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International Radiotelegraphic Time-Signals

THE International Radiotelegraphy Conference, which met in London last summer, was soon followed by an International Time-Signal Conference, which deliberated at Paris from October 15th to 23rd, by invitation of the French Government, on the organisation of a radiotelegraphic time-signal service. The special object of the Conference was to arrange for a distribution of stations, so that every spot in the ocean should be able to receive at least two signals in the course of 24 hours. One of the first points to be considered in this connection was the prevention of interference of signals coming from stations not sufficiently distant from one another. For this reason the list of new stations at present projected does not include any stations in the British Isles and in Italy. Several of the new stations first to be built are to be situated in places which are generally considered to be rather out of the world. Thus, Africa is to have stations at Massaua, in Erythrea (Italian Red Sea district), Mogadiscio (Somaliland), Timbuctoo (Sahara); America, in Arlington (State of Washington), San Francisco, San Fernando (Brazil), and far out in the ocean on Honolulu (Sandwich Islands); other stations in the Pacific are to be erected in Samoa, Guam (Marian Islands), and Manila (Philippine Islands). The control of the service is to be placed under an international bureau at Paris. As regards the reception of the time signals, two methods are in use, apart from the rough method of observing the second hand of the watch whilst listening to the signal. Either the signal is automatically recorded, together with the chronometer time, or the Vernier method of comparing two watches is applied. The first method is probably the most exact; but it requires rather complex apparatus, and a good deal depends upon the time-constants of the apparatus itself; the Conference would prefer this method if it could be simplified. A second method is based upon the acoustic coincidences of the beats of two pendulums or hair-springs of slightly different periods. For this purpose a pendulum of a period of 0·98 seconds emits, on the Eiffel Tower, series of radio-signals which coincide about every 50 seconds with the beat of a watch; these coincidences are very sharp, because each signal is produced by a single spark, not by a train of sparks. In future such coincidence signals will be given every night for a short time before the time-signal proper, so that the observatories within reach can check each other. Storm and iceberg notices are also to be transmitted. The international service is to commence in July of this year, provided that the representatives of the sixteen States which took part in the Conference find the necessary official support.

HIS EXCELLENCY GENERAL DON JOSÉ
DE BASCARÁN Y FEDERIC

His Excellency General Don José de Bascarán y Federic

HIS EXCELLENCY DON JOSÉ DE BASCARÁN Y FEDERIC holds a very prominent position in the Spanish Army, but perhaps it is of more interest to our readers that he is a director of the Compañia Nacional de Telegrafia sin Hilos, of Madrid. Despite the apparent remoteness between the two offices General Bascarán holds, the combination is, as a matter of fact, both happy and appropriate, more especially as it occurs in the person of an eminent Spaniard, for Spain is amongst the most advanced nations in the practical application of wireless telegraphy. From the very outset she took an interest in this great invention, for she immediately foresaw its possibilities, as she recognised that without wireless telegraphy the country would be, as it were, a deaf mute among nations; dependent upon the elements for the delivery of all communication, however great its importance, while her commercial activity and her military prestige would be paralysed by inadequate means of communication.

On November 28th, 1911, was inaugurated her elaborate wireless service by the opening of high-power stations at Cadiz, Teneriffe, Las Palmas and Barcelona, while a little later internal communication was perfected by the opening of a central wireless station at Aranjuez, and on this occasion General Bascarán was amongst those assembled to meet King Alfonso, who opened the station in *propria persona*. But His Excellency's influence is most notable in the development of wireless for the military service in Spain, for, being himself a general of ripe experience, he is well aware of the immense advantages, nay, rather of the absolute necessity, of wireless for modern generalship. As a result, not only has the Army been efficiently equipped, but every effort has been made by the authorities to see that its working capacity is employed to the greatest advantage; and, further, that those to whom the control of this important asset in modern warfare has been given are acquainted with it, not only from the standpoint of a mechanical instrument to be used for the transmission of messages, but have some theoretical and definite knowledge of the principles of wireless science.

He was responsible also for the initiation of the recent manœuvres at Madrid with the portable wireless stations which aroused so much interest throughout the country. These demonstrations were not only watched by all the Spanish military authorities, but by an appreciative assembly which included King Alfonso and Queen Maria Christina, while the events were reported at considerable length in the Press.

King Alfonso, as is well known, takes the keenest interest in the welfare of his army. Only lately he is reported to have said, "If I were not King I should be a captain in the army." It was fitting, therefore, that Senor Bascarán should be one of the principal members of the brilliant group of officials assembled to meet King Alfonso at the demonstration. Indeed, it would be impossible to imagine such an event taking place without his being present, for, besides being a notable member of the wireless world, he is a *persona grata* with His Majesty the King of Spain, from whom he holds his appointments as Aide-de-Camp, General-in-Chief of H.M. Military Household, and Military Governor-General of Madrid. In fact, His Excellency is a well-known figure in the *entourage* of King Alfonso, and has accompanied him on almost all his journeys outside Spain. In this connection he has visited England, France, Germany, Austria and Bavaria, and has been the recipient of many honours from many foreign potentates. He is the holder of the Grand Crosses of the Red Eagle and Crown of Prussia, First-Class Cross of Hohenzollern, Grand Cross of the Iron Crown and Francisco José, Military Merit of Bavaria, Grand Cordon of the Legion of Honour and Grand Victoria Cross, having besides, the Grand Portuguese Crosses of San Benito de Avis and Concepcion de Villaviciosa, and the Spanish Crosses of Carlos III., Military Merit Isabel la Catolica, San Hermenegildo and Naval Merit.

But it was as a soldier that His Excellency first made his mark. During his military career he has held the important posts of Chief of the Field Section in the Ministry of War, and Chief on the general staff of the Captain-General Martinez Campos, whom he accompanied to Marrakesh to negotiate the Peace Treaty between Spain and Morocco in the year 1894. At one time he was the Professor of the General Staff Corps School, and is the author of several books on artillery practice.

The Theoretical Explanation of Wireless Telegraphy

By Professor J. W. Nicholson

THE writer has been urged several times to publish, in an expanded form, his remarks made at the British Association during the discussion on the principles of wireless telegraphy, opened by Prof. J. A. Fleming. THE MARCONIGRAPH, as the journal of the company to whose energies the practical advancement of the subject is so largely due, is evidently the most suitable place for such an account as is contemplated in the present article.

After the admirable account of the present state of the theory given by Prof. Fleming, there seems to be little to add, if anything, on the historical side, and it may be assumed that an acquaintance with all the leading theories which have been proposed is a permanent possession of all the readers of Prof. Fleming's introduction. We shall limit attention, therefore, to a discussion of some of the theories, in the endeavour to select the particular one against which theoretical objections are of least importance.

A Negative Theory.

Theories of wireless telegraphy, like theories of any other phenomenon, can, of course, be positive or negative. Although the present writer is frequently credited with the possession of a definite theory of wireless telegraphy, the position he has taken up is in reality a purely negative one—that diffraction cannot explain the results achieved by the practical engineer in wireless telegraphy. In the first place, therefore, we shall confine our attention to the problem of diffraction. Prof. Fleming has indicated the manner in which the mathematician has attacked this problem. For the convenience of his analysis, the mathematician has assumed the earth to be a perfect conductor; that is to say, a body which in transmitting electricity must show the "skin effect" absolutely, and confine an alternating current entirely to a minute depth from the surface. There are other simplifications which do not need mention in detail. Such a starting-point may appear somewhat artificial and removed from the practical aspect of the subject, but nevertheless it must be a special case of the practical problem, and any solution which is true for the practical problem has its analogue in this theoretical problem—an analogue which must preserve even the orders of magnitude of the various quantities concerned in the two problems; for example, energy received at a station. The mathematical problem has the further merit of supplying an *upper limit* for such quantities. It is evident to any engineer that a wire of a greater conductivity than a second wire is capable of transmitting more energy under any conditions; and if, in the words of the mathematician, we proceed to the limit, and imagine a wire of greater conductivity than any we have experienced, a correspondingly larger amount of energy will be transmitted by it. Such principles, of course, apply if the wire is replaced by the earth. As Lord Rayleigh remarked at the British Association, it would be surprising if it were found that the imperfection of the earth's conductivity really assisted the propagation of waves from the transmitter to the receiver.

Mathematical Solution

The mathematical solution, therefore, of the diffraction problem must endow a receiver, in any case, with more energy than it could possibly collect in practice if diffraction, or wave-bending, is the only agency with which the practical telegraphist has to deal. If the energy so found is too small to be detected by the present degree of sensitiveness of our instruments, we must dismiss diffraction from the field of possible theories. Let us examine the results of such a mathematical solution without taking account of the height of the antenna. This height is evidently a help, but in the *Philosophical Magazine* of November last the writer showed that this degree of help is too small to make any appreciable difference in the results. With a simplification which is therefore legitimate, we can show that the amplitude of a wave which, by diffraction, reaches a receiving station, bears to the amplitude at the sending station a ratio

$$38{\cdot}98.\ \tan\tfrac{1}{2}\theta.\sqrt{\sin\theta}\cdot\frac{1}{\lambda}\,\epsilon^{-}\cdot(\cdot7006)\,\frac{\theta}{\lambda}\,\epsilon^{-}.$$

where θ is the angle subtended at the centre of the earth by the two stations, measured in degrees. If m is the number of miles between the stations, $m = 70\,\theta$ approximately. The wave-length of the oscillation in air is λ.

Diffraction and Wave Lengths

This formula can be tabulated at once for any given wave-length, and we may examine

it for the practical case which is usual in signals sent by the Marconi Company. Prof. Fleming has emphasised the fact that it has not been numerically tested for such long wave-lengths. A set of tables suitable for wave-lengths of about a quarter of a mile was given in the *Philosophical Magazine* for January, 1911, and showed undeniably that diffraction cannot be an important factor for such wave-lengths. For example, it was shown that if the distance between the stations is 2,000 miles, the energy falling on the receiver is only the fraction 10^{-12} of the energy falling on a similar receiver at a distance of 70 miles. For a receiver at 6,000 miles, roughly the greatest distance at which wireless messages have been successfully transmitted, the ratio has sunk so low as 10^{-40}. These figures are absolutely convincing for waves of such a length, and they are quite in accordance with those of the analogous optical case quoted by Prof. Fleming in his article.

But the Marconi Company uses much longer waves, and the difference in the results for such waves is very appreciable on account of the exponential factor in the law of diminution of the waves, so that another precise numerical test of the diffraction theory is desirable. Can it, by an increase of the wave-length sixteen times, explain Mr. Marconi's signals from the Clifden station to South America, a distance of 6,000 miles? We have only to insert $\lambda=4$ and $\theta=90°$ approximately in the formula. Thus

$$\text{Sin } \theta=1, \text{ tan } \tfrac{1}{2}\theta=1.$$

and the final amplitude received becomes $5.37.10^{-8}$. This is the ratio of the amplitude received to that leaving the oscillator. The ratio of the energy-densities in space at the two points is the square of this quantity, or $2.88.10^{-15}$, and this is the ratio which is important in practice.

Other Theories

Although the difference in this case is very considerable, the result leaves no hope of such an explanation as a basis for wireless telegraphy. We are compelled, therefore, to consider other theories. As regards the mathematical accuracy of the formula, it is sufficient to mention that three entirely distinct modes of solution have led to the same results—those of the late Prof. Poincaré, of the present writer, and finally of Dr. H. W. March, of Göttingen.

Prof. Fleming is in favour of Prof. Sommerfeld's theory. He has given so complete an account of the surface waves which appear in Sommerfeld's investigation that there is no need to go over the ground again. As a mathematician who has carefully studied this work the writer is compelled to record his conviction that, from a mathematical point of view, Sommerfeld's investigation, as would naturally be expected from so distinguished an analyst, cannot be attacked. Prof. Fleming has expressed a wish that it should be confirmed independently, and the writer is very glad to be able to meet this wish.

But at the same time, in taking up the view that these surface waves are actually the efficient factor in wireless propagation, an assumption is being made which calls for examination. Prof. Sommerfeld's theory is worked out on the mathematical supposition that the earth may be treated as a flat interface separating two media, both of which, in this simpler problem, can be endowed with all the imperfections of conductivity and the like which are inherent in the materials with which the practical man has to deal. He thus obtains the surface waves or *oberflächenwellen*, whose energy only falls off according to the inverse distance, and not the square of distance, so that at a great distance from the antenna they are still very important. They actually become zero as the conductivity of the earth is mathematically increased, so that their absence from the investigations on diffraction is not surprising. But is it correct, on account of their mathematical form, to formally identify them with surface waves such as are found on wires, and to assume that they would travel freely round the *curved* earth which is dealt with in the real problem? They are only a part of the whole solution for a flat interface, and it is only a mathematical fiction to suppose that an observing engineer would perceive the space and surface waves superposed. He would only perceive the whole effect, and the division into two classes is a purely mathematical process. It is not mathematically possible to suppose that, if we could transform the solution for a plane interface to one involving a curved surface, the space waves would transform into corresponding space waves, and the surface waves into waves which travel freely round the curved surface. We can only say that the whole effects would transform, but any artificial separation in the one case does not of necessity correspond to an exactly similar separation in the other. Unfortunately this transformation of solutions cannot be made, and it can only be done in the reverse order. But it does not seem possible at first sight, even when account is taken of the imperfect conductivity, for the formal solution appropriate to a sphere to give waves whose energy falls off inversely as the distance; and it is by no means certain, therefore, that Sommerfeld's solution takes account of the real problem, though mathematically exact as it stands. A

more complete investigation, starting with the curved surface, is necessary, and fortunately mathematically possible.

Sommerfeld's Waves

We are familiar with the fact that a plane can be thought of as a sphere of infinite radius, so that a solution of any problem for a plane must be a special case of a solution for a sphere. But if we take any sphere and multiply its radius indefinitely, we at the same time multiply any length of its arc. An arc of one foot on the sphere becomes an indefinitely long line on the plane. In particular, a distance of a few feet on the earth, measured from a sending station, corresponds to an infinite distance on a plane. A solution found for a plane interface may therefore correspond to a solution over a very limited range of the actual earth. This may explain what can happen to the surface waves of Sommerfeld if the more practical problem is treated, for it may only be possible to divide the effect partially into surface waves in the immediate neighbourhood of the sending station. If this should turn out to be the case, as seems probable, another theory of wireless telegraphy must be found.

The theory which seems most promising is that partially worked out by Dr. W. H. Eccles. From the mathematical point of view no serious criticism can apparently be made. Prof. Fleming raised an interesting point with respect to which it seemed doubtful, but Dr. Eccles has overcome the difficulty. We shall not at this point give an account of the theory, for it is familiar to readers of this journal. It possesses the great advantage of taking account of a phenomenon discovered by Mr. Marconi—the difference in transmission by day and by night—and, as Lord Rayleigh said at the British Association, this phenomenon seems to demand a theory on these lines for its explanation.

Unsolved Problems of Wireless Telegraphy.

By Dr. A. Sommerfeld (Munich).

I SHALL try to answer the questions put by Professor Fleming, before the British Association meeting at Dundee, from the purely theoretical standpoint.

1. "The exact nature of the machinery by which the transmitter affects the receiver" is given by Maxwell's system of equations. Possibly they may not accurately hold in detail or for the interior of atoms; as regards the character of the phenomena on a large scale they have, however, so far always proved applicable.

2. Maxwell's equations show that a "Hertzian wave effect pure and simple" is not possible near the boundary of a heterogeneous (conducting or dielectric) material; in such material secondary effects are induced which also influence the propagation of waves in air.

3. In the vicinity of the transmitter the earth acts as a "perfect conductor"; at a greater distance the finite magnitude of the conducting power has to be considered. What is to be regarded as a small or as a large distance depends upon the conductivity and the dielectric constant of the soil, as well as upon the wave-length, and cannot accurately be defined theoretically. With long waves over the sea all attainable distances have to be regarded as small (in this sense).

The earthing of the transmitter has no influence upon the process of the spreading of the waves. This is to be understood as follows: Two different transmitters (more or less perfectly earthed), which give the same amplitude of wave at a small distance, will also give waves of the same amplitude and shape at any other distance. Two such transmitters will, however, require currents of quite different intensities and different energy supplies. Thus the efficiency of emission (the ratio of the wave-energy at distance 1 to the energy supplied) depends upon the earthing. In what way it depends can only be determined experimentally for each transmitter. On the other hand, the efficiency of the spreading of the waves (the ratio of the wave-energy at distance r to the wave-energy at distance 1) is independent of the earthing. This may be proved by general theoretical considerations.

4 and 5. There is no contradiction in principle between "true diffraction" and "surface waves." Both the phenomena may be explained by the Maxwell equations. In the case of a curved surface the two cannot be rigorously separated, any more than the space waves (of the Hertz type) can be separated from the surface waves (of Rayleigh's type); the boundary conditions near the earth's surface necessarily connect the two kinds of waves with one another.

6. As regards the influence of the curvature of the earth, I have not myself published any quantitative deductions; I have merely expressed the supposition that the type of

surface waves might be favourable for overcoming the curvature. I have, however, induced Dr. H. W. March to investigate this problem (Dissertation, Munich, 1911, and *Annalen der Physik*, vol. xxxvii.). March found for the amplitude A at a point, which is situated at the geocentric angle θ from the transmitter,

$$(1) \quad . \quad . \quad A = \frac{A_0}{\sqrt{\theta \sin \theta}};$$

that is to say, for small θ the diminution of A would be proportional to θ, and thus to the distance as measured along the earth surface; for large θ the diminution would be less rapid; and for $\theta > 110$ deg. the amplitude would actually increase. Unfortunately, this result is not mathematically correct, as Poincaré demonstrated in 1912 in the *Comptes Rendus*. For there should be added to formula (1) the exponential factor

$$(2) \quad . \quad . \quad . \quad e^{-\beta \left(\frac{2\pi a}{\lambda}\right)^{\frac{1}{3}} \theta}$$

(where λ = wave-length, a radius of the earth, β a numerical factor smaller than 1). When this correction is made, the result of March approaches those of Poincaré and Nicholson. March therefore proposes to retract, in the *Annalen*, his objection to those researches. The exponential damping of the type (2), having thus been deduced from Maxwell's equations in three independent ways, may henceforward be accepted as proved.

The curvature of the earth therefore produces a dispersion of the waves, which increases as an exponential function of the geocentric distance. It would appear to me that the numerical magnitude of this dispersion has been overestimated by Poincaré and Nicholson. The theoretical value of the order of magnitude of the dispersion would probably agree with Austin's observations, whilst Poincaré considered it a hundred times too large. The empirical damping factor of Austin's formula further accords in form with the theoretical formula (2), except that Austin has $\lambda^{-\frac{1}{2}}$, whilst in (2) it is $\lambda^{-\frac{1}{3}}$. We must not be too much impressed by the exponential function of (2), but must bear in mind that for the large wave-lengths of the Transatlantic service $\left(\frac{2\pi a}{\lambda}\right)^{\frac{1}{3}}$ is a moderately large number—*e.g.*, being equal to 21·5 for $\lambda = 4$ km.; therefore the power index of (2) would only be 4, for $\theta = 15$ deg. (corresponding approximately to the largest distance of Austin, which is 900 nautical miles), and for $\beta = 0{\cdot}7$ (Nicholson's value for this factor). In these calculations the earth is presumed to be a perfect conductor; a preliminary calculation has demonstrated that the finite conductivity would possibly improve the resulting wave transmission to a certain, but not to an important, degree.

The form of the factor (1) points, as March has shown, to a surface distribution of the waves. Sin θ is, indeed, proportional to the size of a great circle upon the earth (a parallel) described by the receiver about the transmitter; assuming a pure surface spreading, the energy would be inversely proportional to the area of this circle. In reality the distribution is not purely of a surface character, for there is in (1) the factor $\sqrt{\theta}$, in addition to $\sqrt{\sin \theta}$; and in (2), moreover, there is the important exponential dispersion.

7. I do not believe that we should look for other explanations as long as the above formulæ, derived from the simplest assumptions, have not been compared with quantitative experiments.

8. From my formulæ (*e.g.*, in the *Jahrbuch*) there results, "apart from the earth curvature," a large difference in the spreading over land and over sea, and also over fresh water and sea water, especially in the case of small wave-lengths. The practical endency to pass more and more to large wave-lengths can, from my standpoint, be understood on the hypothesis that the larger wave-lengths suppress the influence of both the imperfect conductivity of the earth and of the curvature of the earth.

9. We may conceive that a non-uniform ionisation of the atmosphere will disperse the waves.

10 to 14. The difference between the night range and the day range seems to indicate that the sunlight exerts an unfavourable influence upon the range, either by improving the conductivity of the air, or in accordance with the interesting hypothesis of Fleming. For this reason I should think that the ionisation of the upper atmosphere may not conversely be resorted to as favourable for overcoming the earth curvature.

15. The research of Hörschelmann would, in my opinion, appear to rest on a strict electromagnetic basis; it does not make use of any special hypothesis made *ad hoc*; he considers in a certain measure even the shape of the antenna. A criterion of the correctness of his hypothesis would be supplied, if it could be demonstrated that the Marconi transmitter does not possess any directive power on board ship.

Rear-Admiral Inglefield, secretary of Lloyd's, informed the Board of Trade Committee inquiring into the question of danger caused to navigation by derelicts, that there are 1,705 British and foreign steamers fitted with wireless telegraphy.

Directional Wireless Telegraphy

By an Engineer

IN many cases the fact that a wireless message travels out from an ordinary aerial in all directions is of the most vital importance—an advantage which cannot be over-estimated or rivalled. A ship in distress, for instance, can in a moment send its call for succour, echoing far and wide, summoning help from any direction where help is available. A land station can send its daily news-message to countless ships dotted about the high seas, and one ship can speak with another wherever it may be, provided only that it is within the circle which represents its "range."

But so many and varied are the claims of wireless that every day sees some new development and some new use, and for some of these it is no advantage—it may even be a disadvantage—that the message should be sent in more than one direction. When this is so, the energy radiated in other directions is wasted, and the attractive problem of how to avoid this waste of energy forms the keynote of an article contributed to *The Times Engineering Supplement*, which we reproduce below.

At present the only methods which have justified their use in practical wireless are two—the Marconi Directional aerial, and the Marconi-Bellini-Tosi system of aerials. To the former of these the article refers briefly when it speaks of "some of the Transatlantic antennæ." The latter it also mentions, referring to a more complex arrangement than those dealt with by Dr. Bellini in the January MARCONIGRAPH.

Other methods, some of them successful in the laboratory, have up to now failed when applied to practical use. As the writer of the article remarks, Hertz demonstrated that electro-magnetic waves could be refracted by a "large" pitch prism, and many experiments have been described dealing with the reflection of waves.

But it is in the word "large" that the difficulty lies—a difficulty not mentioned in the article. A ray of light can be refracted by a very small prism, but the very small prism is very "large" when compared with the wave-length of light. So Hertz, dealing as he did with electro-magnetic waves measured in inches, succeeded in refracting them by the use of a "large" prism—large when compared with his short wave-lengths. To work on the same lines with the waves of practical wireless telegraphy—"Marconi" waves—a prism would have to be "large" when compared with anything from a quarter of a mile to eight miles. And the same difficulty arises in the case of reflection.

Towards the end of the article appears its *raison d'être*—a bare outline of some new experiments in this direction which appear to have given results satisfactory to the experimenters.

It is impossible to form an opinion as to the value of these results from the data given; we are afforded no hint as to what scale the experiments were on. To realise the importance of this point, one has only to suppose that the tests were made with waves 20 feet long from an aerial, say, 5 feet high, and that the "reflecting surfaces" had to be placed perhaps in a semi-circle of radius equal to a quarter wave-length, and were also 5 feet high. Suppose, for the sake of argument, that this arrangement worked well, and then *imagine it* applied to a commercial wireless wave even so short as 600 metres from an aerial 300 feet high. We do not wish to suggest that anything of the kind applies to the experiments in question, but the example makes it clear that the information supplied is quite inadequate for forming an opinion.

(Reproduced from *The Times Engineering Supplement*.)

Increased strength of received signals is a matter of paramount importance in the development of radiotelegraphy; such an absurdly minute quantity of the energy used in transmission is actually received that any present system is enormously wasteful compared with line telegraphy. It is, of course, impossible to make fair comparisons without taking into consideration the initial cost of cable laying, upkeep in each case, and so on. The fact remains, however, that a very real advance will be made in the day when less loss of energy is experienced in wireless transmission.

The direction of the energy radiated from the aerial helps to some extent to solve this problem, if the shape of the aerial tend to produce radiation within a limited area. Any method of direction which depends on the absorption or destruction of the radiations outside the desired area is, of course, useless as a means of concentrating the energy received and thus making radiation less inefficient. The whole problem of directing and concentrating the energy transmitted from a wireless station appears to depend on the aerial and the transformer of the oscillations. Ducretet showed in 1898 how by means of a transformer in the transmitting circuit the radiating power could be greatly increased, and on several occasions he referred to the necessity for the use of oscillation transformers and for the tuning of the

sending and receiving aerials. It is only one step from the use of transformers in the transmitting circuit for producing persistent oscillations to their use for the direction and even the concentration of the transmitted energy. In Bellini and Tosi's arrangement for directing signals they employ what may be regarded as two aerials ; one of these is composite, and its effect is to transmit a maximum of energy in one direction, while the other subdues or counteracts the radiations in the opposite direction. The shape of the aerial and its position relative to the earth have a marked influence upon the direction of the radiation, and Berthenod's discovery, described in the *Engineering Supplement* on October 23rd, shows how productive a sphere of experiment the aerial still remains. The arrangement of some of the Transatlantic antennæ is such that maximum radiation takes place in the direction in which the receiving station lies, and this has made the regular transmission of messages far more certain.

But the final problem in wireless transmission will be the confinement of the radiations to a small area, which area can be both controlled and directed, and some recent experiments made with this end in view have not been entirely unsuccessful. Using a large pitch prism, Hertz demonstrated in the very early days the fact that electro-magnetic waves could be refracted, and many experiments dealing with the reflection of the waves have been described. The experiments consisted in the use of " reflecting surfaces," which in themselves were radiators, and their radiations were in such phase that they appeared to converge the radiations emanating from a central large inductance aerial. The reflecting surfaces consisted of inductance coils wound round frames in which numbers of small soft iron rods were fixed normally to the plane of the coils. Briefly summed up, the result was that a considerably larger amount of energy was picked up at the receiving station than was possible with the methods generally employed, and signals could be obtained at a distance at which in the ordinary way they were quite inaudible. It may be reasonably assumed from these results that it is possible to concentrate, as well as to direct, the radiations from a transmitting station ; in other words, to get considerably more power with no increase in the energy used in sending the signals.

Combined with the extra power obtained through the use of continuous oscillations, the direction and partial concentration of the radiations should soon admit of direct relay work through a rectifier, or the use with a high frequency relay—an apparatus recently perfected in Germany—of a Morse inking apparatus coupled direct to the aerial and

Technical Notes

MEASUREMENT OF WAVE-LENGTH.—In a communication discussing the measurement of wave-lengths in wireless telegraphy, which Mr. R. Jonaust contributes to the *Journal de Physique*, he points out that the period of an oscillating circuit may be calculated by Kelvin's formula when L and C are accurately known. In a wave-meter, where one of the constants is variable, it is necessary to be able to make high-frequency measurements of both L and C. Usually the inductance is fixed and the capacity variable. The necessity for measurements of the capacity may be obviated by measuring the potential at the condenser terminals by the current circulating in the circuit. If V be the p.d. and I the current, then : $V = I\sqrt{C\omega}$. For resonance $LC\omega^2 = 1$ and $\omega = V/LI$. An electrometer is used for obtaining V, whilst I is measured by a thermo-ammeter. The author shows that the equation holds for damped oscillations, using the equations established by Bjerknes. The value of the self-induction L is obtained by comparing it with a standard coil and using an Anderson bridge.

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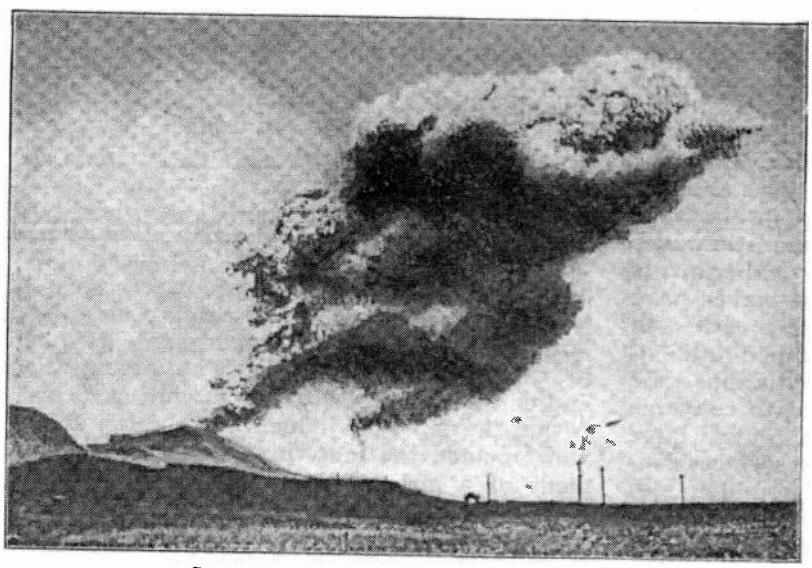
ELECTRICAL RESEARCH.—The Council of the Institution of Electrical Engineers have decided to take up the question of research, and have appointed a Research Committee, both to co-ordinate and to originate research in the electrical industry. The organisation and correlation of the research work carried on within the sphere of influence of the Institution will include the following : (1) The establishment of a general committee for research to which investigators will be invited to send particulars as to the subject and character of the researches they are undertaking. Members of the Institution, especially those connected with the manufacturing side of the industry, will also be invited to communicate to this committee any special difficulties they had encountered which called for investigation, and to make suggestions for subjects for research. The general committee will thus act as a species of " clearing house " for research topics, receiving suggestions from various sources and sending them on after consideration to the most suitable quarters. (2) The collection and publication of particulars of plant available for special testing and investigation work in the various laboratories, together with a list of the subjects in which researches have been carried out. (3) The compilation and publication of bibliographies of specific fields of research. The general Research Committee will have power to appoint sub-committees of experts

Volcanic Eruptions and their effect upon Wireless Telegraphy.

By A. G. McAdie

THREE volcanic eruptions have occurred since January, 1911, in districts bordering on the Pacific Ocean. These form the subject of a paper issued by the United States Weather Bureau at Washington, and from which excerpts may be given as showing the effect of these eruptions upon wireless telegraphy. One of these eruptions occurred at Mount Katmai, in the Alaskan peninsula, on June 6th, 1912, and is best described by an extract from the official report of Capt. K. W. Perry, commanding the revenue cutter "Manning":



Scene of a Volcano five minutes after Eruption.

About 4 p.m., June 6th, 1912, the "Manning" lay moored at the wharf at St. Paul (Kodiak), Kodiak Island. About 4 p.m. I observed a peculiar-looking cloud slowly rising to the southward and westward, and remarked to a friend that it looked like snow. Later, distant thunder was heard, and about 5 p.m. I noticed light particles of ashes falling. At 6 o'clock the ashes fell in considerable quantities, and gradually increased. The cloud-bank had spread past the zenith when I observed another bank to the northward, and the two met about 30° above the northern and eastern horizon. Thunder and lightning had become frequent at 7 o'clock, very intense at times, and though lacking two hours of sunset a black night had settled down. It was impossible owing to electrical conditions to use the wireless apparatus. . . . The 7th began with volcanic matter falling, which diminished and finally ceased at 9 a.m., when it was believed the eruption was over. All of this time no one knew where the eruption had occurred. All streams and wells had become choked, about 5 inches of ashes having fallen. At noon ashes began to fall again, and at 1.30 p.m. it was impossible to see over 50 feet. At 2 p.m. pitch darkness had settled in, heavy static disturbances were observed, and our wireless was dumb. The night was spent in anxious watching. The dawn of the 8th failed to appear. While all ashes of previous day had been removed, masts and yards were loaded, as were also the ship's boats. The ashes were now fine dust and flakes of yellowish colour. Sulphur fumes came at times. Avalanches of ashes on the neighbouring hills could be heard, and these sent forth clouds of suffocating dust and ashes. . . At 2.30 p.m. the fall of ashes decreased, the skies assumed a reddish colour, and distant objects became dimly visible. . . . At 5.30 p.m. the ship set off with two leads going, and at 5.55 we anchored in the outer harbour, having secured a bearing on Woody Island that practically assured us a safe passage to the sea, even though darkness again set in. The night of the 8th was spent in suspense, but as the morning of the 9th dawned the fall of ashes ceased, and it was felt the eruption was over.

Another description of the eruption is given by Mr. O. W. Carlson, travelling in the s.s. "Dora" from Unger to Kodiak:

The vessel was going north-east, and on evening of June 5th put in at Cold Bay,

25 miles from the volcano. The following afternoon at 1 o'clock, as the ship was passing through Karluk Straits to reach the town of Kodiak, the wireless operator reported hearing a loud thundering through his instrument. The concussions were so loud that the operator refused to remain at the instrument. The ship was then about 75 miles from the volcano. A few minutes after the operator gave the alarm, passengers heard thundering, followed by an electrical storm with brilliant lightning flashes. From the volcano burst a sheet of flame several hundred feet high. Dense clouds of smoke and ashes poured forth, and three hours later, at 4 o'clock, a pall of almost impenetrable darkness enveloped the mountain and surrounding country. By 5 o'clock it had reached out to sea, and the "Dora" was forced to abandon landing at Kodiak, nothing being visible even on the horizon toward the east, except a thin streak of light which disappeared a few minutes later. When we first sighted the flames shooting up from the crater the day was perfectly clear, but almost immediately after the first eruption the air became laden with fine volcanic ash, which enveloped everything and penetrated to all parts of the ship. When darkness came, flashes of lightning followed one another in quick succession throughout the night. About dawn a reddish tinge shown on the horizon, and a little later it became yellowish. At 10 o'clock on the morning of June 7th we got out of the haze and sighted Barren Island. We could still see smoke issuing in an uninterrupted stream from the mouth of the crater, but a west wind followed by a north-westerly breeze carried the cloud away from us. That day we visited the ports of Saldovia and Homer in Cook's Inlet, and on the morning of the 8th anchored off Port Chatham. We were then about 90 miles from Mount Katmai, but we headed into a rain of dust that covered the ship from stem to stern. The dust from the first eruption was white and coarse, but that we encountered was yellowish and as fine as talcum powder. None of us suffered any ill effects from dust or smoke.

Through the courtesy of Lieut. Reed M. Fawell, U.S.N., Acting Radio Officer, and Mr. L. Malarin, Marine Superintendent of the Marconi Wireless Telegraph Company, reports have been obtained from various radiotelegraph stations in the vicinity and south as far as San Diego. The following report was made on June 26th by the electrician in charge of Kodiak, Alaska, radio station:

The first intimation of any disturbance was about 2 p.m., June 5th, when static became so heavy that no signals could be read, not even with the U.S. revenue cutter "Manning" alongside the dock in Kodiak, two miles away. At 5.15 p.m. ashes commenced falling from a westerly direction at both Kodiak and the ratio station on Wood Island. Streaks of lightning and heavy thunder commenced with the fall of ashes, and were continuous with them. At 6 p.m. the amount of falling ashes had increased so much that one could not see over 10 feet. The lightning made it dangerous and impossible to use the radio set. The lightning switch was cut in at 6.30 p.m., and a spark of about 2·5 inches was drawn in closing it.

The heavy fall of ashes continued, with lightning, until about 9 a.m., June 7th, when it became lighter. About 6 inches of ashes had fallen at that time. Ashes fell continually until about 8.30 p.m., June 8th, and stopped falling altogether about an hour later. The total fall of ashes was about 18 inches. Strong sulphur fumes were prevalent from the morning of the 11th to noon of the same date.

About 11 a.m., June 8th, the station was struck by lightning, and the building started burning at the same time in both the engine-room and the operating-room, and was completely burned to the ground in about an hour. It was not possible to save any equipment, stores, or personal effects in the building. The masts, coal shed and oil house were not injured. The motor dory was sunk by damp ashes on June 8th, but was recovered by the station personnel, cleaned out, put in condition, and is now all right.

The electrician in charge of the Cordova, Alaska, wireless station made the following report on June 10th:

June 6th, at about 4 p.m., the volcanoes Redoubt, Ilamnia and Kamnia, about 200 miles from this station, became violently active. The first intimation we had of such activity was at 5.30 p.m., when static of extreme intensity commenced coming in. No untoward change in barometer was observed, the pressures for the day being, at 4 a.m., 30·12; 8 a.m., 30·10; noon, 30·08; 4 p.m., 30·05; 8 p.m., 30·04; and at midnight, 30·00, being average good weather pressure. At 6 p.m. we were called on telephone and asked if we heard guns firing. No reports were heard here at that time, although they were heard at "Mile 19," a railroad station about 15 miles away.

At 7 p.m. explosions were first heard, sounding somewhat similar to a signal gun, coming at intervals of about five seconds, but varying in volume. The commander of

the survey boat "Taku" was notified, as it was first believed that some vessel was in distress. These reports were heard from 7 p.m., June 6th, until 10 p.m., June 8th.

Static conditions were such that it was impossible to keep our receiving instruments in service for 48 hours. Ashes fell all day and night of the 7th, being last noticed at noon of the 8th. As soon as it became possible to keep the receiver in adjustment, efforts were made to re-establish communication with the Kodiak station, or the cutter "Manning," which was at anchor there when the eruption commenced. We were unable to raise them, and as a report (somewhat exaggerated) had just been received by cable to the effect that the steamer "Dora," in attempting to approach Kodiak, was turned back while still 90 miles away by showers of rock, dense fall of ashes, and darkness due to smoke, great fears were felt for the safety of the people on Kodiak Island. . . . At 10 p.m., June 8th, the "Manning" was heard calling every station and ship in Alaskan waters. At 12.30 she sent broadcast, "The people of Kodiak are all O.K." Static here was very bad, and it was with difficulty we managed to read the "Manning." A close watch was kept for the Kodiak station and the "Manning" all day of the 9th, and they were called at hourly intervals, with no results. At 10 p.m. of the 9th the "Manning" once more started up, and, although we worked successfully with the steamship "Umatilla," fully 400 miles farther away and in line with the "Manning," we could not get "Manning."

The wireless telegraphic stations at San Diego and North Head reported intermittent static during the afternoon of June 6th, and other stations on the coast reported strong, continuous static. For several days after the 6th static was strong at practically all stations, and communication interfered with.

The Marconi operator at Nak-Nek, 50 miles south of Katmai, states

> that 4 inches of ashes fell at intervals for six days, and there were continuous earth tremors. The beach was lined with pumice-stone floating down the river. Static very heavy, considerable smoke and fire on one night. Muddy showers.

Mr. E. E. Sanders, at Nushagak, reports

> that on June 6th at 7 a.m. static very strong. Heard nothing of Katmai eruption until June 12th, when the air was clear. On Sunday, June 9th, at midnight, flames were seen to the south. This would not bring it in line with the Nak-Nek station. We believed at the time that there were two volcanoes. Intermittent earthquakes occurred from June 6th to June 10th, with the most pronounced occurring on June 8th at 9.32 a.m., our time, lasting 15 seconds. The flames we saw resembled a burning mattress floating up, then to the eastward, then dropping out of sight. Two light showers of ashes occurred, one on June 7th, and the other on June 9th, the latter the heavier. The static charges resembled the roaring of a train with sharp cracks at intervals.

No earthquake or dislocation along a fault line can now occur without being detected by seismographs in various parts of the world. Moreover, no volcanic eruption of marked intensity can now occur without affecting barographs within a radial distance of several hundred miles. And, finally, no great eruption can occur, with its development of atmospheric electricity, without a corresponding electro-magnetic wave disturbance in the ether, shown in the form of static interference on wireless receivers, and more or less pronounced interruption of communication by wireless telegraphy. The time is not far distant when by means of these various records it will be possible for the meteorologist to determine the velocity of propagation of volcanic ash, the detonation or sound waves, the pressure or impact waves, and the duration of thunderstorms and tornadic or whirlwind effects. It will also be possible to account for tidal waves, and, by means of barograph records, time the arrival of marine disturbances of this nature.

It may be pointed out that in the case of vessels equipped with wireless, cruising in the vicinity of volcanoes, the interval between the beginning of static and the hearing of the explosion will give the distance of the volcano. The wireless phenomena are practically instantaneous, whereas the sound waves may be approximately given as travelling at the rate of 343 metres per second (1,120 feet), 12·8 miles per minute, and roughly 772 miles per hour.

The coast station at Vittoria (Sicily), till now exclusively destined to military wireless communications, has been opened to public service. This station will perform day duty, limited to the working hours of the other Italian North African stations, but the public service may be interrupted if military exigencies require it.

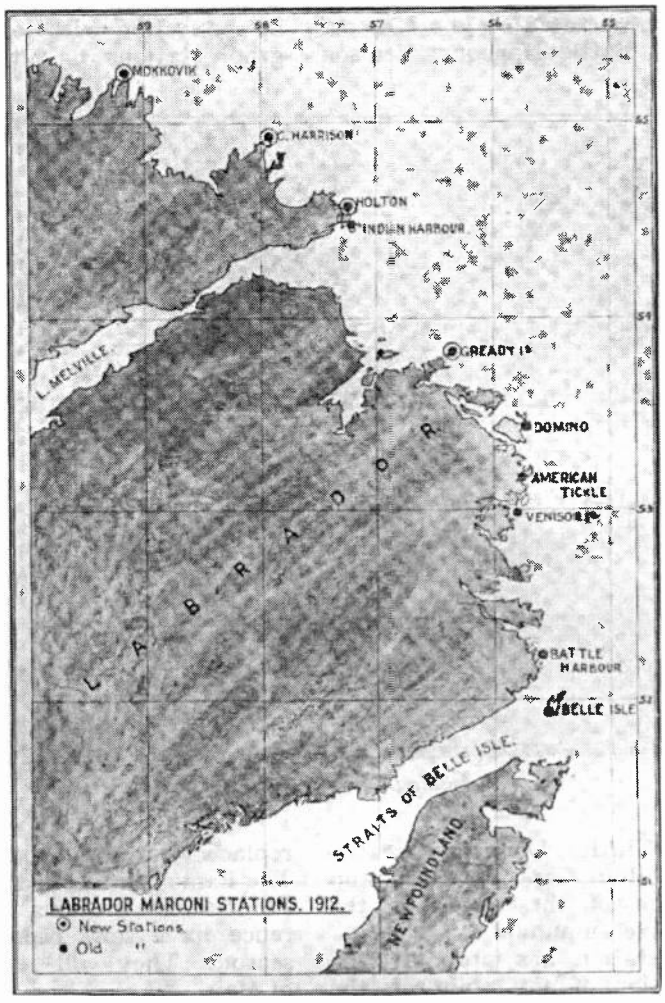
The position of that station is as follows: latitude, 36° 56′ 50″; longitude, 14°. 31′ 25″ East Greenwich.

The call letters are I C V.

Wireless on the Labrador Coast

NEWFOUNDLAND can lay claim to a further distinction besides that of being the "senior colony" of Great Britain, for it was on that island that Mr. Marconi received the first wireless signals sent across the Atlantic from England. How an astonished world received the news of this achievement with a large measure of incredulity is now to be recorded among those chapters of history which reveal the frailty of human judgment upon contemporary events. Nevertheless, the conquest of the Atlantic was an accomplished fact, and the great commercial Transatlantic wireless telegraph service which has developed from that beginning is to-day a tribute to the only system of wireless telegraphy which has made possible continuous long-distance commercial working.

These facts lend additional interest to the important agreement which the Canadian Marconi Company have concluded with the Newfoundland Government, and under which the company has been granted exclusive rights for wireless telegraph stations until the year 1926. It is as long ago as 1903 that the first agreement was made under which the parent Marconi Company erected five stations for the Colonial Government. Unexpected difficulties were encountered in the working of these stations, largely owing to the impossibility of obtaining the services of trained operators in the colony. Two years later the Government passed an Act providing that a tax of $4,000 per annum should be levied upon each wireless telegraph station in Newfoundland working on a commercial basis with places or ships outside the colony of Newfoundland. This decision affected the stations of the Canadian Company at Cape Race, Cape Ray and other points in Newfoundland. These stations were then, as they are now, a most important aid to navigation in dangerous waters, and any regulations tending to restrict their sphere of usefulness would undoubtedly be a serious matter.



Stations on the Labrador Coast.

However, in the following year a new agreement was entered into under which the Canadian Company undertook to operate all the Labrador stations during the fishing season of each year, the Government to pay the company an annual royalty, and the revenue accruing from this traffic to go to the latter, who further agreed to forward all traffic over the Newfoundland Government Postal Telegraph System.

The success of this arrangement prompted the Government to propose an extension of the system on the Labrador by two or more stations—the Marconi Company to erect and operate these stations on the terms provided in the agreement. In the summer of 1910 stations were accordingly erected by the Marconi Company at Cape Harrison and Mokkovik. In 1911 it was agreed to establish a station between Indian Harbour and Cape

Harrison to complete the chain on the Labrador.

After further negotiations, an important agreement was executed in December, 1912, which covers the following points: The old agreement terminating in 1916 is extended for a further period of ten years, terminating in 1926; all other undertakings entered into in the earlier agreement will be continued until 1926; the Marconi Company to erect and operate a station at Fogo, on the East Coast of Newfoundland—this station to be the property of the Marconi Company, and to be exempt from the Government tax of $4,000 during the term of the agreement.

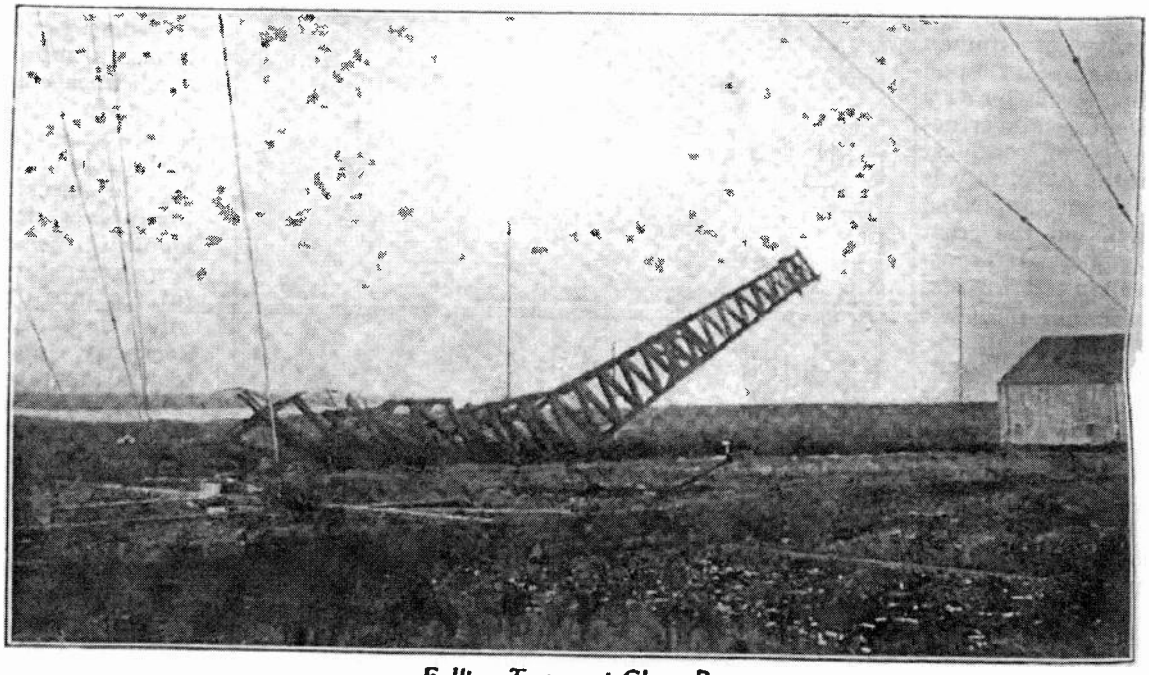
The stations to be operated by the Marconi Company are now: Battle Harbour, Venison Island, American Tickle, Domino, Gready, Indian Harbour, Holton, Cape Harrison and Mokkovik. For each of these stations the company are to receive an annual royalty.

The Cape Race station has probably the finest strategic position of any point on the Atlantic coast of America. A high-power station here would be able to maintain regular communication with steamers practically in mid-Atlantic or within five to six hundred miles off the Irish coast. This would be of inestimable value, and it is therefore obvious that the enlargement and improvement of Cape Race station to enable it to perform these services is a matter that must receive early attention.

The Labrador coast has proved to be one of the most difficult localities for effecting wireless telegraph communication. The rock is very old and exceedingly hard, and being of very high electrical resistance it makes a bad "earth" for wireless telegraphy.

Canadian Notes

Good progress is being made with the work on hand at Glace Bay, and the duplex station was completed and ready for work during January. Great changes have been made at the old Glace Bay station. The lattice-work towers, which have become almost historical in connection with long-distance wireless telegraph stations, have now been demolished and replaced by more modern steel tubular masts. The Fame Point, Heath Point, Harrington, and Point Riche stations in the Gulf of St. Lawrence have now been closed for the winter season. They will re-open about the middle of May.



Falling Towers at Glace Bay.

* * *

It is probable that the erection of stations at Port Stanley, Toronto, and Kingston, on the Great Lakes, will be commenced about the middle of April.

* * *

In December last the s.s. "Easton," plying between Duluth, Minn., and Port Arthur, Ont., ran on a reef near Victoria Island, about

fifty miles from Port Arthur. She was fitted with wireless apparatus, and was immediately in communication with the Marconi station at Port Arthur, with which station she remained n constant communication until her release on the following evening. What the fate of the vessel might have been in the absence of wireless telegraphy it is not difficult to surmise. Lake Superior in the month of December is invariably exceedingly stormy, and had the "Easton" been unable to summon immediate assistance the vessel would probably have been a total loss, and the passengers and crew drowned.

* * *

The report of the Department of the Naval Service of Canada for the fiscal year ended March 31st, 1912, is issued from Ottawa. The publication, which contains a number of illustrations and maps, devotes a special section to wireless telegraphy; one chapter, headed "Shipping Disasters and the Wireless Services," affording particularly interesting reading. Special mention is made of the mishap to the steamer "Tees." This vessel lost her propeller while at the head of Kyuquoit Sound, on the west coast of Vancouver Island. She sent out wireless distress signals, but owing to the fact that she was entirely surrounded by mountains of the order of 7,000 feet she was unable to establish communication with any station.

The peculiar condition of the ether at night time, however, assisted her, and although she was unable to get an answer to her calls, they were heard by the steamer "Northwestern," away up in Alaska, and by her the news was relayed down to Victoria. At the same time the Government station at Estevan received a piece of the message from the "Tees" saying she was in Kyuquoit Sound. Nothing more was received from the "Tees" until assistance arrived at the scene of the accident five days later.

One of the first vessels on the Pacific coast to instal wireless was the "City of Quebla." On December 17th, 1911, this vessel, while on her way from Seattle to Vancouver, blew out a cylinder head, disabling the ship and severely scalding the chief engineer. Wireless messages were sent from the vessel, and responses were received from the stations at Victoria and Point Grey. It is worthy of note that these two stations, the only ones to respond, maintained a 24-hour watch.

Among interesting instances in which wireless proved of value on the Atlantic seaboard mention is made of the disablement of the British steamer "Berwindmoor." Great difficulty was experienced by the Sable Island station in communicating with this vessel, owing possibly to the fact that no regular wireless telegraph operator was employed on the "Berwindmoor," the wireless being attended to by one of the navigating officers. The "Berwindmoor" was towed into Halifax. During the time she was disabled the owners and the public were kept constantly advised with regard to her condition and the progress she was making.

* * *

Mr. J. Herbert Lauer, the manager of the Marconi Wireless Telegraph Co., Ltd., of Canada, has been interviewed by a representative of the *Montreal Gazette* on the question of the regulation of wireless telegraphy in Canada. Our readers will remember that legislation has been proposed, and the attitude of the Marconi Company towards Mr. Hazen's Act may be summed up in the words of Mr. Lauer:

"We consider the proposed legislation to be a step in the right direction, especially with regard to the control and supervision of any private wireless stations."

Mr. Lauer is of opinion that rigorous enforcement of the clauses imposing penalties on unlicensed amateur stations would have the effect of weeding out undesirable interference with and obstruction of legitimate messages.

In making a comparison of the American Act and the proposed Canadian Act, Mr. Lauer noted that the main point of difference in the two measures appeared at first glance to be that the American Act required two operators on all passenger steamers, whether ocean-going or on the great lakes (coming under Class A) to maintain a constant skilled watch; with modification under Class B. That in the case of cargo steamers with crews of fifty or more, the second of the two operators might be a member of the crew certified as competent to receive distress calls, thus maintaining a constant receiving watch with only a limited transmitting service. The Canadian Bill, however, as drawn up, requires "a person" fully qualified to take charge of and operate the wireless apparatus. A third class is also constituted under the American Act, which embraces classification of vessels voluntarily equipped with wireless apparatus.

Mr. Lauer expressed the opinion that the requirement of the proposed Act of one operator only for the present was commendable, as owing to the difficulty of suddenly obtaining a large accession of skilled operators, heavier demands would make it impossible to supply the number required, such operators not being available at short notice. From the point of view of the shipping companies it was also a wise provision not to make too heavy a call for operators.

Wireless Telegraphy in Tropical Countries

Brazil Adopts Marconi System

THE Brazilian Government has concluded an important contract with Marconi's Wireless Telegraph Company for the provision of powerful stations at Rio de Janeiro, Santa Martha, Bauru, and Ladario, the two last-named being important towns in the Sao Paulo and Matto Grosso regions.

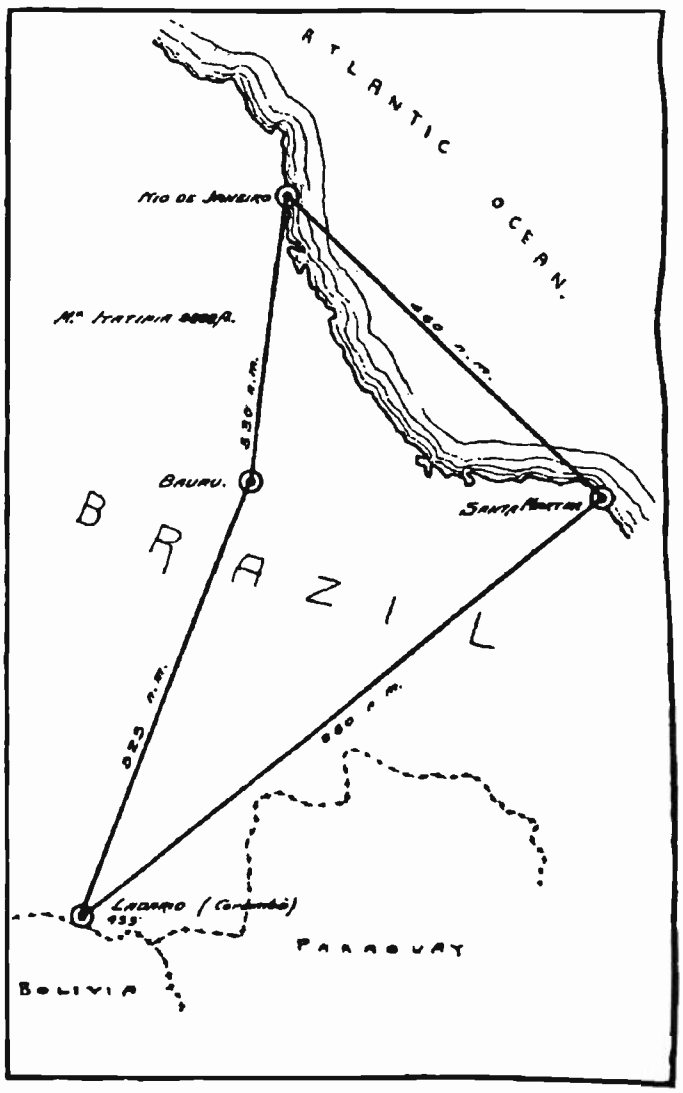
Dr. F. Bhering.

These stations will form the southern nucleus of the Brazilian internal wireless network, first proposed by Dr. Francisco Bhering in the course of a lecture before the Engineering Club at Rio de Janeiro on April 2nd, 1912. This lecture was a masterpiece of concise reasoning and lucid exposition of a comprehensive scheme which provides in all for not less than thirty wireless stations, and makes ample provision for considerations of frontier defence, control of the interior provinces, and safeguarding of navigation on the rivers and around the Brazilian coasts. Dr. Bhering referred with approval to some words addressed by the director of Bolivian Telegraphs to his Government in a report dated 1910, in which the fact was emphasised that "wireless telegraphy was a powerful element of national development and the defence of extensive frontiers, and it would put the Government into immediate communication with other Governments in Europe and North America. No sacrifice should be spared to enable the country to realise these facts, which would confer incalculable benefits upon Bolivia."

The scheme adopted by the Bolivian Government for the construction of Marconi stations was fully described in the September, 1912, MARCONIGRAPH.

As to the Brazilian scheme, Dr. Bhering is satisfied that it is urgent, and that it would be extremely useful. Numerous possibilities of communication are provided for. The proposed new medium-power stations are distributed practically over the whole of Brazil, and are so situated in respect to each other that the average working range of each of them would be about 450 miles. The existing stations at S. Luis de Caceres and Bahia will be enlarged, the former so that it may serve to communicate *viâ* Pimenta, Bueno, with the Acre district, and *viâ* Goyaz with Rio and the coast.

The Marconi Company's success in obtaining



the contract for the four stations now to be erected in the south is the result of the very satisfactory working of the Manaos and Porto Velho stations, which form the northern nucleus of the general scheme. These stations are situated in the tropics on the Amazon River, where severe electrical storms are almost continuous.

Attempts to link up certain parts of the Amazon district by means of ordinary telegraphic lines have all been more or less unsuccessful. Apart from the impossibility of making a profit, and the endless capital expenditure which such arrangements would require, there is further the great difficulty of maintaining ordinary telegraph lines in the extensive uninhabited stretches of woodland, while the transport of materials to build the line in the first place would give rise to numerous complications, owing to the impassability of the roads and the necessity of crossing rivers, swamps, and mountains. Erecting telegraph lines direct through the woods without clearing them would be impossible on account of the difficulties of transporting the necessary materials, and the danger of heavy earths owing to contact with leaves and boughs. Further, in order to prevent severe breakdowns through falling trees, it would be necessary to clear a road to a width of at least 50 mètres on each side of the lines. The vegetation in the Amazon district is so exuberant that, in spite of this precaution, repeated clearing of the twining plants, liana, and shrubs would be necessary every six months, while birds' nests would have to be removed from the wires at frequent intervals.

For these reasons, and because daily inspection would be necessary, especially in the rainy season, when floods and earth movements give rise to constant trouble, the laying of a road or path would be absolutely necessary. The necessity of maintenance and installation troubles would also demand the presence of intermediate stations for the housing of the maintenance staff. Moreover, the difficulties and uncertainty of the work would considerably increase with the length of line, for the further it extended from civilisation, and the nearer it got to trackless and sparsely inhabited districts, the greater would be its difficulty.

Bearing these considerations in mind, it is obvious that only one system of communication is possible in Brazil, and that system is wireless telegraphy. The Brazilian Government have taken the first step in a very large and comprehensive scheme, the progress of which will be watched with interest all the world over.

Call Letters

THE BUREAU INTERNATIONAL DE L'UNION TELEGRAPHIQUE OF BERNE allots to the various nations who are parties to the International Radio-telegraphic Convention combinations of "call" letters which are in turn allotted to ship and land stations. In consequence of the enormous growth of wireless telegraphy, the necessity has arisen for a revision of the list of call letters allotted to signatories of the Convention, and at present the countries named below have had reserved for their exclusive use the letters which are given against their names:

Great Britain.—All combinations commencing with B, G and M.

Colonies of Great Britain.—Combinations CAA to CMZ.

Greece.—Combinations SVA to SZZ.

Germany.—All combinations of letters commencing with A and D, as well as the combinations KAA to KCZ.

U.S.A.—All combinations of letters commencing with N and W, as well as the combinations KIA to KZZ.

Austro-Hungary and Bosnia-Herzgovina.—All combinations of letters commencing with OAA to OMZ, as well as UNA to UZZ.

Belgium.—Combinations ONA to OTZ.

Brazil.—Combinations EPA to EZZ.

Bulgaria.—Combinations SRA to SRZ.

Chili.—Combinations COA to CPZ.

Denmark.—Combinations OUA to OZZ.

Egypt.—Combinations SUA to SUZ.

Spain.—Combinations EAA to EGZ.

France.—All combinations of letters commencing with F, as well as the combinations UAA to UMZ.

Italy.—All combinations commencing with I.

Japan.—All combinations commencing with J.

Morocco.—Combinations CNA to CNZ.

Mexico.—Combinations XAA to XCZ.

Monaco.—Combinations CQA to CQZ.

Norway.—Combinations LAA to LHZ.

Flanders.—Combinations PAA to PMZ.

Portugal.—Combinations CRA to CTZ.

Roumania.—Combinations CVA to CVZ.

Russia.—All combinations commencing with R.

Sweden.—Combinations SAA to SMZ.

Turkey.—Combinations TAA to TMZ.

Uruguay.—Combinations CWA to CWZ.

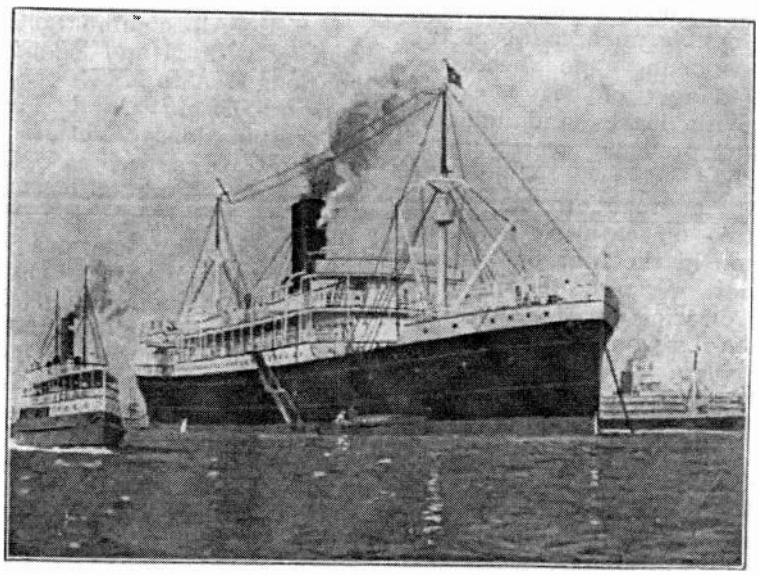
There remain, however, the following letters still to be disposed of amongst the remaining countries:

CUA to CUZ, CXA to CZZ, EHA to EOZ, HAA to HZZ, KDA to KHZ, LIA to LZZ, PNA to PZZ, SNA to SQZ, SSA to STZ, TNA to TZZ, VAA to VZZ, XDA to XZZ, YAA to YZZ, ZAA to ZZZ.

Wireless Telegraphy for Marine Intercommunication

A Standard 1½ k.w. Ship Set.

IT was Heine who once referred to Dr. Samuel Johnson as a barrel of British prejudices, and not even the most ardent admirers of the famous lexicographer will gainsay a large measure of truth in the remark of the brilliant satirist. One of Johnson's prejudices concerned the sea; he heartily disliked travelling by sea. "No man will be a sailor," he once remarked, "who has contrivance enough to get himself into a gaol; for being in a ship is being in gaol with a chance of being drowned." During the two days which he and his familiar spent together at Harwich, from which place Boswell was to sail for the Continent, they chanced to enter a church, and Johnson was moved to say, "Now that you are going to leave your native country, recommend yourself to the protection of your Creator and Redeemer." Probably, had the learned doctor lived in these times, he would have overcome to a great extent his fear of the sea; and there is no doubt that wireless telegraphy would have played no small part in reconciling his troubled mind to the safety and comfort of an overseas voyage.



The s.s. "Christopher," of the Booth Line.

Wireless telegraphy is now regarded as an essential part of the equipment of ocean-going passenger vessels, and, to a rapidly increasing extent, of cargo vessels and smaller craft. It has reached its present position partly through the sensational evidence of its value to ships in distress, but mainly through the experience gained regarding the general usefulness of an extended means of marine communication.

In the professional circles of the mercantile marine great importance is attached to the fact that wireless telegraphy has destroyed the isolation of ships at sea. Apart from the anxieties thus relieved and the risks of loss and delay thus diminished, there are many economies, in connection with embarkation and disembarkation, which may be arranged now that it is possible to send messages to ships at almost any point of their course. These features do not require labouring, however, for the fact that the list of vessels fitted with wireless rapidly increases—and ample proof of this is to be found in the list of ships fitted with Marconi apparatus which appears each month in these pages—shows that wireless telegraphy has attained an assured position among shipowners, underwriters, and the travelling public.

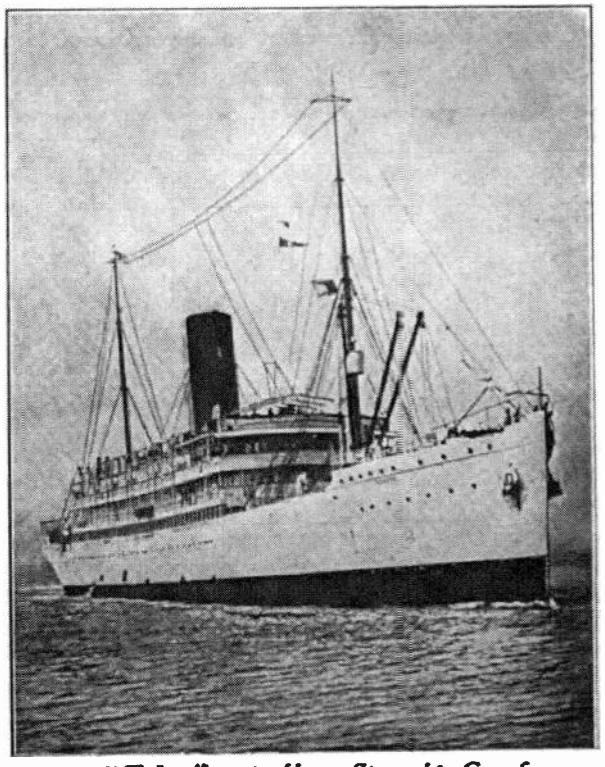
The development of regular communication between an increasing number of moving stations has necessitated not only a carefully devised organisation, but a uniform method of working. This, in turn, has necessitated a practical standardisation of apparatus. At the same time, the demand for absolute reliability in the hands of ordinary operators has led to the evolution of a type of apparatus which is free from complications and is constructed to work continuously without derangement. Most of the working parts are contained in solid boxes, which protect them from damage and limit the responsibilities of the operator to superficial adjustments and the ordinary business of receiving and transmitting messages.

The advance in electrical design has been accompanied by a close attention to mechanical detail, with the result that failure on the part of the apparatus itself is practically unknown.

These points will emerge more clearly from the following detailed description of the standard 1½-kw. Marconi set installed on ships. The everyday transmitting range of these sets varies according to the height, length and shape of the aerial, these factors being determined in turn by the dimensions of the ship. When employed with an aerial having a mean height of 100 feet, the installation is capable of working over a range of 200 nautical miles over water, the maximum range considerably exceeding this figure; while the night range may be anything from two to three times the day range according to the conditions of the atmosphere. The 1½-kw. installation is arranged to tune in transmission to waves of 300, 450, and 600 metres, and to tune in reception to all waves between 100 and 2,500 metres.

Electric current is obtained from the ship's mains, and led to a converter which supplies alternating current to the main terminals of a switchboard. The low-frequency transmitting circuits consist of an adjustable inductance, the coils of a magnetic relay key, and the primary of a potential transformer connected in series and then to the two-line terminals of the switchboard. This circuit is opened and closed by the main switch, and operated by a Morse key actuating electrically the relay key.

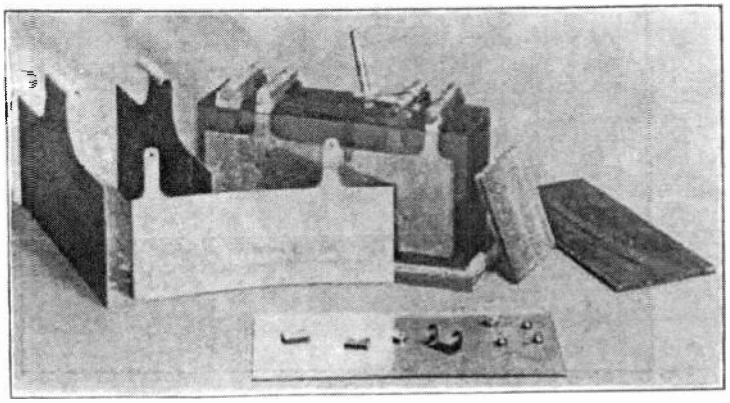
The secondary of the potential transformer connects at the discharger through two air core protecting chokes with the primary high-frequency circuit. The transmitting condenser is connected to one side of the discharger and primary high-frequency tuning inductance to the other side. Between them is connected the primary of an oscillation transformer or transmitting jigger. The secondary of this transformer is connected at one end to the aerial and at the other to the top plate of a spark-gap, the bottom plate being "earthed" by connection with the iron shell of the ship. A tuning lamp and choke are put in shunt with a short length of the wire connecting the jigger secondary to the spark-gap. The transmitting set is completed by an aerial tuning condenser, which is used only when it is necessary to decrease the natural period of the aerial circuit in the transmission of the 300-metre wave.



s.s. "Tahiti," o the Union Steamship Co. of New Zealand.

The connection of the receiving apparatus with the aerial circuit is made at the top plate of the spark-gap. From here a lead is taken to the aerial terminal of the tuner, the earth terminal of the tuner being connected to the bottom plate of the sparkgap. The primary terminals of the magnetic detector are connected to the tuner, and the secondary terminals to a telephone and shunting telephone condenser.

It is worthy of note that recent legislation on the subject of wireless telegraphy in the United States and elsewhere insists upon the provision of emergency apparatus guaranteed to work for a certain length of time in case of breakdown or failure of the power plant from which the



Independent Glass Plate Condenser Parts.

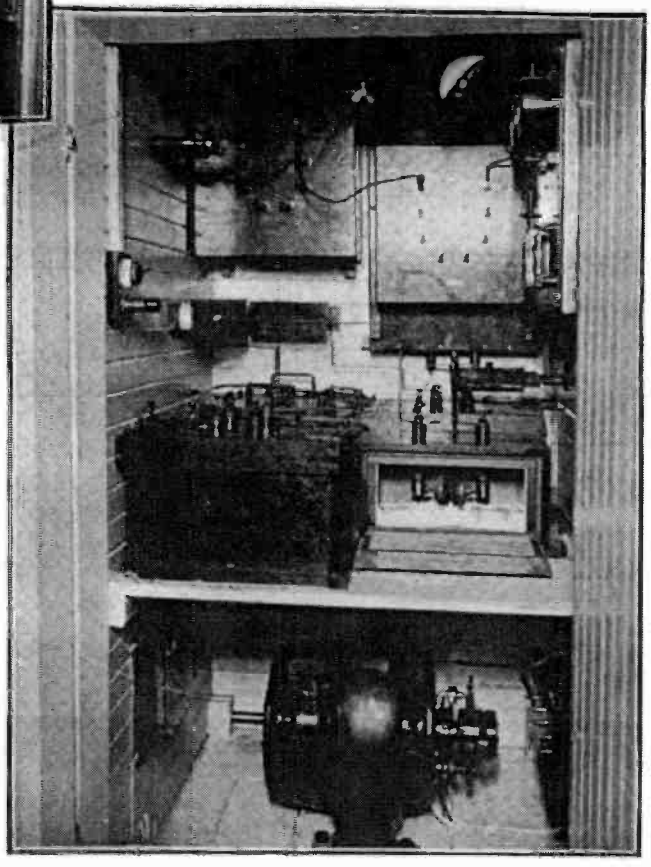
A Marconi Officer receiving Messages in the "Wireless" Cabin on board ship.

wireless apparatus receives its electrical energy. In point of fact, this is merely confirming the practice of the Marconi Company, who have always provided emergency apparatus. In this a battery of accumulators, charged by the ship's dynamo, provides current to work an induction coil. A separate key is used for operating; or, in the cases where a special change-over switch is provided, one key is used for operating both circuits.

A full description of the details of the apparatus would occupy too much space, but the following particulars include the salient points about the more important parts of the transmitter.

The spark discharger consists of a pair of mushroom-shaped electrodes, which are of cast-iron, are mounted one each at the adjacent ends of ebonite insulated brass rods, and are placed in a teak silence box 1½ inch thick. The brass rods, with their ebonite insulation, project through the top of the box. Quicklime is placed in a removable zinc tray to absorb the acid produced by the spark. The gap between the electrodes is adjusted by turning the electrodes on their threaded brass supports. A protective point spark gap is mounted on the same pillar below the ordinary discharger. This is generally set for a fixed gap designed to protect the condensers and other parts of the transmitting circuits from the injurious effects of excessive voltage.

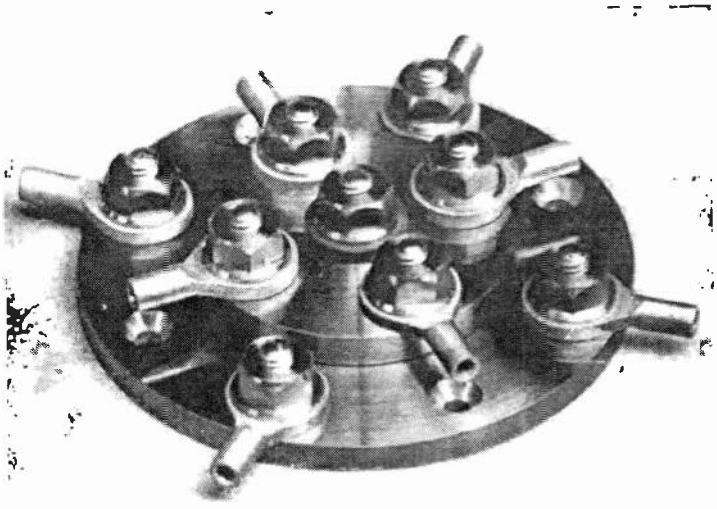
The half-plate condenser is in two parts, each with 36 glass plates interspaced with 35 sheets of zinc. Thirty-four (in each part) of the plates are active, the remainder being guard plates. They have a thickness of one-tenth inch, and are tested individually to 27,000 volts. The container is filled with high-flash insulating oil. The capacity of these condensers is 0·065 microfarad, and they are arranged in groups so that they can be connected either in series ro parallel. The primary and secondary windings are provided respectively by



The Transmitting Apparatus in a Silence Cabin.

two coils of heavily insulated wire, the former of one turn and the latter of seven turns. It is at this point that the wave-generating and wave-radiating circuits are coupled together.

The earth arrester terminal consists of two round brass plates separated generally to about 0·01 inch by discs of mica. The wires to the ship's earth connect with the bottom plate. The top plate is connected to the earth of the oscillation transformer and the aerial terminal of the tuner.

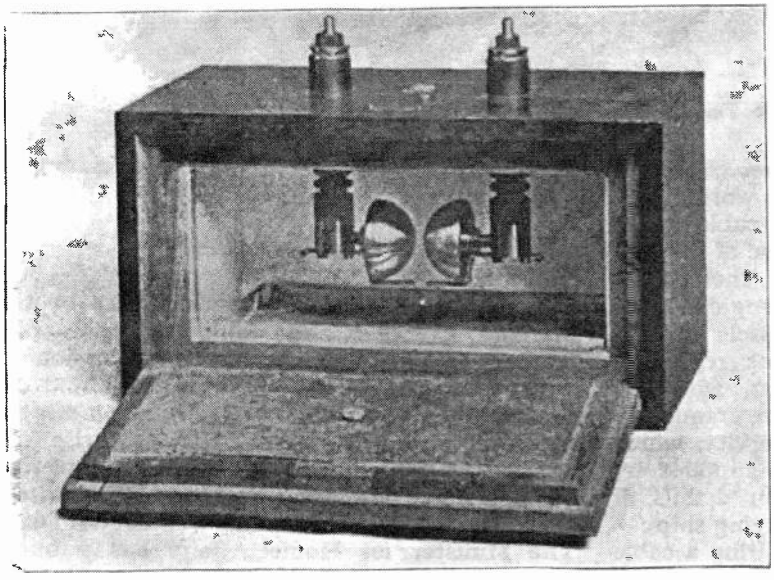


Earth Arrester Terminal.

A means of tuning to the incoming signals of one given wave-length, and eliminating the signals of all other wave-lengths, is provided by three inductively coupled adjustable circuits, the first connected to the aerial and the third to the magnetic detector. The full range of 100 to 2,500 metres is obtained in four steps by a triple four-way switch, which simultaneously alters the amount of fixed inductance and capacity in each circuit. Accurate tuning is obtained by an adjustable tuning inductance and variable condenser in all circuits. Injury to the instrument when transmitting is prevented by a micrometer spark-gap, which automatically shunts the aerial terminal to earth.

The magnetic detector in actual use consists of a soft iron wire slowly revolving by means of clockwork around two horizontal pulleys and exposed to the action of two permanent magnets, which magnetise the wire to the critical point. A coil placed in the receiving circuit surrounds the wire at the point where it is under the influence of the magnets, and there is a second concentric coil placed in a telephone circuit. When a high frequency current passes through the first coil it breaks down the hysteresis of the iron wire, which alters the magnetisation. Thus a change in the magnetic lines cutting the second coil is produced, and hence a current is generated in it, causing a sound in the telephone.

The special manner in which the manipulating key is connected places the two front contacts in parallel with the magnetic key contacts, and provides in the side lever key a ready means at the hand of the operator for breaking the primary circuit in an emergency. There are four primary terminals—one of them is not used on this set, the other three have their connections marked on the base. There are in addition two other terminals, which connect to the telephone terminals of the magnetic detector.

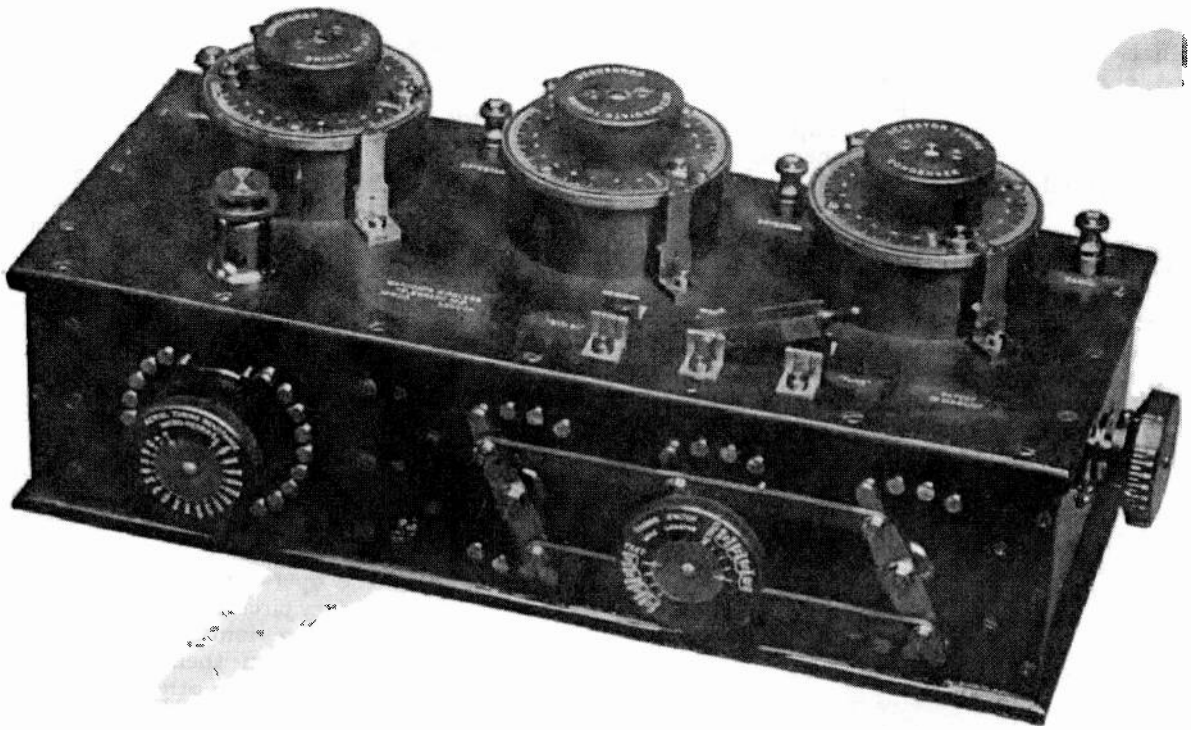


Spark Discharger In Box.

The single magnetic key will allow the current to be broken at or near zero only, and so decreases the sparking at the manipulating key and increases the speed of operating. Two coils of wire are wound on two boxwood bobbins. These are mounted in parallel on two slotted iron cores fixed to a yoke in the base. A slotted armature is mounted above these cores on a brass arm which carries a contact, and is fixed at one end by means of an adjustable

stiff spring; the other end bears against an upper stop. When the manipulating key is down the main current flows through the coils of the magnetic key, the armature is attracted, the top and bottom contacts meet and parallel the manipulating key contacts. When the manipulating key is up the magnetic key armature is not released, and the contacts will not break apart until the current approaches its minimum value.

It is practically impossible to give any idea of the extent to which wireless transmission is in operation, not only on passenger vessels, but in the case of cargo boats, cable-laying vessels, lightships, private yachts, and other classes of vessel apart from the navies of the world.



Marconi Multiple Tuner. For adjusting to various wave lengths.

The conditions under which cable-laying vessels have to work make the value of wireless telegraphy very conspicuous in their case. Repairs have to be carried out at long distances from shore, and, as a rule, the vessels have to return to port before instructions regarding subsequent work can reach them, with the result that expensive delays are frequently incurred. An example of the service which wireless telegraphy may render is supplied by the following extract (modified in details of wording) from the log of a cable-laying ship:

"On one occasion we were repairing a cable some 180 miles from the west coast of England, and required further information about electrical tests from the shore. A message was sent and received by another steamer equipped with a Marconi wireless installation and relayed by her on to England, the result being that in less than an hour we had a reply from London giving the desired information, and enabling the vessel to proceed with her cable-laying operations without delay.

"Considering that the inquiry was relayed, and necessitated a careful answer from headquarters, also relayed, the time occupied was remarkably short. On another occasion, when the vessel was on her way home from the completion of a repair off Ireland, a wireless message was received ordering her to the coast of France for another repair, thus saving a useless voyage back to London."

Negotiations have been entered into by the Marconi Company and shipping companies trading to Australia for the transmission of weather messages between ships at sea and the Commonwealth Weather Bureau. The messages received from the vessels will comprise the position of the ship at the time of taking the observations, barometer readings, wind direction and force, state of the weather and sea. The Minister for Home Affairs has publicly acknowledged on behalf of the Commonwealth Government his appreciation of "this public-spirited act."

The Imperial Wireless Scheme

ON Monday, January 13th, Sir Albert Spicer, the Chairman of the Select Committee of the House of Commons inquiring into the contract by the Post Office with Marconi's Wireless Telegraph Company, announced that in the course of the inquiry the Committee had been much impressed with the ground of urgency—because it had been pointed out to them from the highest Imperial motives that there was great urgency in the present situation—and they had been impressed also with the difficulties connected with the technical side. The Committee felt that they were hardly competent to deal with the latter side of the question, and, in view of these two considerations, it was suggested that an interim report on those points should be considered. It was decided, however, to leave over the consideration of this report until the Committee had had the opportunity of discussing the matter with the Postmaster-General, and hearing his views thereon. Sir Albert Spicer then read the draft interim report, which, after some slight modifications, was published in the following form the next day :

The Interim Report

The Select Committee appointed to investigate the circumstances connected with the negotiation and completion of the agreement between Marconi's Wireless Telegraph Co., Ltd., Commendatore Guglielmo Marconi, and the Postmaster-General, with regard to the establishment of a chain of imperial wireless stations, and to report thereupon, and whether the agreement is desirable and should be approved : Have agreed to the following Special Report :

The Committee have heard a number of witnesses from the Government Departments, and have arrived at the conclusion that it is a matter of urgency that a chain of Imperial wireless stations should be established. They also think that, whatever system of wireless telegraphy is ultimately adopted, and whether or no the present agreement, with or without modification, is confirmed, the first six wireless stations should be situated in the countries or places mentioned in the second article of the agreement. They are of opinion that steps should be at once taken to secure sites for wireless stations large enough for a Marconi or any other installation in the countries or places mentioned.

They further think that, with respect to the construction and installation of such wireless stations, especially in view of what has been stated in the course of the present inquiry as to the developments that are said to have taken place in wireless telegraphy during the last few months, the Government must be free to adopt or reject any system from time to time.

Whatever decision may be come to by this Committee with regard to the particular contract under review, or the form of any alternative proposal that may be recommended, it will be necessary for this Committee to come to a conclusion as to the technical and scientific merits of the various systems of wireless telegraphy which are, in their opinion, capable of fulfilling the requirements of the Imperial wireless chain. Under these circumstances the Committee think it desirable to have before them the views of a highly qualified Committee containing eminent scientific experts, and presided over by a chairman of recognised judicial or administrative ability. It would be the duty of such a Committee to report on the merits of the existing systems of long-distance wireless telegraphy, and in particular as to their capacity for continuous communication over the distances required by the Imperial chain. To enable them to do so, they should be empowered to take all necessary steps, by actual tests or otherwise, to satisfy themselves on the above-mentioned points. In view of the urgency of the question, the Scientific Committee should be instructed to report to this Committee as soon as possible, and in any case within three months from the date of their appointment.

This Committee therefore recommend that :

(1) The Government take steps to secure sites for wireless stations in the countries or places mentioned in the second article of the agreement.

(2) The Government appoint a scientific Committee as indicated above.

The Postmaster-General's Speech

Mr. Herbert Samuel, who was present at the meeting that day, expressed his sense of obligation to the Committee for giving him an opportunity of stating his views, and for having communicated to him the terms of the draft report. With respect to the two points which the draft report raised, he said the Government

were very glad indeed that the Committee had sanctioned the immediate selection of sites for the stations, but he pointed out that the contract which was entered into contemplated that the contracting company should bear the whole of the risk of any failure of the working of the stations, and he did not think that any company could really be expected to undertake a guarantee of that character unless they had some voice in the selection of the sites. The choice of sites was a matter of considerable importance in the working of wireless telegraph stations, and the Government should not obviously place themselves in the position of enabling a contractor to say that, on account of the selection of sites and on account of some unsuitability in their location, or character of the soil, or other causes of the kind, the stations were not working satisfactorily, and that the fault was due to those who had selected the site. All that could be done, therefore, would be to secure options on suitable sites while arranging for the actual purchase after the company which might secure the contract, if there was a contract, had had the opportunity of expressing their opinion. A suitable site had already been secured on Crown land in England. With regard to Egypt, he would be glad at once to send out a commission, with the co-operation of the Admiralty, for the selection of a site there. It was not intended, he explained, to select the sites of all the stations in the various countries before taking adequate steps for the equipment of the first two. It would be a question of the system extending from Egypt to East Africa, and then probably to India and Singapore, but he would suggest that the subsequent inquiries should take a little longer time.

The Admiralty's Objection

With reference to the Committee's suggestion that the stations might be erected by the Admiralty, Mr. Samuel said that he had discussed the matter with a representative of the Admiralty, and gathered from him that the Department viewed the proposal that they should be charged with the duty of working these stations with even greater disfavour than they had a year ago. He had also received a letter from the Department in which the Commissioners of the Admiralty adhered to the view that it was not desirable for the Admiralty to undertake the work, and he thought the Committee were aware that the Post Office had neither the staff nor the experience to undertake the actual erection of the stations, and the direct conduct of so large an enterprise.

With reference to the urgency of the scheme, he remarked that there was a danger that the appointment of a technical committee might increase the delay. He gathered that it was the Committee's desire that such technical committee, if appointed, should report by the time that the Select Committee was ready to report to the House of Commons. A further consideration was that the experts would desire to proceed mainly by tests of actual systems. Very probably they would be more or less divided in opinion on technical points, and unless some limit of time was suggested, at any moment when it was desired to come to a decision they would probably find that some system or other claimed to be just at the point of proving itself. In fact, at any time during the next ten years at which a decision was desired it would probably be found that there was some inventor, or some syndicate, or some company which would come forward and say that if only they were given three months longer they would be able to demonstrate the superiority of their apparatus, either in whole or in part, to that of their rivals. Therefore if any Committee was appointed it should be asked to report by a certain fixed date.

Adequate Practical Tests

There might be a battle of experts in this technical committee which might be infinitely prolonged, and Mr. Samuel suggested to the Committee that the Government would not be justified in entering into any contract, and Parliament would not be justified in sanctioning any contract with any company whose system had not been submitted to adequate practical tests. It was not enough to have experiments in a laboratory or over short range, and he did not think that the State in a matter of this sort should speculate if there was any other course open to it. That had been his view from the beginning. He held that view very strongly still, and on behalf of the Government he urged upon the Committee that the Government ought not to act merely on predictions if there is any alternative and if there was a possibility of practical test.

The question resolved itself down to this : What systems were in a position to submit themselves to adequate test within a comparatively brief period ? Other systems which were not able to submit themselves to tests must necessarily be ruled out whether or not a technical committee was appointed, and whatever the theoretical merits of those things might be. He ventured to suggest that in the first instance, at all events, the Committee could ascertain for itself, or possibly the Government if the Committee preferred could ascertain for them, what systems were in a position of being able to present themselves for tests, and what was the nature of the tests

which they would be in a position to undergo within some such brief period. No experts could be in a position to decide for or against the contract simply on the ground that this or that system appeared to possess merits greater than any other system. For example, would it be in the interests of the State that the contract for these stations which were being erected primarily for strategical reasons should be placed in the hands of any foreign company which was in closest touch with a foreign Government, and which had equipped, let us say, the navy of that foreign Government? Consequently, could a contract be entered into if it embodied a condition that the Imperial wireless station should not communicate with stations of other systems in territories of other Powers? There was also the question as to whether a test made by a technical committee, if one were appointed, say, between California and Honolulu, would show the capacity of an English company to do the same work. The Government, he added in conclusion, attached importance to getting the stations soon—to having stations which could be relied upon to work day and night, and to having complete freedom.

Marconi Co.'s Letter

On Monday, January 20th, the following letter from the managing director of Marconi's Wireless Telegraph Company to the Postmaster-General was read:

"SIR,—*Re* contract of the 19th July, 1912, between the Post Office and Marconi's Wireless Telegraph Co., Ltd., and Mr. Guglielmo Marconi.

"When I submitted to your department the tender of the 7th March, my company contemplated that the Agreement would be drawn up forthwith, and that within a very few weeks it would have been submitted to Parliament and ratified. My company, as was absolutely necessary, accordingly proceeded at once to make arrangements to retain in England a very large, responsible, and experienced staff of engineers, and to prepare them to be in readiness to proceed to the different parts of the world to commence the construction of the stations.

"The complete and eventual signing of the Agreement, probably owing to the International Radiotelegraphic Conference, required more time than we had contemplated, but when finally it was signed on the 19th July last, my company were reasonably entitled to expect that it would have been forthwith submitted to Parliament for ratification.

"This course, however, was not followed, but a Select Committee was appointed. In view, however, of the circumstances which prevailed at that time, my company felt that some delay in the ratification of the Agreement was unavoidable. Over three months, however, have now elapsed since the decision of the House to appoint the Committee, and no less than 28 public sittings of that Committee have been held.

"Although many witnesses have been called, the Committee has had no evidence upon questions of long-distance commercial wireless telegraphy from those best qualified to speak with experience upon the subject. Moreover, much of the evidence which has been given, standing alone, and without any opportunity of refutation being afforded to my company, has resulted in erroneous statements, technical and otherwise, being reproduced in the Press of nearly every country in the world, to the serious detriment of my company.

"I gathered at the hearing of the Committee on Monday, 13th inst., that the Committee had prepared a draft interim report which would be immediately submitted to Parliament endorsing the urgent necessity for the construction of the Imperial stations at the earliest moment possible, and recommending the House of Commons to appoint a Technical Committee which should inquire as to which is the best system of wireless telegraphy to be adopted.

"If this question has once more to be considered, my company would welcome in principle the appointment of such a Committee provided proper facilities were afforded for testing the evidence to be called before it.

"It must, however, be borne in mind that even before the 7th March last negotiations with my company were very protracted, owing to the appointment of Committees, technical or otherwise, comprising representatives of the Admiralty, the War Office, and other of the Government Departments, which investigated and considered prior to the acceptance of my company's tender, whether there were any other systems which could be employed for the Imperial stations.

"My company regrets that the proposed Technical Committee was not appointed three months ago, if it was the intention of the House of Commons that the Select Committee should enter into a highly technical and scientific inquiry, as the necessity for such inquiry, if it existed, is not more apparent now than it was then. Already the staff of engineers retained and prepared by this company for the purpose of this contract have been kept idle for many months. The expense to which my company has been submitted in this direction alone is considerable, in addition to which the cost of material has risen substantially since the contract was entered into, and may rise further before any final decision is taken by Parliament.

"The delays which have thus occurred in the

ratification of the contract were not anticipated by either party to the contract, and it is, I submit, inequitable that my company should remain bound whilst investigations never contemplated should be continued over an indefinite period.

"In all these circumstances, and in order to continue to maintain the company's position here and abroad in an important industry developed in, and conducted from this country, employing over 2,000 British workers, our engineers must be released, and Mr. Marconi and I must be freed to attend to other important work.

"I therefore respectfully request that the Government will agree to the company's treating the contract as no longer binding upon other either party. This course is necessitated solely by the reason of the very serious expense and detriment to which my company is being subjected under the circumstances above explained. It is hardly necessary to say, however, that my company will be prepared, when the investigations are concluded, to devote its whole energy, experience, and staff to the construction of the Imperial stations on such terms as may be then agreed, if the Government should so desire.

"In the meantime, Mr. Marconi and the company's engineers await the opportunity of appearing before the proposed Technical Committee, as they still desire, and have offered to do, before the Select Committee.

"Mr. Marconi, who you will remember became a party to the Agreement of July 19th, at the express wish of your department, requests me to state that he endorses this letter in so far as it concerns him also personally.

"I am, etc.,

"(Signed) GODFREY ISAACS,

"*Managing Director.*"

* * *

QUESTION IN PARLIAMENT.—Mr. Grant asked the Postmaster-General in the House of Commons on January 23rd whether he had yet replied to the communication received from the Marconi Company intimating their desire to withdraw from the proposed agreement with the Government, and if so, what reply was made. Mr. Samuel pointed out that as the contract was under consideration by a Select Committee of the House, he thought it right to communicate the company's letter to that Committee in case they should desire to make any observations upon it. He had not yet received a reply from the Committee, and had therefore not answered the company beyond writing to inform them of the fact that he was sending their letter to the Select Committee. The right hon. gentleman was also asked if no answer would be given to the company until the Select Committee communicated with him, but Mr. Samuel declined to give a pledge to that effect. He said that he must answer the company before very long, and he hoped that the Committee would let him have their views within a short time. Any observations which the Committee might make would be taken into consideration by the Government when they made their reply.

* * *

THE TECHNICAL COMMITTEE.—IN accordance with the recommendation of the Select Committee of the House of Commons on the Marconi contract, the Postmaster-General has appointed a committee "to report on the merits of the existing systems of long-distance wireless telegraphy, and in particular as to their capacity for continuous communication over the distances required by the Imperial chain."

The committee will consist of:

MR. JUSTICE PARKER, Chairman.

MR. W. DUDDELL, F.R.S., President of the Institution of Electrical Engineers.

MR. R. T. GLAZEBROOK, C.B., F.R.S., Director of the National Physical Laboratory, Past-President of the Institution of Electrical Engineers.

SIR ALEXANDER KENNEDY, F.R.S., Past-President of the Institutions of Mechanical and of Civil Engineers.

MR. JAMES SWINBURNE, F.R.S., Past-President of the Institution of Electrical Engineers.

They have been requested, as desired by the Select Committee, in view of the urgency of the question, to report as soon as possible, and in any case within three months from the present date.

Official Intelligence

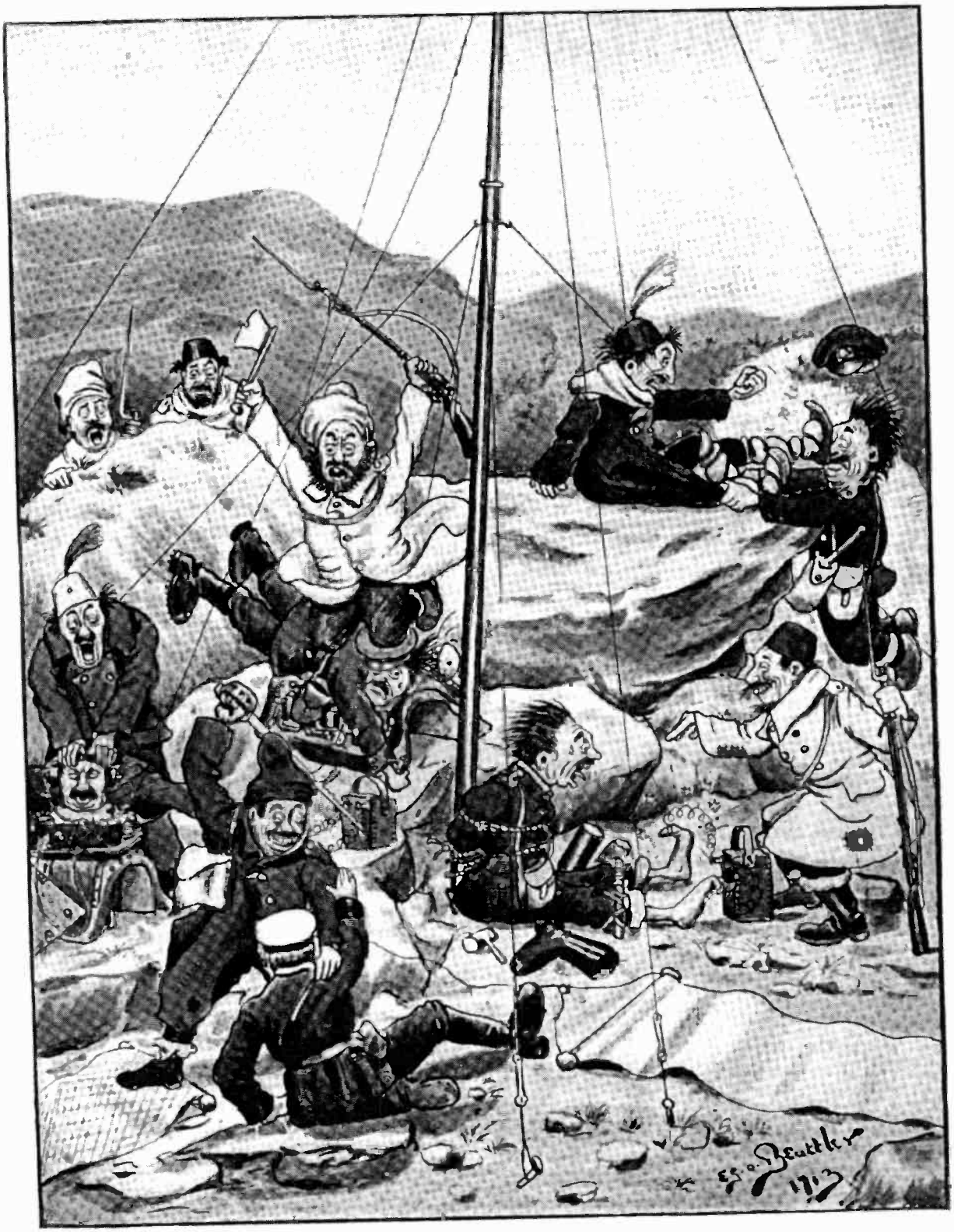
COLOMBIA.

The Government of the Republic of Colombia has been authorised by Congress to proceed with the scheme for the establishment of radiotelegraph stations to enable communication to be made between the capital and other centres within the Republic and abroad. The amount voted for the purpose is $200,000.

* * *

DENMARK.

An official report has been issued concerning the working of the posts, telegraphs, and telephones in Denmark. From this we gather that the number of radiotelegraph stations open for public service is sixteen, comprising one coastal station at Copenhagen and fifteen ship stations. In addition thereto several lightships are equipped with wireless telegraph apparatus, but these are employed to answer appeals for help from vessels in distress.



A FIELD WIRELESS STATION SURPRISED BY THE ENEMY

THE MARCONIGRAPH

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The Editor will be pleased to receive contributions; and Illustrated Articles will be particularly welcomed. All such as are accepted will be paid for.

CONTENTS

The Share Market

London: January 29th, 1913.

The market in the various Marconi issues has been somewhat depressed during the past month, the recent fall being mainly due to the nervousness engendered by the political outlook in Eastern Europe.

The prices as we go to press are: Ordinary, 4 1/16; Preference, 3 5/8; Canadian, 17s. 6d.; Spanish, 1⅛; American, 1¼.

Coltano Station

In the article which appeared in the January MARCONIGRAPH on the Marconi headquarters in Italy, there was a reference to the high-power Marconi station erected for the Italian Ministry of Posts and Telegraphs. The power and range of Coltano, mentioned on page 437 of that issue, were inaccurate, as many of our readers cannot have failed to notice. The power of Coltano is 500 kw., and the range 6,000 kilometres.

Marconi Patents Upheld in France

Judgment has been delivered in the High Courts of Justice of France in the action for infringement brought by Marconi's Wireless Telegraph Co. against La Société Française Radio-electrique, La Companie Générale Radio-télégraphique, and La Société des Transports Maritimes à Vapeur. The case was heard by three judges—the President of the Court, Judge Bonjean, and the judges Dréfus and Clément. The judgment was unanimous, and its delivery occupied 2 hours and 12 minutes. It covers 137 type-written pages, and constitutes a record for length in the French Courts. In the result, the Court declares the validity of all the claims of the Marconi patent No. 305,060, which corresponds to the English "Four Sevens" patent. All the defendants are declared to be infringers, and an investigation of their accounts has been ordered, to arrive at the amount to be paid as damages to the Marconi Company. The Court further orders the confiscation of all infringing apparatus supplied by the defendant companies, and a perpetual injunction, the defendants to pay the costs.

In giving their decision the judges declared that, despite the good work done by individual scientists, the patent was, without doubt, the first of its kind, and, furthermore, could claim priority, not only as regards practical use, but also on the grounds of its continued advance in the matter of scientific research and improvement. The Marconi Company were perfectly entitled to the patent, which was granted on November 3rd, 1900, on the basis that the practical application of wireless telegraphy was of immense value, in that it had introduced an

entirely new branch of industry. Their patent had been infringed in France, to the hindrance of justice, by the manufacture of apparatus, and by their installation in a number of telegraphic stations.

This judgment is of the highest importance, and will have far-reaching effects, for the defendant companies have supplied all the wireless installations to all the departments of the French Government, including the Post Office, the Colonies, the Marine, and the Army, which embraces the station of the Eiffel Tower.

A Share Transaction

An action was heard on January 22nd, before Mr. Justice Scrutton, sitting as a commercial judge, in which Marconi's Wireless Telegraph Company sued Mr. Goukassoff and Mr. Tischenko. The case turned on the construction of certain documents. In October, 1911, there was in existence a company called the Russian Telegraph and Telephone Company of St. Petersburg, in which the defendants were large shareholders. The Marconi Company in September, 1911, entered into negotiations with the defendants with the object of acquiring a controlling interest in the Russian Company. On October 13th a document was drawn up, which was subsequently signed by Mr. Godfrey Isaacs, the substance of which was that the plaintiffs should grant the Russian Company an exclusive licence to use, exercise, and exploit all the patents and inventions which the plaintiff company possessed in Russia, with certain exceptions, upon consideration of the issue by the Russian Company to the plaintiff company of 3,000 fully-paid-up shares of 100 roubles each in the Russian Company. Mr. Tischenko signed a document in these terms on October 16th: "P. O. Goukassoff & Co., represented by myself, hereby bind ourselves by every means to promote the success of the Russian Company of Wireless Telegraphy and Telephony, and not to take any part, directly or indirectly, in other similar companies in Russia. At the same time they hereby bind themselves, in the event of their wishing to sell the shares of the Russian Company belonging to them, of the nominal value of 340,000 roubles, to give to the English Company a preferential right to purchase all those shares on the same conditions, and at the same rate as may be offered for those shares by other persons or institutions."

When this transaction was carried out, the plaintiff company owned shares in the Russian Company of the nominal value of 1,080,000 roubles, out of a capital of 1,800,000 roubles nominal, but under Russian law there were many things which could not be done except by the holders of at least 75 per cent. of the capital of the company. Mr. Tischenko made the Marconi Company an offer to buy shares at 10 per cent. under par. He was in St. Petersburg at the time, and only gave 36 hours for that offer to be accepted there. Mr. Godfrey C. Isaacs, managing director of the plaintiff company, did not accept that offer, and Mr. Tischenko then sold the shares through a Mr. Baruch, who was now asking the Marconi Company to buy them at a premium of 300 per cent.

For the defence it was contended that there was no consideration for the agreement sued upon, and consequently that if there was an agreement binding in law, there had been no breach sounding in damages.

After a hearing lasting two days his lordship delivered judgment in favour of the plaintiffs. He said that in his view the object between the parties was that if the defendants had persons wanting to buy their shares they should give the Marconi Company the chance to take them upon the terms others had offered to give. He found that Mr. George Tischenko, the managing director of the defendant firm, sold the shares after he received the offer he ultimately accepted, giving the Marconi Company the chance to acquire them at the price offered. There would be judgment for the plaintiffs, with £6,000 damages.

Wireless in Scotland

On the motion for the adjournment of the House of Commons on Tuesday, January 21st, the attention of the Postmaster-General was drawn to a reply which he had given to a deputation which had asked for an extension of underground telegraph wires north of Edinburgh. The question was raised by Mr. Robert Harcourt, and Mr. Herbert Samuel, in reply, said it was one of the most unpleasant duties of a Minister to sometimes have to refuse the sanction of expenditure for which a member asked in the interests of his constituents. He did not minimise the inconveniences caused to Dundee and Aberdeen by the interruption of telegraph communication, but the point was whether the inconvenience was such as would justify an expenditure of £130,000 on the underground wires. One suggestion was that the deficiency should be made good by wireless telegraphy. He pointed out that it was the duty of a Minister to weigh all the proposals and see which were justified. There were many districts in England with no underground cables, and Ireland had none. Scotland had the the benefit of security between Edinburgh, Glasgow, and the west, and he asked members to see what could be done with wireless telegraphy before asking him to press the Treasury to expend the very large sum that was required.

Monthly Miscellany

ONE of the most wonderful men now living is Dr. Alfred Russel Wallace, O.M., who on January 8th completed his 90th year. It is not only that he is eminent as a man of science—the man who shares with Darwin the honours of the discovery of the great principle of natural selection is sure of a niche in the Temple of Immortality—but that, having attained the patriarchal age of four score and ten, he is still full of enthusiasm for the cause to which he has devoted his life, and is possessed to all appearance of the energy and the clearness of mental vision of a man of forty. In his beautiful home at Broadstone, in Dorsetshire, he still continues actively engaged in writing and philosophising on the problems of the age, and spurns the delights of leisured ease to which he is so justly entitled. Only recently, discussing affairs with a representative of the *Morning Post* who called to congratulate him on his ninety-first anniversary, he referred in terms of unmeasured admiration on the immense changes brought about in his lifetime through scientific discoveries. Most wonderful of all, he thinks, is the development of electricity in the service of man, culminating in wireless telegraphy. "By means of vibrations in ether," he says, "we now put a girdle round about the earth in forty seconds, instead of Puck's forty minutes, which shows that modern science outstrips even the fancy of the poet."

* * *

Wireless has saved the situation in the Scilly Isles. At this time of the year active business is in progress amongst the growers on these islands, for an important trade is carried on with flowers and hothouse fruits for the early market. Large consignments of narcissi, violets, and lilies of all kinds—and, as regards hothouse commodities, grapes—are sent to Liverpool, Manchester, and other northern towns which are too far distant to allow of the satisfactory transit of such perishable goods from the south of France. As a consequence negotiations between growers and salesmen are actively carried on over the wires. But the recent rough weather has entirely interrupted telegraphic communication, for the heavy gales have resulted in the breaking of the cable at a point seven miles from the mainland. All communication has therefore to be forwarded for the present through the Admiralty's wireless stations.

* * *

Sir George Alexander has recently produced a short play entitled "A Social Success" at the Palace Theatre, London, and the event is noteworthy from the fact that it is his first appearance on the variety stage. But equally noteworthy is the manner in which negotiations were conducted, for Mr. Butt, the Palace manager, was on the way to New York at the time that the negotiations were completed. He had but recently disembarked from the Cunard liner "Carmania," which had had a tempestuous voyage across the "herring pond," and passengers were at some straits to amuse themselves. Mr. Butt had hit upon the excellent idea of whiling away the monotony of transatlantic travel by negotiating by wireless telegraphy with Sir George Alexander, with the result that before the liner arrived in New York he had actually settled the terms and conditions whereby the famous actor is appearing at the Palace. "A Social Success" is a one-act play containing four characters, and lasts about half an hour, and is written by Max Beerbohm.

* * *

A controversy has recently occupied the newspapers on the subject of what boys and girls read, and amongst the correspondents that have taken part in the discussion is Captain Charles Gilson, who in an interesting letter points out the many changes of environment which have affected the standpoint of boy and girl readers in relation to their literature. Only one thing, he said, remains unchanged, and that is the desire for "adventure," which is still the one and only theme capable of enthralling the adventurous period of youth. But, he noted, twentieth-century adventure has shifted its sphere. Red Indians, bushrangers, pirates and discovery of countries were very real a quarter of a century ago. Now, however, they have lived their lives, and their adventures are worn threadbare. For this reason Kingston, Henty and Ballantyne are going rapidly to the boards. Their books sell only because those who buy books for boys remember the tradition of their names. What are now wanted are tales of dreadnoughts, wireless telegraphy, motor-cars and monoplanes, for these are subjects which still possess elements of romance. They bear the stamp of the miraculous, and are themselves concrete proofs of the inventor's imagination, which is the spirit of the age. Nor is there any very great divergence between the wants of girls and boys of to-day in regard to reading matter, for the education of the former has been increased and broadened till, nowadays, it completes practically the whole of the curriculum of the modern schoolboy—not forgetting the attention paid to elementary science; so that the modern girl is able to appreciate a tale on wireless and kindred subjects quite as much as her brothers.

Progress in America

THE progress which has been made during the past six months by the Marconi Wireless Telegraph Company of America is explained in a report which was issued early in January. From this it is evident that the progress made has been considerable, for notwithstanding the fact that the company has been engaged in the very big work of taking over the fleet formerly controlled and equipped by the United Wireless Telegraph Company, it has continued its activity in the matter of additional contracts for equipping new boats, both passenger, cargo, and private yachts, with wireless installations.

Considerable success has been achieved in obtaining the cancellation of the old and somewhat unsatisfactory contracts made by the United Wireless Telegraph Company when they were competing with the American Marconi Company; and the great majority of the vessels, all of which have now passed into the control of the Marconi Company, are operating under new contracts upon a sound paying basis, the result of which will be apparent when the next balance sheet is issued.

During the year no less than two hundred additional craft have been equipped with the Marconi system, and it is estimated that no fewer than fifteen hundred vessels are now so equipped, the majority of which contribute traffic to American Marconi land stations.

Traffic returns for ships' correspondence from the Pacific coast, to which the company has only recently directed its attention, show that the net profits for the six months ending September 1st amount to over $25,000 (twenty-five thousand dollars). Owing to the immense pressure of work for new installations, the books of the company in the East are not yet properly written up, but it is estimated that the net profit for the same period will be considerably in excess of those of the Pacific coast; but this period does not fairly represent what the returns will be, for the increased rentals cannot yet be computed.

Very good work indeed has been turned out by the Engineering Department; a contract has been completed for the United Fruit Company of a 50-kw. station at Santa Marta, and further stations at New Orleans and Swan Island are in course of construction. Five stations have been constructed, delivered to, and accepted by the War Department of the United States Government, and other stations are in course of construction for the Government.

Sites have been purchased at Belmar, New Jersey, and at Somerville, for the construction of high-power stations for the American-Anglo Circuit, and at San Francisco and Honolulu for the American-Eastern Circuit, which is destined finally to reach the Philippines and Japan.

All the orders for material have been placed, and the special engineers to whom is entrusted the erection of these high-power stations have been doing their work with great assiduity. The work of construction is now well in hand, and whilst it is too early to prophesy results, the directors of the company are confident that before a year is out all these stations will be in thorough working order, and conducting a large and profitable business.

The recent new Acts controlling wireless telegraphy passed by the United States Government which have required the furnishing of additional operators, and changes and conditions in the apparatus generally installed on vessels, have given great satisfaction to the company. They have not only ensured far more satisfactory working conditions by reason of the non-interference from irresponsible amateurs and others, but have induced steamship owners to willingly pay for the additional advantages which they receive.

Pending the completion of the several high-power stations in construction and to be constructed, the greater part of the additional capital raised by the company during last year has not yet been utilised. Owing, however, to the dearness of money prevailing in the United States, good interest is being earned thereon.

Wireless Telegraphy in Mongolia and Tibet

The *Peking Daily News* says that, in order to furnish prompt and reliable information on the development of current affairs in Mongolia and Tibet, it is proposed to instal wireless telegraphic stations in Urga, Uliasutai and Kobdo in Mongolia, and in Chiamdo, Batang and Lhasa in Tibet. This proposal has met with the approval of the members of the Cabinet. The Ministry of Communications has therefore been directed to call in tenders for the construction of these stations.

There is a need for stations in China, especially on the east coast, where there is no coast station between Singapore and Shanghai, and during the typhoon season in September shipping is fraught with very considerable danger.

Spanish Notes

The apparatus installed at the Marconi Training School in Madrid is working satisfactorily. Mention has already been made of this school in these columns, and we hope at an early date to publish some additional particulars.

* * *

Operations have already been commenced in connection with the erection of stations at Finisterre and Santander. Work on the Malaga station has also been put in hand.

Travel in the Congo

By Eva Jordan

TELEGRAPHY in Europe has seldom any difficulties to contend with as regards its smooth running. But in some parts of Africa there are impediments to transmission of messages which do not occur in London. Last year my husband and I decided to travel through the uncivilised parts of the Belgian Congo hunting elephants. We were at the time in British East Africa, and we had to make our way to Uganda, where the real treking started. Of course, telegrams can be sent over that country, but even there the wires are not safe. Let me refer to an article which appeared in the January number of THE MARCONIGRAPH. This article speaks of the Kaverondo tribe, and of their love for copper or steel wire which they took from the telegraph poles. Long before the telegraph line was established there was a great demand for wire, and the traders exchanged this commodity for skins, hide, and ivory. But in Uganda telegraphy by wire meets another antagonist. Large herds of elephants are always roaming about. For some reason best known to himself, my lord the elephant has a very great love for telegraph poles and wire. When he is full of good food, after he has enjoyed a good bath in river or pool, life is very sweet to him, and he proceeds to enjoy it. Like a human being in analagous conditions he goes on "The Hurrah," and his form of amusement is to pull up telegraph poles and curl his hair with the wire. He plays with these toys as we would with a ball, and I expect that next morning he would be very much surprised if he were told of the hundred pounds worth of damage which he had done.

Nahuri Canoes

Here steps in wireless telegraphy.

Stations can be established on the trade routes, primarily across country, on lines of latitude. Later on there is a vast field for longitudinal lines, enabling pioneers to maintain connections and so open up the country. It was at first supposed that the wireless system was only suited to marine work. But the traveller in tropical Africa recognises that "wireless" telegraphy is the key to all pioneer work in those regions. Human natives, giraffe, or elephant—nothing can interrupt the messages, and the explorer of woods and forests can keep in touch with the outside world.

But to resume my narrative. After leaving Uganda the wilds of the Congo stretched before us, bounded by the great mountains of Ruwenzuri guarding the frontier. The magnificent stateliness of these everlasting hills is accentuated by the beauty of tropic vegetation and thick forests, while their summits are crowned by perpetual snow. Nowhere in this world can Nature be better seen garbed in all her glory. But the great Congo forest is a hard country to march through. It is peopled by wild tribes of cannibals. It is stocked with herds of buffalo and elephant which have little fear of man. On the native track running from "boma" to "boma" (official posts where there are generally one or two white men) there are always signs of the presence of these

animals. Trees are thrown across the path, and twice on "safari" we had to wait until a herd of elephants had crossed the track.

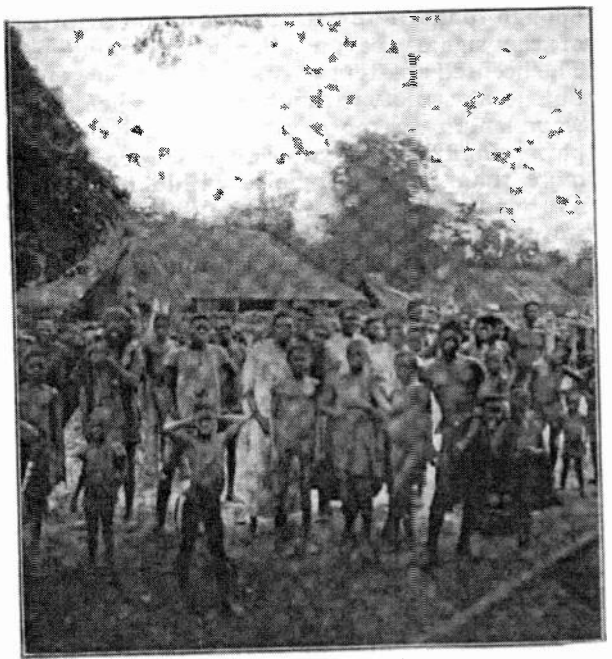
In one camp, in which we stayed for a long time, I often watched the elephants crossing the plains below us. Now and then they would scent our camp and approach us. But their better instincts prevailed, and, instead of trampling us into mincemeat, they turned their dignified heads in the opposite direction, and continued their daily round. What appealed to me most was the pretty sight of the mother elephants attending to their young. Sometimes a mother would pass with two babies, the smaller in front being pushed on by "mama's" trunk, while the elder calf trotted on behind. The baby was usually about the size of a Shetland pony.

At this camp a big native chief came to pay his respects to us, and incidentally to gaze on a white woman. We offered him a cup of tea, and at first he was most suspicious of it! He looked at it from all directions, smelt it, and then gave a spoonful to his Lord High Chancellor (or some functionary of corresponding title). The chief watched with eager interest to see if his minister displayed symptoms of the expected agony. Disappointed in this, another Lord High Mightiness essayed a spoonful, and there being no maleficent result, His Majesty the Chief tried it himself. I think he must have thoroughly enjoyed it, as he drank the whole cupfull. Then we entertained our guests with the gramophone, but the chief listened without smile or twitch of muscle. At last we put on one of Lauder's laughing songs. Then a ray of sunshine burst through the clouds which overspread the blank official face and the spell was broken. Oh, the joy of it! Could Lauder only have seen the "ticklish feeling" on those ebony faces he would have sung to them for a week without any salary! Some of the less dignified of the court officials rolled on the floor in their appreciation of Scotch wit—or was it that infectious laugh which carried them away? Future African travellers may take note that a passport signed by Mr. H. Lauder and transmitted to an African chief's court by aid of the gramophone is more likely to ensure a courteous reception than any offering of the tea-cup, which forms the central attraction of London drawing-rooms.

Practically all African natives like the gramophone, but the pigmies proved to be the exception. They were afraid of it. African natives are by no means musical. Their vocal efforts are confined to chants, and half the tonic sol-fa will cover the range of African opera. Musical instruments are usually restricted to two strings, and they have not yet arrived at the state of musical perfection of being able to play "Home Sweet Home" on one string!

From Kasindi, the frontier station between Uganda and the Congo, to Stanleyville is a distance of nearly 1,000 miles by native track. The only communication between these two points is by native runner. From the station of Avakubi, the central "boma" of the march, telegrams, letters, etc., are sent by runner to Toro, on the Uganda frontier, fifteen days' march (which would take a white man at least a month to accomplish) to the *eastward*. A little further on messages are sent *westwards* to Stanleyville, and from there to Coquilhatville, by the Congo river steamers—oh, what dear little pets these river steamers are! They possess everything that can be most desired in the way of dirt and smells.

When we passed through the country between Irumu and Avakubi the natives had risen, not against the Belgians, but in tribal war. Often we heard the sharp report of rifles, and knew that fighting was still going on around us. The natives were ready with their poisoned arrows and spears for any one who might be inclined to molest them. Imagine the position of a white resident there, without any possible telegraphic communication with the coast, and with still less chance of getting a "runner" through.



Natives Awaiting Boat

The Wireless Amateur

U.S. Regulations

THERE has of late been a persistent demand in the United States on the part of the amateur interested in wireless to know where he stands with relation to the new wireless law, and to know whether his station conforms with the provisions of the law. The new law has been set out in full in a recent number of our American contemporary, *Modern Electrics*, but we think it will be useful to present a brief summary of this law so that the public in this country can understand how that much-abused person—the wireless amateur—is controlled in the United States.

Under the new Act it is forbidden for a private person, unless he has a licence, to use transmitting apparatus powerful enough to send signals across the boundaries of the State in which he dwells, or with sufficient energy to be detected by a sensitive receiving set just beyond the State boundaries, or powerful enough to interfere with the reception by others of the signals beyond the State boundaries. The licensed amateur may so transmit messages, but he must not, without special licence, use a wave-length of more than 200 metres, or a power input to his transmitting apparatus of more than 1 kw. If he is within more than five nautical miles of a military or naval station, his wave-length must not be more than 200 metres, nor his power input more than ½ kw. The penalty for operating a station without a licence after December 13th, 1912, is a fine of not more than $500 and the forfeiture of the apparatus.

Licence for Transmitting Station

Messages may be received from any direction, and on any wave-length, without licence, provided the station is not equipped for sending. If the station is equipped for sending as well as receiving, then the owner must possess both a station licence and an operator's licence, and he is forbidden to permit an unlicensed person to use his sending apparatus except under direct supervision. The penalty for failure to observe the latter provision is a fine of not more than $100, or imprisonment for not more than two months, or both, as provided in Section III. of the Act. For repeated violations of the law the licence is liable to forfeiture.

The sending wave must be sharply tuned, and the fourth regulation requires that " at all stations the logarithmic decrement per complete oscillation in the wave-trains emitted by the transmitter shall not exceed two-tenths, except when sending distress signals or signals and messages relating thereto." This provision sounds rather mysterious, and is not a little formidable, but it is simply a statement of the damping permitted in the wave-trains sent out by the aerial. Amateurs will not often find it possible to plot an actual curve of the current in the aerial, as the only method of determining the value of the logarithmic decrement is by means of a decremeter or some similar instrument, which is sometimes beyond the power of their purse. The limit to the damping is specified in order to provide a wave that may be tuned without much trouble, as it is well known that a wave in which the damping is slight may be sharply tuned and easily tuned out, while a highly damped wave may be heard all along the tuning aerial, and is nearly as loud at one point as at another. If the transmitter is so adjusted that the wave radiated by the aerial does not conform to this regulation an opportunity will be given the owner to readjust it so as to avoid violating the law, which would mulct him in penalties of $100.

Distress Signals

Absolute right-of-way must be given to distress signals and to messages relating thereto, and the owner of a private station must stop sending if told by a Government or commercial station operator that he is interfering with reception of distress signals or messages relating thereto. The penalty for failure to observe this regulation is a fine of $100, and for repeated offences the forfeiture of his licence in addition. In no case, except in the case of signals relating to vessels in distress, may the private owner use more power than is necessary to carry his messages to the station with which he is communicating or wishes to communicate. He must not divulge the contents of any message he receives or intercepts except to the person for whom such message is intended, or to another station which is to forward the message to its destination, unless required to do so in a court of law. The penalty in this case is a fine of not more than $250, or imprisonment for three months, or both. The effect of this prohibition should be to prevent an amateur from keeping for the inspection of his friends or visitors copies of interesting private messages he may receive or intercept.

Wilful Interference

Wilful interference is one of the principal causes that made Government regulation of wireless communications necessary, and it is interesting to note that the penalty for wilful interference is particularly severe. The owner, or operator, or both, may be subject to a fine up to $500, or imprisonment for one year, or both, for interference with Government or commercial messages, and in all probability the licence would be forfeited for interfering with the work of other amateurs. Severe punishment will be meted out to the person who transmits, or permits anyone else to transmit, while using his sending apparatus, any false or fraudulent distress signals or calls, or any other false or fraudulent signal, call, or message of any kind. The penalty for sending out a false distress signal or call is a fine of not more than $2,500, or imprisonment for not more than five years, or both, for each and every such offence. And the penalty for sending out, or permitting to be sent out, any false or fraudulent signal, call, or message, is a fine of not more than $1,000, or imprisonment for not more than two years, or both, for each and every offence.

The amateur must have a station licence if his station is equipped for sending, and he must also have a licence at least equal to that of a first-grade operator. He may receive messages without either licences if his station is equipped with receiving apparatus only, but he should obtain an operator's licence if he is capable, because an unlicensed person may not operate a sending apparatus in any station except as an apprentice actually serving under a licensed operator for the purpose of learning the art.

Wireless Regulations

The first person to be arrested on the charge of violating the United States Wireless Act, which was passed early last year, and has recently come into force, is Captain John Hull, who has been indicted on the ground that his vessel did not possess auxiliary equipment sufficient to send a message one hundred miles.

The South African Telegraph Department has made arrangements which will ensure continuous communication between the several ports of the Union. By this means distress signals received at one station can immediately be notified to that port nearest the vessel requiring help.

Examinations of candidates who desire to become wireless telegraph operators are held at the New York Navy Yard, Brooklyn, N.Y., each weekday with the exception of Thursday and Saturday. The examining officer of the electrical class issues government licences to those who successfully pass the examination. Successful applicants then advise W. D. Terrell, radio inspector at New York, when they pass and the serial number of their licence, also the grade.

The United States Court, at Norfolk (Virginia), decided recently that vessels entering American ports for bunker coal only are not subject to the provisions of the U.S. Wireless Telegraph Act, making it compulsory for certain classes of vessels to carry wireless telegraph outfits.

The decree issued by the Government of Uruguay making compulsory wireless telegraph installations on all passenger ships conveying passengers between Uruguay and other ports came into operation on August 15th last. Ocean-going vessels comprehended by this order have to carry an equipment capable of transmitting and receiving messages over a distance of 248½ miles (equal 400 kilometres).

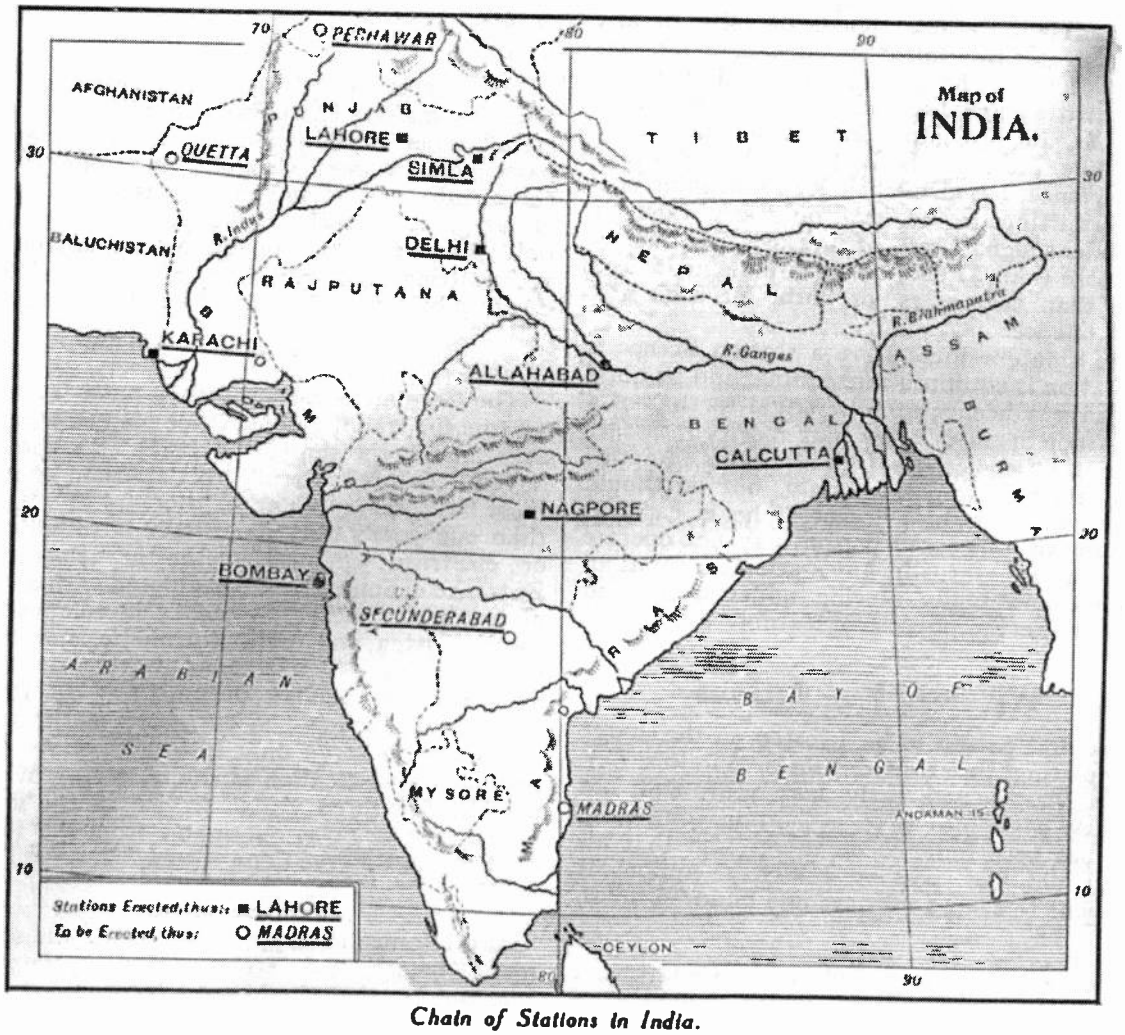
The German naval authorities have devised a scheme for training non-service men as wireless assistants in the shipyard division at Wilhelmshaven. Before entering this division a man must have served an apprenticeship of not less than one year's duration, either in mechanical or electrical engineering, or in telegraphy. Entrance examinations are imposed with a view of testing a candidate's ability in composition (both written and oral), arithmetic, and technical drawing. Testimonials are required from an evening or Sunday class held at the Royal Engineering School; a certificate entitles the candidate to serve only one year. Another necessary qualification is the obtaining of permission for three years' service in the navy, which permission is obtainable from the President of the Reserve Commission.

Prof. James Money recently made the statement before the archæological society in Washington that the Morse telegraph code was not the invention of Prof. Samuel F. B. Morse, but is of Irish origin, being the old Gaelic dot and dash alphabet used as early as the year 1150. "There were seventeen letters in the Gaelic alphabet," said Prof. Money, "and they began with one dash, went up to five dashes, then from five dashes down to one dash, and then began the dots, very much the same as the Morse alphabet used in telegraphy."

The Defence of India

More Marconi Stations

IT is not so long since we described in these columns the noteworthy chain of Marconi stations which the Indian Government decided to erect in order to link up the principal towns and military garrisons of the vast area under its control. The first four stations erected were at Simla, Delhi, Allahabad and Calcutta, but this was only a preliminary move in the more ambitious scheme of establishing a rapid and reliable means of communication between the long chain of outforts extending from Quetta to Peshawar. A little later, stations at Karachi, Bombay, Lahore and Nagpore were put in hand, and now the Indian Government have instructed the Marconi Company to complete the network by the erection of stations at Madras, Secunderabad, Quetta and Peshawar. The stations about to be erected will probably be placed in fortified positions. Calcutta, Allahabad, Delhi and Jutogh stations are in strongly fortified positions; three of these forts cannot be overcome except by heavy artillery, while the Jutogh station is situated about six miles from Simla—a district where native risings are unknown. The new stations will be similar in almost all respects to the majority of the existing stations. They will be furnished with the Marconi Company's standard 30 kw. sets, while the receiving apparatus will be of the very latest type.



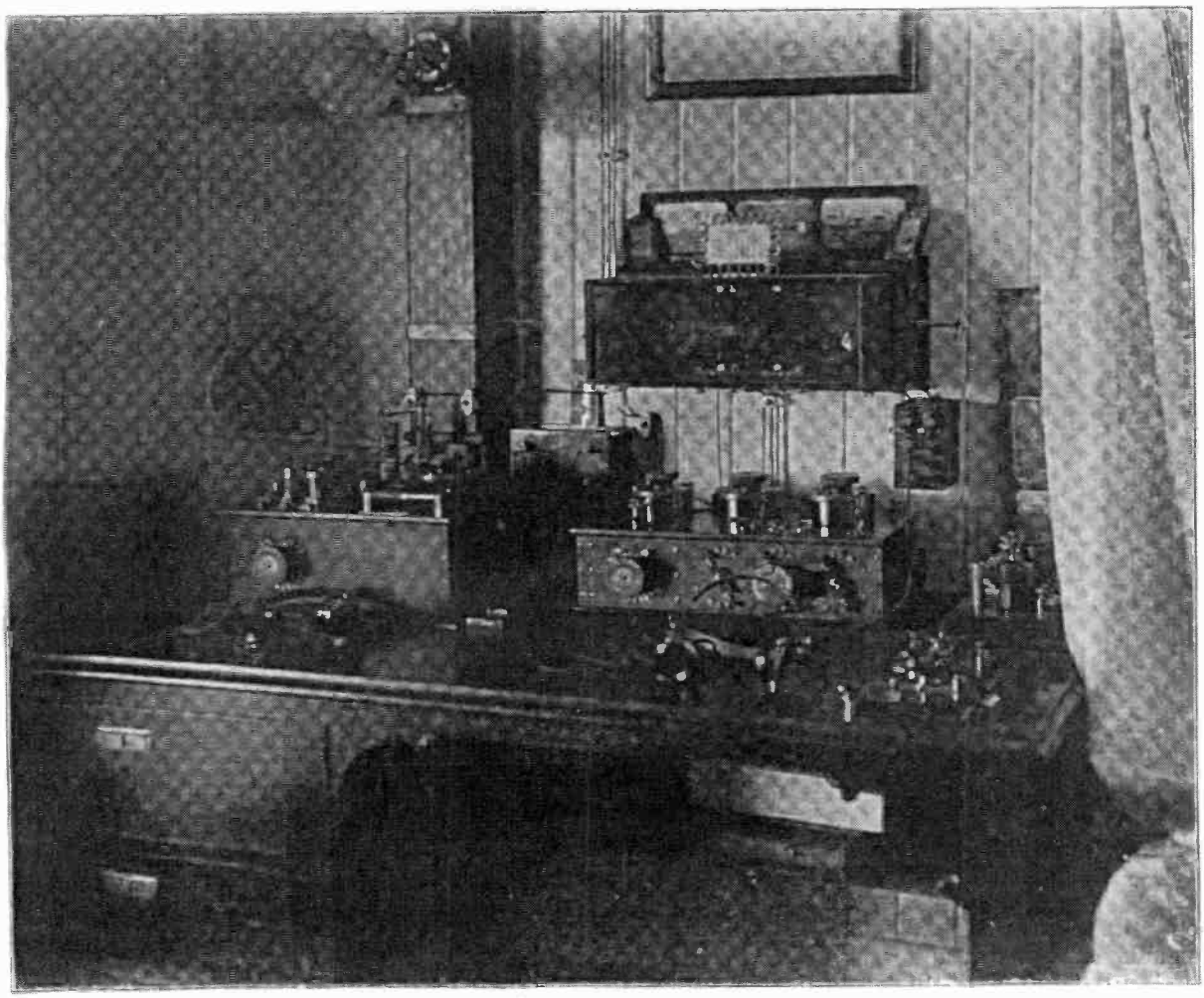
Chain of Stations in India.

From Yacht to Hospital Ship

The S.Y. "Mahroussa"

THAT beautiful yacht the "Mahroussa," which is the property of H.H. the Khedive, has been doing praiseworthy work during the Turco-Balkan war in bringing succour to wounded Turkish soldiers. At the end of November last year the yacht was suddenly commissioned to sail for Turkey in the interests of the Red Crescent Mission. She proceeded to Cavalla, a port on the northern extremity of the Ægean Sea, where she remained for nearly three weeks, with a short break, during which she voyaged to Chanak Kilissi, in the Dardanelles.

The "Mahroussa" is equipped with a 5-kw. Marconi wireless set, of the type which is used on battleships. Current for driving the transmitting apparatus is obtained from a battery of 42 accumulators, and there is a variable primary in the jigger suitable for the transmission of wave-lengths of 300 metres and anything between 600 and 1,200 metres.



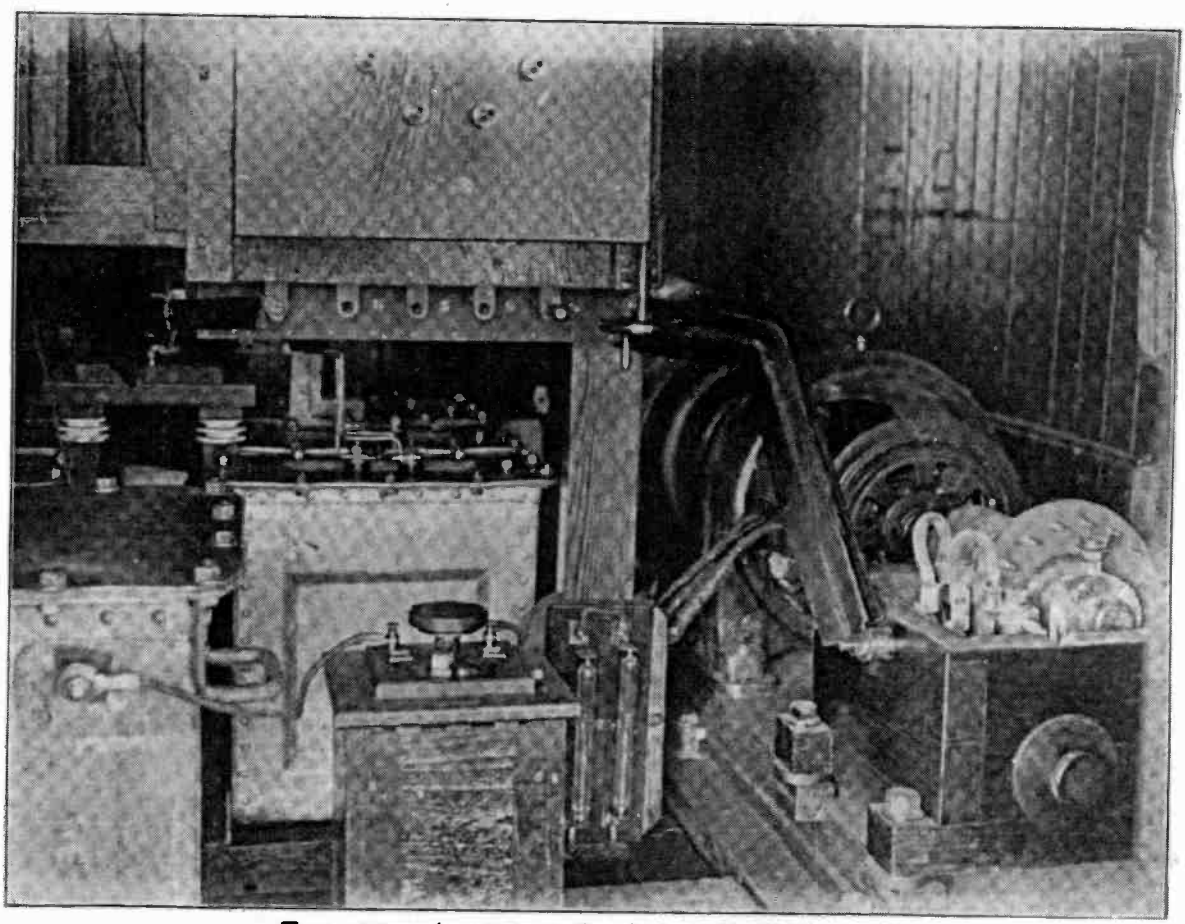
Receiving Cabin on the "Mahroussa."

While at Cavalla the "Mahroussa" maintained regular nightly wireless communication with Port Said, clearing, besides ordinary marconigrams, nearly fifteen hundred words of figure cypher, some of the messages reaching

one hundred words each. The distance between Cavalla and Port Said is 685 miles as the crow flies. The island of Thasis, which has an altitude of about three thousand feet, intervenes, and the route traverses the islands of Lemnos and Mitylene, also part of the Asiatic mainland. But the wireless communications continued uninterrupted, and even the operations of the wireless on foreign cruisers outside Constantinople failed to interfere with the successful working of the Marconi apparatus on the "Mahroussa." On some evenings signals were received on board after the sun had disappeared, although it was still light. This work is unusually interesting, and was all done on 3½ kw. Reception was by means of the crystal detector.

The importance of the wireless services can well be gauged from the fact that there was no other means of communicating with headquarters, Cavalla being occupied by the Bulgarians. Before departing on the mission there was a lurking fear among some that the "Mahroussa" would not be able to maintain communication from Cavalla; but this fear was never shared by the distinguished owner of the yacht, whose confidence was based upon previous achievements over a very considerable period, and was amply justified by the splendid results. The "Mahroussa" left Cavalla with 1,800 refugees on board and a crew of over two hundred. There was not a lifebelt of any description on board, and only eight boats.

The accompanying illustrations were sent to us by Mr. J. C. Hawkhead, who was formerly wireless instructor to two Khedivial telegraphists on board the "Mahroussa."



Transmitting Apparatus on board the S.Y. "Mahroussa."

The United States Navy Department announced that the six naval wireless telegraphy stations in Alaska, at St. Paul, Dutch Harbour, Unalga, Kodiak, Cordova, and Sitka, would be opened for commercial business on January 15th, when prepaid messages to ships in Alaskan waters would be accepted for transmission.

Correspondence

Kelvin and Wireless

(*To the Editor*)

SIR,—I have read with interest the letter which appeared on page 396 of your December number, in which the writer refers to Mary Somerville's investigations. In Thompson's "Life of Lord Kelvin," vol. i., page 237, appears the following:

"He (Lord Kelvin) discovered that a critical relation occurred if the capacity in a circuit was equal to four times the co-efficient of self-induction divided by the square of the resistance. If the capacity was less than this the discharge was oscillatory, passing through a series of alternate maxima in opposite directions before dying out. If the capacity was greater than this, the discharge was non-oscillatory, the charge of the condenser dying out without reversing. He suggested that it might be possible, by discharging a Leyden jar or other condenser of small capacity, through a circuit having large self-induction and small resistance, to produce artificially such oscillatory discharges. If the oscillations followed one another too rapidly for the eye to distinguish them, Wheatstone's method of observing them in a rotating mirror might be employed, and would show the sparks as several points or short lines of light separated by dark intervals, instead of a single point of light, or an unbroken line of light, as it would be if the spark were instantaneous, or were continuous or of appreciable duration."

This mathematical analysis may be said to have laid the foundation of the theory of electric oscillations.

Yours, etc.,

C. MASTERS.

A Strange Occurence

(*To the Editor*)

SIR,—On December 17th, 1912, about 4 p.m., as the ss. "Keemun" was coming out of the harbour, Yokohama, I put on my receivers, and after "listening in" for a few moments, I was very much surprised to hear, in place of the customary Morse buzz, a faint unusual sound of varying pitch, which on "tuning-in," I recognised to be a *human voice singing!* For a few minutes the tune was drowned by the sending of a neighbouring station, but between the breaks, however, the voice was faintly but distinctly audible. When this station ceased transmitting the tune and the words became easily distinguishable, and they proved to be those of the "Village Blacksmith."

Two verses were heard, and towards the end the voice became clearer—possibly due to some readjustment of the transmitter being used, and the final words, "*Like chaff from a threshing floor,*" were as distinct as though from a gramaphone.

Later in the evening I called up the Japanese Government station, Chosi, and asked him if he could suggest who was likely to have been experimenting in wireless telephony, and he replied probably the Department of Communications at their laboratory in Tokyo.

My receiving set is of the ordinary ship type, and as detector I then had a piece of silicon in use.

I thought this would interest you, and so have taken the liberty of writing.

Yours, etc.,

HERBERT S. PEET.

Question and Answer

We invite our readers to send us questions, preferably on technical problems, that have arisen in actual practice. To ensure a reply in the current number, such questions should reach the Editor not later than the 15th of the month.

CROOKHAVEN.—Change of Wave-Length.—"In changing from the 2,000 ft. to the 1,000 ft. wave, why are two arrester-spark gaps used?"

Answer: The arrangement to which you refer is where a 1,000 ft. wave has to be imposed on an aerial whose wave-length, in combination with the jigger secondary, exceeds that value. In this case, the aerial is connected through a certain amount of tuning inductance and through the jigger secondary to earth through an arrester-sparkgap, and also through a capacity of definite size to earth through a second arrester-sparkgap. If you draw out the connections and try and dispense with this second arrester, you will find that you have to connect the lead from the condenser to the same terminal as the lead from the earth side of the jigger secondary, and that then you have a closed circuit, consisting of an inductance (tuning inductance and jigger secondary) and a capacity (the short-wave tuning condenser) between your aerial and your receiving circuits. This circuit has a wave-length of its own, and the result of its presence between the aerial and the receiving apparatus is that when signals of that particular wave-length are being received, some of their energy will be used up in setting this circuit oscillating, generating a back-e.m.f. at the point where the aerial joins the circuit, and opposing the passage of signals to the receiver. It will, in fact, act as a well-known form of "tune-stopper" for waves of that frequency. The use of the second arrester completely insulates the condenser earth-lead so far as received signals are concerned, and obviates this danger of weakening signals of a particular wave-length.

[*Other questions reached us too late to be dealt with in this issue, and replies will appear in the March* MARCONIGRAPH.—ED.]

Contract News

The following vessels will be equipped with apparatus for wireless telegraphy by the Canadian Company:

S.S. "Aranmore," owned by Messrs. HOLLIDAY BROTHERS, QUEBEC.

S.S. "Lintrose" and "Kyle," owned by the REID NEWFOUNDLAND RAILWAY COMPANY.

The American Marconi Company have received an order from the UNITED STATES MILITARY AUTHORITIES for a 1-kw. high-frequency set.

The Canadian Government have decided to instal at Port Arthur and Sarnia, Ont., standard duplicate 5½-kw. Marconi equipments.

The following Vessels have been equipped with Marconi Apparatus.

Owners.	Name of Vessel.	Installation.	Remarks.
The British India Steam Navigation Co., Ltd.	s.s. "Arankola" ...	1½ kw. and emergency set	Passenger between England and India or Australia
" " "	s.s. "Elephanta"	1½ kw. and emergency set	Passenger between England and India or Australia
The White Star Line ...	s.s. "Cufic" ...	1½ kw. and emergency set	For service between America and Australia and New Zealand
" "	s.s. "Tropic" ...	1½ kw. and emergency set	For service between America and Australia and New Zealand
" " ...	s.s. "Arabic" ...	1½ kw. and emergency set (refitted)	For Atlantic service
Andrew Weir & Co. (Bank Line, Ltd.)	s.s. "Naueric" ...	1½ kw. and emergency set	General trade
New Zealand Shipping Co., Ltd.	s.s. "Tongariro" ...	1½ kw. and emergency set	Coast trade in New Zealand
Ellerman Lines (Bucknall s.s. Line)	s.s. "Bulawayo" ...	1½ kw. and emergency set	Passenger between England and S. Africa
" " "	s.s. "Saldanha" ...	½ kw. and emergency set	Trading between England and S. Africa
Ellerman Lines (City Line)	s.s. "City of Glasgow"	1½ kw. and emergency set	Passenger between England and India *via* Suez Canal
" " "	s.s. "City of York"	1½ kw. and emergency set	Passenger between England and India *via* Suez Canal
Ellerman Lines (Hall Line, Ltd.)	s.s. "City of Durham"	½ kw. and emergency set	Trading between England and Bombay and Karachi
Watts, Watts & Co., Ltd. ...	s.s. "Willesden" ...	½ kw. and emergency set	The first of a big fleet of cargo vessels owned by this company to be fitted with wireless. Destined for Honolulu
Gellatly, Hankey & Co. ("Mogul" S.S. Co.)	s.s. "Ghazee" ...	½ kw. and emergency set	—
Societa Nazionale di Servizi Marittimi	s.s. "Firenze" ...	1½ kw. set	Sailing between Genoa and Alexandria
Guyton & Co.	s.s. "Pettibone" ...	½ kw. set	Barge
The "Heroine" Co. ...	s.s. "Heroine" ...	1½ kw. set	—
Geo. J. Whalen, Esq. ...	s.y. "Cassandra" ...	1½ kw. set	Private yacht
Hubbard Steamship Co. ...	s.s. "General Hubbard"	1½ kw. set	—
Inter-Ocean Steamship Co.	s.s. "Borgestad" ...	1½ kw. set	—
Arrow Line (Swayne, Holt & Co.)	s.s. "Apraiso" ...	1½ kw. set	Pacific Coast service

Orders have been received to equip the following Vessels with Marconi Apparatus.

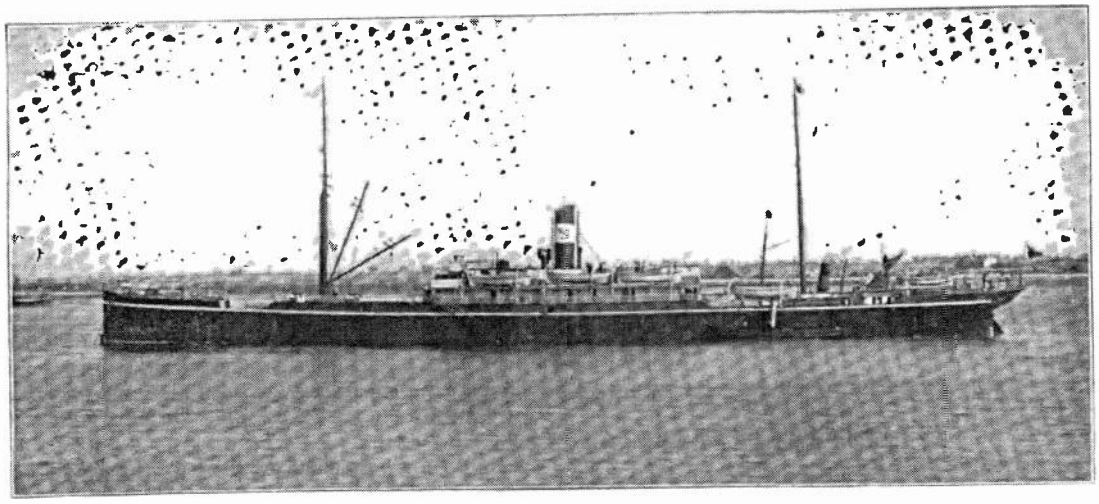
Owners.	Name of Vessel.	Installation.	Remarks.
P. & O. Steam Navigation Co.	s.s. "Benalla"	1½ kw. and emergency set	Building
Burns, Philp & Co., Ltd. ...	s.s. "Morinda" ...	1½ kw. and emergency set	General trading
New Zealand Shipping Co.	s.s. "Rimoutaka"	1½ kw. and emergency set	Engaged in general trade on New Zealand coast
" " "	s.s. "Paparoa" ...	1½ kw. and emergency set	Engaged in general trade on New Zealand coast
Union Steamship Co. of New Zealand	s.s. "Wahine"	1½ kw. and emergency set	For service between America and Australasia
Union of South Africa ...	s.s. unnamed	1½ kw. and emergency set	Destination undecided
White Star Line ...	s.s. "Ceramic"	1½ kw. and emergency set	General trading with Australia

Maritime Wireless Telegraphy

There has been a severe roll of maritime disasters during the wintry gales of the past month, and almost the whole of this section is on this occasion occupied with a record of the services rendered by wireless telegraphy. Pressure upon our space has rendered it necessary to hold over our usual miscellaneous record of maritime news.

FEW winter storms have equalled in violence that which swept over the whole of Western Europe on December 26th and 27th last year. It had its origin in the Atlantic, but its full force prevailed in the English Channel, the Bay of Biscay, and other adjacent coasts. It was not to be expected that such a gale would be unmarked by shipwreck, but the list of vessels damaged is, under the circumstances, comparatively light.

On December 24th the s.s. " Narrung " left Tilbury bound for the Cape and Australia with two hundred and forty-eight passengers—mostly emigrants—on board. She encountered the full force of the gale in the Bay of Biscay, and it was only the good seamanship of the captain and his officers and crew which brought her out of her perilous position. While she was still in the Channel the seas were running high, and she suffered a good deal of buffeting, but when she was twenty miles off Ushant her position had become one of great danger. Huge waves were sweeping the decks, one in particular—estimated by the ship's officers to have been seventy feet high—entirely enveloped the vessel. It wrecked all the tackle in front of the mast and flooded all the passengers' accommodation in that part of the vessel. It carried away the winches and broke in through the hold, while the iron deck was ripped up and crumpled back. It was then that the captain recognised the futility and, moreover, the impossibility, of continuing the voyage, and determined to turn back. But think of it—reversing engines and presenting a broadside to the fury of the gale! So imminent was the danger that it was thought advisable to send out a wireless message for help, and two steamers—the " Bavaria " of Hamburg and the " Negada " of Guadeloupe—intimated in response that they were steaming full speed to the rescue, and within a short time Lloyd's sent out the following message from their signal station at Horse Sandfort :.



The S.S. Narrung.

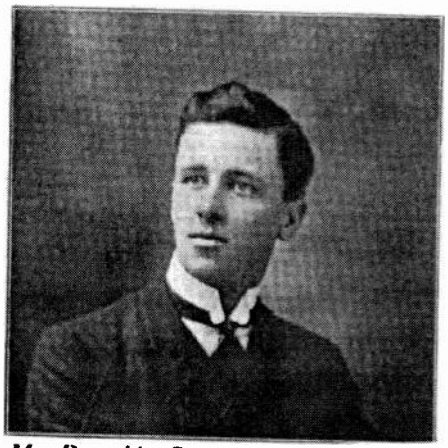
> The British steamer " Narrung," London for Sydney, steaming north-east at 10 knots, requires immediate assistance. The " Bavaria " and " Negada " are proceeding to her assistance. A wireless message from the captain states that the " Narrung " put back with her fore deck swept,

and shortly after the French Government replied from Cherbourg offering to send a gunboat to the assistance of the distressed vessel.

The difficult manœuvre of turning round in the teeth of the gale was successfully accomplished, and occupied an hour and twenty minutes in the doing, while it was not till four o'clock—or five hours after—that the

worst of the danger was over, then, steaming before the gale, the "Narrung" made its way towards safety. As soon as Captain Bidwell found that he could make the return journey unaided he sent a message to that effect in answer to the advices received from numerous vessels that were hastening to his help.

All this time the wireless operator (Mr. H. A. Reynolds) was fully occupied in the Marconi room receiving and sending the various messages.



Mr. Reynolds, Operator on the Narrung.

He remained at his post for something like forty to fifty hours, and it was the knowledge of the working of the wireless apparatus that did much to allay the fears of the passengers.

After the task of turning had been satisfactorily accomplished, a quick running of four or five hours enabled the vessel to reach comparative safety, and it was only a question of time and brilliant seamanship that effected the stages of the "Narrung's" return.

At seven o'clock in the morning of December 28th the liner dropped anchor off Gravesend, weather-beaten and dishevelled, but with every soul on board safe. All's well that ends well.

Electrical Engineering, commenting upon the "Narrung" experience, states: "The fact that the wireless equipment was able to remain in operation throughout the exceptionally boisterous weather experienced in the Bay of Biscay on Saturday last speaks volumes for the solidity of the mechanical and electrical construction, especially that of the aerial. We understand that the equipment is the standard 1½-kw. emergency set supplied by the Marconi Company. The aerial is of the standard twin type, and is 200 feet long, supported between the two masts."

The terrific gale which swept the north-east Atlantic towards the end of last month has been followed by an endless succession of cyclonic disturbances travelling east and north-east from Canada, the Straits, or the Gulf of Mexico. Such storms have not been experienced for over thirty years, and shipping has greatly suffered thereby. The British Isles have felt, in a minor degree, the influence of the disturbances, although few of the cyclone centres—that is to say, the danger zones of the storms—have reached these shores. The centres of many of them have been exceptionally deep, records from ships showing that on quite a number of occasions the barometer has dropped as low as 28½ inches. But this was not the lowest measurement, for on one occasion the Meteorological Office reported a cyclone with centre in Lat. 50 deg. N., Long. 25 deg. W., which reached the abnormally low level of 27½ inches—a reading scarcely ever registered in any part of the world.

As a result Lloyd's underwriters have had an anxious time, and wireless telegraphy has been not only in constant use to allay suspense, but has been the direct means of saving a number of vessels, which, but for this aid, must have inevitably perished. Such rescue is reported from all parts of the world, but space limits us to the mention of only a few outstanding examples.

One of the most prominent among these is the rescue of the "Oravia," which struck the Billy Goat Rock off the Falkland Isles on the night of November 12th. The occurrence has already been mentioned in THE MARCONIGRAPH, but details of the incident are now to hand.

At the time of the collision a number of the passengers were up, waiting until the ship had anchored for the night, as it was too dark to enter Port Stanley. There was great consternation, therefore, when, instead of hearing the anchor let go, they felt the ship strike with great force. The passengers were told to clothe themselves warmly and put on lifebelts. The weather was bitterly cold. The bell was rung for boat stations, and the lifeboats were swung out. The captain was on the bridge. In reply to a wireless message, the Governor of the Falkland Isles sent word that the gunboat "Sampson" and several whalers would leave immediately for the scene. An hour after the ship had stranded the lights of a vessel were seen. It was a cheering sight to the 261 passengers huddled together on deck, for they realised that the ship was in a very precarious position, and might at any moment slip off the rock and sink in deep water. But owing to the rough sea none of the boats could come alongside, and, to make matters worse, the wind increased in violence and a thick rain set in. Four lifeboats were lowered and filled with women and children, who were transferred to the whalers. Presently the Government launch "Penguin" managed to work alongside, and the remainder of the women and

children and some men embarked in her. The "Sampson" next got alongside. The remainder of the passengers, 200 in number, were then embarked and taken to Port Stanley. The captain, officers, and crew remained in the "Oravia," and after the passengers had left the mails and baggage were got up on deck. All this time the ship was grinding on the rocks, her stern being afloat. Heavy seas caused her to strain badly, and the water-tight bulkheads gave way. Later in the day the boats brought the mails and baggage ashore, and in reply to an urgent message, sent by Captain Poole to the wireless station, the "Sampson" brought off the crew, officers, and Captain Poole, who was the last to leave. The passengers were surprised to find that nothing was lost, even the loose clothing being bundled together and labelled with the number of the cabin they were taken from.

. . . . .

The British steamer "Alcazar," with a crew of 23 aboard, has had an uncomfortable experience. On December 26th the steamer "Dorchester" picked her up after she had been reported abandoned. It was found that her cargo had shifted, and she was towed into Beaufort, North Carolina, where the owners' agent took her over, the cargo restowed, and the ship again taken in tow. But later, on January 9th, she sent a wireless message from the Diamond Sholes Lightship, saying she was adrift and leaking. The British Vice-Consul immediately called for assistance, and every effort was made to reach the distressed vessel. But shortly afterwards her position became less perilous, and she was able on the following day to enter Norfolk Harbour, Virginia, under her own steam, but with a bad list to port.

. . . . .

On January 12th the British steamer "Uranium," bound from Rotterdam to Halifax, N.S., and New York, with 883 passengers and a full crew, crashed on to the rock-bound coast near Chebucto, twelve miles from Halifax. The vessel, commanded by Captain Eustace, struck the reef in a dense fog; there was a heavy south-west wind blowing, but she was protected by the headland. Had the gale been from the north-east, the vessel would have been exposed to the mighty sweep of the Atlantic, and could not have withstood the terrific pounding long enough for help to arrive. As it was, the "Uranium" was able to send an appeal by wireless, and within four hours from the time she struck, the "Lady Laurier," a Canadian Government steamer from Halifax, reached the scene of the disaster, and safely took off every passenger. The captain and crew refused to forsake the stranded liner. The "Uranium" hit the reef at 11 a.m. with a terrific crash, and momentarily her 700 odd passengers were thrown into panic. The officers and crew, who throughout behaved with great courage, soon quieted their fears, and despite the horrible sound of the broken steel plates grinding on the rocks and the icy water sweeping the decks from stem to stern, the passengers commenced to collect their luggage and await the coming of assistance.

As the "Lady Laurier" came slowly out of the mist towards the shipwrecked passengers, they gave a cheer, which even the roar of wind and wave could not stifle, and the work of rescue began immediately.

Every man, woman, and child of the 883 passengers safely reached the "Lady Laurier's" deck, and all were transported without mishap to Halifax.

. . . . .

Perhaps the most dramatic of situations is that in which the "Veronese" found herself on January 16th, when she had accomplished but a mere fraction of her intended voyage. She was a vessel of considerable importance, for she carried 300 souls aboard, and her cargo was underwritten to the amount of £150,000. The "Veronese" was bound for Brazil, and had only just passed Leixoes harbour, which is practically a suburb of Oporto, when she ran on the Boa Nova Rocks. At first it was thought that she would be a total loss as, though firmly embedded on the rock, she was breaking slowly in two, and the starboard side was completely awash. After a slight delay caused by the difficulty of working conditions, she got into wireless communication with the shore, and the Government immediately sent gunboats to her aid, while the Argentine steamer "Hollandia" stood by her in order to render assistance. But the violence of the storm made communication other than by wireless impossible, and it was only after many hours' struggle that the shore station succeeded by means of its rocket apparatus in getting out a life-line to the wreck. Then the work of rescue proceeded apace, despite the desperate weather which caused the landing cable to break frequently, and by the morning of the 19th all that could be saved were saved. That some of the passengers were past help was already known, for a wireless message from the "Veronese," sent soon after the disaster, reported that fifteen deaths had occurred owing to passengers being swept away in the heavy wash of the seas. That any loss of life should have occurred is to be deplored, but there is no doubt that without wireless telegraphy, whereby the shore stations knew exactly the position of affairs on the wreck, and so were able to make plans for the rescue and relief of the unfortunate passengers, the death roll would have been greatly increased.

Life as a Wireless Telegraphist

THE varying incidents in the career of a wireless operator always make interesting reading, and the article which adorns a recent number of *Chambers's Journal* is no exception. The name of the author is not given, but he has evidently had a fairly lengthy experience, for he refers to the time when wireless was not in such common use on board ship as it is at present. His first experience as a wireless operator was on board a liner. He tells us that he had gone through a short period of training with wireless work, which together with his previously acquired knowledge of ordinary telegraphy was supposed to render him thoroughly competent for any duties. We are not surprised to learn that the writer was soon disillusioned, for anyone who imagines that he has merely to don an operator's uniform to become a proficient telegraphist will speedily awaken from his nightmare if he will but turn over the file of THE MARCONIGRAPH and read the article which appeared in the October (1911) number on the operating side of wireless telegraphy as a career. Moreover, some of the experiences which befell the writer of the article demonstrate the pitfalls for the insufficiently trained telegraphist.

Conducting Business from Mid-Ocean

A short time ago the writer of the article in our contemporary met with an experience which shows the great utility of wireless telegraphy. The vessel had left Liverpool about half an hour, when an elderly gentleman went up from the cabin and asked the operator if he could get a message through at once to his office in London. The message was to the gentleman's junior partner in the City and was in code, so the operator did not understand it, but later the gentleman informed the operator that he had obtained from one of the passengers an important item of information concerning a certain firm in the City, and it was of such a nature as to make him very anxious to prevent his partner from engaging in a big transaction with the firm in question which he contemplated doing. By the aid of a wireless message the senior partner, though miles out at sea, was able to warn his junior of the danger of doing business with this firm and thus saved both himself and his partner from losing a great deal of money.

On another occasion a well-known English theatrical manager, who was going to America with a view of purchasing the rights in certain plays, got into communication by wireless with the playwright when the vessel was 300 miles from New York, and long before the vessel entered the harbour the theatrical manager had secured the rights in the plays he required.

Another story is told that in the early days of wireless telegraphy the captain of a liner wanted to signal to another vessel which he knew ought then to be within 50 miles of him bound for Southampton. The operator signalled her, but the receiver did not record a reply, and he was in the act of testing his apparatus when he suddenly received some signals. Thereupon the captain, who was in the operating cabin at the time, exclaimed: "There they are; we have got them at last."

"We are the 'Minerva,'" ran the message, "we are operating experimentally. Please reply." Then came a full stop, and the message was repeated again. The liner acknowledged it, but still the same message came running off the tape. After it had come through a dozen times the captain of the liner got into a furious rage. "Tell them," he exclaimed, "to chuck the machine overboard. Ask them who let them loose. Tell them to work for Colney Hatch."

"I cannot tell them anything," replied the operator. "I think their receiver must be out of order, though they do not seem to know it; but it must be or they would have received our reply and acknowledged it."

An Unlicensed Operator

One night, a little while after, the same vessel expected to be called up by a liner passing some 30 miles east of her. The operator was in his cabin about the time when the call was expected, and the captain came in to ask if there was any news. Almost at the same moment the tape began to come very slowly in jerks from the printer. "There you are," said the captain, "unless we have been picked up again by some experimenting pirate. That ought to be the liner. Get your reply through quickly, for I believe she has one of our directors on board." The signals were, however, utterly unintelligible. "I don't think it's the liner," answered the operator, "it seems to me a queer jumble of signs and letters. However I will answer them anyway." When the telegraphic key of the transmitter was depressed a big blue spark flashed out between the polished brass knobs on the coil. "What ship is that? We are the 'X' bound for New York." But no response came through, nothing but a mysterious jumble of letters that came out on the tape in jerks. "It is just possible," remarked the operator to the captain, "that we have picked up a message in code passing between two men-of-war."

On arrival at New York a most elaborate examination was made of the apparatus, when it was found that a big beetle was crawling about the relay of the receiver, and the dots and dashes were nothing more than a record of his wanderings in a place where he had no right to be.

"Heroes of Science"

MUCH has been done of late to popularise science, and as a result the interest in scientific discovery is practically universal. Nevertheless there still remains much to be done. And in this way: While the minds of those who have a scientific bent are fostered diligently and books of unlimited variety minister to their needs, little is done to bring the unscientific—by antithesis it might be called the "artistic"—mind into harmony with the distinctly scientific trend of the times. That is why Mr. Gibson's book* is particularly to be welcomed, for it does a great deal towards breaking down the barriers which divide these two natures. Its subject-matter is of common interest, and affords a ground where these two classes of readers can meet on an equality, and for that reason, if for none other, it should command success. Primarily the book is intended for young people, and the author, keeping his purpose well in view, has adopted an admirably simple style of writing. There are no "frills" of diction, nor any unnecessary wanderings from the subject in hand; the sentences are short and lucid, while the grouping of incidents into paragraphs has been raised to a fine art. Consequently the youthful reader can focus his entire attention on the story brought to his notice.

FARADAY GIVING HIS CARD TO FATHER THAMES;

And we hope the Dirty Fellow will consult the learned Professor.

If he be of the artistic temperament before alluded to, he will be fascinated to find that the men who made science were not the mere dry automata he took them to be when at school, or supermen "too great or good for human nature's daily food," but were very companionable heroes, who could crack a joke and enjoy life with the rest of us. By this means sympathy for the man's work is evoked, and this is the surest method of awakening in the mind of the child a vital interest in his studies.

But take the boy or girl who has an aptitude for the sciences; the chances are he may know a lot about the theory of evolution, and nothing at all about Darwin—the man—except as a cipher. He may write an interesting essay on the dynamo, while he could not put together a single sentence about Michael Faraday. To him the lives of these heroes of science would be a revelation, and the perusal of such a book as this would give him a broader outlook on his hobby, and teach him to realise the great truth that the be-all and end-all of science is not merely knowledge, but the betterment of mankind.

Among the "lives" in this book, one of the

* "Heroes of Science," by Charles R. Gibson. London: Seeley Service & Co. 5s.

best written is that of Clerk Maxwell, for it gives us a charming glimpse of the private life of one of Britain's greatest scientists. As has been pointed out in an earlier number of THE MARCONIGRAPH, Clerk Maxwell's career is of particular importance to those who are interested in wireless telegraphy, for it was he who established the fundamental laws of motion and electro-magnetic waves, and so paved the way for Hertz to demonstrate their actuality to an astonished world. In this connection a letter has been included by his biographer, from which we take leave to quote. It contains references to Lord Kelvin, who was then a young man known only as Professor Thomson, and reads :

"I was writing great screeds of letters to Professor Thomson about those Rings (*Saturn*), and lo ! he was a-laying of the telephone which was to go to America, and bringing his obtrusive science to bear upon the engineers, so that they broke the cable with not following (it appears) his advice."

Maxwell then proceeds to give the words of a "common song" which he "conceived on the railway to Glasgow." This is entitled "The Song of the Atlantic Telegraph Co.," and to avoid repetitions the formula U=(" under the sea") is used, so that 2(U), by parity of reasoning, represents two repetitions of that sentiment. The first two verses read as under :

2(U)
Mark how the telegraph motions to me,

2(U)
Signals are coming along,
With a wag, wag, wag ;
The telegraph needle is vibrating free,
And every vibration is telling to me
How they drag, drag, drag,
The telegraph cable along.

2(U)
No little signals are coming to me,

2(U)
Something has surely gone wrong,
And it's broke, broke, broke ;
What is the cause of it does not transpire,
But something has broken the telegraph wire
With a stroke, stroke, stroke,
Or else they've been pulling too strong.

. . . . .

"Little," adds Mr. Gibson, "did Clerk Maxwell think that his own scientific work was one day to lead men on to the invention of wireless telegraphy. It was Clerk Maxwell who first predicted the existence of electro-magnetic waves, such as we use to carry our wireless messages through space."

A word must be spared for mention of the chapter devoted to Faraday's life and his connection with applied electricity. It is a model of clear and unostentatious writing, and gives an interesting account of the great general interest which he obtained for electricity, not only by his inventions, but in a large measure also to his charming courtliness and really wonderful tact. A proof of Faraday's popularity is his frequent mention in *Punch*, and among the illustrations of the book is the accompanying cartoon, which we reproduce by kind permission of the publishers. When Faraday was sailing down the Thames he was so impressed with the pollution of the river that he wrote a letter to the *Times* deploring the condition of things. *Punch* followed this with the cartoon shown on preceding page.

Wireless Amateurs in America.

AN operator contributes to the American MARCONIGRAPH a humorous description of the nuisance afforded by irresponsible wireless amateurs—"We're not trying to knock kids who are in earnest, but we're tired of listening to their love songs in springtime. It is an odd fact that no sooner does a kid get a wireless plant than he gets a girl who has a wireless plant. Or else his chum gets a girl—and that girl always wants to talk over the currents—and there isn't a girl living that can talk for three consecutive seconds about anything but a man.

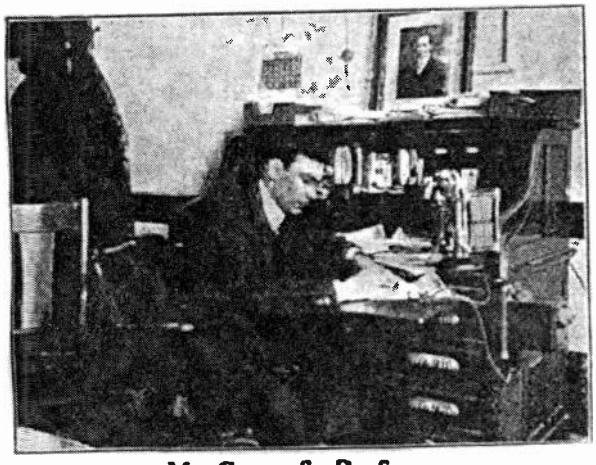
"The other night we were expecting an order to whoop it out of here on the hunt of a derelict. Washington told us that one had been sighted down about Hampton Roads—in that dangerous angle of which Cape Hatteras is the peak—and the moment that she could be definitely located we were to be off. We had steam up in our boilers, and at a minute's notice we would have yanked the hook out of the mud. And then, as I sat there with my ears growing fast inside the receiver, the kids began to coo. I'd hear a little, faint click. 'Is that you, Sallie ?' some kid would ask. And Sallie would say, 'Yes, darling,' while every wireless operator between Point-o'-Woods and Portland light howled to her to go kiss a pig.

"And that pair of drooling infants kept up that annoying blither until everybody suddenly went mad. The men on the incoming steamers and the Fire Island station and the station at Sagaponack, and on the cutters and on the steamers in port, began to 'jam' those messages of endearment. For a solid hour they kept up, until the youngsters finally saw that they would not be permitted to utilise the air for their dribbling folly. And in the meantime the business of all this end of the water world was held up because Sallie loved her Joe."

Personal

Vice-Admiral Sir Henry Bradwardine Jackson, who has been appointed first chief of the Admiralty War Staff, is an officer of high scientific attainments who for the past two years has commanded the Naval War College at Portsmouth. Sir Henry Jackson is a well-known torpedo expert, and has commanded both the Portsmouth and Devonport torpedo schools. His interest in wireless telegraphy is well known, and he was elected F.R.S. in recognition of his researches in electrical physics. He has been Assistant Director of Torpedoes, and from March, 1905, to October, 1908, was Third Sea Lord and Controller.

Congratulations to Mr. George S. De Sousa, the traffic manager of the Marconi Wireless Telegraph Co., Ltd., of America, on his approaching marriage to Miss Weymann. The ceremony will take place in New York on February 10th. Mr. De Sousa joined the company about ten years ago as assistant traffic manager, and was later promoted to the important position which he now so capably fills. He controls and supervises the telegraph staff on ship and at shore stations, deals



Mr. George S. De Sousa.

with reports from operators and with all correspondence relating to the telegraph business; prepares and issues all forms and circulars relating to the conduct of the ship and shore stations, prepares and issues sailing lists and charts, obtains and issues call letters for all ship and shore stations. Mr. De Sousa's department is also responsible for the training and engagement of operators.

We regret to report an accident to Mr. R. Bickerdike, one of the directors of the Marconi Wireless Telegraph Company of Canada. Mr. Bickerdike was on his way to the House of Parliament in Ottawa when he had the misfortune to slip on the icy pavement, and fell heavily, breaking his kneecap. Mr. Bickerdike is not at an age when such an accident can be borne with ease, and it is feared that he will be confined to his house for some considerable time.

Football

The Marconi Club (London) have played the following matches during the last month: On January 11th a League match with Aster resulted in a notable victory for the Marconi Club, who won by 8 goals to nil. The winners showed capital form under very trying weather conditions, while their opponents put up a very stubborn defence. A second League match was played against All Saints, when again the Marconi team won by 4 goals to 2. On this occasion it was the excellent play of the forwards rather than a favouring fortune which decided the contest. Two friendly matches were also played—one against Treloar's, on December 28th, when the Marconis won by 5 goals to 1, and one against Talbot II., when again they were successful by 4 goals to 1.

Movements of Engineers

(London)

P. Boucicault, who has been engaged since May in erecting installations on the Great Lakes, Canada, for the Canadian Marconi Company, has now returned to England, and is at present stationed at Poldhu for experience in high-power station work.

F. E. Burrowes, having completed his foreign service leave, is now at Liverpool assisting Mr. Pereira in ship equipment work.

H. B. T. Childs has returned from Canada, and is now at the London office.

W. B. Cole, who has been to Barrow-in-Furness inspecting the Chinese cruiser "Ying Swei," which is equipped with a 3-kw. Marconi installation, is now back in the drawing office, London.

P. Croker has returned from Carnarvon, Wales, where he has been engaged in preliminary work on the site for the Welsh high-power trans-ocean station, and is now at head office.

E. de Lange has been transferred from the Brussels office of the Belgian Marconi Company, and is now attached to the engineering department of the parent company in London.

G. H. Major and H. F. J. Merton have been temporarily transferred from the London drawing office to Liverpool for practical experience in ship equipment work.

A. T. Pole has been transferred from Clifden high-power station to Poldhu for further experience in high-power work.

R. C. Quick left London on January 22nd for Spezia, Italy, to supervise the work of equipping a Portuguese submarine with a Marconi installation.

H. J. Round left London for the Canadian Marconi Company's Glace Bay high-power station, Canada, on January 4th, for special work in connection with trans-Atlantic communication.

A. G. Savill left London on January 10th for Rio de Janeiro, to superintend the erection of two 25-kw. and two 15-kw. land stations in Brazil, which are being erected for the Brazilian Government by the Marconi Company.

E. J. Watts, who has for several months been occupied in China with special work for the company, is now returning to London.

Engineers engaged in the work of equipping merchant ships with Marconi installations are located as follows:

W. H. Brown and A. Flood-Page, assisted by T. H. White (wireman fitters), Glasgow.

W. F. Fielding and L. G. Jeffery, Liverpool.

G. S. Wood, Hamburg.

K. Tremellen and W. H. Venn, London Office.

N. C. Rackstraw, Hull.

G. J. Boome, assisted by T. Harrisen, D. Hasler, and T. Y. Hayton (wireman fitters), London Docks.

(Canadian Company)

W. A. Appleton has arrived at Montreal from the Labrador stations.

L. S. Hawkins has been transferred from Tobermory, Ont., to Port Arthur, Ont., to take charge of the alterations and installation of new type of apparatus at the latter station.

E. E. Robinson has left Midland, Ont., for Sarnia, Ont., to take charge of the installation of new apparatus at the latter place.

Movements of Operators

F. W. Adams, from the "Megantic" to the "Tunisian."
S. H. Adames, from the "Beacon Grange" to the "Cluny Castle."
L. W. Alford, from the "Montezuma" to the "Trent."
F. Amott, from the "Ivernia" to the "Saldanha."
V. W. Ball, from the "Minnetonka" to the "Arzila."
G. K. Barber, from the "Agadir" to the "Moravian."
B. J. Basson, from the "Gloucester Castle" to the "La Rosarina."
C. H. Bartlett, from the "Kenilworth Castle" to the "Edinburgh Castle."
H. S. Bride, from the "Dover Castle" to the "Namur."
A. F. Bruton, from the "Caronia" to the "Empress of Britain."
A. E. Ballard, from the "Athenia" to the "Caledonia" (anchor).
R. E. Blizzard, from the "Saxonia" to the "Demerara."
C. T. Baldon, from the London School to the "Rohilla."
A. H. Bocking, from the London School to the "Rewa."
F. N. Calver, from the "Mandingo" to the "Saxonia."
W. H. Chick, from the "Garth Castle" to the "Potaro."
H. T. Clarke, from the "Nore" to the "Waimana."
L. B. Cleary, from the "Denis" to the "City of Glasgow."
H. T. Cottam, from the "Goorkha" to the "Dover Castle."
K. S. Cowhey, from the "Elmina" to the "Akabo."
W. Crabb, from the "Tainui" to the "Minneapolis."
A. Crofts, from the "Vestris" to the "City of Durham."
C. H. Crossman, from the "Orita" to the "Antony."
D. R. Cormack, from the "Cameronia" to the "Scandinavian."
H. E. Cutbush, from the "Caledonia" to the "Numidian."
F. Campbell, from the "Minneapolis" to the "Royal Edward."
G. M. Coates, from the "Montfort" to the "Inkosi."
C. S. Coulson, from the "Devonian" to the "Cedric."
F. Clark, from the Liverpool School to the "Laurentic."
E. C. Cousins, from the London School to the "Montreal."
N. S. Clarke, from the Italian Company to the "Gascon."
E. W. Dexter, from the "Braemar Castle" to the "Agadir."
R. Dawson, from the Liverpool School to the "Celtic."
R. Ferguson, from the "Ambrose" to the "City of York."
H. A. Flick, from the "Lusitania" to the "Arankola."
P. Foran, from the "Antony" to the "Tropic."
W. G. Fox, from the "Aguila" to the "Suevic."
G. C. Fenton, from the "Simla" to the "Cassandra."
J. C. Farmery, from the London School to the "Magdalena."
F. J. Fookes, from the London School to the "Araguaya."
C. C. Goulding, from the "Salsette" to the "China."
F. N. Gowlett, from the "Grantully Castle" to the "Minnehaha."
F. T. Gardiner, from the London School to the "Californian."
W. F. Gray, from the London School to the "Dongola."
H. P. Hart, from the "Potaro" to the "Montfort."
H. Haynes, from the "Sardinian" to the "Scandinavian."
S. C. Howes, from the "Munster" to the "Flamenco."
H. P. Hunt, from the "Guelph" to the "Arawa."
W. E. Hutchinson, from the "Mount Temple" to the "Edavana."
W. C. Henderson, from the "Lusitania" to the "Ivernia."
C. Harris, from the "Minnehaha" to the "Ascania."
T. H. Hallsall, from the London School to the "Lake Michigan."
E. A. Hickman, from the London School to the "Nyanza."
E. L. Henri, from the London School to the "Arzila."
A. Kingsbury, from the "Suevic" to the "Cufic."
R. Leith, from the "Lusitania" to the "Caronia."
F. J. Linnell, from the Mantaro to the "Oropesa."
R. A. Lovibond, from the London School to the "Highland Piper."
J. MacLeod, from the "Trent" to the "Gaika."
S. E. MacLeod, from the "Athenia" to the "Caledonia."
P. B. Maltby, from the "Empress of Britain" to the "Carmania."
J. E. Marriott, from the "Wakool" to the "Carisbrook Castle."
C. T. Massey, from the "Minneapolis" to the "Kia Ora."
C. V. Maudsley, from the "Caledonia" to the "Karina."
J. M. McKenna, from the "Pretorian" to the "Sardinian."
F. Milford, from the "Virginian" to the "Tunisian."
H. P. Murphy, from the "Flamenco" to the "Victorian."
T. W. Murray, from the "Worcestershire" to the "Nigeria."
M. Monsey, from the "Ortega" to the "Aguila."
H. Melling, from the London School to the "Ausonia."
L. S. Newns, from the Liverpool School to the "Devonian."
R. H. Nash, from the Liverpool School to the "Cornishman."
W. C. Obey, from the "Carpathia" to the "Abosso."
P. O'Keefe, from the "Baltic" to the "Canada."
J. E. Osborne, from the "Lake Erie" to the "Montrose."
T. O'Riordan, from the London School to the "Potaro."
R. H. Packer, from the "Simla" to the "Minnetonka."
C. T. Parker, from the "Kia Ora" to the "Norseman."
G. F. Pepper, from the "Caledonia" to the "Numidian."
C. Peters, from the "Oropesa" to the "Mantaro."
T. G. Peterson, from the "Aragon" to the "Moldavia."
W. Pettingell, from the "Medina" to the "Neuralia."
A. Pink, from the "Uranium" to the "Ortega."
G. Plummer, from the "Gaika" to the "Roya Edward."
A. G. Powell, from the "Narragansett" to the "Lake Erie."
T. W. Page, from the "Highland Scot" to the "Uranium."
J. H. Payne, from the London School to the "Montezuma."
E. P. Parker, from the London School to the "Minneapolis."
D. Robertson, from the "Campanello" to the "Ballarat."
F. W. Rivitt, from the "Columbia" to the "Sardinian."
F. V. Robinson, from the Liverpool School to the "Bohemian."

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