wireless of the South African Army.



Italian Warships at Venice.

An amusing incident in the course of what we may call the siege of the German cruiser *Königsberg*, which was shut up in the Rufigi river at the end of October last, and was finally destroyed on July 4th, illustrates not only the scouting value of aeroplanes fitted with "wireless," which located the ship and directed the fire of the British monitors *Severn* and *Mersey*, but also wireless possibilities in the way of establishing communication between the commanders of rival enemy forces. The incident we have in view was merely an interchange of jests, but there is no reason *in principle* why it should not be repeated in earnest on some future occasion.

* * *

The story comes through a Lancashire naval officer just returned home from the British operations on the German East African coast. It appears that the *Königsberg* was attacked several times, in the course of her "internment," by bomb-dropping seaplanes. During these hostilities the captain of a British warship, waiting at the mouth of the river, sent sarcastic

greetings to the German commander through the medium of "wireless," saying "I hope to see you soon." The latter replied "thanks for invitation, but if you wish to see me you will always find me at home."

* * *

Italy is justly proud of her distinguished son Senator Marconi, and now that she is at war on the side of righteousness and peace her battle fleet—whose vessels have formed the field for many of the Italian inventor's recent experiments—is engaged in the stern struggle. Our illustration shows some of the Italian battleships lying at anchor off Venice. Under the supreme command of the Duke of the Abruzzi, King Victor's men-of-war are sure to be skilfully handled, and as far as wireless telegraphy is concerned, no fleet could possibly enter into conflict under better auspices than does that of our gallant Italian allies.

* * *

The iniquitous attempts on Sir Cecil Spring-Rice and Mr. J. P. Morgan constitute only instances of the ruffianly spirit widely prevalent amongst a certain

section of German Americans. The warning letter sent to Mr. Daniels, Secretary for the United States' navy, reveals the possibility of further attempts at even more wholesale murder. Mr. Daniels was, *thanks to "wireless,"* able to communicate those warnings to the vessels concerned, probably an eventuality overlooked by the criminal, whose boasting words were intended to advise the New York authorities—too late. The utility of this capacity of radio-telegraphy for keeping vessels at sea in touch with land has been once again eloquently exemplified.

* * *

The old proverb that "the pen is mightier than the sword" still embodies a truism, although in terms which are slightly out of date. To express the same fact in modern phraseology we should have to put our apothegm in some such phrase as this: "The printing-press is mightier than the bomb-mortar." A shipload full of printing-press bombs consigned to Herr Dernburg has recently been prevented from reaching the hands of that expert juggler through the instrumentality of wireless. The commander of the Italian liner *Dante Alighieri* on his arrival in New York with this incendiary cargo excused himself from delivering it on the plea of a promise given to the British authorities at Gibraltar. After passing that port he was recalled and allowed to proceed without the delay involved in dragging the "stuff" up from the bottom of his

hold on the strength of "the word of an Italian." * * *

The various members of the Marconi staff who are serving King and Country in divers capacities all over the world occasionally favour us with letters describing their personal adventures. The following extract comes from a letter written by Private L. Juniper, of the 1st Essex Regiment. This gallant young man has been serving with the Forces ever since the beginning of the present struggle:

"I expect you have seen by the papers the reception the Turks gave us at our landing on the Dardanelles. It was a terrible task, as we had to force a footing on the beach. We were taken from the transport boats at 7 a.m. on April 25th, and put into small rowing boats, manned by sailors, about a mile from the shore. We had to proceed most of the way under fire, but about 50 yards from the beach we received a regular fusillade from their forts; many of our fellows being shot out of the boats and drowned. Off shore they had laid mines and barbed wire entanglements 25 yards away from the beach level. We were losing such a lot of men that we finally got orders to fix bayonets, and on the word of command to charge each man jumped out of the boats and found himself well over his waist in the water. This was a terrible time, and we lost a great many killed over it, because the wounded were drowned as they fell. When, however, we got a fair landing, the Turks did not stay long, as they would not face our steel. I don't want to boast, but I must say that every man who got through that landing is something of a hero, and I think that if our people had had the position the Turks had, it would not have been possible for men of any nation to land there."



A Russian Giant Aeroplane.



THE FAR-FAMED BERSAGLIERI.

Mr. Marconi's gallant compatriots, whose proficiency in mountain warfare is being so brilliantly exemplified at the expense of their traditional foes.

In our *Notes of the Month* we refer to the report of the Royal Commission on Aeronautics as to the supreme importance of wireless telegraphy for aerial machines. Our illustration, depicting one of the giant Shumski aeroplanes, will perhaps bring this home more forcibly than any words of ours can possibly express it. It is only wireless telegraphy which has rendered it profitable to build, equip, and utilise these vast war birds of Russia, whose example is being followed in this respect by our own country.

Some of our contemporaries, on the arrival of the *Dunvegan Castle* at Plymouth, under the heading of "Recruiting on a Liner," published some gushing remarks concerning what happened "when it was announced" on board that General Botha had accepted "the surrender of the enemy in German

"South-West Africa." The journalistic reporter responsible for this "copy" evidently forgot the existence of wireless ocean newspapers. The passengers on the *Dunvegan Castle* received by wireless full information about the great success of General Botha before reaching Madeira, five days previous to their arrival at Plymouth.

It is usually the unexpected that happens! One of our daily contemporaries recently published an answer to a correspondent under the title of "Wireless Telegraphy." It appears evident from the answer that the letter replied to was from a domestic servant, who, weary of washing pots and pans, aspired to transmitting electric waves through the ether. The journalist in charge of the correspondence column appears to have poured cold water upon the soaring aspiration. But why? Was it not the kitchen that gave us Cinderella? For aught we know there may be an embryo Marconi in petticoats attending to the humdrum duties of daily life, only awaiting the wand-touch of the fairy Opportunity to rise to the occasion and widen her sphere of usefulness.

The sinking of the Leyland liner *Armenian* (8,825 tons, with a length of 512.5 ft. and speed 14 knots) does not present any special feature, for the heroic tenacity of the wireless operators under the most adverse circumstances has become traditional. It was displayed on this occasion almost as "a matter of course." The ship's "Marconi House" was carried away by shell fire, but not before she had got into communication with the West African Mail Steamer *Tarquah*, which arrived at Plymouth on the 1st July, without having herself been attacked by the enemy's vessel. The first message appears to have been picked up on the 30th June at 4 p.m., and the final message at 6 p.m. Just after the latter had been received all communication suddenly ceased, and it was evidently at that hour that the Marconi gear was destroyed by the enemy's shells. The captain made a gallant effort to escape, but the speed of his vessel was not sufficient to entail success.

One of the recent victims of German submarine piracy was the Norwegian mail

steamer *Venus*, which was on her way from Bergen to Newcastle when she was held up. The captain of the Norwegian vessel went on board the submarine with the ship's papers, which showed that this vessel was freighted with a small-sized cargo consisting of 416 casks of butter and 69 boxes of salmon. The German commander declared this, as food for the enemy, to be contraband of war, and sent two of his subordinates to see the cargo jettisoned and examine four British passengers who were on board. The German submarine during the two hours that she was alongside *hoisted her two masts and wireless gear*, by way of protection, because the *Venus* was also fitted with wireless and might have been sending out undetected messages asking for help. A number of Dutch fishermen were in the neighbourhood, and the captain is of the opinion that a good deal of the floating cargo would find its way on board their smacks. It is a curious coincidence that the *Venus* has met with submarines four times recently; on two occasions she was stopped and on two occasions she managed to get clear away.

* * *

Mr. J. B. Maxwell recently contributed an excellent article on the Royal Naval Division to one of our Western contemporaries. The account constitutes, perhaps, as eloquent a testimony to the value of hard physical training as it is possible to imagine. Mr. Maxwell gives instance after instance of not only the methods adopted but of results obtained. Naturally signalling forms an important branch of the special training, and those applicants already provided with a fairly good education take eagerly to this branch. All forms of signalling seem to appeal to the recruits and the instructors' verdict is "they gain efficiency in a wonderfully short time." Wireless is the most popular of all, according to Mr. Maxwell, who remarks, "Of the quickness of the men to read the *buzzers* so baffling to the uninitiated I had an object lesson. Nearly two dozen recruits sat down to the desks ranged around the walls. Only that day had they entered the class and this was the beginning of the second lesson. The wireless began to buzz out a medley of a dozen letters. Only two mistakes had been made by the man whose paper I picked out at haphazard."

* * *

On June 24th an important meeting was held by the Manchester Education Committee to deal with the subject of technical students and the war. The Chairman of the Committee, Sir Thomas Shann, gave some details of the way in which the School of Technology was assisting the local Munitions Committee. His remarks were supplemented by particulars of the various branches of work already undertaken, in an able address delivered by Mr. Maxwell Garnett, Principal of the Municipal School. The record as set forth by Mr. Garnett constitutes one of which Manchester has good reason to be proud. No fewer than 967 of the men attached to the school have either enlisted or received commissions; 13 have already been killed. Prof. Miles Walker, Head of the Electrical Engineering Department, had designed all the motors which are being put into submarines at the present time. In the radiotelegraphic sphere Prof. Field had done valuable work in connection with the wireless installation of aeroplanes. Other valuable technical assistance has been rendered to the Government by Prof. Knecht, Prof. Fox, and Mr. Gamble. Manchester has always been famous for her zeal for the organised instruction in practical science, and her technical teachers and pupils have "risen to the occasion" in the present crisis in a manner worthy of their city's proud traditions.

* * *

It is with very great pleasure that we record a correction of the final paragraph under this heading included in our July issue.

The information available at the time of writing impelled us to say that a Roman Catholic priest, at Caporetto, had been caught by the Italians communicating with the enemy by means of a wireless apparatus concealed under the High Altar of his church.

It is gratifying in the highest degree to find that the "traitor priest" was no priest at all, but an Austrian officer disguised in priestly garb.

Every Catholic has a right to be proud of the way in which the priests of Belgium have discharged their pastoral duties in the true spirit and in accordance with the holy tradition of their church. Such action as was recorded in connection with the Catholic priest involves a desecration and a crime that it is impossible to imagine any Catholic priest perpetrating.



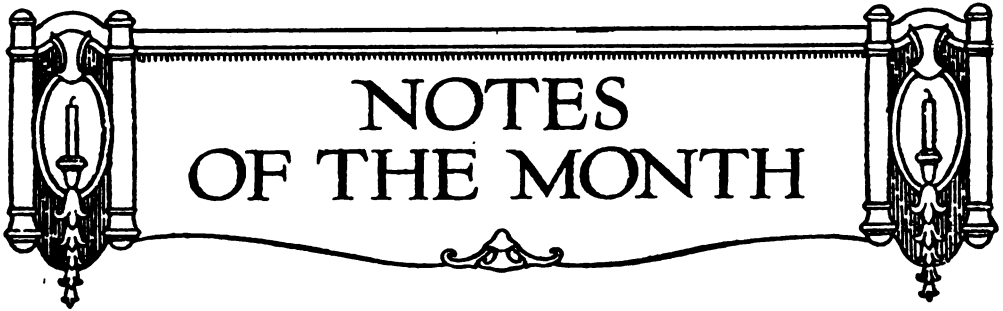
The "Wireless Station" which controlled the attack.

An artist correspondent (Monsieur F. Gueldry, one of the eight artists specially commissioned by General Niox to work for the *Musée de l'Armée*), contributes to the *Graphic* of July 10th a couple of sketches of the French operations at Les Eparges. Next in importance to a general panorama of the countryside, the artist chooses for his illustration what he denominates as "the wireless station which controlled the attack." It was at this point that one of the greatest successes achieved for many months by our gallant Allies took place. As a result of five days' continual hand-to-hand engagements, the French succeeded in mastering the position, which had been converted by the enemy into a powerful fortress. The enemy's entrenched position dominated the plain of the Woevre at this point, and in their attempt to hold it at all costs the Germans lost the equivalent of an army corps.

* * *

The distances in Africa are enormous in comparison with the population (especially, of course, the white population). The result is that news of happenings in the British-African campaigns come through at

such long intervals that public interest is not aroused in them anything like the extent to which the country and the operations deserve. The same characteristics of preparedness on the German side, and utter lack thereof on the British, which have recently become so notorious in the Mother Country, are prevalent also in these Colonial possessions. British resourcefulness is inevitably destined to triumph in the long run everywhere, and at certain points in the African Colonial possessions the British command of the sea has accelerated this process. The recent operations in East Africa and the Uganda have resulted in the destruction of the German base in this part of the "dark continent," the Port of Bukoba, on the western shore of Lake Victoria Nyanza. The town had been fully equipped for defence; it possessed a fort and a *fine wireless installation*, besides military stores of all kinds. The British expedition took the form of joint operations by water and land, and started on June 20th last. At the end of the month they returned after attaining a complete success and destroying the fort and wireless installations, besides a number of boats belonging to the enemy, and capturing his guns, rifles and stores.



NOTES OF THE MONTH

THE association of wireless telegraphy in the lay mind has up till now been almost exclusively with the sea. It is in this connection that it has shone more conspicuously than in any other. But the utility of wireless is not confined thereto. Its application to the services of an army in time of war has been ably demonstrated by its use by all the belligerent Powers in the great European conflict now raging. To many, however, the idea of timing races by wireless will seem far-fetched, but such has actually taken place. The Mississippi Valley Power Boat Association, at Hannibal, in the United States, employed wireless for timing their races at the annual regatta, held on July 5th, 6th and 7th. This system of timing was tried at Buffalo last season, and it was found that a difference of over one second to a mile existed between the wireless and the old system of sight timing. Wireless is absolutely instantaneous, and racing men will benefit by every fractional part of a second of speed made.

* * *

The necessity for the exercise of extra vigilance during this time of national emergency was exemplified recently when a charge was preferred against an English Justice of the Peace. This was made under the Defence of the Realm Act, and the complaint was that the accused, a civil and mining engineer, "did unlawfully, without the permission of the competent naval or military authority in that behalf, make a sketch or plan, or representation of a naval or military work, and being in the vicinity of such work did unlawfully have in his possession apparatus or material suitable for use in making such representation, such representation being of such a nature as is calculated to be, or might be directly or indirectly useful to the enemy." The "naval or military work" mentioned were the

towers of the Marconi high-power station at Towyn. For the defence, accused contended that there was no line or bit of colour in his picture which could possibly indicate any Government work. There was no sign of a Marconi installation or of a railway line, for the all-sufficient reason, from an artist's point of view, that these objects mar the beauty of a picture. After evidence had been given the bench decided to dismiss the charge with a caution, and ordered the picture to be interned until after the war. A warning was conveyed to the public that neither sketching nor painting is allowed in this or similar areas.

* * *

Over two years ago a traveller on a steamer off the coast of Japan sent a wireless message to a friend in Peking. This man was "not at home," but had been called to the interior of China on a tour of inspection. The telegram followed him, and was finally delivered in December last, after having taken twenty-two months. This is a victory for wireless. Had the telegram been sent over land-wires it would probably never have been delivered in the "Celestial" Republic.

* * *

That excellent little magazine *St. Martin's le Grand* prints the following paragraph concerning the hardships of the staff of the International Telegraph Bureau at Berne:—

"The staff of the Radio-Telegraphic Section of this Bureau at Berne consists normally of a Secretary, a Registrar, and two clerks. Switzerland is a neutral country in the present war, and one would assume therefore that its public institutions could have gone on the even tenor of their way. But no. Taking the above-mentioned Bureau as a sample we find that pressure of business necessitated the employ-

ment of an extra clerk on July 3rd, 1914. War broke out in August, and there was a general mobilisation of Swiss troops. The temporary clerk had to answer the call. In view of the publication of an official chart of radio stations, a cartographer was engaged on August 1st. In four weeks his place was vacant, and he was under arms. In addition to this, the Secretary and the two clerks were mobilised, and the Registrar was left alone to work the section 'dans la mesure du possible.' We think the brave Registrar deserves a St. Martin's medal! But the whole incident is remarkable as showing how the actions of the 'mad dog of Europe' affect a peace-loving and neutral nation."

* * *

The report for the year 1914-1915 of the Advisory Committee for Aeronautics, recently issued, emphasises the essential connection between this branch of the National Service and "Wireless Telegraphy." One of the paragraphs dealing with a number of special investigations undertaken for the Admiralty and the War Office makes special mention of "Tests of magnetos forming part of wireless installations to determine their liability to ignite explosive mixtures of gases." Here we have a reference which indicates the activities of the Committee in the direction of "lighter than air" machines. It is obvious that there are certain dangers in connection with gas-filled aircraft which do not occur in the case of "heavier than air" machines. Both come within the province of this Committee, and on page 7 we find reference to fresh designs of wireless and other signalling apparatus attached to aeroplanes. It is obvious that under existing circumstances it is undesirable in the public interests for the Committee to make public any details, but it is at all events interesting to know that these affairs are occupying the full attention of our public experts.

In connection with this subject it is interesting to note the essential connection between aeroplanes and wireless installations, indicated by the Inventory published by the Italian Government of the recent sequestration of the German steamer *Bayern* at Naples. This Inventory includes a number of comprehensive wireless station outfits, besides "four aeroplanes complete with wireless installations and machine guns."

A curious case recently came before Judge Shearn in the Supreme Court at New York. The facts are these. During a voyage of the *Minneapolis* from London to New York a passenger died, and, following the customary practice, the body was immediately consigned to the deep. On the arrival of the ship at New York one of the relatives of the deceased sued for £600, claiming that the steamship company had no right to dispose of the body. The Company contended, however, that the practice of immediate burial at sea is countenanced by custom, but the Judge ruled that in view of the facilities afforded by wireless telegraphy the relatives should have been consulted. He allowed the Company ten days in which to reply preparatory to trial.

* * *

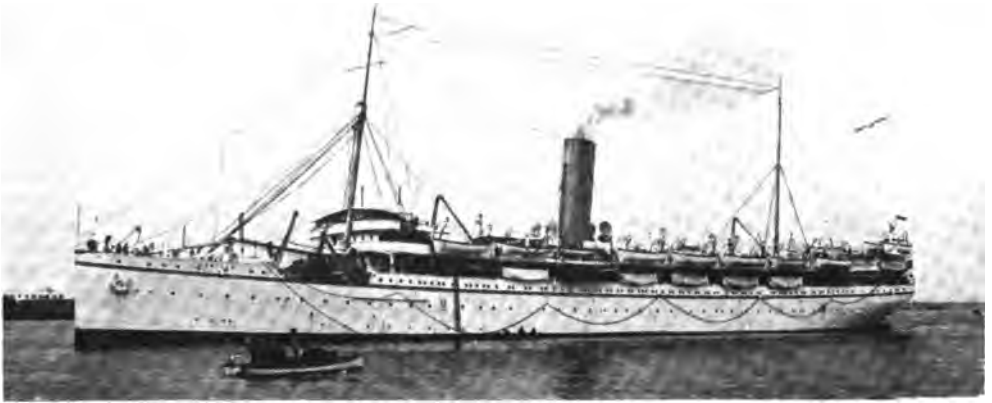
We take the opportunity afforded by these columns to call our readers' attention to an article of quite unusual interest, which will be found on page 278 under the title of "The Physical and Electrical State of the Atmosphere." This article contains the results of a considerable amount of original research by Mr. H. M. Dowsett. His general idea in the contribution is to enable the reader to visualise more clearly what is meant by terms like: The "Diurnal layer," the "Heaviside layer," etc. To many of our readers such phrases are probably merely terms and nothing more.

Mr. Dowsett's contribution forms an attempt to get a better perspective of the principal medium through which the electric waves used in wireless telegraphy are propagated. The subject is of extreme interest, strikes right at the root of wireless theory, and should form an excellent starting point for further discussion of the various theories of wave propagation round the earth.

We invite correspondence on the subject from other investigators and theorists.

WIRELESS TOWERS FOR THE UNITED STATES.

TWELVE steel wireless towers have recently been constructed for the Government of the United States. All these towers will be used for the radiotelegraphic stations which are to form the links of a chain of powerful Government stations now in course of erection.



The Hospital Ship "Rohilla."

Maritime Wireless Telegraphy

TRAGIC pathos constitutes the keynote of human feeling in connection with the wreck of the hospital ship *Rohilla*. At the end of last year, with her complement of doctors and nurses, she left a Scottish port for France to take up her work of mercy. She only succeeded in getting as far as the north-east coast of England when she was driven ashore by the boisterous weather. We are now enabled to give a full account of this calamity from the pen of the senior operator on the ship, Mr. Robert T. Utting :

"The *Rohilla* left the Firth of Forth on Thursday afternoon, October 29th, 1914, bound for Dunkirk, with a light N.N.E. breeze ; when off St. Abbs Head the weather came on to blow very hard, with a very heavy beam sea. The rolling of the ship was terrible, so much so that the large sideboards and tables in the saloon and smoke-room became unshipped and careened madly about. This rolling of the ship lasted all night. Unaware of our position, at 4.15 a.m. on the Friday morning, after a series of violent bumps, the ship finally stopped, her engines refusing to go astern. Second Officer Winstanley came to the wireless room and said : 'Send out the SOS quickly ; she is ashore. Operator Wilson, who was on watch at the time, sent out the call, but no answer was received. By this time I had slipped on my pants and taken the

'phones over from him. I again sent out the distress call, and received a reply from Cullercoats (coast station). I had just switched off the motor when the lights went off. I immediately joined up the emergency set, and had obtained a spark when a huge sea broke full on top of the wireless cabin, carrying away the Bradfield insulator and trunk, which put the whole wireless apparatus out of use, as the aerial came down at the same time.

"Several of the crew had by this time taken shelter in the wireless room, all practically naked. I told them to put on some of my clothes which were in the cabin. By this time the wireless room became untenable owing to the tremendous seas attacking it on the port side, which caused the cabin to break up very fast. This soon all disappeared over the side.

"Our boats had all unshipped, and out of twenty-nine boats twenty-eight were stove in and useless ; the one left was launched at daylight, and with Second Officer Jwyn in charge attempted to take a line to the shore. This they had to cut to prevent the boat from being swamped, the breakers being much too large to allow sufficient line to be paid out to the boat.

"The Whitby lifeboat now made a successful trip to the doomed ship, which was now breaking up very fast. It took off the four nursing sisters and our stewardess.

On the second trip it took off more men, but on arriving back ashore it had the misfortune to have a large hole stove in its bottom, and had to be abandoned.

"The gale blew furiously all day, the force of the wind being seven to nine.

"The shore people now accomplished a splendid piece of work by bringing the Upgang lifeboat by road and lowering it down the cliffs, a height of 200 feet, by ropes. All attempts at launching it, however, failed owing to the tremendous breakers. We hung on in despair all through Friday night. At daybreak on Saturday, after all attempts by both rocket apparatus and lifeboat had failed, Captain Neilson told all who could swim at all that, as the ship was breaking up so fast, and could not last through Saturday night, he thought it was their one chance to put a lifebelt on and swim for it, the distance to shore being about 700 yards. About fifty men started to swim ashore, including Mr. Wilson, the junior operator. About forty reached the shore in an exhausted condition. The Scarborough lifeboat arrived about 10 a.m. in tow of a steam trawler, but could not do anything at all for us, as the sea was much too fierce. At low tide the Upgang lifeboat was launched, but failed to reach us owing to the fierceness and tremendous size of the breakers. The

captain now signalled to the shore: 'Have ambulance parties ready to-night at low water; all leaving ship on rafts, as she will not last the night.' We set to work hard, and made rafts of gratings and drawers from the bridge and captain's cabin. Darkness came on, and we all made up our minds to try to swim at 10 p.m., but our luck was dead out again. The weather freshened up harder still, and Captain Neilson ordered all to stay on, saying: 'As long as there is anything to hang on to, we will stop, boys.' About thirteen, however, left, and out of that number only three succeeded in getting to the shore, one being the Chief Officer. A message was now received from the shore saying: 'Motor lifeboat coming at daylight'; but as we had had so many disappointments, the captain would not tell the men. About midnight Saturday a powerful searchlight arrived by special train from Newcastle, and was put to play on us. This greatly gave us hope and lit up the chart-room, where we were all huddled together soaked to the skin and being cold and hungry, most of the men not having had a morsel to eat or drink since Thursday night. At daybreak Sunday morning our faith in being rescued was very small, but presently appeared a small craft rolling heavily in the tremendous sea. This craft turned out to



The Whitby Lifeboat taking off Four Nursing Sisters.

be the South Shields lifeboat, and after a terrible buffeting and splendid behaviour of its crew they came alongside, pouring oil on the sea, and which ultimately took off fifty survivors. With one huge cheer we greeted them with what little strength we had left, and another cheer when they told us the Chief Officer had been saved. The *moral* of the men from Friday morning to Sunday morning was splendid. They always looked on the bright side all through this awful time, although all attempts at rescue by both rocket apparatus and lifeboat had failed. They made cigarettes from magazine paper obtained from the captain's cabin, and those who had a pipe would have a draw and then pass on to one of his mates. The captain and officers were splendid, and all did their duty. The people of Whitby were beyond praise, and did everything in their power to alleviate our sufferings — in fact, they practically killed us with their kindness.”

* * *

Once again it has to be recorded that wireless telegraphy was used to good purpose in bringing aid to a stranded vessel. The s.s. *Colon* left San Francisco for Mexican ports on January 16th of this year, and after making a call at Guaymas proceeded to Topolobampa. On the morning of February 4th, about 10.30 o'clock, she stranded on the bar at the entrance to the latter port. Mr. W. R. Lindsay, the wireless operator, immediately sent out the distress signal, to which the U.S.S. *Maryland* responded saying she was coming to the assistance of the *Colon*. She arrived about 6 p.m. The steamers *Cetrianna* and *Korigan III*, also arrived late in the afternoon, whilst the U.S.S. *Annapolis* appeared next morning. The transfer of the passengers and crew to the United States war vessels commenced forthwith, whilst the Marconi operator, with the wireless apparatus, found a temporary dwelling on board the *Cetrianna*. This removal of the installation to another ship enabled the commander of the *Colon* to communicate with his owners in San Francisco. The *Colon* was floated on February 10th, and accordingly her wireless apparatus was re-installed.

* * *

The following report, received from the senior operator of the *Ancona*, forms evi-

dence of the important rôle played by wireless telegraphy :—

“ On May 14th, at 2.5 a.m., near Europa Point, during a very thick fog, the s.s. *Latitia* issued the signal SOS after having collided with another vessel. The position as soon as received by the *Ancona* was transmitted to the Commander.”

In this connection the Ministry of the Italian Navy, to whom the incident was reported, writes as follows :—

“ This Ministry thanks you for having communicated to him the report of the s.s. *Ancona's* operator, referring to the rescuing of the s.s. *Marcorusco's* crew, during the night of the 14th May last, by means of the Marconi's wireless telegraphy. The wireless also in this case, as in other circumstances, has demonstrated to be very efficient.”

* * *

“ We mentioned in our July issue that the s.s. *Rijndam*, of the Holland-America Line, had been in collision with s.s. *Joseph J. Cuneo*. We are now able to give a full account of the catastrophe from the pen of the wireless operator :

“ We left New York on Tuesday, May 25th, bound for Holland, under the most promising circumstances, the weather being fine and clear. We all felt we should make a quick passage home, but we did not get far before the following incident occurred. In the early morning of May 26th, a little while after my assistant had relieved me, I was awakened by a heavy shock. I first thought of the aerial coming down. It was something worse, however. Suddenly my assistant jumped in and said, ‘ We have been in collision ; you had better put your clothes on.’ I looked out of my porthole, and saw the boats lowered and passengers and crew with lifebelts on. I dressed in record time. I then took charge of the station, while my assistant was busy looking up the lifebelts. Shortly afterwards the chief officer came with the order to send out the SOS signal. Not a second later many operators were startled by hearing this well-known wireless cry for help. We were then twenty-six miles south-west of Nantucket Lightship. It was distressing to see the lifeboats with passengers and crew leaving the ship for s.s. *Cuneo*, a Norwegian fruit steamer,

with which we had been in collision, and which had made a big hole in our side. It was a lucky thing the ship's dynamo could be kept going. Communication was so much the better for it.

"Not for a moment did we really think about the danger. My assistant, who was making his second trip, stuck on board as well, and was of service by taking messages to the bridge and relieving me now and again. The only steward left made coffee and tea and was serving the officers on the bridge. After all the passengers had left the ship in strict order and calmness, only some thirty people were left—(captain P. v. d. Heuvel, some officers, all engineers, and a few firemen, and sailors. Everybody did his utmost to save the ship, sailors relieving firemen and acting as trimmers. Everybody knew it was a last effort, and this co-operation resulted in success.

"Immediately after the collision we stopped, and the *Cuneo* stood by until help should come. The distress signal was readily answered by several ships, amongst them U.S.S. *Wyoming* (NWQ), s.s. *Nacoochee* (KFP), *North Star* (KJS), *Cretic* (MRC). I sent out our position, and all were coming to our rescue. The *Wyoming* then informed us that U.S.S. *Texas* and *Louisiana* were coming at top speed to our assistance. This was considered sufficient, and the other merchant vessels were told to proceed on their way. The damage done was rather bad. The bow of the *Cuneo* was smashed and our ship had a big hole amidship on the port side extending 9 ft. below the water-line, through which the water was rushing. Soon holds Nos. 5 and 6 were filling, and the stern sank dangerously deep into the water. We went down aft for about 6 ft., and that seemed to be the limit, for we remained afloat. Then came the good news: 'Battleship division coming to your assistance. Hope to intercept you at seven.' Soon afterwards the battleships *Texas*, *South Carolina*, *Louisiana*, and *Wyoming* were noticed, and from another direction the *Michigan* (another U.S. battleship) arrived. As soon as they were in sight we felt safer, and the captain wirelessed that we were proceeding full speed and gave his course. Now we did everything possible to bring the ship quickly back to New York, but if any contingency should arise help was near. The passengers were taken from the *Cuneo* by the

South Carolina, and three battleships were coming towards us. Soon they were alongside, and after wireless conference it was resolved that the *Texas* should accompany us to port. It may be stated here that a message was filed in New York at 3.18 p.m., and its answer delivered at 3.45 p.m. in New York. At 8.30 p.m. we arrived at Sandy Hook, where tug-boats were awaiting us, and the *Texas* returned to join the fleet again. The last message we received from the *Texas* congratulated us upon our safe arrival so far.

"About 10 p.m. we arrived safe and well at New York Quarantine. We dropped anchor till daylight and docked again in Hoboken early Thursday morning.

"We need not point out the great service the wireless once more rendered in a very bad accident. No doubt the possibility of calling ships to his passengers' and his own ship's assistance gave the captain a free hand to make a rush for port, and so save the valuable ship and cargo.

"B. P. MOREL,
"Officer-in-Charge."

* * *

Since the disaster to the *Volturno*, which caught fire in mid-Atlantic, the seas have been remarkably free from such catastrophes. Notification was recently received by wireless telegraphy, however, announcing that a fire had broken out in No. 3 hold of the *Minnehaha*, a vessel of 13,714 tons belonging to the Atlantic Transport Company. Subsequent wireless messages from the captain stated that the fire on board was completely got under without having recourse to outside help. The *Minnehaha* had on board about 12,000 tons of cargo, but no passengers.

ANOTHER WIRELESS DOG.

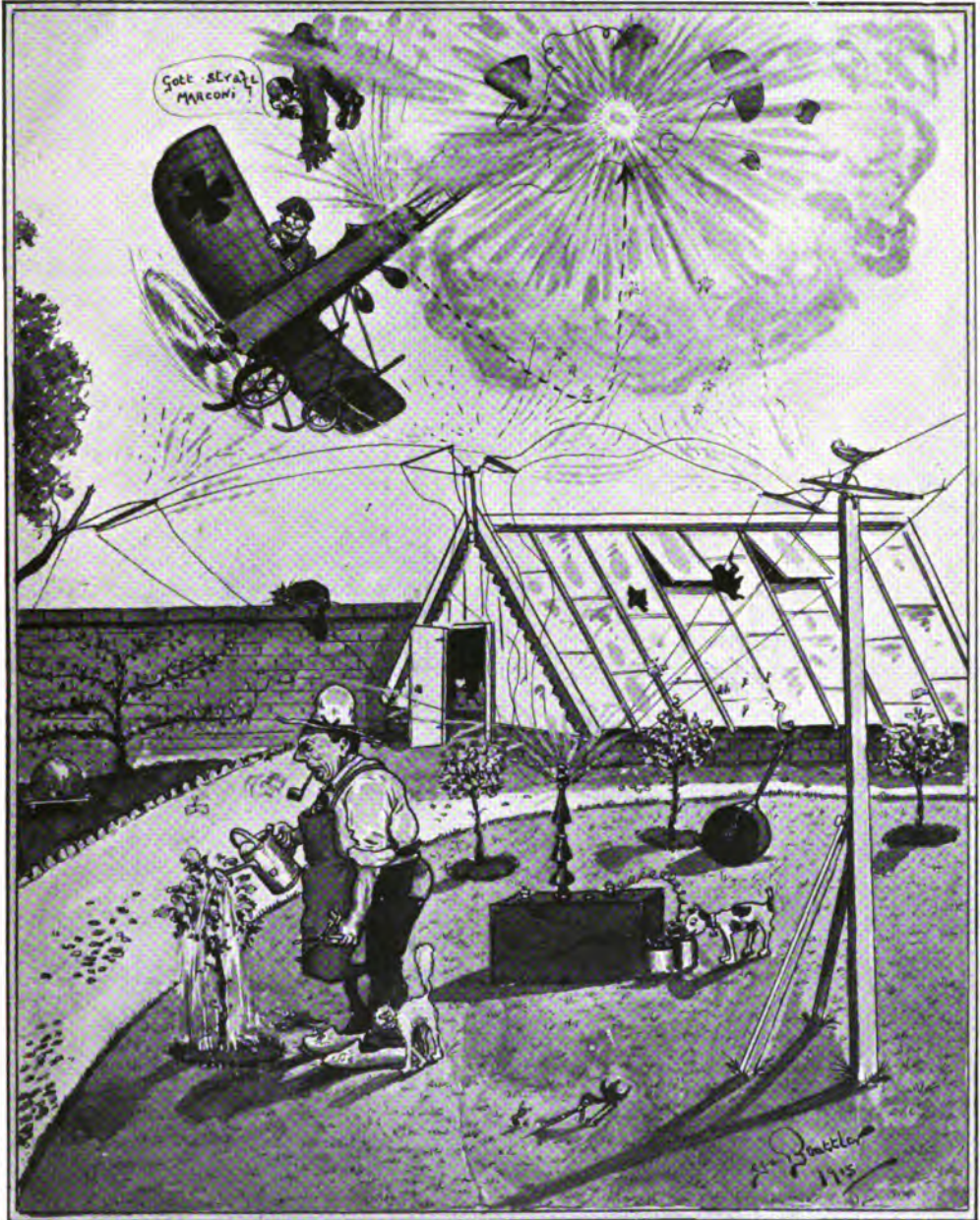
The references in previous numbers to a wireless-controlled dog have evidently aroused some amount of jealousy in the canine tribe, for we have received from a Dutch correspondent the following letter:—

"Dear Sir,

"Volume 3 No. 27, new series June 1915 is eaten by my dog. Do you have please another copy for me, thanking you in advance."

We trust that the dirigibility of the animal in question has been considerably improved.

CARTOON OF THE MONTH



Wireless Netting for Aerial Bombs.

The Effect of Coupling in Eliminating Atmospheric Interference.

By LOUIS COHEN.

A SERIOUS difficulty to contend with in the reception of wireless signals is that of interference, and particularly that due to disturbances caused by atmospheric, or strays, as they are sometimes called. Every experienced operator knows how annoying the atmospheric disturbances are at times, and during the summer months they may become sufficiently troublesome to make it altogether impossible to maintain regular communications between stations. The importance of overcoming this difficulty is fully appreciated by wireless engineers, and various schemes have been proposed to remedy this evil, but none, to the author's knowledge, have proven effective in practice.

The only method which is at all helpful in reducing atmospheric disturbances is the use of loosely coupled circuits. It is a matter of experience that within certain limits loosening the coupling between the secondary and antenna circuits reduces the atmospheric interference at a more rapid rate than the signals from another station, and this is particularly more marked the less the damping factor of the incoming signal. In fact, if the oscillations of the signals are sustained, or only feebly damped, the intensity of the signals at first increases as the coupling is decreased up to a certain point, and then gradually diminishes as the coupling is further decreased; but in the case of atmospheric disturbances the intensity is continuously diminished as the coupling is decreased. It is proposed to give here a brief discussion of this problem to show the law of variation of the strength of signals for different degrees of coupling for free and sustained oscillations which will throw some light on the question under consideration.

Let us first consider the case of sustained oscillations. We will assume that the incoming electro-magnetic waves impinging on the antenna induce in it an e.m.f., $E \sin \omega t$, no damping, and let us denote by R_1, L_1, C_1 and R_2, L_2, C_2 the resistance, inductance and capacity of the antenna and secondary circuit respectively. We have then the following equations giving the reactions in the circuits:—

$$\left. \begin{aligned} L_1 \frac{dI_1}{dt} + R_1 I_1 + \frac{1}{C_1} \int I_1 dt + M \frac{dI_2}{dt} &= E \sin \omega t \\ L_2 \frac{dI_2}{dt} + R_2 I_2 + \frac{1}{C_2} \int I_2 dt + M \frac{dI_1}{dt} &= 0 \end{aligned} \right\} (1)$$

I_1 and I_2 denote the currents in the antenna and secondary circuits respectively. The general solutions of the above two equations are well known and need not be discussed here; we shall consider here only the important case when the two circuits are

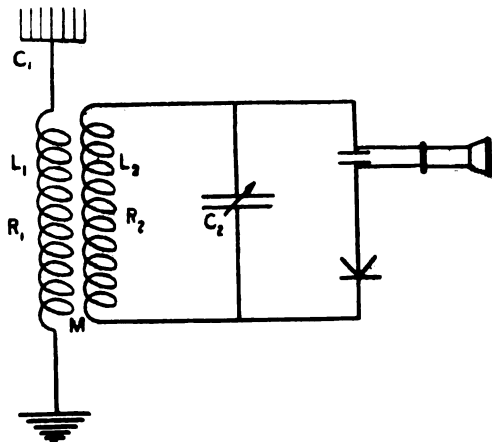


Fig. 1. Digitized by Google

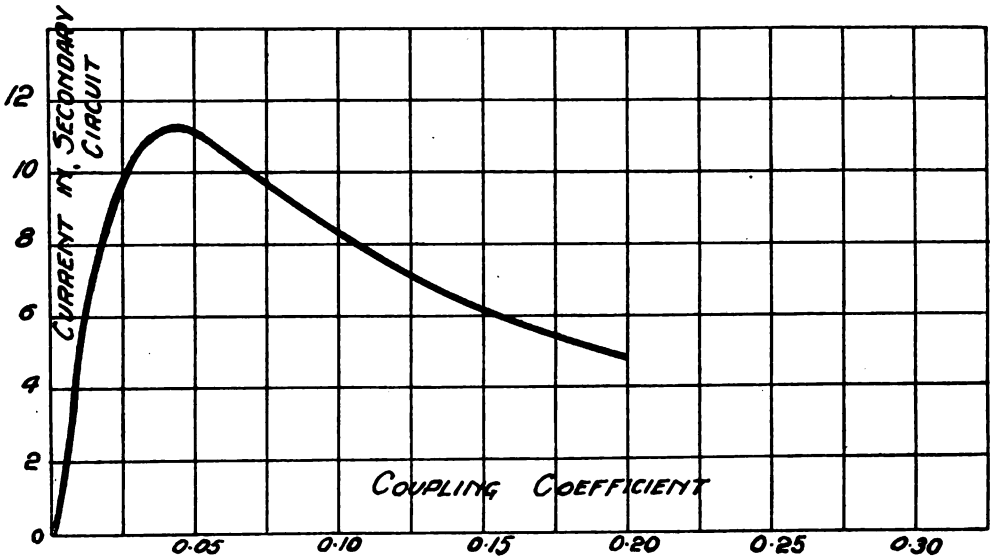


Fig. 2.

separately tuned to the frequency of the incoming waves, and we have then :—

$$\left. \begin{aligned} L_1 \frac{dI_1}{dt} + \frac{1}{C_1} \int I_1 dt &= 0 \\ L_2 \frac{dI_2}{dt} + \frac{1}{C_2} \int I_2 dt &= 0 \end{aligned} \right\} \dots (2)$$

Under this condition the current in the secondary circuit is given by the expression :

$$I_2 = \frac{EM\omega}{M^2\omega^2 + R_1R_2} \dots (3)$$

or we may put above equation in the following form :—

$$I_2 = \frac{E\sqrt{L_1L_2}\omega K}{L_1L_2\omega^2 K^2 + R_1R_2} \dots (4)$$

where $K = \frac{M}{\sqrt{L_1L_2}}$ is the coefficient of coupling. The current in the secondary circuit has its maximum value when

$$K^2 = \frac{R_1R_2}{L_1L_2\omega^2} \dots (5)$$

and

$$I_{2,max.} = \frac{E}{2\sqrt{R_1R_2}} \dots (6)$$

If we assume now certain values of L_1, L_2, R_1, R_2 and ω and plot a curve with I_2 as ordinates and K as abscissa, we find that the current rises in value as K is increased until we reach the value of K given by equation (5), and then gradually diminishes

as K is further increased. The curve shown in Fig. 2 gives the values of I_2 as a function of K for the following values of the constants of the circuits :—

$$L_1 = L_2 = 1 \text{ mh.}, R_1 = 20 \text{ ohms}, R_2 = 100 \text{ ohms}, \omega = 10^6.$$

R_1 represents the total resistance of the antenna, including the radiation resistance, and R_2 represents the resistance of the secondary circuit and the energy absorption factor of the detector.

Let us now consider the case of free oscillations—that is, we will suppose that the e.m.f. induced in the antenna is caused by an atmospheric discharge generating in it electrical oscillations. The problem to consider is the character of the current, and the variation of the current in the secondary circuit for different degrees of coupling. The analysis required for the complete investigation of the problem is very complex, and we shall give here only the final formulæ and illustrate by a numerical example the points under consideration.*

It is well known that in the case of two coupled circuits an electrical discharge will generate oscillations of two distinct frequencies and two different damping factors, and if we denote by ω_1 and ω_2 2π times the frequencies, and denote by a_1, a_2 the damping

* The complete solution of the problem is given in a forthcoming book by the author on the "Theory of Electrical Oscillations."

factors, we have for the square of the total current for a discharge :—

$$I_2 = \frac{E_0^2 C_1 C_2}{4} \left\{ \frac{\omega_1^2}{4a_1} + \frac{\omega_2^2}{4a_2} - \frac{(a_1 + a_2)\omega_1\omega_2}{(a_1 + a_2)^2 + (\omega_1 - \omega_2)^2} + \frac{(a_1 + a_2)\omega_1\omega_2}{(\omega_1 + \omega_2)^2} \right\} \dots \dots (7)$$

E_0 is the maximum potential on antenna, and C_1, C_2 are the capacities of the antenna and secondary circuits respectively. The values of ω_1, ω_2, a_1 and a_2 are approximately given by the following formulæ :—

$$\left. \begin{aligned} \omega_1 &= \frac{1}{\sqrt{LC(1+K)}} \\ \omega_2 &= \frac{1}{\sqrt{LC(1-K)}} \\ a_1 &= \frac{a_1 + a_2}{2(1+K)} \\ a_2 &= \frac{a_1 + a_2}{2(1-K)} \end{aligned} \right\} \dots \dots (8)$$

where

$$a_1 = \frac{R_1}{2L_1}, a_2 = \frac{R_2}{2L_2}, K = \frac{M}{\sqrt{L_1 L_2}}$$

In the above formulæ it is assumed that the two circuits are syntonised, $L_1 C_1 = L_2 C_2$.

It is obvious that since $\omega_1, \omega_2, a_1, a_2$ are functions of K , the coupling coefficient, the current in the secondary circuit as given by equation (7) is also a function of the coupling, and it can be shown that on substituting the values of $\omega_1, \omega_2, a_1, a_2$ as given by equations (8) into (7) will give an expression for I_2 which would show a continuous increase of the current in the secondary circuit as the coupling is increased. A numerical example will bring out this point clearly.

Let us assume the following values for the electrical constants of the circuits :—

$$L_1 = L_2 = 0.5 \text{ mh.}, C_1 = C_2 = 0.002 \text{ m.f.}, R_1 = 10 \text{ ohms},$$

$$R_2 = 100 \text{ ohms}, a_1 = 20 \times 10^3, a_2 = 100 \times 10^3.$$

The values of $a_1, a_2, \omega_1, \omega_2$, and I_2 for different degrees of coupling are given in the following table :—

K	ω_1	ω_2	a_1	a_2	I_2
0.05	1.025×10^6	0.975×10^6	6.31×10^4	5.76×10^4	$1.2 \times 10^{-8} E$
0.10	1.05×10^6	0.952×10^6	6.67×10^4	5.45×10^4	$1.96 \times 10^{-8} E$
0.15	1.085×10^6	0.938×10^6	7.06×10^4	5.22×10^4	$2.25 \times 10^{-8} E$
0.20	1.11×10^6	0.917×10^6	7.41×10^4	5.04×10^4	$2.44 \times 10^{-8} E$
0.30	1.19×10^6	0.877×10^6	8.57×10^4	4.26×10^4	$2.75 \times 10^{-8} E$

It is seen from the values given in the above table that the current continuously increases as the coupling is increased.

Let us see now the significance of the above results in connection with the use of coupled circuits for wireless signalling. If the signals to be received consist of sustained oscillations, then, as was shown above, it requires only a comparatively weak coupling to get the maximum current in the secondary circuit. Any other electrical disturbances which may give rise to free oscillations in the antenna circuit, such as atmospheric discharges, or disturbances from other stations using highly damped oscillations, affect the secondary circuit only to a small extent, since the free oscillations require a strong coupling to induce a maximum current in the secondary circuit. It is evident, therefore, that there is considerable advantage in using sustained oscillations for signalling, since it enables one to use weak coupling, and thus insure comparative freedom from interference of foreign disturbances. In using damped oscillations the current generated in the receiving antenna consists of forced and free oscillations; the less the damping of the oscillations of the transmitting station the greater the predominance of the forced oscillations in the receiving antenna. The coupling required for this case will be intermediate between the two extreme cases considered above, and obviously the less the damping of the oscillations the smaller the coupling required at the receiving station, thus making it more possible to eliminate interferences.

WIRELESS AND ELECTRIC POWER SUB-STATIONS.

The *Electrical World* states that the Public Service Company of Northern Illinois has been experimenting with storm detectors of the Hertzian wave type used at the waterside station of the New York Edison Company, and in installing these detectors at various points on its system has added the small additional equipment necessary to make full-fledged wireless telegraph stations of the local equipments. Messages have been exchanged between the system operator's office at Joliet, Ill., and the company's generating station at Blue Island, but the wireless method has not yet been called into service because of the failure of the means of communication that are ordinarily employed.

Doings of Operators

LAST month we spoke in this place of the experiences of Messrs. Shrimpton and Coats, to whom not one but many adventures had come to prove their mettle. This month we must tell of operators Swift and Murphy, who "kept their end up" and maintained the tradition whilst the good ship *Armenian* suffered, and was sunk by an under-water and underhanded enemy.

There were two wireless operators on the *Armenian*—John Stafford Swift, the senior, and James Dominick Murphy, as assistant. Swift had been at sea for some three years, working the wireless key mostly in South American waters. His home is at Southend-on-Sea, and his opinions of Germany are those of all the residents of that watering-place. Murphy comes from O'Leary's country and resides at Cork when at home. His service in the wireless cabin has not been as long as that of Swift, for he only joined in November last. Both men had been on the *Armenian* for several trips, and so were well acquainted with the vessel.

In the late afternoon of June 29th—a fine day with a calm sea—the periscope of a submarine appeared above the water, followed by the deck and hatchways. Hoisting the German ensign, the submarine peremptorily called upon the British vessel to stop, but the commander of the *Armenian* had his own opinions, and did not show that courtesy which the humane methods of German submarines might be considered to invite. Much to the annoyance of the "culture" craft, he put on full speed ahead, and the submarine, foiled for the moment, put on full speed also. In the tense moments which followed the submarine slowly overhauled the *Armenian* and fired shell after shell on the steamer. When first the hostile craft appeared Murphy was on duty, but Swift immediately took charge and sent out the signals of distress and indications of the ship's position. For twenty-five minutes the signals were sent out, and then with a deafening explosion a shell burst on the engine-room skylight, blowing away by its force the whole of the wireless cabin roof. Hardly had Swift left the cabin when a further shell completely demolished the cabin. The rain of bursting shells created

a carnage on deck as ghastly as could be imagined, and Swift tells us that even now he can scarcely realise how he managed to escape death, for the dead and dying cattle-men and crew were strewn on every side.

Their wireless duties perforce at an end, the operators rendered assistance in lowering boats. How great the peril still continued to be may be gauged from the fact that whilst they were assisting the commander and some of the officers to lower one of the boats a shell carried away half of the ropes. The boat thus partially released shot all who were in it down into the water; no less than fourteen were thus thrown out, and several were never recovered. When the boat was righted again eighteen people slid down the ropes into it and were able to make away. Other boats were also lowered, although a number were smashed to atoms by the bursting shells. Murphy was in the water for fifteen minutes before being picked up.

When all who could had left the vessel



Operator Swift.



Operator Murphy.

the pirates sent a torpedo to finish their fiendish work, and the *Armenian* sank stern first beneath the waves. In the boats the cattlemen and crew made the best of the position and rowed about until three hours later a Belgian trawler found them and took them all on board. Some time after the trawlers picked them up the survivors were transferred to patrols, which landed them a little later at the port of Avonmouth.

Apart from slightly injured hands, Swift seems no worse for his experiences and is taking a short rest. Murphy sustained some slight hurt, and is also resting for the moment.

COMPANY NOTES.

THE Annual General Meeting of the Compagnie Française Maritime et Coloniale de Telegraphie sans fil (the French Marconi Company) was held in Paris on June 30th. The annual report submitted to the meeting stated that the Company had fitted fifteen additional ships during the year 1914, and had a total of 89 ships fitted at December 31st, 1914. In spite of a reduction in the ship telegraph traffic due to the war, the accounts show an available balance of 142,288.86 fr. as compared with 63,867.33 fr. for the previous year. A dividend of 10 per cent. on the ordinary shares and 31.25 fr. on the profit shares payable on July 15th was declared, and Messieurs Dal Piaz and Musnier were re-elected directors of the Company for three years.

Marconi International Marine Communication Company.

Despite the troublous times which caused disorganisation of business and restriction of shipping during the last five months of its financial year, the Marconi International Marine Communication Company's report and balance sheet recently issued proved satisfactory reading for the proprietors.

This company, which possesses the rights of Marconi wireless telegraphy for marine purposes, was bound to share for the latter five months of 1914 in the lean times generally prevalent in shipping circles. Taken as a whole, however, the year's work shows a marked improvement on its predecessor's financial results. The gross revenue from ships, telegrams, subsidies, news service, rentals and sundry receipts amounted to £175,021, an increase on the preceding year of about £29,000. After providing £21,188 for depreciation and £6,812 for debenture interest, the net profit amounted to £55,668—an improvement of £18,500. Some loss has been sustained through attacks on the mercantile fleet by enemy submarines, and (despite anticipation of compensation in due course) the directors consider it desirable to place £10,000 for the time being to a special reserve.

For the third year in succession the shareholders receive the satisfactory dividend of 10 per cent., and the result of this favourable report has been shown in the hardening of the market quotation to 1³/₈. The war has clearly demonstrated in a very striking and continuously increasing manner, the paramount importance of wireless fittings for vessels of all descriptions, so that when the war-cloud lifts and British commerce is able once again to progress under the stimulating effect of peace, there is every reason to expect that the Marconi International Marine Communication Company will more than maintain its past uninterrupted progress.

* * *

The report and balance sheet of Marconi's Wireless Telegraph Company will be found on pp. 345-6 of this issue; but the meeting will not take place until July 26th, too late to be reported in this issue. We feel certain that the shareholders of this company, like that of the "International," will find good reason for self-congratulation in the results attained.

How to Become a Wireless Operator

WE are so frequently receiving letters from correspondents asking us to explain how they can join the ranks of the professional operators that we think it advisable to devote some space this month to considering the subject rather more fully than is possible in the column for "Questions and Answers."

Wireless operators can be divided into two classes: naval operators and commercial operators. The wireless telegraph service of the Navy is under the sole control of the Admiralty. Now that the war has increased the demand, a number of wireless operators have been enrolled for the duration of the war from men who are physically fit and in possession of the Postmaster-General's certificate, or otherwise sufficiently qualified. In normal times, however, the only way to join the wireless telegraph staff of the Navy is to enter as a boy or youth, just as one would do to become a gunner or any other skilled rating.

Commercial operators can further be divided into two classes: ship operators and shore operators. The ship operators are employed either by the shipping companies direct, or by the Marconi Company on behalf of the shipping companies. As by far the greater number of ships are operated by the Marconi Company on behalf of the shipping companies, it will perhaps be best to consider first what it is necessary to do in order to join the Marconi Company.

The applicant for the Marconi Company's service must be physically fit in every way. Slight defects of sight, providing they are properly corrected by glasses, do not debar the applicant from admission; but lameness, even slight, will debar. Before being accepted, all applicants have to pass the Company's doctor.

A thorough practical acquaintance with telegraphy is required, and a speed of eighteen words per minute, sending and receiving, is the very lowest that is usually accepted. It should be remembered that in normal times the number of applications for employment usually exceeds the vacan-

cies that can be offered, and therefore if there are more applicants than vacancies the best men are selected. It is highly advisable to acquire a speed of at least twenty-five words a minute, sending and receiving, before applying for employment, if the applicant wishes to stand a good chance. For the same reason it is advisable to obtain the Postmaster-General's first-class certificate of proficiency before applying, although at present, when the demand for operators is very great, suitable applicants may be taken without the certificate and their training completed in the Company's school in London. The certificate is obtainable by study at any of the numerous colleges and schools such as those advertised in **THE WIRELESS WORLD**.

One of the most important qualifications, and one which is often overlooked by intending applicants, is good clear and rapid writing. Several cases have been known where applicants, possessed of the Postmaster-General's certificate and otherwise quite suitable, have been rejected because their writing was wholly useless for practical telegraph work. Too much importance cannot be attached to this subject.

All applicants must be British subjects and within the ages of eighteen and twenty-five. The greatest importance is attached to a man's previous record and character, and references are required from independent sources and from past employers. If the intending applicant can comply with all the above requirements, he should write to the Traffic Manager, Marconi International Marine Communication Company, Ltd., Marconi House, Strand, W.C., setting forth clearly his qualifications, and asking for a form of application and conditions of employment.

In the event of an applicant being considered suitable, the man in question is asked to call at Marconi House for the purpose of an interview and test. The test comprises telegraphy and writing and any further subjects which the Company may consider advisable. If he is approved, the budding operator visits the Company's

doctor for a medical test, and on passing has to be prepared to spend some time in the Marconi House School. Here he will learn the various methods of accounting for messages and other matters connected with the Marconi Company's business. If he has not yet obtained the Postmaster-General's certificate, he will have to stay in the school until his studies are completed and he is able to sit for the examination.

Telegraphists with previous land-line or cable experience, able to send and receive twenty-five words per minute, are accepted without any previous wireless training, and are paid 17s. 6d. per week until they have obtained the certificate and are appointed to the staff. Other applicants who are accepted receive 5s. per week whilst in the school. On appointment to the operating staff the minimum commencing salary is £1 per week and all found on board. Annual increases of salary are given as set forth in the Conditions of Employment sent to every applicant. An applicant with the Postmaster-General's certificate is not likely to remain more than a very short period in the school.

Positions in shipping companies who employ their own operators are obtained by applying to the companies direct.

Vacancies on land stations in Great Britain do not occur very often. All of the commercial coast stations except those of high power are owned and operated by the Post Office, and the operators are recruited solely from the Post Office staff. The big power stations at Poldhu, Clifden and Carnarvon are operated by Marconi's Wireless Telegraph Company, Ltd., and when men are required for these advertisements appear in the daily press. For the guidance of those who wish to obtain such positions we would say that a high degree of telegraphic skill is required, and only those with previous professional experience in telegraphy are usually taken.

There is one accomplishment which in both land and ship wireless operating is of the utmost importance, and cannot be too highly valued. We refer to tact. On many occasions an operator will find that the man at "the other end" is sending perhaps too fast or too slow. It is useless for him to pass sarcastic remarks regarding the "other man's" abilities at the key, and just as

foolish to get offended when he himself is asked to send slower or faster, as the case may be. For the conscientious man there is only one thing to be thought of in such circumstances, and that is an efficient service. Amicable working on a circuit between two operators of average ability will clear much more traffic than recriminations between experts.

Positions on coast stations abroad are often filled from the ranks of the experienced ship operators in the Marconi Company. It is not usual for these positions to be given to men with less than two or three years' experience. They are, indeed, reckoned as the "plums" of the service, and are usually given to men who have shown themselves to be of more than average ability. Positions on the Inspecting Staff are also recruited from the senior men.

Altogether the profession of a wireless operator is a very pleasant and interesting one, with many opportunities for seeing the world. In these times, too, the wireless operators on merchant ships are doing a magnificent work in carrying out their duties, for they are assisting in bringing safely to this country the valuable cargoes of food and merchandise. The Admiralty fully recognises the importance of their work, and has stated that it considers that the mercantile operators in performing their ordinary duties are serving their country just as truly as if they were with the fighting forces.

AMONG THE WIRELESS SOCIETIES.

Notes on Meetings.

The Institute of Radio Engineers.—

The June meeting of the above society was held on Wednesday evening, June 9th, in the Columbia University. A paper on "Engineering Precautions in Radio Installations" was read by Mr. Robert H. Marriott, and the result of much experience with methods of installing radio apparatus was given. An address was also given by Dr. Alfred N. G. Goldsmith on "Static Elimination—Some Suggested Methods." Much material of interest to all those working at this great problem was contained in the address, a digest of which we hope to give at a later date.

The Two Strange Men

A Story of the Crusades.

By P. W. HARRIS.

Editorial Note.—In the course of excavations for the foundation of a wireless mast somewhere in England the following parchment (apparently a portion of a letter written from Palestine by a gallant knight of the Crusades) was discovered in a battered and much bent casket. Certain portions of the letter indicating the position of the forces of the Duke Robert of Normandy have been deleted in deference to the present censorship of news, but otherwise the parchment is reproduced practically as found. The old spelling has been slightly altered so as to make the wording more easily intelligible to modern readers.

* * *

(Portion torn) . . . for in good faith the elements have not favoured our movements.

This morn at daybreak the messenger brought thy message, written on good parchment by the Friar Thomas. It gladdened my heart to hear that thou art in good health and that our little maid Elfrida is growing so bonnily. If the varlet cometh again for the income tax whilst I am in a foreign land straightway have him cast into the dungeon that he may join his predecessors. Please convey my greeting to the lady Winifred and thank her for the respirator, which came to hand yestereve.

We are making good progress against the forces of the Saladin, and his troops are retreating towards the coast. I trust that by the time I write again there will be a great victory to record. Let us hope that it may be so.

But, before all else, I must recount a strange occurrence which hath befallen us, and which hath occasioned much controversy amongst the wise men. On the eve of Candlemas there arrived at the camp two old men, bent and careworn and dusty with much travel through the desert sands. The elder of the two immediately demanded an audience with the Duke, saying that he had matters of great urgency to lay before him. He was straightway brought before Sir

Stilton Parmesan, who at that time was Chief of the Guard, who forthwith demanded to know what the old man had to tell.

"Good, my Lord," quoth the man. "In very sooth I cannot tell thee, for my message is for the ears of the Duke alone."

"Then canst thou not see him," was the reply. "I forbid thy approach even to the door of the tent."

"Be it so then," answered the old man. "I must depart and my mission must remain unfulfilled. Had I been allowed to enter," wistfully continued the old traveller, fingering his wallet, "peradventure certain shekels might have found their way to a welcome quarter. Farewell!"

"Tarry thee a moment," exclaimed the good Sir Stilton, hastily. "Methinks I did judge thee too harshly. In plain language of the good King Henry, how much?"

The matter was soon arranged, and the old man led before the Duke. Making deep obeisance he spoke as follows:

"My Lord Duke, I have hastened hither from the plains of Araby, whither thy fame has spread, and where thou art known as a great deliverer. It is claimed amongst my people that thou wilt overthrow the power of the Saladin, and as we ourselves are sworn enemies of the Infidel, I have been sent to aid thee with the magic box."

"The magic box!" quoth the Duke, "and what might that be?"

"Truly it is marvellous," replied the old man, "for in it is a spirit which doth journey at our bidding. My brother who doth await without hath also a magic box with an attendant spirit and the two sprites do act as messengers. Although thou wilt scarcely give credence when I tell thee, in sooth we can talk by these spirits for a distance of three full days' march. I pray thee, therefore, allow my brother to accompany the next expedition against the Saracens, and I, thy good servant, will remain here, and will hold frequent inter-

course with my brother who is with the troops far distant. In this manner, my Lord Duke, thou wilt be informed right speedily of what occurs in battle, and there will be no need for constant envoys and messengers."

The Duke was evidently much impressed, for he called to his trusty friends Count Gorgon de Zola and Sir Robert Gruyere, who were standing by, and said :

"Thinkest thou, my friends, that this old man doth speak sooth? If it is as he doth state the box will help me mightily."

"We cannot say," was the answer, "but we would suggest that if he cannot do what he claimeth he be forthwith put to death."

"Ha! ha!" said the Duke, "a right good plan thou hast suggested! Old man! To-morrow the Count Gorgon de Zola and Sir Robert Gruyere set forth upon an expedition against the great Saladin. After three days they will come upon the enemy and do battle for the good cause. Thy brother shall accompany them and daily I shall expect to hear how all matters progress. But if thou fail in what thou hast set thyself to do, thy life will be held forfeit. Sergeant, lead him away and give him food and drink. His brother also must be cared for."

And so it was arranged; the younger of the two men set forth with the Count Gorgon. On the third day the Duke Robert called a council of all the nobles and knights, and ordered that the old man be brought before him with the magic box.

"My Lord Duke," said the old man. "I am here ready to do thy bidding. But first I must crave indulgence while I make a small preparation. In order that the spirits may know the tent in which we are I lead this golden thread away from the tent to a high lance-pole which I have placed without." As the old man spoke he unrolled a coil of golden thread and went out through the door of the tent. In a short time he returned with his task completed.

"I now open the magic box and place upon my head the casque which is a sign that the spirit must speak to my ear and my ear alone. Next with this crystal set in a golden mounting I invoke the spirit and command him to go forth to thy good servant, my brother, who is three days' journey from here. I charge him ask my brother all the news, and as he tells me so I will write. He is gone! He returns! Ha! I hear the voice!!!"

All in the tent were now possessed of a



"All in the tent were now possessed of excitement."

great excitement. The Duke Robert leant forward in his chair and shook with expectancy. The nobles and knights all held their breath as the old man inscribed on the parchment line after line in feverish haste. For five long minutes he wrote silently, and intense was the anxiety with which the assembly waited. Then the old man spoke :

"Behold, my Lord, I have the message. With thy permission I will read it forth. 'Crusaders' Headquarters fourth day after Candlemas. To the north of Jerusalem our troops continue to advance. In the region of the Dead Sea there is nothing to report stop The Jerusalem'sche Zeitung commenting on the Crusaders' advance states that it is established fact that poisoned arrows being used appeals to neutrals protest against this flagrant breach rules civilised warfare stop.'"

"Yes, yes!!" cried the Duke. "'Tis in sooth a marvellous power thou hast shown to us. Read on!!"

"Saladin addressing assembled troops before Jaffa states Damascus must be occupied by Saracens fourth February latest stop Saracen prisoners just captured report bad morale Saladin's army. Mohammedan commercial industrial activity paralysed stop Market report Circassian slaves spot 22/6 October delivery 18/- Georgian ditto dull some transactions effected low prices Jerusalem selling plate won by Deadsea Fruit with Sally Dean second large field stop Latest during the operations last two days our troops captured three million four hundred twenty-five thousand six hundred four prisoners seven hundred fifty machine bows quantity stores stop..."

The Duke now sprang from his chair with flaming eye. "Stop, thou sayest! Stop it shall be, in sooth, for thou liest!! In the whole of Islam there is not that number of troops to be found!!! Sergeant! Take the perjurer forth and have him executed, for . . ." (the remainder of the parchment is illegible).

WIRELESS IN ROUMANIA.

ONE of our contemporaries eloquently entitled the *Near East* recently published the following paragraph :—

There is now in existence at Bucharest a wireless telegraph station which is more powerful than the older one. On Tuesday night the new station spoke to Athens, which replied, and messages have since been exchanged with the Eiffel Tower.

Such a paragraph makes a peculiar appeal to those of us who take an interest in the history of civilisation. The Balkan kingdom of Roumania in its very title enshrines two important phases of European history. "Roumi" is the name traditionally given by Turks and Arabs to Christians in general, and is a mere corruption of "Roman." The reason is, of course, that the first Christians with whom the Mohammedan invaders came directly into contact were the Christians belonging to the Christian Roman Empire, whose seat of government was Constantinople. Thus the term Roumania speaks eloquently both of the Roman civilisation imposed by force of arms upon the Thracian and Dacian tribes and of the Mussulman invasion of Southern Europe, which in the fifteenth century threatened to penetrate into the very heart of Europe. When we find Roumania, once the fringe to the Roman Empire and afterwards the bulwark of Christian Europe against the Turks, communicating by wireless ether waves on the one hand with Athens, whose valiant sons in ancient days preserved Europe from the Persians, and on the other hand simultaneously interchanging wireless messages with Paris, the centre of the great Carolingian Empire which rose from the ashes of Western Rome, we have brought home to us in a very graphic way a lesson of faith in general human progress, despite dark epochs of reactionary struggles, which appears peculiarly appropriate during the present days.

* * *

Our contemporary concludes the paragraph above referred to by calling attention to the fact that

Wireless apparatus and material being uniformly contraband of war, every part of the new installation has been constructed in this country, partly at the State railway workshops and partly in those of the Postal Service.

The pride of nationality which finds its (perhaps most legitimate) expression in conscious independence of outside support, remains as strongly developed a feature amongst the descendants of Wallachia and Moldavia as was the case in the days of Roman imperialism or those of Michael the Brave (the Roumanian hero in their Turkish struggle), whose memory is perpetuated by a beautiful equestrian statue at Bucharest.

Amateur Work during the War

A Few Suggestions.

IT is much to be regretted that in the world of amateur wireless there are appearing signs of stagnation—a stagnation which, if continued, cannot fail to have a serious effect on the progress of the science as a whole. Although for the moment all practical work has ceased perforce, amateurs should remember that the restrictions will not last for all time, and that directly the war is over many of them will be immediately removed. The great field of theoretical work is still open, and as practice without theory can only progress very slowly, it behoves every experimenter to be fully prepared with sound theoretical knowledge in readiness for resuming practical work.

In normal times we find wireless telegraphy taken up by three distinct types of amateurs. Firstly, we have what may be termed the “fully qualified expert,” with a thorough theoretical and practical acquaintance with electricity in its many applications, a sound knowledge of technical mathematics, and plenty of leisure in which to conduct his experiments. He either possesses or has access to a well-equipped laboratory, and his work is usually of an extremely advanced nature. To him the cessation of practical working means some inconvenience, but, knowing the importance of theoretical work, he continues his studies and investigations with considerable benefit both to himself and to the world at large.

Secondly, we have the “serious experimenter,” who occupies his spare time with the study of the theory and practice of radiotelegraphy, and, by means of his home installation, investigates to the best of his ability the many practical problems which come his way. He endeavours to find a reason for the phenomena which he encounters: as experience and theory give him new ideas from time to time he alters

the construction and arrangement of his apparatus accordingly. Unlike the “fully qualified expert,” his experience of electrical work is not great and his knowledge of mathematics is often far smaller than he would like it to be. Nevertheless, he is able to do much excellent work, as the pages of this magazine have amply demonstrated. To him the cessation of practical work is a very serious matter, as most of his time at wireless is spent in practical experiment.

Lastly we have the large—perhaps too large—class of “wireless dabblers,” who with crude apparatus jamb their own friends, use excessive power, and think they are brilliant and unrecognised geniuses because Paris and Poldhu come through on their receivers. Their bedrooms and studies are full of weird apparatus, notices of “Danger” appear on every side, and intricate coils and jumbles of wire indicate the position of what is called their “station.” Their ideal of a private installation is a roaring and deafening spark, thousands of terminals, insulators like those of a million-volt transmission line in the wilds of America, and crystals, potentiometers, and switches galore. Their work is aimless, and they never worry about theory, for they think it too “dry.” Directly the present restrictions came into force and their apparatus had to be packed away and sealed up, the “dabblers” believed their hobby to be completely stopped, and as a consequence have turned their energies in other directions.

Whilst we are mainly concerned in this article with the second class of amateur—namely, the serious experimenter—we trust that the “dabbler” will not overlook what we have to say. Dabblers not only do themselves no good by irresponsible experimenting, but are likely seriously to harm the cause of amateur wireless by bringing

amateurs into disrepute with the authorities. In the United States the abuse of wireless by such experimenters resulted a year or two ago in legislation of such a stringent nature that now before a licence for experiment can be taken out the experimenter must fully satisfy the authorities as to his capabilities. Faced with official questions, the transatlantic dabbler is in a very unhappy position.

Wireless telegraphy as a science has no clearly defined boundaries, for it is intimately connected with many other branches of electricity. Before it can properly be studied, a sound knowledge of elementary electricity and magnetism is required, and the principles at least of alternating current work should also be mastered. It would be well, therefore, if each amateur were to subject himself to an examination in these two subjects by the aid of the well-known "Test Cards" issued by our publishers.

An excellent way of testing one's knowledge of wireless theory is to undertake the complete calculations of a wireless transmitter and receiver for a certain range of wave-lengths. This will, of course, comprise the working out of inductances, capacities, wave-lengths, aeriels—in fact, everything that pertains to the installation. Where points of difficulty occur, the Instructional Articles which have appeared in THE WIRELESS WORLD or Bangay's *Principles of Wireless Telegraphy* should be consulted. It is surprising what interest can be derived from work of this kind.

The student who proceeds beyond the superficialities of the subject will soon find that without a fair knowledge of mathematics he is severely hampered. For those who have not had the advantage of a mathematical training we can recommend *Engineering Mathematics Simply Explained*, by H. H. Harrison, a little book selling at 1s. 6d. and obtainable through the Wireless Press, Ltd. This will be found to give the student much help and an excellent grounding in mathematical work. More advanced books should, of course, be studied as soon as this has been mastered. It may be mentioned that we are considering the advisability of publishing a series of articles on the Mathematics of Wireless Telegraphy especially for the benefit of those who wish to improve their knowledge in this direction.

The *Wireless Telegraphist's Pocket Book*, by Dr. J. A. Fleming, advertised on another page and now in the press, will also render great assistance to all who are intent on mastering the principles of wireless. The Mathematical Notes which form the first chapter will be found especially valuable for those who already have some knowledge of mathematics, and we would strongly advise every serious student to obtain this book and devote himself diligently to its study.

The amateur who intends to train for the wireless operating profession will, of course, make a point of studying the construction and use of the commercial apparatus which he will be called upon to handle. For this purpose the *Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead, is indispensable. The official *Handbook for Wireless Telegraph Operators*, issued by the Postmaster-General, should also be obtained, so that the rules for the handling of traffic may be mastered.

In conclusion, we need hardly mention that Morse Code practice should be kept up at all costs, as it is wonderful how rapidly one can lose speed from want of practice. In this direction the societies should afford great help, for one experienced telegraphist can give expert instruction to a large number simultaneously.

We will welcome suggestions from our readers regarding the lines of study which they think it desirable to take, and shall be particularly glad to hear what is being done in this connection by the various wireless societies distributed throughout the kingdom. We are sorry to notice that the activities of several of the societies have considerably lessened. This should not be so, as so much work needs to be done in connection with theory.

NEWFOUNDLAND IMPORT TARIFF.

Amongst the articles removed from the free list and made dutiable at the rate of 10 per cent. *ad valorem* under the Newfoundland Import Tariff appears material for installing wireless telegraphic apparatus on ships engaged in the trade and fisheries of that Colony.

New Applications for Wireless

No. 2.—*The Case of the Undesirable Members.*

By W. B. COLE.

A WEEK after the dramatic exposure of the famous thought-reading Zananis* our amateur wireless "investigators" met Weston, their *Daily Thunderer* friend, at Frascati's.

Dinner over, and the first glass of comradeship drunk, Clifford leans forward and starts yarning.

"Holland and I believe that we are on the track of a regular little secret society, up to every move on the modern scientific board, and specially proficient in wireless. We have selected two of their number for our next investigation, and want you to come along and help us. It'll be best for you to wait for explanations until afterwards, because if you act in the dark all your actions will be perfectly natural, and no suspicion can be aroused of our working in collusion."

"Right you are," Weston answers, "but you must take care to make your final explanations in full, for I shall expect to be provided with fresh 'copy' for another article. You may rely upon me implicitly."

"Thanks awfully!" replies his friend; "and to start with, I may tell you that to-night, as soon as we are all ready, we are going to take you to a club, most of whose members hail from foreign parts. Holland and I joined a fortnight ago for this special purpose, and are fairly well known by now. You are to be my guest for the evening, and the club committee is expecting you."

Clifford had during the past week left his face unshaven, and a fair silky down appears upon his fair white skin. He sports a loose black velvet coat, and his general appearance is carefully calculated to suggest a man in easy circumstances slightly negligent with regard to personal appearance. Holland wears his usual clothes, but Weston had been instructed to "make up" for the rôle of a wealthy plunger.

Soon the trio arrive at an ugly red brick building several storeys high, standing in a quiet street not far from Soho. The place is brilliantly lighted, dark hangings drape all the lower windows, whilst the upper ones—glazed with opalescent glass—remain uncurtained. A large double door divides the ground-floor front rooms and opens on to a narrow hall. At the doorway they are stopped by a pleasant-faced man of stalwart stature and swarthy complexion. After a few sentences of cautious parley, in the course of which Clifford whispers the password, this un-uniformed custodian steps aside with the words, "Monsieur will find the key on the table under the book; my place is here." Clifford and Holland sign their proper names, whilst Weston inscribes the borrowed patronymic of A. Wilson. Passing up a wooden staircase and along a corridor, they come to a door bearing an inscription, in many different languages, which announces that the room is used as a photographic dark-room, but has been temporarily closed for repairs. Side by side therewith, a half-open doorway shows a large room crowded with men of all nationalities, some talking in groups, whilst others are engaged in games of dominoes, cards, or chess at the small tables which cumber the floor in large numbers. They unlock the dark-room door, enter, and switch on the electric light. Besides the usual photographic fittings a rough improvised bench stands in the farther corner covered with various wireless instruments.

"This is surely a piece of retrogression, isn't it?" remarks Weston, touching one of the items of apparatus. "I thought the days of coherer receivers were over years ago."

"We all hoped so," replies Clifford. "Most of *this* set, however, is home-made. That brute of a coherer nearly wore out our patience days ago, but we have got it into good going order now."

*See "The Case of the Empress Music Hall," WIRELESS WORLD, April, 1915.

"It doesn't give bad signals," remarks Holland, as he sends V's on a small buzzer key. In response to his fingers the paper strip starts forward from under the guide roller of the inker, whilst its little well-inked wheel jumps up to the paper at every impulse of the key, marking it with three dots and one dash of the Morse code letter "V." At the same time the tapper, in synchronism with the inker movements, with gentle and rhythmic insistence raps back the coherer tube into a state of de-coherence.

"You've got a jolly small aerial," remarks Weston, as he traces out a wire mounted on porcelain cleats running along the wall under the bench; "it only amounts to about ten feet or so."

"You just wait and see," quotes Clifford. "I think you will find it prove long enough."

Five gentle knocks at the door, delivered in quick succession, interrupt further conversation.

"One of the committee," says Clifford, as he opens to admit a middle-aged man, who bows ceremoniously to them. "My friend Mr. Weston, of the *Daily Thunderer*—Mr. Alexander Wilson for the nonce." Then, turning round, he completes the introduction by: "This is Mr. Stoneham, the secretary of the club."

Mr. Stoneham's name strikes Weston as the only British thing about him. He has come to see that all is ready for the night's experiment, and, learning that this is the case, passes out of the room with an enigmatic smile, as he murmurs, "It is *au revoir*, is it not so?"

Leaving Holland to act engineer-in-charge for the evening, Clifford and Weston pass into the next room and start a game of chess. All around them men of every nation, as foreign in their apparel as in their talk; some play dominoes, others draughts and chess, but cards obtain the greatest favour, and for the most part the games played appear to be for fairly high stakes.

"You would never expect to find such a thorough-going gambling den right in the heart of London," remarks Weston. "Aren't they ever raided?"

"I should say," returns Clifford, "that it would be very difficult to get evidence, if the police tried it on. I know for a fact that there is a most elaborate system of electrical

warnings arranged for, and though you may only have noticed our stout friend at the door on guard, other eyes are watching us all the time."

After sitting a little while at chess our two friends perceive a pair of men whose accent and appearance plainly bespeak their south European origin. They have just come in, seated themselves, and started shuffling two packs of cards at one of the small tables. In a minute or two the younger of the pair whispers to his companion, and they come across the room. After the usual preliminary greetings the elder stranger asks, "Do you want your revenge this evening, Mistair Clifford?"

"I do very much, Mr. Browski," replies the latter, introducing Weston as "My friend Wilson, who would like to make the fourth in our game."

Mr. Browski in turn presents Monsieur Zepachi, and the four adjourn to one of the larger tables in the corner of the room. After the polite but unnecessary preliminary of each offering the other his chair on the plea of its being the more comfortable, the quartette settle down for an evening's battle with luck and skill at the good old game of whist, each player taking his place with a little pile of gold and silver on his left-hand side.

Our friends' adversaries are well-known members of the club—called by their fellow-clubmen "the twins." This sobriquet is not due to any physical resemblance, for with regard to appearance they were literally "the long and the short of it," but is bestowed on account of their inseparable companionship. They pursue an invariable habit of partnership, and such is their power of co-ordination that even with moderately bad hands they seldom lose. As a rule, they rise from an evening's play considerably the richer than when they sit down, and have issued a standing challenge to club members offering to play any other pair for high stakes. This challenge, though many times taken up, has up to the present almost without exception ended in favour of the challengers.

There is no suspicion of foul play, but this constant success and refusal of "the twins" to mix in the social life of the club has brought in its train a certain amount of unpopularity. Little is known about them except that they appeared to have travelled together all over Europe and America, and

visited most of the principal clubs. Club etiquette usually demands that silence from which whist derives its name, but—as the game proceeds—Weston notices that Clifford, contrary to his usual custom, is taking every opportunity of interpolating remarks in a slow and distinct tone of voice, most of what he says bearing upon his opponents' luck, and he neglects no chance of mentioning the cards played.

In less than an hour Weston's little pile is exhausted, and he finds himself obliged to appeal to his friend for assistance. The stakes had just been regulated accordingly, when Mr. Stoneham, the secretary, accompanied by his assistant and three members of the committee, enter the room and walk up to the table. Turning to "the twins," Mr. Stoneham, in a loud, staccato voice, so pitched as to reach the whole apartment, exclaims: "You are a pair of card-sharpers and cheats!"

Conversation is immediately hushed. You might hear a pin drop. A player lets his ivory domino fall upon the floor. The sound seems to penetrate to every corner of the room, and gives the effect of the striking of a stroke of fate. Browski and Zepachi jump to their feet.

"Monsieur," Browski screams, "what mean you? I will—I will——"

"Take your hand away from your hip pocket; I have you covered," says Weston sternly, as with his right hand in the side of his jacket he pushes the corner of the table towards Browski. The latter, finding himself surrounded by alert men, obeys reluctantly. By this time the committee have placed themselves round the table.

The members present desert their games and crowd round.

"I repeat what I said just now," says Stoneham quietly. "You two are card-sharpers and cheats."

There is no necessity to indicate which two of the four he accuses. Browski, livid with rage, jumps up and faces his accuser. His friend, still seated, turns white with fear and rage, whilst with trembling fingers he twists his moustache, his eyes are roaming round seeking an outlet for escape.

"Prove it," snaps back Browski.

"Very well, then," replies Stoneham. "Take your coat off and open your waistcoat."

Browski is evidently not prepared to hear this. His companion leans back in his chair, and again his hands nervously seek comfort from the hairs on his upper lip. Browski alone continues defiant, and seems the only one capable of acting as spokesman.

"Why should I take my coat off? Is this a dressing-room? Perhaps you wish to fight me?" rapidly questions Browski. "Yes, yes, I am quite willing to fight you with the usual weapons, but I will not take my coat off! Yes, yes, I challenge you to fight me. To-morrow I will come here with my friend, who will be my second, and we can settle this affair below. Follow me, my friend," he adds, turning to Zepachi and taking his arm. "We will show them to-morrow we cannot with impunity be abused as card-sharpers and cheats!"

"One moment," says Stoneham quickly. "Listen to me, all of you. I accuse these men of having wireless telegraph instruments concealed on their persons, and by its means they have passed messages between them describing their cards. If they will take their coats off you will see the wires and connections. It is the business of all the members here who have lost money by playing with these men to help me to prove this."

"Let us see what's under your waistcoat," shout several members.

In a moment Browski's coat is half-pulled off and his waistcoat torn open, revealing to the astonished spectators a coil of wire as thick as one's little finger wrapped round his body. This disclosure brings forth a chorus of exclamations and execrations, and things look very ugly for the two sharpers. Browski, pale with fury and fear, makes a rush to break through the throng now pressing him on all sides.

"Sit down!" shouts the secretary sternly; and a dozen willing hands force Browski heavily into his chair, where he sits glowering at them. "Gentlemen," continues Stoneham, "in the next room we have had installed a small wireless telegraph receiving-station, which has picked up a series of messages and recorded them on the tape. I have that tape here for your inspection. It shows the signals, with a translation of them underneath. Behind that picture, gentlemen, hangs a telephone transmitter, and all the conversation that has passed at



Browski's coat is half-pulled off, and his waistcoat torn open.

this table has been taken down by one of the committee downstairs. I have that here also. A comparison of the conversation with the tape will amply prove my case, for the cards played by these men correspond with the wireless tape."

This damning evidence produces a tremendous sensation among the crowd.

"Cads! Cheats! Scoundrels!" is shouted simultaneously by a dozen voices, in almost as many languages.

"Now we know why we always lost!" cries one.

"Down with the sharpers!" cries another.

Seeing that the crowd is beginning to look threatening, a member, known as the "Colonel," steps forward and proposes that, in view of the seriousness of the charge, the matter should be fully "investigated at a court-martial downstairs."

"No, no!" shriek the two culprits together.

"I will return all the money I have won," screams Browski, trembling. "Yes, yes, to

each one I will give double—there—there—double the money. I will write a cheque now, and then never, never come back again—I promise you," he added rather unnecessarily.

"That will hardly do now, or satisfy us," replies the Colonel, with ominous quietude. "This club is run on military lines, as you know well enough, and you will have to stand your trial."

"Quite right, Colonel," shout many voices behind him.

The room is strangely silent now, save when the principals speak; and the words of the Colonel as he turns to a military-looking friend sound strangely impressive. "Please remove the prisoners downstairs. We must look at this wireless installation and satisfy ourselves of the correctness of the evidence. Mr. Secretary, I will take the tape and the conversation notes. Thank you."

The body of some thirty members who are crowding round the door make way amid

perfect silence. Browski, realising that this moment gives him his sole chance of liberty, makes a dash for freedom, and displays his ample acquaintance with the art of *la savate*. On the one side his right knee strikes hard on to the stomach of one of his captors, whilst on the other he digs his left elbow into the nearest face. Both victims fall with a gasp. From the recoil Browski leaps forward, flinging his arms outwards as if swimming, whilst his feet keep time with vicious sideway kicks. By means of this determined and vigorous onslaught he actually covers a good deal of the road to liberty, whilst his companion in wireless iniquity follows in his footsteps and guards his rear. Now they are within a few feet of the door, but two against thirty forms hopeless odds. The members close round, and a fierce struggle ensues. Two tables are reduced to splinters, electric lights are broken, the fuse is blown and the room plunged in perfect darkness. Browski rises to the occa-



Dejected beyond description . . .
they are shuffled downstairs.

sion, and for a while the advantage seems to rest with him. Oaths and execrations in many different languages issue from the darkness, but numbers at length prevail. The two sharpers are overpowered, their hands bound behind their backs with four table-covers hastily requisitioned. They now present a pitiable sight; their coats are in shreds and covered with blood, personal and acquired, whilst the aerial wires originally wound round their bodies are trailing on the floor. Dejected beyond description, and sullen at their defeat, they are led, or rather shuffled, downstairs. Noticing the wire of the aerals trailing behind them, one man, with a significant gesture, picks them up and winds them round their necks.

All through the fracas Clifford and Weston have remained pinned behind a card-table, unable to render any assistance. From their position they have but acted the parts of fascinated spectators, and Weston has lost few significant acts and gestures of the crowd.

"There is no need for us to stop any longer," he says. "They do not require our evidence now; we can leave it to the others. Come to my club and have some supper; there are many little points which I should like you to clear up for me."

An hour later, after treating themselves to the sorely needed refreshment of oysters and wine, our trio are seated in a private room in Weston's club. As the first clouds of smoke ascend from their cigars Weston opens the discussion, hitherto suspended by tacit mutual consent, by suddenly remarking, "I suppose it is all over by now."

"Yes. I wonder what the sentence has been?" ejaculates Holland. "There cannot be much doubt about the verdict."

"No; and I can pretty well guess the sentence also. I have had some experience of these clubs run on military lines before. You remember when one of the committee picked up the aerial wire trailing from Browski's concealed equipment he wrapped it lovingly round the scoundrel's neck with the remark that it would serve the purpose excellently and save expense. His smile as he made this remark was diabolical."

Clifford starts jerkily in his chair. "Yes, I noticed," said he; "but you don't think they mean to hang them?"

"From what I know of these people's methods," replies Weston seriously. "I

should judge that that is exactly what happened half an hour ago, and that by this time they are being buried in quicklime under the flagstones of the basement."

"Good heavens!" exclaims Clifford; "that's awfully like murder."

"Well, they don't think so," says Weston. "They consider they are a law to themselves. Under the rules of the club, subscribed to by every member, the decision of the majority of the members in any dispute is absolute and final. I am quite sure that they had a fair trial, but would naturally be obliged to plead guilty. Their own words in offering to pay back double damned them completely."

"Well," comments Holland, "we are well out of that part of the business; but it must have been rather an interesting trial, for I suppose that it will be the first time in history that wireless tape has been put into a court as evidence."

Silence falls upon the group for a few minutes, all of them quietly reviewing the exciting succession of events through which they have recently passed. The solemn stillness is at length broken by journalistic curiosity, and Weston asks for the full explanation he had been promised. "There are several points I do not understand about that wireless plant. I suppose the transmitting arrangements were similar to those employed by Signor Zenani last week?"

"Yes, I think so," admits Clifford, "except that to-night each had a transmitter."

"But in this case they could not have had wires passing into their mouths to their dental plates," argues Weston.

"No; but you remember," answers Clifford, "last week I told you we were experimenting on a new physiological receiver. Holland and I have devised quite a satisfactory one. Inside two half walnut shells a tiny spring presses down on a perforated copper plate. Around the spring a piece of sponge soaked in vinegar keeps the copper plate moist. These are fitted one on each of the two sensitive spots on a man's chest, and wires run from them to the usual rectifier."

"A truly great and simple idea," admits Weston. "I suppose the sending was done by the big toe again in this case also."

"Most probably," agrees Clifford, "but

Browski and his pal would probably use both toes—that in one boot for sending, and that in the other to cut off his receiving circuit when transmitting. It would be distinctly uncomfortable to receive his own messages."

"That accounts for everything, then," says Weston. "Anything more in this line for me to join you in?"

"Yes, there is," says Clifford. "We are on the track of another group of the 'wireless gang' now. This, I am afraid, involves a very serious matter. I have excellent reason for believing that some mysterious businesses which have completely baffled police investigations are due to the diabolical ingenuity of these scientific criminals. It may take us some weeks to unravel the skein. Can you spend the whole time with us?"

"Won't I!" exclaims Weston enthusiastically. "I can easily manage that, if you promise me a scoop for my paper."

"Right you are," answers Clifford; "that is agreed, and I will drop you a line as soon as we are ready to start again."

BIG WIRELESS STATION AT BRUSSELS.

IN a recent issue of THE WIRELESS WORLD we gave an account of the destruction of the high-power wireless station which had recently been erected at Brussels. It subsequently transpired that it had been the aim and hope of the invading German armies that this powerful station would remain intact. The Belgians, however, were more than a match for their adversaries and succeeded in reducing to a shapeless and unrecognisable mass the whole of the installation. The Germans were disappointed and furious, but this did not deter them from expending time and energy in the erection of a wireless station in the Park at Brussels.

By way of Rotterdam a message comes to us from the capital of Belgium that the Germans have enlarged this station, which they constructed four months ago. It is now capable of tapping all wireless telegraphic messages sent out within a radius of 1,250 miles, and there is no doubt that they consider the greater range will be a great deal more useful to them than that attained by the old installation.

Germany's Transatlantic Wireless Schemes

FOR some time prior to the outbreak of war the German Government occupied itself in the perfection of a system of communication with distant parts of the world by means of wireless telegraphy, and, unlike our own Government, which in the Imperial scheme was hampered by political controversy, proceeded apace with little interruption. In Togoland, in both German South-West and East Africa, large and powerful wireless stations were erected; even in the distant Pacific Islands, which quite early in the war were lost to the German Empire, great aerials were raised to signal in the ether. Nor did Germany ignore the importance of communicating with neutral countries, and as it was obvious that the submarine cables could easily be severed, wireless communication with America was regarded as of primary importance.

A straight line drawn between Berlin and New York will be found to pass over France and the Atlantic for no less than 4,300 miles. Between Berlin and Togoland there was almost as great a distance. The German Government therefore set to work to increase the power of their great station at Nauen, near Berlin, so that communication could easily be effected.

Nauen is some few miles from Berlin, and the land in the neighbourhood is eminently suitable for a wireless station, the soil being marshy and the surroundings clear and open. The wireless station which was built in 1906 at first was of comparatively small power—some 10 to 15 kw.—but the plant which now occupies the buildings bears no comparison with that then installed. The present transmitters are of at least 250 kw. capacity. The aerial mast—really a steel tower insulated at the bottom—at first



Nauen Station Buildings.



Instrument Room, Nauen.

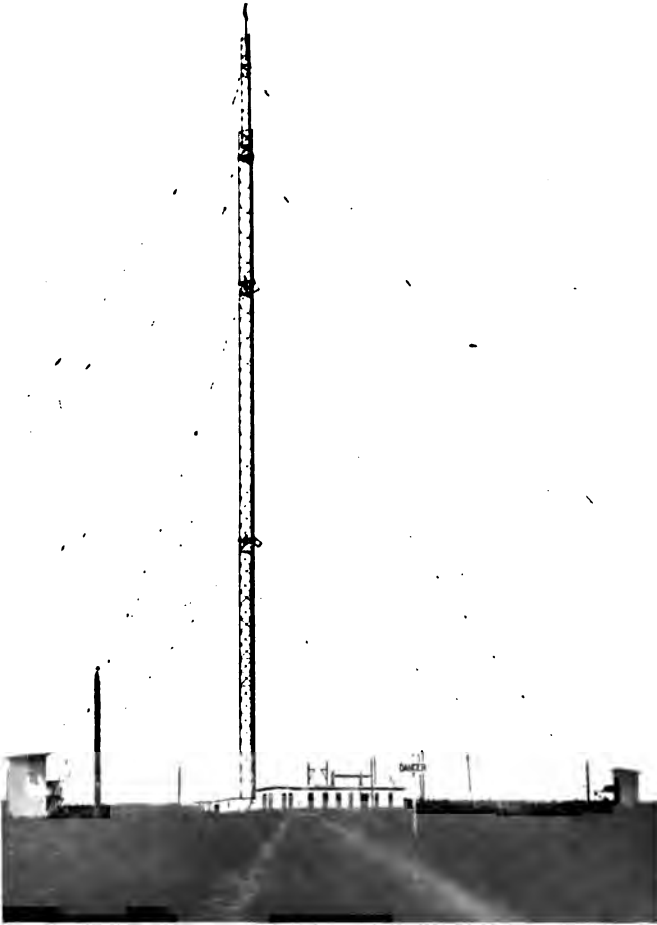
reared itself for 300 feet: no mean height for any structure. A year or two ago the height was increased to 600 feet, and even this dizzy altitude would scarcely give the results required. Communication with Togoland and other parts was being steadily attempted when suddenly, in the middle of a windy day, the whole aerial structure came crashing to the ground and lay a heap of ruins. This would be thought sufficient to discourage the engineers engaged upon the work, but it was not so, and in a little time another tower arose, this time not 600, but no less than 750 feet in the air!

In America the wireless company which represented the German interests erected in the year 1912 a station at Sayville, Long Island, nominally for the purpose of communicating with German ships at sea and for distributing a service of news. As first erected the station had two sets of transmitting apparatus, one said to be of "five kilowatt antenna energy," and the other of "thirty-five kilowatt antenna energy." The smaller plant was designed for communicating with the ships and the larger for the press service. We would draw special attention to the method used by the

Germans for indicating the power of the station. To say that a station has a power of so many kilowatt "antenna energy" does not mean that the apparatus uses only that amount of power, but that after all losses have been allowed for there remain so many kilowatts for *radiation*. Both in England and America it is customary to refer to a station as having a power of, say, five kilowatts when the alternator output has that figure. As efficiencies count at present, a five kilowatt station would have about three kilowatts "antenna energy." It will thus be seen that Germany systematically misstates the power of her installations.

Although, as we have remarked, Sayville was ostensibly intended for communicating news and messages to ships, soon after the station was completed it was announced in Germany that "easy communication" had been effected at night between Nauen and Sayville. No attempt, however, was made at sustained day and night communication, and Sayville became quite fully occupied in handling the traffic for which it was nominally designed.

Upon the invention by Dr. Goldschmidt



The Big Wireless Tower at Sayville.

of the famous high-frequency alternator which bears his name, a very powerful wireless station was erected in Hanover at Eilvise, and a second station at Tuckerton, New Jersey. Both aerials were of enormous size, that at Tuckerton being no less than 820 feet high. On the opening of the Tuckerton station President Wilson and the Kaiser exchanged messages of a cordial nature, and made reference to the link which was formed by these two gigantic stations.

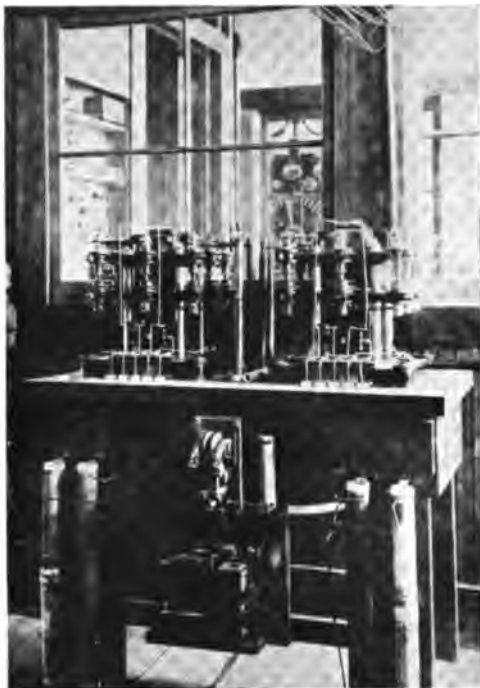
At the outbreak of war the British Government, it will be remembered, succeeded in cutting every German Trans-Atlantic cable within four hours of the commencement of hostilities. Wireless telegraph communication thus became at once

of vital importance to Germany—in fact it offered the only direct means of communicating with the United States. With Nauen and Hanover in Germany, and Sayville and Tuckerton in the U.S.A., Germany seemed sufficiently well equipped for Transatlantic work, but diplomatic difficulties arose, and after only a few weeks Washington notified the owners of the station at Tuckerton that the licence granted them was only good for three weeks' experimental work, and that the station must therefore cease operating as the three weeks had expired. Sayville, too, was not working satisfactorily, as the power was insufficient for any but occasional communications in good atmospheric conditions. Questions of neutrality were also raised concerning this station, and for the moment wireless communication between America and Germany seemed threatened.

After some amount of negotiation between President Wilson and both England

and Germany, it was agreed to allow belligerent nations to send code and cypher messages through the American stations provided they were censored by U.S. Government officials, and Tuckerton once more resumed transatlantic work. The Tuckerton station, however, could scarcely cope with the enormous traffic between the embassies, quite apart from the volume of commercial and newspaper traffic, and the position for Germany became difficult indeed. Something had to be done.

What actually happened was that the American public became aware one morning that the power of the Sayville station had been quietly and secretly increased. Before the war the larger plant was a spark transmitter working with alternating current of



The Relay Keys of the Transmitter at Sayville.

500 cycles supplied from a 60-kw. generator. The aerial was supported by a single steel tower.

The new installation was found to consist of a 100 kw. antenna energy transmitter, and to possess an aerial much larger in extent, supported by no less than three 500-foot steel towers. With this apparatus it was confidently expected that all difficulties would be overcome, but predictions proved false in practice, and with the approach of the hot season atmospheric conditions became so bad that for long periods scarcely a word could be read by the operators at either end. The Marconi Company, whose long experience of transatlantic work has taught them the need for special apparatus to counteract the effect of these electrical disturbances in the atmosphere, have at their transatlantic stations sufficient power to work through interference of this nature even in the worst seasons. The Germans, however, lacked the necessary experience, and suffered accordingly. Experienced wireless men can well imagine the state of nerve-tension produced in the operators at Sayville, who

day and night were straining their ears to read the feeble musical note through the crash of continuous atmospheric noises.

Whilst the Sayville engineers were attempting to grapple with the problem of atmospheric interference, an enterprising American morning newspaper, the *Journal*, deliberately accused the Sayville wireless station of being part of the German spy system. It declared that a great part of the information that has reached the War and Admiralty Departments in Berlin has been sent through by Count Bernsdorff, the German Ambassador, and Captain Boy-Ed, Attaché to the Embassy, both in their own names and in secret code, but very much more frequently by signing fictitious names. The *Journal*, by means of a collection of messages which it had taken some months to prepare, submitted to the U.S. Government evidence which, it claimed, proved conclusively that the Government had been persistently and deliberately misled by the German Embassy, who were also accused of furnishing a false translation of the codes to the Government officials. Several statements had been made by various papers as to how the fraudulent transmission of messages was being carried out, one of the



One of the Concrete Anchors to hold the Wireless Towers.

most likely being that fictitious "repeats" were asked for and given. These "repeats," ostensibly repetitions of messages previously sent and which had not been properly received, were alleged to consist really of entirely new matter.

With this, and probably further evidence culled from other sources, the Secretary of State, Mr. Lansing, and the Secretary of the Navy, Mr. Daniels, held close conference as to what steps it would be proper to take. On July 8th it was announced in the American press that as a result of the conference the Government had decided to take over the control of the Sayville station, and thus once more the German Government is shown in its true light.

WIRELESS TELEPHONES IN PENNSYLVANIA.

WE read in the *World's Advance* for July that a Pennsylvania Electric Power Company is contemplating the installation of wireless telephones for ensuring communication between their power houses and sub-stations at all times. These scattered points are now joined by ordinary wired telephones, and the wireless apparatus is to be used in emergencies.

WIRELESS TELEGRAPHY AND THE "FAIR SEX."

IT is a somewhat curious thing that up to the present the practice and study of wireless telegraphy does not appear to have attracted much attention from women. Their energies have in the past been mainly directed in a certain few well-defined directions. Whatever else it may be doing, the war is undoubtedly exercising an influence in the direction of practicality, and some of our contemporaries have been recently chronicling the activities of the Women Signallers' Territorial Corps, who have placed themselves under the Commandant-in-Chiefship of Mrs. E. J. Parker, sister of Lord Kitchener. They invite any woman of good education, who is prepared to devote a certain number of hours daily to learning the art of signalling, to apply at their headquarters, 184a

Oxford Street. Their activities are apparently intended to cover every branch of the occupation, and to include the methods of flags, air-line, buzzer, cable, wireless, whistle, lamp, and heliograph signalling. Most of these form exceedingly interesting subjects in themselves; and wireless telegraphy, which forms the most modern and most scientific, should make a strong appeal to feminine intelligence.

MARCONI HOUSE NEWS.

THE NEW WAR LOAN.

A MEETING was held on Wednesday, June 30th, 1915, in the Lecture Room of Marconi House, Strand, at which Mr. Godfrey Isaacs, Managing Director of the Marconi Companies, announced that the Directors are anxious to offer assistance to the staffs of the Companies in subscribing to the War Loan now being raised by the Government. For this purpose the entire sum required to meet applications for Stock would be advanced, free of interest, subject to such applications being approved by the Secretary of the Marconi Companies and to the subscribers undertaking to repay by instalments the amount so advanced by the Company within a certain period.

The Directors' objects, said Mr. Isaacs, were twofold. Firstly they wished to arouse a patriotic spirit which should find expression in subscribing to the National Loan, and secondly to stimulate individual thrift amongst their staff.

Mr. Gray proposed, and Mr. Vyvyan seconded, a vote of thanks to the Chairman of the meeting and to the Directors for their generosity, which was carried with acclamation.

RIFLE CLUB.

The result of the June Handicap Competition was as follows:

1. Mr. W. H. Smith, Ship Fitting Department, with handicap... 102
 2. Mr. H. S. Pocock, Secretary's Department, with handicap... 98
- Mr. F. Atkin, Secretary's Department, won the third spoon for the highest actual score—namely, 88.

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 the Editor, THE WIRELESS WORLD, Marconi House, Strand, London, W.C. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered: and it must be clearly understood that owing to the Defence of the Realm Act we are totally unable to answer any questions on the construction of apparatus during the present emergency.

A. M. (Melbourne, Vic.) refers to certain formulæ which he has found in *THE WIRELESS WORLD*, and asks the meaning of " 2π and 4π ." We should have thought that most wireless amateurs were acquainted with the use of the Greek letter π to indicate the relationship between the circumference of a circle and the diameter. π equals 3.1416 approximately. Other questions asked by our correspondent indicate most clearly that he is commencing his studies, and in these circumstances it would be much more to his advantage to discover the answers to his questions by studying such a book as Bangay's "Elementary Principles," rather than that we should answer them for him. The purpose of this column is to give assistance in cases where the correspondent cannot very well solve the difficulty himself, and to help with advice and comments.

Pte. T. D. (Llanely, Wales) and others who ask what steps they should take to become operators are referred to the article on the subject which appears in this issue.

C. J. M. (Upminster) writes to ask whether wireless telegraphists must transmit with the right hand. He says that at present he can transmit 20 words per minute with his left hand, but only 15 or so with his right.

Answer.—We would strongly advise C. J. M., and any other students who have acquired the habit of sending with their left hand, to confine their practice to the right hand until they are able to send at a good commercial speed. Ability to send with the left hand is an accomplishment of some value when the possessor is already expert with his right hand, for on occasions where a considerable amount of traffic is being handled a change from one hand to the other may come as a welcome relief. Normally, however, all wireless work is done with the right hand, and the apparatus is arranged on the operating table in such a way that left-hand working is most inconvenient.

J. J. M. (Co. Limerick) asks us to inform him what we would consider a good course to pursue to enable him to follow the technical points (mathematical and otherwise) arising in *THE WIRELESS WORLD*. We would refer him to the article on "Amateur Work During the War," which appears in this month's issue, and in which points of this nature are specially considered.

"BIRMINGHAM READER."—We think you are a little confused between "half a millionth of a second" and "a half millionth of a second." Think it out!

C. J. S. J. (Halesowen).—There are several methods of which the power of the $1\frac{1}{2}$ kw. installation can be temporarily decreased, one of which is to insert more L.F.I.C.I., and thus put the low frequency circuit out of resonance. The spark-gap will, of course, need to be adjusted accordingly. A better method is to loosen the coupling between the primary and secondary of the jigger. In the case of fixed-discharger installations the power can also be reduced simply by shortening the spark-gap, but as this tends to make the spark "arc" and give poor signals it is not a very satisfactory method to use. The coupling method is probably the best and simplest. We regret that a detailed consideration of your other questions would occupy too much space.

T. R. W. (South Grafton, N.S.W.).—Many thanks for your kind appreciation of our magazine. You say that when you were working before the war you could not get a metal filament lamp to glow when connected up as a tuning lamp in the aerial circuit, notwithstanding that a carbon filament lamp of higher voltage acted well. The probable explanation is that the metal filament lamp had far more inductance than the carbon filament lamp, and therefore acted as a choke. On referring to your diagram we see that you have the tuning lamp shown in a shunt circuit above the secondary of the jigger. This is about the worst place that you could have chosen. Tuning lamps should always be placed between the secondary and the earth. We are glad to hear that you have had good results with your installation, and trust that after the war you will write us again concerning your experiences.

PATENT RECORD.

The following patents have been applied for since our May issue:

(MAY, JUNE, JULY, 1915.)

7358. May 17th. Gesellschaft fur Drahtlose Telegraphie M.B.H. Receiving arrangement for wireless telegraphy. (Addition to No. 5342/15. Convention date, May 30th, 1914. Germany. *Complete.*)

7367. May 17th. British Thomson-Houston Co., Ltd. (General Electric Co., United States). Wireless signalling systems. (*Provisional.*)

7953. May 28th. Alban J. Roberts. Wireless telegraphy. (*Provisional.*)

8321. June 4th. M. F. Sueter, R. M. Groves, and B. Binyon. Apparatus for use in wireless telegraphy and the like. (*Provisional.*)

8923. June 17th. Rene Jean Bourgeois. Method for the production of an electric discharge of high frequency by means of sparks. (*Complete.*)

8926 and 8927. June 17th. Marconi's Wireless Telegraph Co., Ltd., and George M. Wright. Wireless telegraph receivers. (*Provisional.*)

8928. June 17th. Marconi's Wireless Telegraph Co., Ltd., and George M. Wright. Wireless telegraphy. (*Provisional.*)

9007. June 18th. Henry J. Furber. Process of determining the distance and direction relatively to pre-established points of an unknown source or point of projection of vibrating impulses. (*Complete.*)

9374. June 26th. James R. Halliwell. Method of, and means for, producing undamped or persistent high-frequency electric oscillations for telegraphic or like purposes. (*Provisional.*)

9720. July 3rd. British Thomson-Houston Co., Ltd. (General Electric Co., United States). Wireless signalling systems. (*Provisional.*)

INSTRUCTION IN WIRELESS TELEGRAPHY

(Second Course)

(XIII.) The Receiving Circuit.

[The dislocation of our arrangements, due to the war, has prevented us from completing, in our last Volume, the second course of Instructional Articles. These are being continued in the third Volume, and we hope to arrange for the Examination (full particulars of which are given on page 333 of our issue of August, 1914) to be held in the early autumn of this year. The present is the twelfth of the second series of articles, which will deal chiefly with the application of the principles of wireless telegraphy. Those who have not studied the first series are advised to obtain a copy of *The Elementary Principles of Wireless Telegraphy*, which is now published, price one shilling net, and to master its contents before taking up the second course of instruction.]

THE TELEPHONE.

790. By far the greater proportion of the reception of wireless messages is carried out with the aid of the telephone.

Although there are several schemes for the automatic reception of signals, some of which have been proved by practical trials to be well adapted for the purpose, they are all more complicated and, for the most part, require stronger signals than a telephone.

Moreover, there is an interval of time between the actual reception of a message and when it is read and dealt with at the receiving station. For large stations dealing with a large amount of traffic this interval is not detrimental, but for small ones, such as ship or field stations, where a large proportion of the traffic necessitates an immediate reply, the telephonic method of reception has an additional advantage above the greater part of the apparatus in use.

791. The usual form of telephone receiver used for wireless reception is well known, and need not be described here (see previous Instructional Articles or Bangay's handbook).

The resistance of the coils in the usual patterns varies from 60 to 4,000 ohms per head, according to the particular circuit with which the instrument is to be used.

For a carborundum crystal or Fleming valve detector the telephones are of 8,000 ohms for the two heads in series; lower resistance crystals work best with telephones also of less resistance, and the magnetic detector is arranged for use with telephones of 120 to 180 ohms.

792. For a telephone to be sensitive it is essential for the diaphragm to be as close as possible without touching the magnets, and

in some patterns a fitting is provided by which this distance can be adjusted.

A very sensitive form of telephone is that due to Mr. S. G. Brown. In this a stiff steel reed is fitted near the poles of the magnets so as to be acted on by them in the same way as the ferrotype diaphragm in the ordinary pattern.

A thin aluminium, cone-shaped diaphragm is screwed to the reed at its centre, the rim being held by a thin paper ring fixed to the rim of the receiver case. An adjustment is provided for altering the distance of the reed from the poles, by which the sensitivity can be adjusted.

When telephones are in constant use a certain amount of moisture condenses on the diaphragm, and some will find its way into the case. To prevent this from rusting the magnets or spoiling the insulation of the windings they are sometimes embedded in wax, leaving only the pole faces projecting.

793. In place of high-resistance telephones a telephone transformer and low-resistance telephones are often used.

By proper design the combination can be made more sensitive than the equivalent high-resistance telephones. The transformer is constructed by winding the high-resistance coil round a core of iron wire, and winding the low resistance coil outside. The whole should be embedded in wax.

794. In previous articles attention has been drawn to the necessity for careful tuning of the various circuits to the wave-length of the signals received. In the telephone circuit the current due to the signals is in the form of impulses, all of one sign (*i.e.*, not alternating), the frequency being that of the spark at the transmitting station. These impulses, although not alternating, require

the circuits through which they pass to be tuned to their frequency just like alternating currents. Since the telephones and telephone transformer are highly-inductive circuits, condensers must be connected in parallel with them to tune them for the best results.

The capacity required to tune a circuit of inductance L henrys to a note of frequency n per second is given by $4\pi^2 LCn^2 = 1$ where C is in farads.

Where a telephone transformer is used a condenser of the proper capacity should be connected across each winding. The values of the capacities can be worked out if the inductances of the various parts are known, but a simpler way is to connect a variable condenser across the terminals of the instrument and note when the signals are best. The condensers must be of low dielectric loss or the note heard will to a certain extent have a muffled tone.

Although the best results will be obtained if these condensers are adjusted exactly to the note of the signals, this would entail, in a receiver for general use, a large variable condenser on the low-resistance side (where the inductance is small) and a correspondingly smaller one on the high-resistance side, and these would complicate the receiver. For practical purposes an average value of the capacity is selected, and fixed condensers of this value connected to the windings.

By a careful adjustment of this note tuning, however, interference from stations having a different spark note from that of the one required can be greatly reduced.

795. In receiving signals by the ordinary headgear telephones it is to be noted that the metal cases are either directly connected to the observer's body or form a condenser with it. They also form a condenser with the coils carrying the signals.

Similarly the observer's body is connected with the earth either directly or by a capacity.

A certain fraction of the signal current flowing through the coils will pass through this system of condensers to earth.

It is sometimes noted that, particularly when receiving signals from a local buzzer circuit or near-by transmitting set, on touching some parts of the receiver signals are increased in strength. This is due to a modification of the capacity current referred

to, which causes the current in the coils to be increased. Interfering sounds from local alternating current leads are similarly increased by earthing certain parts of the instrument with the fingers. Hence there is an additional necessity for keeping the receiver and all its accessories, such as connecting leads, batteries, etc., well insulated and arranged to have a minimum capacity to earth.

In bringing this series of instructional articles to an end with this number it is not to be supposed that the subject of wireless telegraphy has been exhausted. The object of the series has been to explain the absolutely necessary parts of an installation.

Hence no mention has been made of the various devices, such as telephone relays, automatic recording or transmitting devices, etc., which are, in every case, additional to the apparatus which has been described.

In a later series we may perhaps be able to amplify the subject by descriptions of these.

TEUTON TRICKS

The following paragraph appeared in the *Daily Express* from the pen of a Special Correspondent:

"I noticed a huge mast belonging to the 'great wireless station in Constantinople.

"What do you think of that, eh?"

"German lieutenant asked me. 'With this wireless station we can communicate with Berlin.'

"Is this the wireless station from the 'Goeben?' I asked innocently.

"Oh, no; ships do not carry masts of that size. It came from Germany,"

was the reply.

"From Germany? But a wireless apparatus could never pass Rumania!

"That would be against her neutrality!"

"Well, it did not pass as a wireless apparatus. We got it here as a circus."

Considering that the station in question was erected by the Marconi Company long before the war commenced, our contemporary's quip would appear to lose some of its force.

WIRELESS FABLES.

A NUMBER of marvellous fairy stories with regard to the figures of prisoners captured by the German and Austrian armies form the subject of an amusing little article appearing in a recent issue of the *Birmingham Post*. The fancy figures given are dealt with under the head of "Wireless Fables." There seems to be just this amount of justification for the title, that the medium of "Wireless" has been the favourite method of propagating these absurd claims. The authors of these imaginative "yarns" mainly affect the Russian campaigns, the idea evidently being that the number of men ranged against them on this frontier are so stupendous that it is absolutely necessary for them to be destroyed if only fictitiously. So effectively does the German wireless romanticist do his work that, if we could believe him, the Grand Duke Nicholas's army must by now have been reduced to a mere phantom. On unsubstantial unrealities Von Hindenburg, Mackensen, and the rest of them are expending endless ammunition, striking "sledge-hammer" blows, and they are incidentally suffering huge losses at the hands of mere shades! Unfortunately, at one point of this story "murder came out," and the "Wolff Bureau" not long since was actually obliged to announce to the world at large on behalf of the German Government that to attain exactitude their figures required dividing by ten. Never in the history of "Wireless," or, indeed, in any other history, has such a confession been made officially by any Government.

TRAWLERS AND WIRELESS.

WITH reference to the fitting of trawlers with wireless, the *Grimsby Saturday Telegraph* recently published the following remarks:—

"As a means of securing revenge on these submarine pirates, wireless on trawlers would have been all that was necessary. For an illustration we have only to remember the lively little naval action last week-end, which resulted in two German torpedo boats being sunk by British destroyers. The trawler *Columbia*, for

"the destruction of which the German boats set out, was one of the very few vessels of its type fitted with a wireless installation. No sooner had the attack on her developed, than British destroyers appeared on the scene, with the very happy result that we all know. But how many trawlers have been sunk by the enemy without their ever having an opportunity to send out a call for help? We do not know, nor shall we ever be informed.

"In times of peace, when the trawler has been following its occupation of fishing, a valuable food for the nation, the possession of wireless has been proved of almost inestimable value for commercial purposes. Many a call from shore to ship, or *vice versa*, has more than covered the cost of the installation by the enhanced value of the catch landed on specific days. Surely, with the present means of organisation in a port like Grimsby, it is not expecting too much to suggest that the trade should tackle the proposition at an early date."

In view of the trawler interests which are so ably represented by this paper, such remarks from them should bear fruit in due season.

NEW WIRELESS STATION AT SEATTLE.

At Seattle there has recently been erected and placed in commission a wireless telegraph station for the use of the Port Warden. The call letters "KPE" have been assigned to it.

SHARE MARKET REPORT.

The Share Market in the various Marconi issues has been very active during the past month in anticipation of the annual report, which appeared on July 16th.

The excellent results shown by the parent company and the continued progress of the subsidiaries were well received by the market.

The closing prices as we go to press are: Ordinary, 1 $\frac{7}{8}$; Preference, 1 $\frac{5}{8}$; American, 12s.; Canadian, 4s. 6d.; Spanish, 3s. 6d.; Marine, 1 $\frac{3}{4}$ d.



“BEHIND THE SCENES AT THE FRONT.” By George Adam. London: Chatto & Windus. 6s. net.

It is not often that such singular facilities are vouchsafed to newspaper correspondents to visit the battle area as were afforded to the author of this book. Mr. George Adam, the Paris correspondent of the *Times*, rather than attempt any coherent chronicle of things, has given us in his work a series of impressions, obtained at first hand, of the events which daily take place at the “back of the Front.” In his preamble Mr. Adam goes so far as to state the opinion that the disclosures in the French Senate on July 11th, 1914, concerning the defective military organisation of France, figured prominently amongst the important considerations which caused Germany to launch the present war on Europe. Among other things, these disclosures stated that the French frontier wireless station at Verdun was operated only by sufferance of the powerful German apparatus at Metz; and that while the French guns only numbered 2,504, the Germans possessed 3,370. Despite this latter disadvantage, on the declaration of war Frenchmen rallied round the flag right nobly, and Mr. Adam shows how, inch by inch, step by step, the French Army has proceeded with its work of reorganisation. And this has proceeded *pari passu* with heroic endurance of the terrible ordeals of the modern battlefield. The author, taking us successively through the preliminary engagements, describes the great German

rush on Paris, the big retreat from the Marne to the Aisne, and dwells on the system of trench warfare which dragged its heavy weight all through the winter months. He speaks in glowing terms of General Joffre, and eulogises General Foch as “the man with the brain to plan vast strategic movements . . . the man with the obstinacy and decision, the strength of character necessary for the actual translation of strategy into action.” Altogether it is a well-written volume, and makes very agreeable reading.

* * *

“ADVANCED THEORY OF ELECTRICITY AND MAGNETISM: A TEXT BOOK FOR COLLEGES AND TECHNICAL SCHOOLS.” By William S. Franklin and Barry MacNutt. New York: The Macmillan Company; London: Macmillan & Co., Ltd. 1915. 10s. 6d. net.

Whilst numerous excellent books are published from time to time dealing with the elementary theory of electricity and magnetism, the number treating of the advanced theory is comparatively small. This is quite easy to understand, as the majority of people who buy elementary manuals do not require to enter deeply into electrical matters. There are, nevertheless, a not inconsiderable number of students who, on mastering the contents of an elementary manual, desire to proceed further with their studies, and to these we can recommend the volume under review.

Hailing from the other side of the Atlantic, the book immediately arrests our attention by the breezy style of its preface. After remarking that in order to make the study of theoretical physics something more than a purely formal mathematical exercise, it is necessary to keep physical things always clearly in mind, the authors state that "The character of the treatment in this book has been determined throughout by the desire to keep the student's mind jammed up tight against physical things!" An excellent idea, truly, but rather picturesquely phrased.

About a quarter of the volume is occupied by a consideration of elementary theory, after which we come to an exceedingly clear chapter on ship's magnetism and the compensation of the compass. Chapters follow on the Electric Charge and the Condenser, the Electric Field, the Idea of Potential, and Electric Oscillations and Electric Waves. A final chapter is devoted to a consideration of the Electron Theory.

Throughout the volume are scattered many parallels which assist the student to grasp the subject thoroughly. Chapter Nine, for example, commences by giving three parallel columns showing the identity of many equations of mechanics and electricity. The first column deals with Translatory Motion, the second with Rotatory Motion, and the last with Electricity and Magnetism. Such treatment as this is undoubtedly of great value.

During this time when restrictions are placed on amateur wireless working we would especially commend to amateurs the study of electrical theory. It is our constant experience to find experimenters designing apparatus in such a way as to indicate that they have no idea of subjects such as high-frequency resistance and much time and labour is wasted as a consequence. To all experimenters who have mastered the elements of electricity and magnetism we can recommend the volume under review as one which will render them much valuable assistance.

* * *

"SCANDINAVIA OF THE SCANDINAVIANS."

By Henry Goddard Leach. London: Sir Isaac Pitman & Sons, Ltd. 1915. 6s. net.

The recent opening of the Marconi high-

power wireless telegraph station at Stavanger, concerning which an article appeared in the February number of THE WIRELESS WORLD, has brought us into touch with those eminently interesting people, the Norwegians. They form part of the great Scandinavian family which finds a home in those lands of the Midnight Sun, the pine, and the elk—to wit, Norway, Sweden and Denmark. Mr. Leach devotes a section of his book to each of these countries and has a word for the religion, politics, art and social life of all of them, whilst prefixing his book with a brief survey of Scandinavia as a whole. Dissertations on the industrial and commercial possibilities of the three kingdoms occupy a large share of attention, but no mean space is given to historical notes on manners, customs and folklore. A high place in the destinies of Europe is allocated by the author to the people who "have not failed to furnish the modern world with their growth of successful plans for social betterment, working men's insurance, co-operative methods of farming, discoveries in physics, . . . inventions of mechanical devices, and important contributions to music, painting, poetry and drama." Mr. Leach eulogises the inhabitants as hospitable, warm-hearted people. In connection with the Norwegians, the author calls attention to the fact that they have realised the commercial possibilities of wireless telegraphy, and he refers to the suggested establishment of direct wireless communication between Norway and the United States. As mentioned above, this project is now an accomplished fact. The book is excellently illustrated by reproductions from photographs, and Mr. Leach, who, by the way, holds the office of Secretary of the American-Scandinavian Foundation, seems to have given his heart to his work. Altogether it is a very creditable and interesting book.

* * *

"CONTINUOUS CURRENT ELECTRICAL ENGINEERING." By W. Tolme Maccall, M.Sc., A.M.I.E.E. London: W. B. Clive, University Tutorial Press, Ltd. 10s. 6d. net.

This volume, which runs into some 450 pages, is designed to provide a good text book on Continuous Current Engineering concerned mainly with engineering practice. Its scope is sufficient to meet the require-

ments of most technical colleges and schools, and the instruction given will be found to cover all the C.C. work that is required in the usual three years' course in Electrical Engineering. It also well covers the Continuous Current Section of the Grade II. Examination in Electrical Engineering of the City and Guilds of London Institute. The book is well illustrated by numerous diagrams, line drawings and photographs of apparatus, and the inclusion of questions and answers adds considerably to the value of the volume for those who study privately without a teacher.

* * *

"MONTHLY WEATHER REVIEW." Vol. 43, No. 2. February, 1915. Government Printing Office, Washington, U.S.A.

We have received from the Weather Bureau of the U.S. Department of Agriculture a copy of the February issue of the above. It contains contributions on the research work of the Weather Bureau, and deals with climatic, aerologic, meteorologic and seismologic conditions generally in the United States. Several tables, diagrams, and charts are appended, whilst a very comprehensive index for Volume 42 (1914) is included.

* * *

"THE 'STEP-UP' BY 'WIRELESS.'" The Marconi School of Wireless Telegraphy, "Wireless House," Sydney, Australia.

This is a little booklet issued for the benefit of our friends "round underneath" who wish to take up the art of radio-telegraphy and obtain employment as wireless operators on board ship. Issued by the Marconi School in Sydney, a school conducted under the auspices of the Amalgamated Wireless (Australasia), Ltd., it gives full particulars of the various courses which can be taken and the fees charged for the tuition. The first pages, which are devoted to a very brief, but nevertheless interesting, account of what is being done by wireless telegraphy, explain that the field of work for wireless operators is now full of opportunities. The School and its aims are next described and photographs convey to the reader a clear idea of the class rooms and equipment. Altogether the pamphlet is a bright little book and no doubt

will help many to decide on their future career.

* * *

"SCOTLAND FOR EVER." With a Preface by the Earl of Rosebery, K.G. London: Hodder & Stoughton. 3s. net.

We have hitherto been regretfully obliged to defer our notice of this excellent book owing to lack of space for a reasonable consideration, but we are unable to withhold some form of recognition any longer. In this time of stress and tumult our thoughts naturally go out to the societies which are subscribing to the tenets of mercy by the alleviation of pain and suffering. A book such as that before us is therefore particularly welcome at this time. It is a work of art containing some beautiful illustrations reproduced from paintings, and a large number showing the uniforms of various Scottish regiments at different periods. The record of their exploits is each dealt with in its own section by a different author, and herein the glorious traditions of the Scottish army are splendidly upheld. These same regiments are now represented on the battlefields of France and Flanders and are gaining fresh consecration in fire and blood. These traditions "are only maintained by lives gallantly laid down and by wounds and suffering patiently endured." The production of the work represents an effort to obtain subscriptions in the worthy cause of the Scottish Red Cross, and in this we trust it will receive high and well-merited support.

* * *

"SELL'S WORLD'S PRESS." 34th Year: 1915. Sells, Ltd., London. 5s. net.

Once again we are reminded of the flight of time by the arrival of a copy of Messrs. Sell's excellent newspaper press directory. Its continued successful existence affords proof of the need it fills, and this year it appears more comprehensive than ever. In addition to the actual sections concerning the British, Colonial and Foreign Press, a number of articles are presented dealing chiefly with the war and consequences of the war. In fine, the whole publication merits the thanks of the newspaper world, whose needs it so aptly supplies, and it should certainly find a place on the bookshelves of all whose business carries them into the "Realm of the Press."

Foreign and Colonial Notes

Alaska.

A rate-card showing the tariff for the wireless telegraph service to Ketchikan has just been issued by the Marconi Wireless Telegraph Company of America. On comparison with the cable rates now in force these Marconi rates show a considerable reduction. This link forms the first of the Marconi Alaskan Chain of Stations now approaching completion. It is hoped that the extension to Juneau will be completed shortly.

* * *

Argentina.

In view of the difficulties which have arisen in connection with the European War in the way of securing the necessary materials, the period within which vessels sailing under the Argentine flag were to be equipped with wireless telegraph apparatus has been extended to May 1st, 1916.

* * *

Caribbean Sea.

Patience in loneliness is the forced virtue of many an islander who is cut off from the world for months at a time. Such was the condition of the inhabitants of Swan Island only a short while ago before the United States Fruit Company erected a powerful wireless telegraph station there. This island is situated in the Caribbean Sea, ninety miles to the north-east of the coast of Honduras, and in a particularly ideal location for a wireless station. It is secured from interference by other stations by its perfect isolation, and this very reason enhances its efficiency. Eight years ago the apparatus was installed on this land of coral and sand to fill the position as "clearing house" for all the wireless business between the station in New Orleans, 800 miles away, Santa Marta 700 miles away, and the smaller stations throughout Central America and the West Indies.

* * *

Ecuador.

The linking up of the interior points of South America proceeds apace. Machacala, Ecuador, is the latest town to announce the construction of a wireless telegraph station.

Japan.

As the result of satisfactory investigations on the part of the Japanese Government, it has been decided to erect wireless telephone stations at Shinojima, Saksishima, and Himakashima in the Chita Peninsula bordering on Ise Bay. This course has been adopted in order to prevent, in some measure, the frequent calamities which befall fishing vessels in the neighbouring waters, which are very liable to sudden squalls from time to time. An important factor is that the cost will be considerably less than would be the case were submarine cables laid. It is understood that if the installation of this wireless telephonic system be followed by good results, the Government will extend it all over the country. As the wave-lengths of each wireless telephone station will vary, there is no fear of interference or confusion.

* * *

United States.

Condemnation Commissioners have been appointed at Trenton, N.J., to fix upon a fair valuation for the right-of-way for the line of poles and wires along the high road connecting the high-power wireless stations at New Brunswick and Belmar.

* * *

Some months ago we were enabled to give full particulars of the wireless installation on a passenger train belonging to the Lackawanna Railroad Co. We now learn that quite recently the wireless operator on board the train reported by wireless telephone to the dispatcher at Scranton station as the train passed through each station between that town and Cresco, a distance of forty miles.

* * *

In this time of stress and warfare it is interesting to note that Mr. John Hays Hammond, Junr., the well-known wireless expert, has proposed a system of aero-radio scouting districts or zones along the seaboard of the United States as a defensive measure against attacks. He argues that with such a system the land forces can cooperate with the fleet at sea in preventing landing operations by the enemy.

COMPANY NOTICES

THE MARCONI INTERNATIONAL MARINE COMMUNICATION COMPANY, LIMITED.

DIRECTORS' REPORT AND BALANCE SHEET, 1914.

DURING the last five months of the year under review the Company's business suffered considerable disorganisation and some loss in consequence of the state of war, entailing a great increase of work and strain upon those responsible for the conduct of the business. It therefore affords the Directors considerable satisfaction to inform you that notwithstanding the adverse circumstances the Company's business has continued to show substantial progress.

The net profit for the year amounts to £55,668 1s. 1d., after deducting the sum of £28,000 8s. 10d. for depreciation and debenture interest, compared with a net profit of £37,029 5s. 7d. for the preceding year. The revenues from ships' telegrams, subsidies, etc., amounted to £175,021 1s. 10d., which is a substantial increase over the amount of £146,316 18s. 11d. for the year 1913.

The number of telegraph stations owned and worked by the Company as public telegraph stations on the high seas increased from 788 at the end of 1913 to 905 at the end of 1914. Although these figures denote a marked appreciation of the Company's organisation, the increase would have been even more satisfactory had normal conditions prevailed. It will be a matter of some satisfaction to the Shareholders to know that during the current year further progress is being made, the number of steamers fitted to the 19th June having increased to 970.

It is of the highest satisfaction to the Directors, as it will be no doubt to the Shareholders, that having regard to the present circumstances, the vast organisation that for so many years has been patiently and laboriously built up by the Company at great cost and without return should now prove to be of the utmost utility, besides being financially successful. The fact that there are now over 2,000 ships, exclusive of ships of war, fitted with Marconi telegraph stations, and for the most part worked under the direction of this Company and its associated companies, has an importance in these times which all Shareholders will appreciate.

The Amalgamated Wireless (Australasia), Limited, in which this Company is interested, has paid a dividend of 4 per cent. in respect of the period to June 30th, 1914, and an interim dividend of 2½ per cent. in respect of the half-year ending December 31st, 1914.

The amount to the credit of Profit and Loss Account now stands at the sum of £64,855 14s. 11d., including the sum of £6,067 13s. 10d. carried forward from the preceding year.

The Directors have pleasure in recommending the payment of a final dividend for the year 1914 of 5 per cent., which, with the interim dividend of 5 per cent. paid on February 1st last, will make 10 per cent. for the year, the total amounting to £30,608 8s.

The Company has sustained some loss in consequence of the attacks upon our mercantile fleet by enemy submarines, for which it is contemplated compensation will be received. However, your Directors think it desirable that £10,000, a sum far in excess of all losses to date, should, in the meantime, be placed to the credit of a Special Reserve Account, and having regard to the prevailing circumstances and the desirability of their holding a strong financial position, with ample cash resources to provide for the continuous increase of telegraph installations on board ships, it is deemed prudent to carry forward the sum of £20,747 6s. 11d., after allocating the sum of £3,500 to the repayment of debenture account.

The option on the 43,916 unissued shares of the Company for two years from June 27th, 1913, mentioned in the last report, has not been exercised.

The Directors deeply regret having to record the death of two of their colleagues, General Albert Thys, of Brussels, who died on February 10th last, and Major Samuel Flood Page, who died on April 7th.

The retiring Directors are Captain H. Riall Sankey and Mr. Henry S. Saunders, who, being eligible, offer themselves for re-election.

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

MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED.**DIRECTORS' REPORT AND BALANCE SHEET, 1914.**

AS will be seen from the Profit and Loss Account the gross profit for the year amounted to the sum of £371,071 14s. 6d., and the net profit carried to the Balance Sheet to £232,716 8s. 11d., showing an increase of net profit over the preceding year of £110,392. The net profit of the year, added to the sum of £76,549 15s. 7d. brought forward from the previous year, increases the balance now to the credit of Profit and Loss Account to £309,266 4s. 6d.

The basis of remuneration from the Government for the use of the Company's high-power stations since the beginning of the war and other services not yet having been settled, it has not been possible to include any sum in respect of them in the Profit and Loss Account of last year.

In the Balance Sheet, Shares in Associated Companies and Patents are again taken into account at their cost price—viz., £1,360,125 15s. 4d., showing an increase of £61,382 1s. 10d. This addition is mainly comprised of the Company's proportion of the increased capital of the Russian Company. The Company's holdings in Associated Companies, except for these additions, have undergone no change during the year. The par value of shares held in Associated Companies, as shown in the margin, now stands at £2,469,858 14s. 10d., exclusive of shares which have no capital denomination.

The amount which stood to the credit of Share Premium Account has been transferred to General Reserve Account, which now stands at £867,530 0s. 6d.

The French Company (Compagnie Française Maritime et Coloniale de Télégraphie sans Fil) has declared a dividend for the year 1914, at the rate of 10 per cent. on the Ordinary Shares and 31.25 francs per share on the Founders' Shares.

The Marconi International Marine Communication Company has again shown substantial increase of business and profits, as shown by their report on page 343.

The Russian Company (Société Russe de Télégraphes et Téléphones sans Fil) has made satisfactory progress. A dividend at the rate of 15 per cent. for 1914 compares with 6 per cent. for the previous year.

The Marconi Wireless Telegraph Company

of America earned increased profits, but owing to present conditions in Europe, and the consequent postponement of the opening of their Transatlantic Service, the Directors decided not to declare a dividend.

The outbreak of war caused considerable dislocation of our Company's affairs as well as those of the Associated Companies. Businesses of importance which were on the point of fruition have had to be deferred; many negotiations which were in course of successful progress with Foreign Governments had for the time being to be abandoned; the opening of the direct public telegraph services between this country and the United States of America and Spain have had to be postponed. In some cases, owing to unfavourable exchange, substantial sums have had to be deposited at interest with bankers abroad, and some payments from Foreign Governments deferred with interest accruing until after the war. The sum of £4,347 0s. 6d., due from the Turkish Government, has not been received.

In all these circumstances the Directors consider it prudent to recommend the declaration of a dividend of 10 per cent. upon the Ordinary Shares; to place a further £100,000 to General Reserve Account, increasing that account to £967,530 0s. 6d., and, after deducting the dividend of 7 per cent. paid earlier in the year upon the Preference Shares, to carry forward the sum of £69,497 8s. 6d. The Directors do not contemplate that any loss in consequence either of loss in exchange or deferred payments will result, but having regard to the war, they consider they are best studying the interests of the shareholders in adopting a conservative policy.

The Board are gratified to be able to state that during the current year the Company has been engaged to its fullest capacity in supplying the demands of the British, Colonial and Foreign Governments. The orders in hand justify the anticipation that the volume of business this year will exceed that of any previous year. The Directors retiring are Mr. H. S. Saunders and Mr. S. Geoghegan, who offer themselves for re-election. The Auditors, Messrs. Cooper Brothers & Co., also retire and offer themselves for re-appointment.

Marconi's Wireless Telegraph Company, Limited.

PROFIT AND LOSS ACCOUNT

For the Year ending December 31st, 1914.

Dr.	£	s.	d.	Cr.			
	£	s.	d.	£	s.	d.	
To RENTS, RATES, TAXES, TRAVELLING AND GENERAL EXPENSES	21,138	14	1	By BALANCE OF CONTRACTS, SALES AND TRADING ACCOUNT	371,071	14	6
To SALARIES OF STAFF, CONTRIBUTION TO STAFF SUPERANNUATION FUND AND DIRECTORS' REMUNERATION	58,434	11	4	By TRANSFER, SHARE WARRANT AND OTHER FEES	716	10	8
To LAW CHARGES, PROFESSIONAL FEES AND PATENT EXPENSES	12,872	13	10				
To DEPRECIATION OF PLANT, MACHINERY, BUILDINGS AND FURNITURE	19,668	8	7				
To FOREIGN AGENCIES EXPENSES	3,653	10	1				
To STATION EXPENSES AND EXPERIMENTAL WORK	23,303	18	4				
To BALANCE, BEING PROFIT FOR THE YEAR CARRIED TO BALANCE SHEET	232,716	8	11				
	£371,788	5	2				

APPROPRIATION ACCOUNT.

Dr.	£	s.	d.	Cr.			
	£	s.	d.	£	s.	d.	
To DIVIDEND OF 7 PER CENT. ON PREFERENCE SHARES FOR THE YEAR ENDING DECEMBER 31st, 1914, paid April 19th, 1915	17,500	0	0	By PROFIT AND LOSS ACCOUNT—			
To DIVIDEND PROPOSED FOR THE YEAR ENDING DECEMBER 31st, 1914, ON THE ORDINARY SHARES AT THE RATE OF 10 PER CENT. PER ANNUM	122,268	16	0	BALANCE BROUGHT FORWARD AS PER DIRECTORS' LAST REPORT	76,549	15	7
To GENERAL RESERVE	100,000	0	0	PROFIT FOR THE YEAR AS PER ACCOUNT	232,716	8	11
To BALANCE CARRIED TO NEXT ACCOUNT	69,497	8	6				
	£309,266	4	6				

Marconi International Marine Communication Company (Ltd.)

Account of General Meeting

THE 15th Ordinary General Meeting of this company was held on July 7th last at the Whitehall Rooms, Hotel Métropole, Mr. Godfrey C. Isaacs (managing director) presiding.

The Secretary (Mr. Henry W. Allen, F.C.I.S.) read the notice convening the meeting, and the auditors' report.

The Chairman, after apologising for the enforced absence of Mr. Marconi, proceeded to deal with the balance-sheet, and to give some explanation of the figures.

On the debit side the Debentures are reduced from 6,250 to 6,094, representing £121,880 instead of £125,000, as appeared in the balance-sheet of 1913. This difference is accounted for by the purchase by the Company of 156 Debentures of a value of £3,120. The amount appearing to creditors is some £8,000 to £9,000 in excess of the figure of the preceding year, accounted for merely by the normal increase of business. On the credit side the plant, apparatus, furniture and stores show an increase of between £39,000 and £40,000, due to the additional number of telegraph stations installed on board ships during the year, after making the customary substantial allowance for depreciation upon all installations fitted in previous years.

The debtor balance shows an increase of some £13,000 to £14,000, consistently with the growth of the business. The available cash, represented by cash at bankers and loans against securities, is less than in the preceding year, in consequence of the considerable sum to which I have already referred which has been added to plant in the shape of additional stations installed.

Turning to the profit and loss account, it will be observed that, in consequence of the bigger business, expenses and salaries show an increase over the figures of the preceding year, but it will be satisfactory to note that these figures have not increased in the same

ratio as the increase of business. Whilst each new installation entails additional salaries to operators, the establishment costs of the complete world-wide organisation increase but slightly. The revenue on the other side shows an increase amounting to between £28,000 and £29,000. I would point out, however, that in consequence of the outbreak of war the receipts from ships' telegrams and news services during the last five months of the year suffered very materially. In the circumstances, and bearing in mind that ours is not the nature of business which derives any advantage in consequence of the war, I think you will agree that the result of the year's operations is the more satisfactory. It shows a continuous development year by year of a sound and growing organisation. The net profit for the year, £55,668 ls. 1d., after deducting £28,000 8s. 10d. for depreciation and Debenture interest, will, I am sure, be regarded as highly satisfactory. This sum, added to the amount carried forward from the preceding year of £6,067 13s. 10d., leaves an available balance to the credit of profit and loss account of £64,855 14s. 11d. An interim dividend at the rate of 5 per cent. has already been paid, and it is now recommended that a final dividend of 5 per cent. in respect of the year 1914 should be declared, making 10 per cent. for the year.

As you have been informed in the report, some loss has been sustained in consequence of the destruction of ships by enemy submarines, and, having regard to the fact that this method of warfare continues, your directors have thought it desirable to place a sum of £10,000 to a special reserve account to provide for any eventualities as being the prudent course, although they contemplate that compensation will be received. After allocating a further sum of £3,500 to the repayment of Debenture account, there will remain an amount of £20,747 6s. 11d., which, it is recommended, should be carried forward in order that the Company shall

have at its disposal ample cash resources. Every week we are adding new installations entailing additional capital expenditure, but adding steadily to the growth of our revenue. At the end of last year we had installed and were operating 905 telegraph stations upon the high seas; up to June 19th this year the number had increased to 970, and contracts continue to be entered into in much the same ratio.

It is with very great regret that we have to record the deaths of two of our colleagues, General Albert Thys, of Brussels, and Major Samuel Flood Page. These two gentlemen were associated with the Company from its very earliest days. They took a considerable part in the great struggle which the Company had for its existence. It is hard to appreciate to-day that an invention of this great value, and an organisation of such immense utility, should have required many years of very hard work and persistent canvassing before justifying its existence. At no time before, perhaps, has the value of Mr. Marconi's invention and the utility of this Company's organisation been more prominently emphasised than since the outbreak of war, and when peace once more obtains an interesting chapter may be written of the part played by the 2,000 Marconi stations fitted upon the vessels of the mercantile marine under the control and management of the Marconi Companies.

Our great thanks are due to our manager, Mr. Bradfield, and the other members of the staff, who have so ably handled our business during very difficult times; and the greatest appreciation is due to our magnificent army of telegraph operators, who have unflinchingly carried out their duties on board ship. As an instance I would mention the operator of the *Armenian*, whose cabin was blown to pieces by shell fire, but who stood to his duty to the end, and I am glad to say that Mr. Swift was miraculously saved and is unhurt. Again, all will probably have read of the admirable conduct of the operators on the *Lusitania*, who never left their wireless cabin until the hurricane deck alone remained above water. Upon the outbreak of war we called upon our operators for volunteers to serve as operators both in the Navy and the Army, and there are some

400 of our men now in those Services. We regret to have to record the death of five of them, who went down with their ships or were killed in action. On more than one occasion the Admiralty have expressed their satisfaction and appreciation of the resource and courage displayed by our men. (Cheers.) Ladies and gentlemen, I have nothing further to tell you with regard to the Company's affairs, and I now formally move, "That the report of the directors submitted together with the annexed statement of the Company's accounts at December 31st, 1914, duly audited, be received, approved, and adopted." Captain H. Riall Sankey, R.E., seconded the resolution.

No questions being asked, the Chairman put the resolution to the meeting, and it was carried unanimously.

The Chairman then moved, and Mr. Alfonso Marconi seconded, "That Captain H. Riall Sankey and Mr. Henry S. Saunders, the retiring directors, be re-elected directors of the company." The motion was unanimously agreed to.

Captain H. Riall Sankey moved, and Mr. Henry Saunders seconded, "That the remuneration of the directors for the year 1915 shall be the sum of £2,000, subject to such further sum, if any, as may be determined at the next general meeting of the Company, and that in respect of the year 1914 an additional £1,000 shall be paid to the directors," and the resolution was unanimously carried.

The Chairman moved, and Mr. Alfonso Marconi seconded, "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, 1914; that the said dividend be payable on July 31st, 1915, to the shareholders now registered on the books of the Company and to holders of share-warrants to bearer." The resolution was unanimously passed.

Mr. W. W. Bradfield moved, and Mr. C. J. Ketteridge seconded, "That Messrs. Cooper Brothers & Co. be re-elected auditors for the ensuing year, and that their remuneration for auditing the accounts to December 31st, 1914, be 250 guineas." The resolution was unanimously agreed to and the proceedings then terminated.

PERSONAL PARAGRAPHS.



Air-Mechanic Leonard Newns.

It is right that the authorities should take stock of the talent and skill of the nation in order that they may best apply it to the needs of the country in a time of national emergency like the present. Many ways in which the wireless telegraphist can serve his King and Country have presented themselves, and

not a few of these practical young men have volunteered for service at home and abroad. It is with pleasure, therefore, that we hear of the award of the D.C.M. to Air-Mechanic Leonard Newns, of Tabley, near Knutsford, for plucky conduct in France. He joined the service of the Marconi International Marine Communication Co., Ltd., in 1912, and served on board the s.s. *Devonian*, *Mechanician*, *Manco*, and *Canning* in the capacity of wireless telegraphist. When war was declared Newns' ship was then lying at New York. His patriotic instincts at once came to the fore, and on his return to England he immediately enlisted in the Royal Flying Corps. Within three weeks he found himself in France, and in a very short time his expert knowledge of wireless telegraphy was detected. He received promotion from mechanic to the Wireless Telegraph Department, and thus became the medium between "men in the clouds" and the officers in charge of the guns. The act which gained him the coveted distinction was of a high degree of gallantry. He was in the trenches when a shell shattered a huge oak tree in whose shadow he was stationed. He thought it time to quit, and he set off on his three-mile run along the bank of the river Yser. When quiet ensued, he remembered his instruments and records, and of what advantage would fall to the enemy if they came into his possession. He was warned not to return, but he did so and secured the tackle. Altogether his act constituted a brilliant achievement, and we take this opportunity of offering him our congratulations.

We are advised that in connection with the proposed wireless service between the United States, Honolulu, and Japan, Mr. E. J. Nally, the vice-president and general manager of the Marconi Wireless Telegraph Company of America, has left New York. He will visit the Pacific Coast and the Hawaiian Islands. The Japanese Government

stations are nearing completion, and preliminary tests are in course of progress.

At the meeting of the Council of Armstrong College held recently at the Medical College, Newcastle, the secretary was instructed to convey to Mr. Morris-Airey, Lecturer in Physics, the congratulations of the Council on his appointment to H.M.S. *Vernon*, with the rank of Lieutenant, R.N.V.R., specially for the purpose of wireless work. Mr. Morris-Airey has devoted special attention to radio-telegraphy.

We are sure a large number of our readers will be pleased to hear that Mr. H. Francis White, of the Marconi International Marine Communication Company, Ltd., was happily married on June 23rd to Miss Gertrude Edith Thomas, of Crouch End.

The ceremony took place at Christ Church, Crouch End, and was solemnised by the Vicar, the Rev. C. J. Sharpe, in the presence of a large gathering of relatives and friends. The bride, who was dressed in white charmeuse and carried a sheaf of lilies, was attended by four bridesmaids attired in white taffeta and voile, carrying bouquets of pink roses. The bride was given away by her father, Mr. J. Thomas, of Crouch End, and the duties of best man were ably carried out by Mr. J. C. Hawkhead, who for a number of years has



Mr. and Mrs. H. F. White.

been closely associated with the bridegroom during his long service with the Marconi Company. Dr. Robson officiated at the organ.

After the ceremony a large company of guests was received at the bride's house, where the many presents received were displayed. Mr. and Mrs. White afterwards proceeded to Torquay for the honeymoon, and were favoured by most delightful weather.

The bridegroom's old associates and many friends in the Marconi service presented the happy pair with a handsome canteen of cutlery, and amongst the numerous presents were a handsome dinner service and a cheque from the bridegroom's father, a cheque from the father and mother of the bride, a set of fish carvers from Mr. and Mrs. G. A. Manson, and a French onyx clock from the best man. Many other presents of silver and glass were received from friends and relatives, and by good fortune the too frequently occurring duplication was conspicuous by its complete absence.

A few words dealing with Mr. H. F. White and his association with the Marconi organisation may be of some interest. Mr. White was educated at Blackheath College, and joined the Marconi International Marine Communication Company on August 1st, 1904. He spent a number of years at sea as a wireless operator, serving on the *Teutonic*, *Majestic*, *Caronia*, and other liners of the North Atlantic trade, and afterwards spent some time on the South American runs, being one of the first operators on the Royal Mail Steam Packet Company's ships. In due course he was appointed to the rank of inspector, and whilst holding this position spent an exciting and interesting time in the North American icefields with the Newfoundland sealing fleet.

About three years ago Mr. White took an active part in the then newly formed London school of the Marconi Company, and will be remembered in this connection by many of the junior operators in the service. At a later date he was appointed to his present position as manager and agent at the Company's depot at Newcastle-on-Tyne. Many of his old *confrères* will remember the occasion on which, as conductor of the Marconi House Orchestra, he was the first recipient of the handsome silver cup which was presented by Mr. Godfrey Isaacs for competition between the bands of Marconi House and the works at Chelmsford.

Mr. White has asked us to take this opportunity of thanking on his behalf the many kind friends in the wireless service who sent telegrams of congratulation and subscribed to the handsome canteen of cutlery.

Mr. Bradley John Bartlett, of Roundmead, Malmesbury, has attained a notable success in a recent naval examination in Wireless Telegraphy. Of a large number of candidates he was placed first, and gained 100 per cent. of marks in that subject. He also passed his rating examination with 93½ per cent. of marks. At the beginning of July he went to Portsmouth for further tests, in which he hoped to be successful. Mr. Bartlett was educated at Malmesbury Secondary School, of which last year he was top boy. He is an accomplished cornet player, and in that capacity has joined the naval band of H.M.S. *Impregnable*, on board of which ship he is training at Devonport.

Pluck and endurance have again asserted themselves, this time through the person of Mr. Claude Hendry. He acted for some considerable time as wireless operator on board H.M.S. *Vulcan*, whilst that ship was lying in the River Tay at Dundee. He had, however, relinquished the post to become wireless telegraphist in the Air Service. His Majesty the King has now been graciously pleased to confer upon Mr. Hendry the Albert Medal. The act which gained him the coveted distinction is as follows:

Whilst in flight 10 miles to the north of Yarmouth a bomb accidentally exploded, destroying the aeroplane and precipitating the occupants, Flight Lieutenant Lan Davies and Telegraphist Hendry, into the sea from a height of about 150 feet. When the machine fell Hendry managed to swim clear, but the Flight Lieutenant remained in his seat and quickly became unconscious. Hendry, seeing this, immediately returned, and diving under the wreckage, succeeded in rescuing the officer. Some half an hour later the steam drifter *Noreen* of North Shields arrived at the spot. By that time, owing to the fact of his having supported the insensible man, Hendry was very exhausted, and both the aviators were taken aboard and conveyed to Lady Crossley's Hospital on the Quay at Great Yarmouth.

We congratulate Mr. Hendry, and would say that he is only the fifteenth recipient of the Albert Medal since its institution in 1867. The honour of its receipt is eagerly sought, and the last medal was granted in 1913.

Last month, in this column, we recorded the promotion of Warrant Telegraphist F. J. Linnell to the rank of Flight Sub-Lieutenant. Whilst the magazine was in the press, Sub-Lieutenant Linnell succeeded in obtaining his pilot's certificate at the Hendon Aerodrome, where he had been for some time training. We must again congratulate our friend on his progress, and wish him every success in other interesting if somewhat perilous duties.

It is with deep regret that we have to record the death of Mr. Leonard S. Mendes, a member of the



Mr. L. S. Mendes

operating staff of the Marconi International Marine Communication Co., Ltd. Mr. Mendes, whose home was in Manchester, joined the Marconi Company in December last, and, after performing some special duty in connection with the war, served for some time on the s.s. *Minnewaska*. On April 4th Mr. Mendes was landed from his ship at Alexandria and placed in hospital suffering from tubercular pleuritis. As soon as he was well enough to be moved he returned to England, and proceeded home on sick leave. Although everything possible was done to facilitate his recovery, Mr. Mendes made no real progress, and, becoming worse, passed away on June 21st. Deep sympathy is felt for Mr. Mendes's mother in her sad bereavement.



Sergeant R. Shorter.

One of the first of the Marconi House uniformed staff to be called up for service at the beginning of the war was Bombardier R. Shorter, a reservist of the Royal Field Artillery. Bombardier Shorter, soon after rejoining his regiment, proceeded to France and took part in the great retreat at Mons. Amongst the exciting experiences through which he has passed may be mentioned an attempt to stop a motor-car containing some German officers. Shorter managed to achieve his object, although he himself was knocked down and suffered injury to his leg and head.

As a result of the injuries sustained, Bombardier Shorter returned to England and spent some time in hospital. We are glad to record that he has now completely recovered, and was able recently to visit his friends at Marconi House attired in the uniform of a sergeant, to which rank he was promoted in the middle of June. We are sure all of the staff will join with us in offering Sergeant Shorter heartiest congratulations and best wishes for the future.

To the long list of brave men who have gone unflinchingly to their doom has yet to be added another name, that of "Pegg," a wireless boy on board H.M.S. *Majestic*, who was drowned when that ship was torpedoed on May 27th last whilst fighting Britain's battles in the Dardanelles. He died, as do most of those who "go down to the sea in ships," like a hero. A correspondent writes that the torpedo struck the *Majestic* just by the sea gangway. He says, "The poor old ship shook terribly. A huge volume of water shot up to port some 250 feet in the air. Her end had come. Men obeyed orders to the last. All recognised that it would be a fight for life. Everyone aft was cool. There was no panic whatsoever. Transports sent boats; trawlers and tugs came close in, but all had to take to the water to get saved." Such is a pen portrayal of the last anguish of the good ship *Majestic*, and in this turmoil one yielded up his life, the promising life of a youth.

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