THE MARCONIGRAPH

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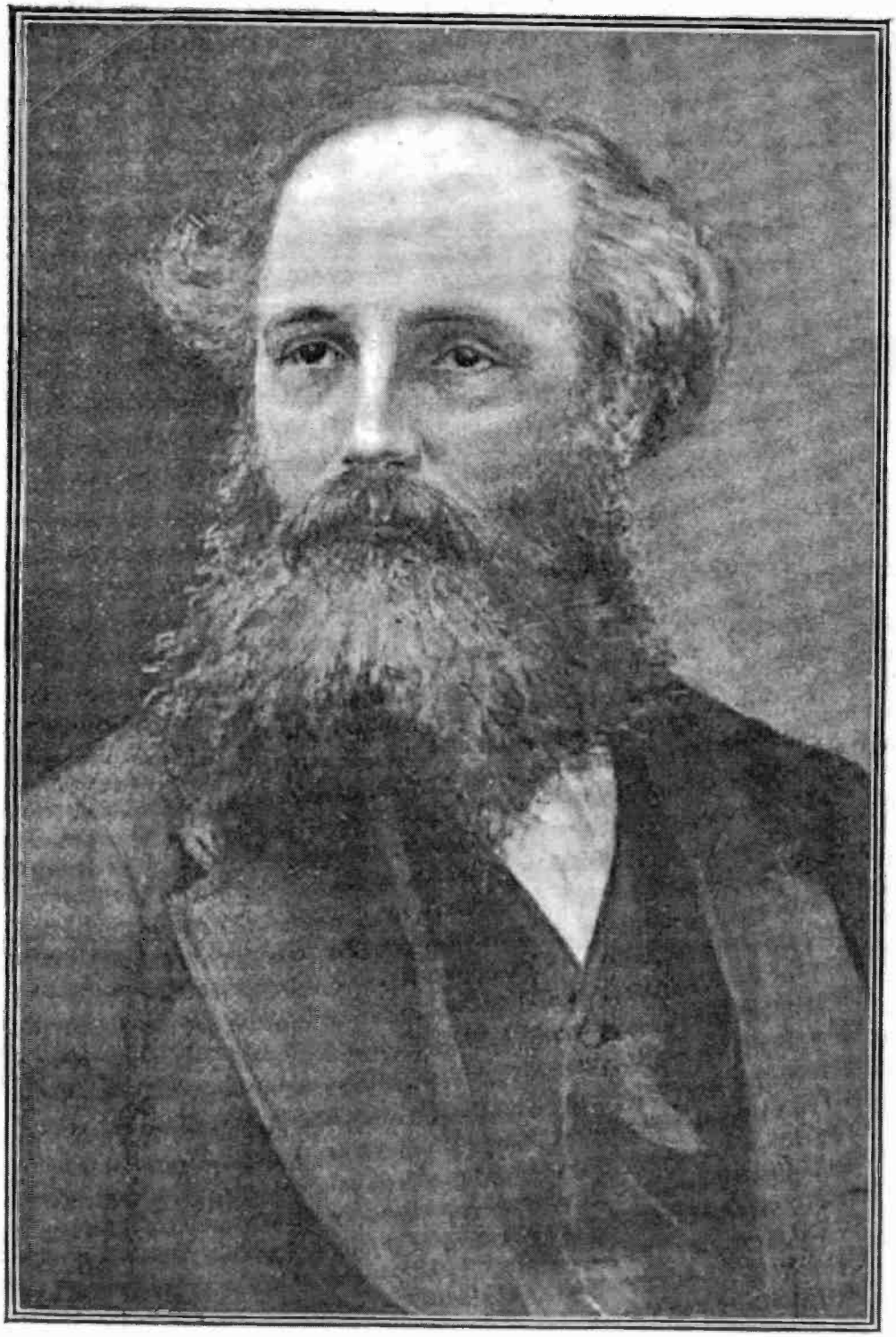
The Training of Operators

WIRELESS telegraphy has become as indispensable to ships for communication as the ordinary land line telegraphs are to the working of our railway systems, and as no railway station or signal-box is without its telegraph instruments, so it is safe to predict that in the near future no ship will be without its wireless telegraph installation. This business has created a new type of telegraphist, known as the "Marconi operator." At the present time there are several hundreds of these operators, with a growing demand for skilled men.

The problem to be faced is that of coping with this demand. The occupation is one which should appeal strongly to young men of fair general education and good penmanship, who, in the ordinary way, might drift into offices and finish up their lives as clerks. To facilitate the entry into this occupation Marconi's Wireless Telegraph Company has decided to inaugurate evening classes at the Marconi House, Strand, London, for training men to take charge of wireless installations on board ship.

Prospective students should not be under nineteen or over twenty-four years of age. After enrolment as a student the beginner will be taught to transmit and receive signals by means of the Morse sounder, buzzer and telephones. He will then follow a course in elementary magnetism and electricity, and when he is sufficiently versed in this theoretical knowledge he will be taught the practical use of the various pieces and types of apparatus employed in installations. This instruction will enable him to connect up the various parts which comprise the wireless set, to trace and remove faults, and repair breakdowns. Finally, he will receive instruction in the various rules and regulations laid down by the Radio-telegraphic Convention for the commercial working of wireless telegraphy, and all clerical work in connection with telegraphic accounts and returns. When this curriculum has been gone through—and, despite the formidable list of work to be done, the course need not last much over six months—the student should be qualified to pass the necessary examination enabling him to take up his duties as wireless operator on board ship. On his appointment to a post he will be required to sign on the ship's articles as a member of the crew—generally with the honorary rank of junior officer—and he will also be expected to observe the disciplinary regulations of the ship, but he will have no more duties than such as are peculiar to wireless telegraphy.

On joining the Marconi classes the student will be expected to pay a weekly fee, but as soon as he has attained the required standard of proficiency and entered the service in his capacity as operator the total fee will be refunded.



PROFESSOR JAMES CLERK MAXWELL

Professor James Clerk Maxwell

THROUGHOUT the study of the scientific theory of wireless telegraphy there live and move the images of three men—Faraday, Maxwell and Hertz—each of whom has added an important quota to the sum of research work that has made possible the brilliant practical results of the present day. Of these, Clerk Maxwell stands in a direct relationship to the other eminent scientists, for it was he who translated the ideas of Faraday into the succinct and expressive notation of the mathematicians, and it was he who established the fundamental laws of motion and electro-magnetic waves of which it was reserved for Hertz to give to the world an experimental proof of their reality.

The last representative of the younger branch of a well-known Scottish family, James Clerk Maxwell was born in Edinburgh on November 13th, 1831. He was educated in his native city and entered Cambridge in 1850. Four years later he took his degree as Second Wrangler, and was declared equal with the Senior Wrangler of his year in the highest ordeal of the Smith's prize examination. In 1856 he was appointed to the chair of Natural Philosophy in Marischal College, Aberdeen, and held that post till 1860. For eight years subsequently he held the chair of Physics and Astronomy in King's College, London, but resigned in 1868 and retired to his estate in Scotland. He was summoned from his seclusion in 1871 to become first holder of the newly-founded professorship of Experimental Physics in Cambridge, and it was under his direction that the plans of the Cavendish Laboratory were prepared. He superintended every step of the progress of the building and of the purchase of the very valuable collection of apparatus with which it was equipped at the expense of its munificent founder, the seventh Duke of Devonshire (Chancellor of the University). He died at Cambridge on November 5th, 1879.

For more than half of his brief life he held a prominent position in the very foremost ranks of natural philosophers. We cannot outline here the noteworthy achievements which stand to the credit of Maxwell, but mention might be made of a contribution on "The Equilibrium of Elastic Solids" which he made to the Transactions of the Royal Society of Edinburgh when only eighteen years of age. That contribution is remarkable not only on account of its intrinsic power and the youth of its author, but also because in it he laid the foundation of one of the most singular discoveries of his later life—the temporary double refraction produced by viscuous shearing stress. In his elaborate memoir on Faraday's "Lines of Force" he gave the first indications of some of these extraordinary electrical investigations which culminated in the greatest work of his life.

In 1873 his great treatise on "Electricity and Magnetism" made its appearance. This work is one of the most splendid monuments ever raised by the genius of a single individual. The author modestly regarded this work as being principally for the assistance of understanding Faraday's mode of thought. It was full of new discoveries, but we are chiefly concerned with only one of these. Clerk Maxwell formulated the hypothesis that the electro-magnetic strains in the medium travelled at a definite speed, depending upon the permeability of the specific inductive capacity of the medium. He showed, however, that in air this speed was the same as that of light, which led him to suppose that light was an electro-magnetic wave probably due to electric vibrations taking place over the surfaces of masses of molecular dimensions. Within twenty-five years from the publication of Maxwell's treatise Heinrich Hertz gave a complete demonstration of electro-magnetic waves and paved the way to the discoveries in wireless telegraphy which have led to achievements that are to-day almost commonplace by their frequency.

Maxwell's contributions to scientific societies began in his fifteenth year and continued over a long period. He obtained in 1859 the Adams Prize in Cambridge for an original essay on "The Stability of Saturn's Rings." From 1855 to 1872 he published at intervals a series of valuable investigations connected with the perception of colour and colour-blindness, for the earlier of which he received the Romford Medal from the Royal Society in 1860. He wrote an admirable text-book on the theory of heat in 1871, and an excellent elementary treatise on matter and motion five years later. One of Maxwell's last contributions to science was the editing of the "Electrical Researches" of the Hon. Henry Cavendish. According to a biographer, Clerk Maxwell was in private life one of the most lovable of men. Though perfectly free of any trace of envy or ill-will, he yet showed on fit occasions his contempt for that pseudo-science which seeks for the applause of the ignorant by professing to reduce the whole universe to a fortuitous sequence of events.

Some Observations on the Strength of Signals and X's

By H. J. Round

IN view of the attention which is now being given to the question of the transmission of electric waves over great distances on the earth's surface, it may be of interest to record here some observations taken over an extended period. Owing to the requirements of commercial service, it has often been impossible to observe the various phenomena sufficiently frequently to make certain that they were of constant occurrence. In July, 1911, Mr. Tremellen and the writer succeeded in obtaining at Chelmsford some fairly accurate observations on the variations of the strength of signals from Clifden. An extremely sensitive method of measurement was devised which gave readings proportional to the R.M.S. value of the current in the receiving aerial, provided the musical note and decrement of the transmitter remained constant during the tests. The receiving aerial consisted of a T aerial of average ship size and height; the method used consisted actually in the measurement of the maximum voltage across the secondary of the receiving transformer by means of a Fleming valve, and during the test it occurred to us to obtain some curves of strays or X's. The apparatus enabled us to obtain some sifting of the X's, so that we could either get all the atmospherics or only those whose maximum voltage was above any given figure.

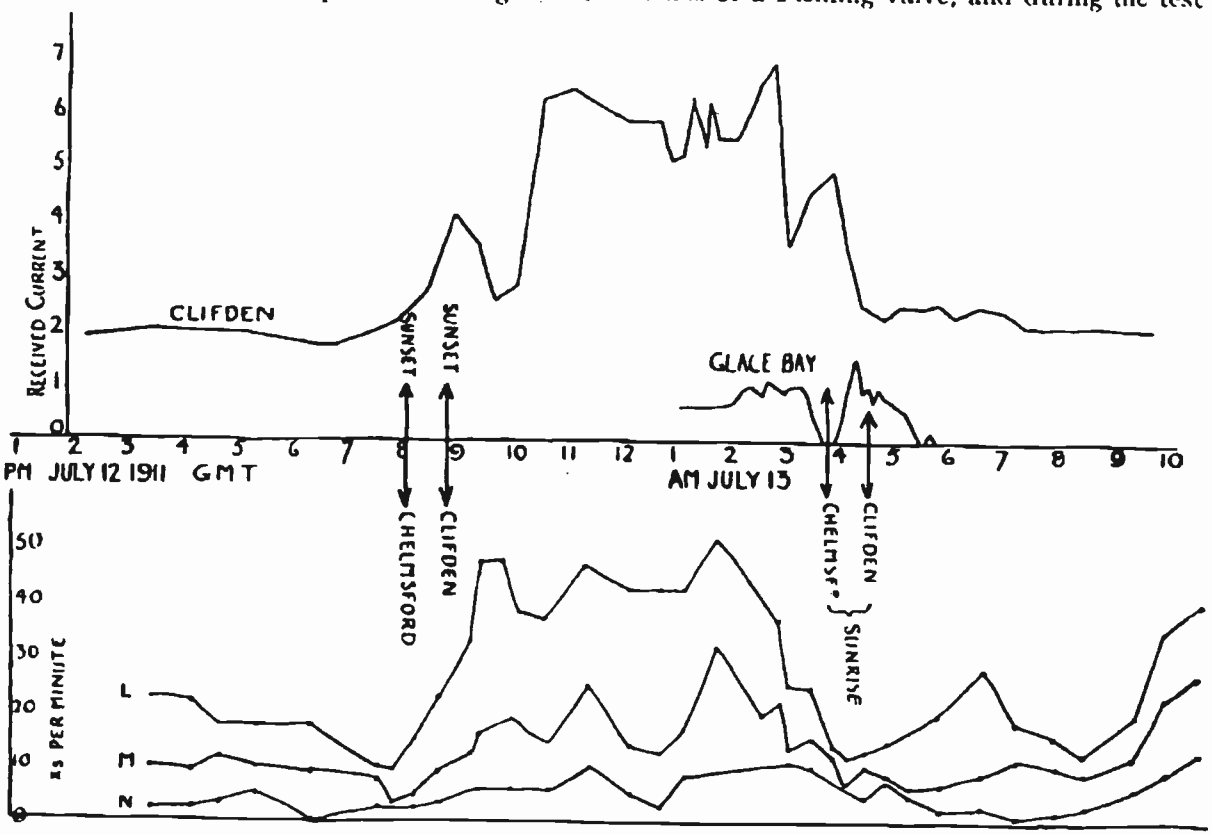


Fig. 1. Upper curves relate to Clifden and Glace Bay signals received at Chelmsford; lower curves represent X's at Chelmsford on July 12 and 13, 1911.

Figure 1 represents the results during a 21 hours' continuous test throughout which Clifden read their aerial ammeter every hour, and arranged to send once at least every half-hour. In the two curves shown (Figure 1) of Clifden and Glace Bay the strength at any point is proportional to the square of the ordinate.

One very interesting feature is that at sunrise at Chelmsford, and for several minutes on either side of sunrise, Glace Bay signals vanished, although it was known that the latter station was sending at the time.

In Dr. Marconi's curves of strength obtained over the Atlantic a dip of signals invariably occurs between sunset at Clifden and sunset at Glace Bay. This is curiously absent in the curve of Clifden signals taken at Chelmsford. Mr. Tremellen made many attempts to obtain the minimum, but on looking through the records we can only find evidences of a slight kink in the curvature during the upward rise. This slight kink I have also recently noted in signals between Porto Velho and Manaos on the Amazon. The minimum only seems to become distinct over greater distances, or perhaps at other times of the year.

At Glace Bay there is often a slight rise of strength of signals from Clifden just about sunset at Clifden, this rise usually being observable simultaneously at Clifden with signals from Glace Bay. In Figure 1 this rise and the great rise of strength when the sun is setting at the most westerly station apparently overlap and suppress the minimum. The minimum of signals about one hour after sunset at Clifden is very noticeable at Chelmsford, and the position of the minimum is a distinct function of sunset. Thus on July 12th, 17th and 26th, 1911, the times for the minimum were 9.55, 9.48 and 9.37. The most remarkable rise of all is that between 10 and 11 p.m.; very often signals will quadruple in strength in five minutes. The rise of strength is apparently most noticeable over short distances, for it is rarely obtained over the Atlantic except as a freak. After the sunset maximum between Clifden and Glace Bay is over a period of extreme variability sets in, but between Chelmsford and Clifden an extremely irregular period occurs only after the above rise has taken place. About an hour before sunrise at Chelmsford a minimum occurs which is not quite so regular in occurrence as the 10 p.m. minimum, and maximum occurs at sunrise at Chelmsford which compares curiously with the sharp minimum from Glace Bay. After this signals fall first to an irregular period. Possibly there is a tendency to another minimum. Day strength then sets in with very few variations taking place.

Curves L M and N were taken simultaneously with the curves of Clifden and Glace Bay, and represent the number of strays per minute (counted) which reached a maximum voltage of 3, 6, and 12 volts respectively across the receiving transformer secondary. At first there seems to be a general resemblance between these curves and the signal curve. In so far as there is a general increase of X's, particularly small ones, at night this is true, but the day variations are very great. Usually in the summer there is a maximum about 4 or 5 p.m. One noticeable point about curve L is the maximum at the 10 o'clock minimum of Clifden's signals. We have other records to prove that this occurrence is not accidental. Its exact import is difficult to appreciate, but we proved beyond doubt that it was not the action of these X's on the receiver that caused the minimum of signals. It will be noted that this is a maximum of small X's, if curves L and M are subtracted. A comparison of the curves between Clifden and Glace Bay, and between Chelmsford and Glace Bay discloses the fact that during certain periods of the night rapidly varying signals are obtained. Over the shorter distance these rapid variations are seldom of

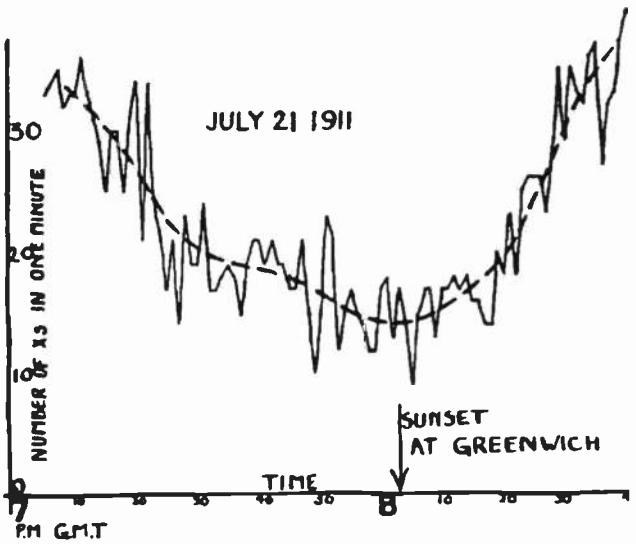


Fig. 2. A Record of X's near sunset, taken at Chelmsford, July 21, 1911.

sufficient amplitude to weaken signals to even the average day strength. But over the Atlantic the variations are of much greater amplitude and convey the idea that average signals are no stronger than daylight signals. In these curves the minimum occurs, roughly, twenty minutes after Chelmsford sunrise, but if curves L and M are subtracted it will be seen that there is a " small X " minimum very near to sunrise. It should be noted that there is a maximum of small X's after the sunrise minimum. These curves seemed to indicate a minimum of X's just before sunset. Mr. Tremellen went into this point fairly completely, and practically settled that at least in July at Chelmsford the minimum is within a minute of the moment when the top edge of the sun sinks over the horizon. Figure 2 represents a series of observations taken over about one hour and

forty minutes on July 21st, 1911. On many nights this minimum was hidden by local storms. I have since on several occasions taken many of these minima and actually roughly determined the longitude on board a ship by means of them. These minima are usually only observable on long waves, and Figure 3 shows clearly the effect of wave-length on the minimum, two curves being drawn over the same sunset at 13,500 ft., and 19,700 ft. wave-lengths. It will be noted in examining the curve of Clifden (Figure 1):

1. That there is a maximum at about sunset at Clifden—the most westerly station.

2. That there is a maximum at about sunrise at Chelmsford—the most easterly station.

These maxima are also noted on Dr. Marconi's curves taken across the Atlantic, where it is shown that short waves give the highest maxima. The sunset and sunrise maxima and minima are usually simultaneous at both stations. Reasoning from these observations of signals at sunset (the darkness being to the eastward at Chelmsford), one would expect a maximum of distant strays, especially of short wave strays. An examination of wind charts at South Kensington has led me to believe that at sunset and sunrise a steady state of the atmosphere occurs when there are less air eddies than usual. Consequently if one assumes that a large number of strays are produced locally by the collision of charged and uncharged masses of air, these local strays will be a minimum when the air eddies are a minimum. Therefore the only X's received at sunset will come from a distance, and short wave X's should predominate. This is distinctly shown in Figure 3. What probably happens at sunset is that a minimum of local X's overcomes a maximum of distant X's. One can apply exactly the same reasoning for

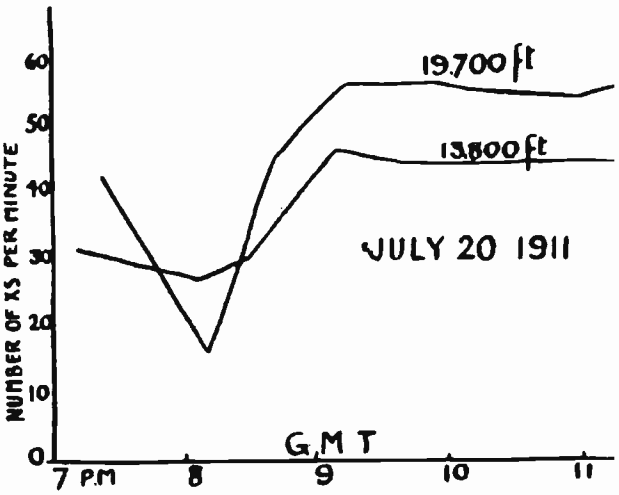


Fig. 3. X's near sunset, taken on two wave lengths at Chelmsford, July 20, 1911.

sunrise, the distant strays now coming from the west. Unfortunately we have no data on short and long waves at sunrise. A possible explanation of the maxima of small X's after sunset and sunrise is that local X's are stored up during the steady state, and rise to a maximum when air eddies occur again.

Phenomena of Terrestrial Magnetism

And the Effect upon Wireless Telegraphy

By Dr. C. Chree

THOUGH not an expert in wireless telegraphy, I have read with interest the communications on the effect of daylight upon radio-telegraphic waves in the August and September numbers of THE MARCONIGRAPH, by Prof. Fleming, Dr. Eccles and Mr. Wheeler. These writers refer to various possibilities in which a part is played by phenomena of terrestrial magnetism and atmospheric electricity, subjects to which I have devoted special attention. It may thus tend to narrow the inquiry if I refer to some geophysical phenomena with which experts on wireless may be less familiar. Mr. Wheeler, if I correctly interpret him, thinks that the difference between wireless phenomena by day and night may be directly due to the difference between the intensity of the earth's magnetic field in the day and night hours. Even in the horizontal component of magnetic force—which shows a notably larger diurnal variation than the vertical component—the regular daily range is only of the order of ½ per cent. of the force. A variation relatively so minute can hardly be the *direct* cause of so prominent a phenomenon as the one in question. Again, irregular changes in terrestrial magnetism are numerous, and at times much larger than the regular changes. Thus, if variations in the magnetic force of the size of the regular diurnal inequality can produce large effects on the transmissibility of electric waves, similar large effects should be

of frequent occurrence both by night and day, and during really large magnetic storms the effect should be simply enormous.

Evidence from Aurora

Dr. Eccles' theory is that for the purposes of wireless telegraphy the earth may be regarded as surrounded by a "lower" atmosphere but slightly ionised, a "middle" atmosphere strongly ionised by day, and an "upper" atmosphere permanently ionised. He apparently supposes electric waves to be reflected under all conditions by his "upper" atmosphere, and the difference between day and night to be due to the fact that the "middle" atmosphere is highly ionised only during the day. Dr. Eccles seems somewhat vague as to the heights of his "middle" and "upper" atmospheres and as to the rapidity of transition of electrical conditions in passing from one layer to the next. These, however, are very vital points when it comes to considering the probability of the theory.

Probably the only direct evidence we possess as to the electrical condition of the atmosphere at heights higher than manned balloons have attained is afforded by Aurora. Assuming—what is hardly open to doubt—that aurora is an electrical discharge, the portion of atmosphere occupied by an aurora must possess high conductivity. Estimates of the heights of aurora were of uncertain value until recently, but Prof. Störmer of Christiania has obtained satisfactory photographs of auroras from the ends of a measured base, and has thus estimated the height of selected prominent points trigonometrically. He took a number of these observations in the spring of 1910 in the north of Norway. The calculated heights varied from 24 to well over 200 miles, heights from 60 to 80 miles being the most common. Different parts of aurora measured on the same occasion sometimes differed in height by more than 100 miles. Aurora presumably attains both lower and higher altitudes than Prof. Störmer's observations included. Aurora is very frequent in a so-called auroral belt passing from the north of Norway to near the south of Greenland, but is rare in Southern England and very rare indeed in Southern Europe. The absence of visible aurora may be due to deficiency either of electromotive force or of conductivity; thus the high conductivity, of whose frequent existence at heights over 30 miles in Arctic latitudes aurora affords direct evidence, *may* not be limited to particular occasions or to particular latitudes, but be universally characteristic of altitudes of 30 miles or even less. There are, however, various reasons for believing that the conductivity is abnormally high in space occupied by aurora, and so the *continual* existence of a very high conductivity in the atmosphere all over the globe at heights of 30 miles and upwards, though probable enough, cannot be said to be demonstrated. Further the strong probability is that the conductivity at these heights is not constant, but in the auroral belt at least highly variable.

Mathematical Support

This latter conclusion is supported by the phenomena of terrestrial magnetism, if we accept the views of Prof. Schuster, who has made a special study of the subject. He claims to have proved mathematically that the main part, at least, of the regular diurnal magnetic variation is directly due to electrical currents in the upper atmosphere. This view is generally accepted, even by those magneticians who question whether the physical data at Prof. Schuster's disposal were altogether adequate and satisfactory. The amplitude of the regular diurnal magnetic variation varies greatly with the season of the year, and the changes as a rule are notably more rapid by day than by night. These phenomena might conceivably be associated with changes solely in the electro-motive force. But the facts that the diurnal variation at any season is much larger in years of many than of few sunspots, and that the difference between day and night phenomena is relatively reduced in years of many sunspots, amount almost to a proof of variability in the conductivity in the regions occupied by the currents to which the diurnal variation is due. This, at least, is the view that has been taken by Prof. Schuster and myself independently. It is possible, of course, that the currents in question are below the ordinary aurora level. There are, however, strong reasons for thinking otherwise. In the latitudes where aurora prevails the range of the regular diurnal magnetic variation is much enhanced, and irregular magnetic variations are large and numerous. Further, at times of bright aurora, in temperate latitudes, it is usual to experience the large irregular variations known as "magnetic storms." During these storms a regular diurnal variation can be traced which possesses a specially large range, and resembles that in high latitudes in showing a reduced difference between day and night.

Interrelated Currents

These phenomena are certainly most easily explained by supposing the currents producing aurora and those causing magnetic variations, both regular and irregular, to be very closely interrelated. The probable seat, in short, of both discharges is what is generally known as the upper atmosphere, and the natural inference is that any action which the conductivity of

the upper atmosphere enables it to exert on wireless phenomena will be far from constant. One would, in fact, expect a difference between day and night, between summer and winter, between temperate and auroral latitudes, and between years of many and of few sunspots.

More definite information is desirable as to what Dr. Eccles means by his "middle" atmosphere. Judging by remarks on pp. 90 and 92 of his Royal Society paper, it comes down to within 12 miles—possibly a good deal less—of the earth's surface, but is above the ordinary cloud level. What the electrical conditions are at, say, the 12 mile level is very problematical. The conductivity depends both on the mobility and the number of the ions. The mobility, under laboratory conditions, increases rapidly as the air pressure diminishes; thus, if the number of ions is large the conductivity will naturally be high. But as regards a difference between day and night, what seems most natural in the "middle" atmosphere is something intermediate between what occurs in the upper and the lower atmospheres. In the former, as we have seen, there is strong reason to believe that in the absence of aurora conductivity is reduced at night, but by no means relatively negligible. In the latter, conductivity does not seem specially low at night; at some stations, in fact, the maximum seems to come before sunrise.

The Earth's Vertical Electrical Field

A phenomenon which Dr. Eccles mentions as probably characteristic of the middle atmosphere is that "there occurs during the day a great sifting of oppositely charged ions under the operation of the earth's vertical electric field, positive ions moving up and negative ions moving down." This would be equivalent to an upwardly directed vertical current during the day, with presumably a corresponding downwardly directed current soon after sunset. If this be the case, it seems to add to the difficulty of explaining one of the great puzzles of atmospheric electricity—viz., that in fine weather the vertical current at ground level is practically always directed downwards by day as well as by night. As a matter of fact, the intensity of the earth's vertical field is known from balloon experiments to diminish very rapidly as we rise in the lower atmosphere. At the three-mile level it seems to be of the order of a tenth of what it is at ground level, and whether it has a finite value at the twelve-mile limit is, at least, somewhat doubtful.

The only other point I shall refer to in Dr. Eccles' paper is the remarkable disappearance of "strays" he describes as occurring about ten minutes before sunrise and ten minutes after sunset. If generally true, this would be a fact of much significance. Confirmation of its generality by means of records taken for some time at several stations, preferably with some form of self-recording apparatus, is thus highly desirable. Remarkable changes in the earth's electrical field at sunset and sunrise have been described by more than one observer, but in this case, judging by the continuous records obtained at observatories, the phenomenon would seem to have been either of a purely local character or else accidental.

Assuming—what seems hardly open to doubt—that sunshine exerts some potent influence on the medium in which wireless waves are propagated, that influence must vary with the altitude of the sun, and thus greater heterogeneousness should prevail along the path of the waves by day than by night. Increased homogeneousness naturally means diminished loss of energy by reflection.

I think special interest would attend experiments made within the Arctic circle during the continual day of midsummer and the continual night of midwinter, especially if regard were paid to the presence or absence of aurora.

Spanish News

During the discussion in Parliament of the War Office estimates, the Marquis of Teverga, who holds the rank of major in the Military Engineers, urged that one and a half million pesetas should be allocated for the purpose of military wireless stations, land and portable type. The proposition did not succeed, however, although there is a likelihood that something may be done when the estimates are discussed before the Senate.

* * *

The wireless station at Soller, on Mallorca Island, was opened for public service on October 14th. This station was constructed by Marconi's Wireless Telegraph Company, and is operated by the Compañia Nacional de Telegrafia sin Hilos. The power employed in it is 5 kw., and the wave-lengths 780, 600, and 300 metres; the range over sea is 800 km.

* * *

The Marconi Training School at Madrid has been open since September 21st, and is performing a very useful work. So keen is the desire of young men in Spain to become wireless operators that on notifying the students that there were vacancies for twenty operators on board ship, about 200 applications were made, and after a severe examination no fewer than fifty candidates obtained sufficient marks to entitle them to a certificate.

Time Sign

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points are the extraordinary accuracy of the signals and the ease with which they can be observed. They are certainly worth the confidence of navigators. Paris may be considered as 200 miles, and Norddeich as 270 miles from Greenwich.

Educational and Lecture Notes

On October 17th Professor Marchant, of Liverpool University, delivered the first of a course of six illustrated lectures on "Wireless Telegraphy," which are being held at the university under the auspices of the Faculty of Engineering. In introducing his subject the lecturer dealt at some length with the history and progress of the invention. The lectures are being continued each Thursday in the Lecture Theatre of the Laboratory of Applied Electricity, Brownlow Street. They are illustrated by experiments and lantern slides, and are supplemented, when necessary, by demonstrations with the wireless station attached to the laboratory.

* * *

From the University of London, University College, we have received particulars of two courses of post-graduate lectures to be delivered by Professor J. A. Fleming. The first course, which commences on Wednesday, November 6th, will comprise six lectures upon electromagnetic waves and the theory of electrons, and is intended for electrical engineers chiefly concerned with telegraphy, telephony and wireless telegraphy. Those attending this course are assumed to have an elementary knowledge of the differential and integral calculus and of elementary electrical theory. It is preliminary to a course of radiotelegraphy which will commence in the following term, Wednesday, January 22nd, 1913. The latter lectures are intended to enable telegraphic, telephonic engineers and radiotelegraphists to follow the most recent investigations in the theory and practice of wireless telegraphy. The fee for each course is £1 11s. 6d., and tickets may be obtained from the secretary, University College, Gower Street, London, W.C.

* * *

A demonstration in wireless telegraphy, arranged by the University Extension Society, was recently given by Mr. G. P. Bailey, M.A., before a large and appreciative audience at Stowmarket. The lecturer spoke at some length on the relationship between Hertzian waves and wireless telegraphy, and afterwards illustrated his lecture with practical experiments.

An After-dinner Autograph

SIGNOR BORIANI is co-proprietor of the Pall Mall Restaurant at the Haymarket, London. He is besides a man of much enterprise and has not allowed opportunites to pass by unheeded. His profession brings him into contact with the *élite* of the world of wit and fashion, and some years ago he conceived the happy idea of paying the more notable members of his *clientèle* the compliment of a request for their autographs for preservation

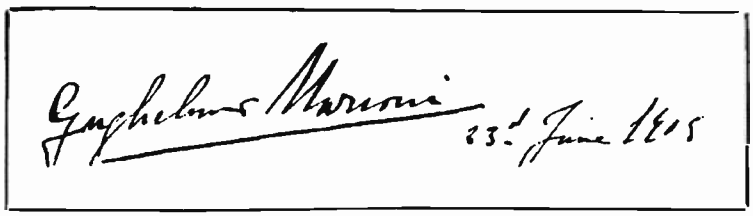
A. Boriani, by Caruso.

(we hardly dare say writ neatly) in a large book. The names of authors, musicians, statesmen, *prime donne*, aviators, are to be found in these pages, and often a distinguished signature is accompanied by some *jeu d'esprit* or thumbnail sketch by no means unworthy of the owner of the great name written beneath. Signor Boriani can tell many amusing anecdotes of the way in which many of the notable signatures came to be included in the book, and some of his recollections of autograph collecting make a fascinating article in the October issue of the *Strand Magazine*. Commenting on Mr. Lloyd George's autograph, which is appended to some Welsh hieroglyphics, he expatiates on the difficulty experienced in obtaining the Chancellor's consent to writing in his album, affirming that it was only a long list of great statesmen's signatures that persuaded Mr. Lloyd George to include his own in the number. "But," adds Signor Boriani, "Mr. Marconi was even more difficult." In this instance he succeeded by a ruse. One day he saw Mr. Marconi entering the restaurant, and noticing the table at which the great inventor intended to sit, he took the menu card, and for *Haricots verts au beurre*, which was an item on the bill of fare, substituted *Haricots verts à la Marconi*, in compliment to his guest. But the celebrated inventor was not to be bribed, however neatly a compliment might be turned. "Why should the beans be labelled '*à la Marconi*,'" he remarked to his host, "seeing that they were—very ordinary beans?" Signor Boriani professed himself to be deeply hurt that his dish should be so lightly judged.

"Quite ordinary beans?" he objected, "but did Mr. Marconi find them stringy?"

"No, not the least suspicion of anything approaching a thread was to be found in them."

Then Signor Boriani brought the whole battery of a Southerner's exquisite logic into play. "Therefore, they were in very truth *Les Haricots verts sans fils*"—that is to say, those French beans were acknowledged to be threadless—"but since Mr. Marconi was the inventor of La Télégraphie sans Fils, surely the beans had every right to be called *Haricots verts à la Marconi*." There was no disputing such logic, and when the victor in the argument produced his little album what could Mr. Marconi do but sign the proffered page?—while we, by the courtesy of Signor Boriani and the publishers of the *Strand Magazine*, are able to reproduce this signature here.



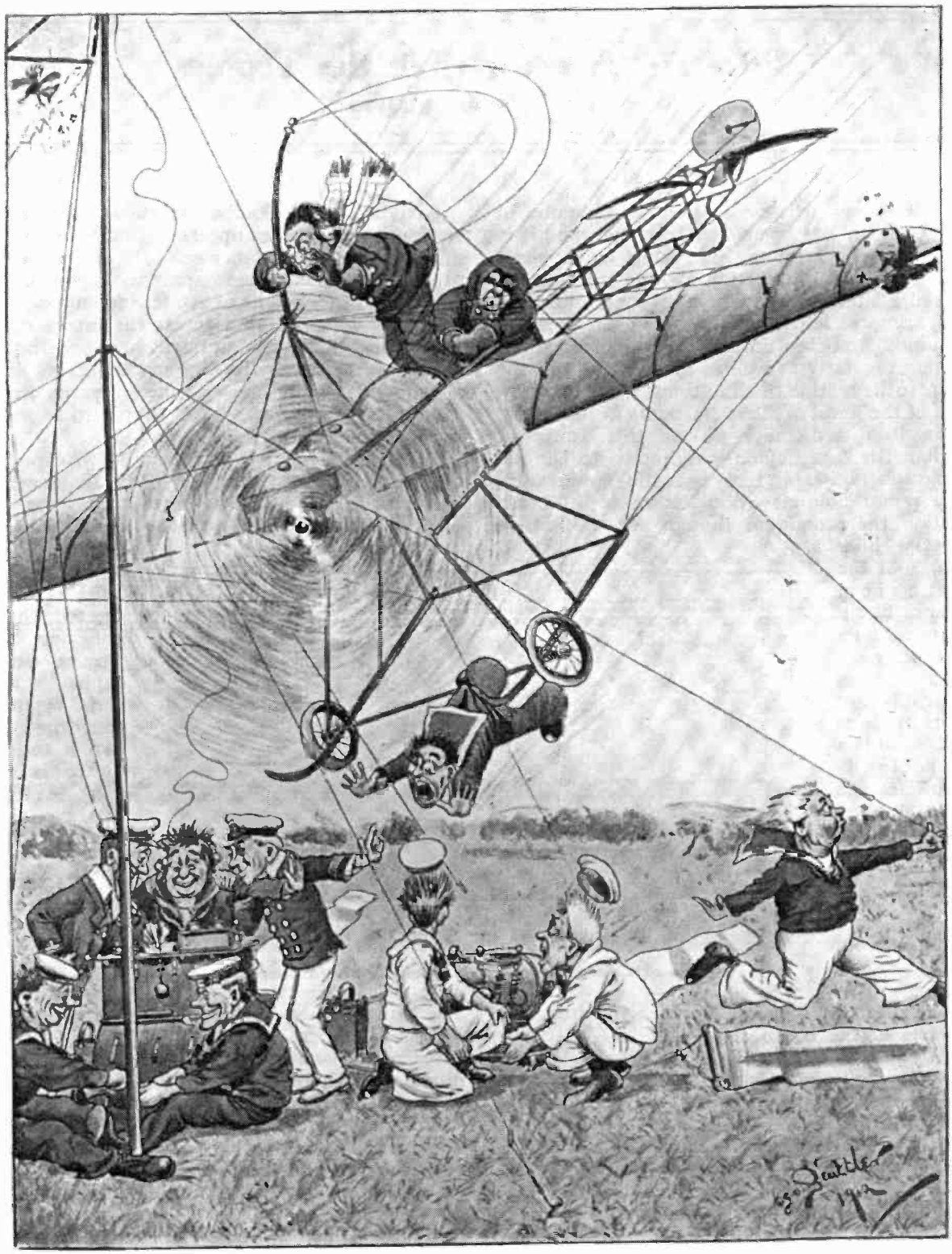
On the River

"Stroke, you're late," said Thomas, butting me violently in the back with his oar.

"My dear Thomas, when you have been in the Admiralty a little longer you will know that 'bow' is not the gentleman who sets the time. . . ."

"I'm not used to the Morse system of rowing, that's the trouble," explained Thomas. "Long-short, short-short-long, short-long. You're spelling out the most awful things, if you only knew."

The Holiday Round.

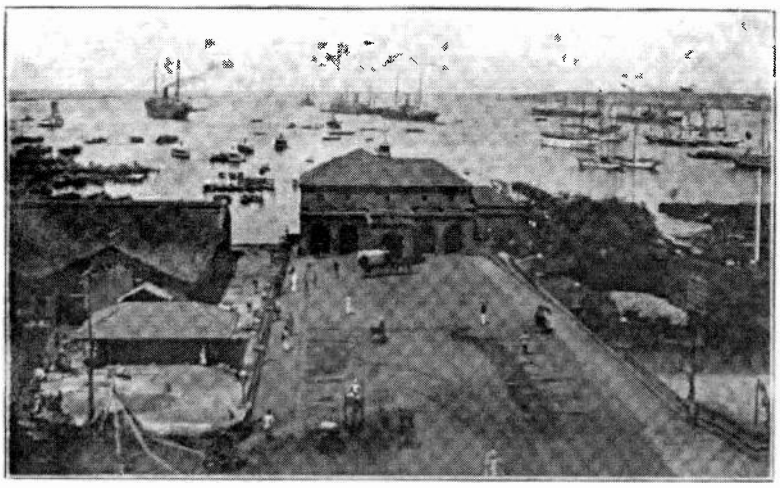


"WIRELESS" EXPERIMENTS WITH AEROPLANES

Wireless Telegraphy in the Tropics

The Colombo Station

THE new wireless station at Colombo in Ceylon was opened in July last, and it is already proving its value as a coast station for communication with vessels engaged in the Eastern trade. The need for a station at Colombo was felt for a long time; the port has assumed first-class importance, mail steamers calling regularly as well as men-of-war and the mercantile marine of all nations, while it is now one of the finest artillery harbours in the world. Seen from a distance at sea this "outmost Indian isle," as Ceylon was known to the old geographers, wears a truly beautiful appearance. The remarkable elevation known as "Adam's Peak," the prominent though not the loftiest of the hilly ranges of the interior, towers like a mountain monarch amongst an assemblage of picturesque hills, and is a sure land-mark for the navigator when as yet the Colombo lighthouse and wireless station are hidden from sight amid the groves and palms that seem to be springing from the waters of the ocean.



View of Colombo Harbour. Customs House in centre.

Adam's Peak is chiefly remarkable as the resort of pilgrims from all parts of the East. The hollow in the lofty rock that crosses the summit is said by Brahmins to be the footstep of Siva, by the Buddhists of Buddha, by the Mahommedans of Adam, whilst the Portuguese Christians were divided between the conflicting claims of St. Thomas and the eunuch of Candace, Queen of Ethiopia. The footstep is covered by a handsome roof, and guarded by priests of a rich monastery half-way up the mountain, who maintain a shrine on the summit of the peak.

Arriving in Colombo Harbour, the new station immediately impresses itself upon one's mind. From the distance one catches a glimpse of two steel masts, wide apart, rising up from the ground to a height of 270 ft. and supporting the wires which stretch across the intervening space, with little wooden hoops here and there, around which the wires are spaced. This and a little brick-built house, some 50 yards from the masts, are practically all that is to be seen by the casual visitor.

The station has a 5-kw. installation capable of communicating with ships over a distance of 450 nautical miles. Two steel masts, 270 ft. high, composed of steel sections 10 ft. in length and 2 ft. in diameter, have been erected. They are 600 ft. apart and support an aerial system consisting of two cages, comprising six wires spaced around ash hoops 3 ft. in diameter. The total amount of wire aloft is approximately 10,000 ft.

The building has been erected by the Public Works Department, and is divided into three rooms—one to accommodate the transmitting instruments, the second to accommodate the receiving instruments, and the third serves as a store room. The transmitting apparatus consists of a motor generator set, with a single-phase motor directly coupled to an alternator, an exciter, and a rotary spark discharger, all coupled to the same shaft. This generator, which has been designed to work off the city electric supply, is provided with a pulley in order that the set may be belt-driven from a 10-h.p. oil-engine, which has been installed. The transmitter will be capable of

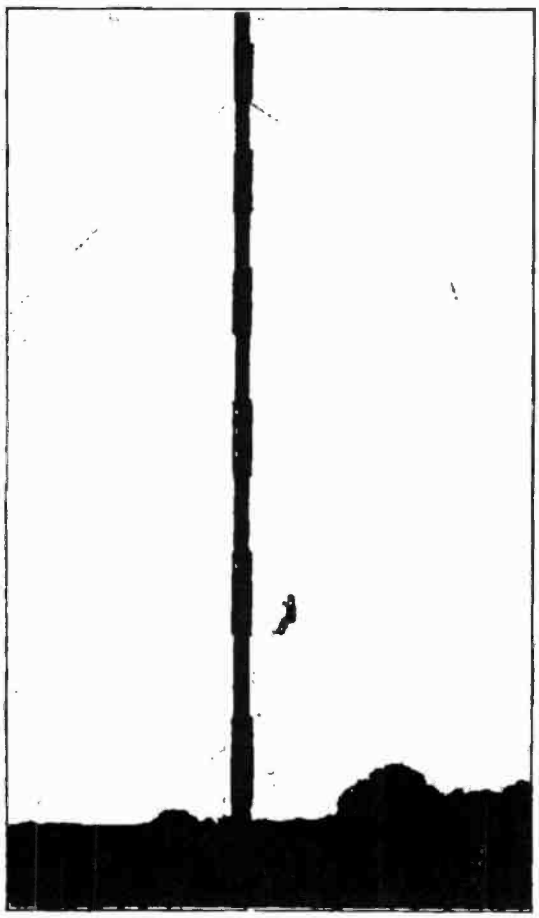
transmitting waves between 600 and 2,000 metres in length, being well beyond the limits that may be required. The rotary spark discharger, driven at 2,000 revolutions per minute, is provided in order that the signals received by neighbouring stations may be received as a musical tone.

The receiving apparatus consists of a Marconi standard magnetic detector, and multiple tuner, together with a Fleming oscillation valve detector.

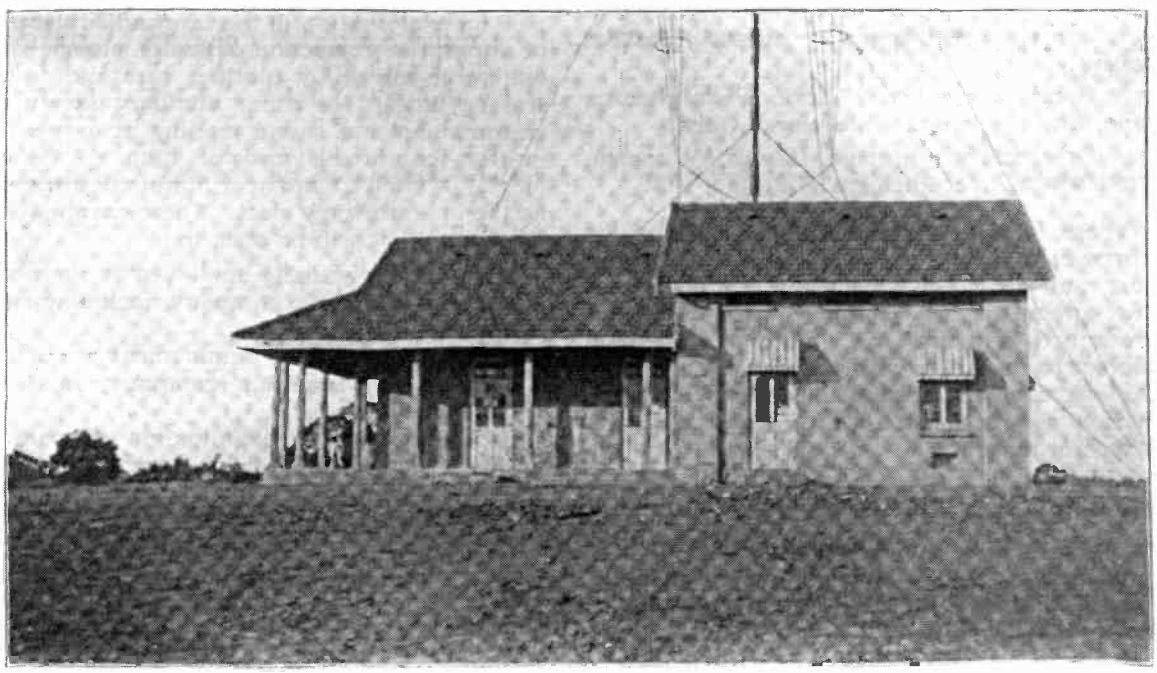
Although this installation is guaranteed for 450 nautical miles there is little doubt but that the range will be in excess of this figure, especially during night time, it being well known that the propagation of ether waves during night time is considerably facilitated.

As it is essential that good connection should be made with the earth, 15,000 ft. of wire, connecting galvanised iron plates buried in the earth and arranged in a circle around the transmitting room, have been laid. The selected site is very suitable for the efficient working of the station, and the close proximity of the paddy-fields should be very favourable for transmission purposes.

Mr. J. R. Stapleton is in charge of the station, and he is assisted by three native operators. It has already been explained that the station is intended to work with ships. The rate of transmission of telegrams has been fixed at 8d. per word, made up of 4d. per word for coast station and land line and 4d. per word ship tax.



The Steel Sectional Mast.



Colombo Station : Transmitting Room on the right ; Store Room in the centre and Operating Room on the left.

Official Regulations

United States

AN Act prohibiting the use of United States ports by ocean-going vessels carrying fifty or more persons, unless such ships were fitted with efficient wireless apparatus and carried a qualified operator, came into force in the United States on July 1st, 1911. On July 23rd of this year an Amending Act was passed in accordance with which ships navigating the great lakes are now included, while more definite regulations are laid down regarding plant and operators. We published particulars of the Amending Act in the September MARCONIGRAPH. Since then the Department of Commerce and Labour at Washington have issued regulations concerning the operations of the Act of this year. The first section of the regulations deals with the administration of the Act, and announces that the department has established the following districts, which will be in charge of inspectors stationed at the ports named :

1. New England States (Boston, Mass.).
2. New York and part of New Jersey (New York, N.Y.).
3. Pennsylvania, part of New Jersey, Delaware, Maryland, Virginia (Baltimore, Md.).
4. North and South Carolina, Georgia, Florida (Atlantic coast), Porto Rico (Savanah, Ga.).
5. Gulf States and Florida (Gulf Coast) (New Orleans, La.).
6. California, Hawaii (San Francisco, Cal.).
7. Oregon, Washington, Alaska (Seattle, Wash.).
8. Great Lakes : New York, Pennsylvania, Ohio, Lower Michigan (Cleveland, Ohio).
9. Great Lakes : Indiana, Illinois, Wisconsin, Minnesota, Upper Michigan (Chicago, Ill.).

These inspectors, also customs officers, are empowered to visit steamers before they leave port, and ascertain if they are equipped with the apparatus in charge of the operators prescribed by the Act. Where a steamer subject to the Act is without the apparatus and the operators prescribed, or either of them, and is about to attempt to leave port, the inspector must :

(*a*) Notify the master of the fine to which he will be liable and of the particulars in respect of which the law has not been complied with ;

(*b*) Notify at once the collector of customs, if necessary by telephone ;

(*c*) Prepare in writing a report of his action, stating particulars as in (*a*), to be transmitted to the collector of customs. The collector will transmit a copy to the United States attorney for the district in which the port is situated.

The Act does not authorise the refusal of clearance in case of violation of its provisions, but specifically provides for the imposition of a fine of not more than five thousand dollars upon conviction by the court. The collector of customs, accordingly, when advised that a steamer subject to the Act is attempting to leave port in violation of its requirements, must at once notify the United States attorney. The Act does not apply to a vessel at the time of entering a port of the United States. Inspectors and customs officers may, however, accept as evidence of the efficiency of the apparatus and the skill of an operator messages shown to have been transmitted and received by him over a distance of at least one hundred miles by day during the voyage to the United States.

Operators' Certificates

The second section deals with the question of operators, and the regulations are in accordance with the International Convention. In the case of vessels under the flag of any nations which have not ratified the Convention, the operator, before the departure of the vessel from the United States, must furnish the inspector with evidence that he is "skilled in the use of the apparatus." The Commissioner of Navigation will issue operators' certificates of skill, and operators holding these certificates will be recognised until December 13th, 1912, as persons "skilled in the use of such apparatus." To secure a certificate an operator must pass an examination in the care and adjustment of apparatus, correction of faults, change from one wave-length to another, care and use of storage battery or other auxiliary apparatus, transmission and sound reading at a speed of not less than fifteen words per minute American Morse, or twelve words per minute Continental, as the operator may elect. These examinations for the present will be open to :

1. Operators actually employed as such by a wireless or steamship company, including shore operators.
2. Operators seeking employment as such by a wireless or steamship company, including shore operators.
3. Applications for examination of operators of either class may be made by the wireless or the steamship company on behalf of a number of operators by name.
4. Applicants under eighteen years of age must satisfy examining officers of their intention to secure employment as commercial operators, if passed.
5. Women are eligible for examination under the conditions above.

Revised Wireless Rates

AN important alteration in the rates for the transmission of messages to and from ships through American coast stations takes effect on November 1st. This is one of the results of the working arrangements entered into earlier in the year between the Marconi Companies and the Western Union Telegraph Company of the State of New York. The method of counting and charging for American land lines differs from what is known as the "cable" or international system. In the American system the address and signature are free, and the words of the text only are counted, with a minimum charge for ten words. In the international system the address and signature are counted and charged for in addition to the text. Formerly the radio-telegrams sent from ships through American coast stations were subject to the system of charging used on the land lines. Now the existing message rates *viâ* certain American coast stations are cancelled, and in place thereof through word rates with a minimum charge for ten words become effective so far as these coast stations and Western Union North American land lines are concerned. The cable system of counting and charging will be used throughout, the address and signature being counted and charged for. Every message which contains less than ten words will be charged for in the same manner as if it contained ten words, subject to certain deductions in the case of vessels which do not apply a minimum. The wireless rate applied by the coast stations has been fixed at 12 cents per word, with the exception of Siasconset, where the rate has been fixed at 17 cents per word. To these rates must be added the land line word rates to and from all points in the United States of America. Thus the combined ship, coast station and land line charged rate for a message to or from New York City through Seagate is 22 cents per word. The cost of a message through this station containing ten words, address, text and signature would therefore be $2.20. If the message contained only eight words there would be an allowance of 8 cents ship tax for each word below the minimum.

The introduction of a flat rate per word in radio-telegraphy will do away with the complications that must necessarily exist as the result of the imposition of land taxes upon ship taxes, which are counted and charged for upon different systems. The new rates represent an important step towards the realisation of the flat word rate. It will now be a simple matter for the sender of a radio-telegram, or the operator, to ascertain the cost per word of messages passing through American coast stations. This new arrangement is the direct outcome of the important arrangement which has been made by the Marconi Companies with the Western Union Telegraph Company, and is calculated to greatly facilitate traffic.

Berne Notes

In accordance with the instructions of the Japanese Government, Chosen, Formosa and Japanese Sakhalin have been registered in the sixth class. The republic of Saint Martin has also been registered in this class.

* * *

The report on the new coast station at Antivari-Volouïtza should be modified to read that the station is intended for public service with all ships furnished with the Marconi system.

* * *

The Emperor of Austria has appointed Col. Rudolphe Schamschula to be Manager-General of the Telegraph in Bosnia-Herzgovina in succession to General Henri Goiginger, who has been promoted to another post. Col. Schamschula is anxious that the present friendly relations between the Administration of Herzgovina and the other offices shall continue.

* * *

Circular No. 43, issued on October 1st, refers to the appointment of the Hon. Robert Heaton Rhodes as Postmaster-General for New Zealand, in place of the Hon. Geo. Ell, who has retired. His Excellency, Sabri Bey has been appointed Minister of Posts, Telegraphs and Telephones of the Turkish Empire, in place of his Excellency Mehmed Talaat Bey.

* * *

The Italian Government having ratified the International Convention, the country's coast stations are now open for general public correspondence.

* * *

The Russian Administration have announced that the hours of service of the coast stations Fort d'Alexandrovsk and Petrowsk are from 5.50 to 9.50 a.m. and from 11.50 a.m. to 3.50 p.m. (St. Petersburg time).

The Marconi Agreement with the Government

Debate in the House of Commons

ON October 11th the House of Commons approved the decision of the Government to appoint a Select Committee to investigate the circumstances attending the negotiations of the Agreement between Marconi's Wireless Telegraph Co., Ltd., and the Postmaster-General for the establishment of a chain of wireless stations throughout the Empire. In the course of the animated debate to which the proposal gave rise references were made to the sinister reports, amounting to allegations of corruption, which had been put forward in various quarters. A monstrous fabric of falsehood, misrepresentation and misunderstanding was razed to the ground as the result of the speeches by the Chancellor of the Exchequer and the Attorney-General; and, in the words of one of the Press correspondents in the gallery, "Never in the history of the House of Commons has there been a more shattering and more crushing reply to odious calumnies."

From a broad standpoint the debate was exceedingly interesting, inasmuch as it helped to clear up several misunderstandings about the terms of the contract. From the allegation that the bargain made with the company was tainted with corruption, almost all the speakers dissociated themselves entirely, believing it to be without a shadow of foundation, and one hon. member expressed the hope that the Committee would call before it any persons who made charges of the kind.

Objections Outlined

The debate was opened by Sir Henry Norman, who submitted various reasons for his disapproval of the Agreement. The hon. member contended that the Agreement did not carry into effect the resolution of the Imperial Conference, as the stations to be erected under it could not possibly be described as "State owned." He contended that the Government were needlessly employing a middleman to buy ordinary and every-day machinery and materials which it ought to purchase by tender in the open market. No guarantee of electrical efficiency was even asked for, he maintained, whereas a slight output of electrical energy would render the whole scheme ruinously expensive. A further reason for disapproval of the Agreement by Sir Henry Norman was the alleged extravagant royalty which the Government were to pay, and the duration of this royalty. Sir Henry Norman contended that the Postmaster-General, notwithstanding what he had told the House, could only employ any other system at a huge waste of public money, and by deliberately contracting the public out of rights specifically conferred upon them by Act of Parliament. He maintained that the stipulations regarding inspection and disclosure were wholly intolerable unless Clause 18 were dropped, and that the Post Office in spite of previous warning and votes of censure had once more set its hands to what would be to all practical intents and purposes a monopoly for the Marconi Company. The final objection of the hon. member was that the ratification of this Agreement would inevitably result in the formation of a great monopolistic trust which would restrict the development of wireless telegraphy, double its cost, and set back independent scientific progress for a generation.

A Question of Dividend

Mr. G. Terrell turned his attention to the shares of the Marconi Company, and pointed to the fact that the shares had risen from a low figure up to a high figure during the time that the contract was in negotiation and within a few months after it was published, and, he said, all this was presumably on the strength of the contract. The Postmaster-General later in the debate asked Mr. Terrell whether he was aware that the Marconi Company began to pay dividends for the first time last year. Mr. Samuel further pointed out that on July 11th the company paid an interim dividend at the rate of 5 per cent.; in December a further interim dividend at the rate of 5 per cent.; and in June, 1912, a final dividend at the rate of 10 per cent.; so that for the year 1911 the Marconi Company, which had never previously paid any dividend on its ordinary shares, paid for the year a dividend of 20 per cent. The Postmaster-General emphasised the fact that that had no relation to the contract, for the contract was not yet operative. He showed that the company had not received a single sixpence of revenue under it, and that the

dividends had been declared out of the profits of the business. The following extract from the official report of the debate is interesting:

Mr. Herbert Samuel: "I would ask the hon. member for the Chippenham Division (Mr. G. Terrell), across the floor of this House, was he aware that a dividend of 20 per cent. was being paid by the company for the first time that year? If he was aware of it, why did he leave the House to believe that the rise in the price of shares was due to this contract, without mentioning that fact?"

Mr. G. Terrell: "I was not aware of the dividend the company was paying. What I referred to was the speech of the chairman, in which he stated that this Marconi contract was the most important business of the year."

Mr. Herbert Samuel: "I do not think that that absolves the hon. member at all. Of course, any chairman of a company which was entering into a contract with the Government would naturally speak of it in terms of the warmest praise when meeting his shareholders. This tender was accepted in March, 1912. In October, 1911, the Marconi Company bought up the rights of the Lodge-Muirhead patent, which, having just been extended by the courts, had a considerable term of years to run. That, from the patent point of view, which is of supreme importance in this business, placed the Marconi Company in a very strong position, a stronger position than they had before. Was the hon. member aware of that? If so, why did he not mention it as one of the reasons why these shares had risen? Further than that, in March, 1912, just at the time when the tender was being accepted, the Marconi Company brought patent actions against the United Wireless Company and the Clyde Shipping Company. These were test actions to decide the validity of certain remarkable patents, and the Marconi Company won them both. As a consequence of this, on March 25th they absorbed the important United Wireless Company of the United States. *The Times* in their financial article of March 27th last said that there was a strong buying of Marconi ordinary shares on the news of the absorption, and they pointed out the rise in price."

We need make no apology for inserting here this extract from the Postmaster-General's speech, inasmuch as it brings to light circumstances which have never been mentioned by those who have tried to draw evil deductions from the fact that when the contract had been entered into prices had risen.

All the points raised by the other speakers were fully covered by the Postmaster-General, and will be referred to when we summarise the latter's speech.

Unsupported Charges

It was Mr. Lansbury who brought about the intervention of the Chancellor of the Exchequer. The member for Bow and Bromley referred to whispers which have been passing round the City. There had been grave rumours, he said, that considerable sums of money had been made by persons who had information which was not available to other people, and he expressed a hope that there would be no shrinking on the part of the Select Committee. Mr. Lloyd George instantly rose and said he hoped there would be no shrinking on the part of those who made the allegations. When Mr. Lansbury pointed out that he was not the only member who had spoken of the rumours and pleaded that he had not mentioned the Chancellor of the Exchequer's name, Mr. Lloyd George demanded to know what were the allegations made. "If," he said, "the hon. member has any charge to make against the Government as a whole, or any individual member of it, I think it should be done openly." He added that the Government wanted to bring out "these sinister rumours which have passed from one foul mouth to another," and he demanded that Mr. Lansbury's charges should be formulated. The member for Bow and Bromley did not accept this challenge.

The Attorney-General's Repudiation

The Attorney-General formally and emphatically denied that there was the slightest foundation for the suggestion that any person had used influence with the Government in the interests of the Marconi Company. In categorical terms he declared that he had never discussed from beginning to end the making of the contract by the Postmaster-General. Indeed, he said, he did not know such a contract was in contemplation until a few days before it was signed.

As for the Attorney-General's alleged intervention against the continuance of a rival patent, the fact is that by law the Crown must be represented at every such application. The reason is simple. The High Court, in considering whether a patent should be extended, must receive some independent statement of the public as distinct from the private interests involved. In the present case, Sir Rufus Isaacs, on receiving the papers, handed the brief to Sir John Simon, the Solicitor-General, who dealt with it in Court, making it quite clear that he was there not to oppose but

merely to set out the facts for the Court's opinion.

The Postmaster-General's Reply

Mr. Herbert Samuel made what has been admitted on all sides to be a strikingly able speech in defence of the Agreement. He confirmed Sir Rufus Isaacs' statement that there was not a syllable of truth in the insinuation that members of the Cabinet had, knowing that the contract was in contemplation, directly or indirectly, bought shares in the Marconi Company. "Neither I myself nor any of my colleagues," he affirmed, "has at any time held one shilling's worth of shares in the company directly or indirectly, or derived one pennyworth of profit from the fluctuations in their price." The suggestion that the contract was discussed privately or secretly between himself and the Marconi Company was utterly preposterous, as it must have appeared to be to any hon. member acquainted with the way in which Government affairs are managed. There is a Standing Committee representing six departments of the State called the Cables Landing Rights Committee, of which the Postmaster-General was a member, and of which the Parliamentary Secretary for the time being of the Board of Trade was chairman. That Committee was acquainted with the whole of the negotiations from the beginning to the end. As long ago as March, 1911, that Committee decided that a State-owned system was desirable and that the Marconi Company should be approached with a view of its carrying out the work. In May, 1911, the Committee agreed to a long report of several printed pages going into every aspect of the matter and suggesting terms on which the company might possibly be employed as contractors. From that date until the first tender was accepted the Committee held eleven meetings, was acquainted with the whole of the negotiations from beginning to end, and, on January 24th, 1912, approved the price to be paid, the royalty to be given to the company, and the period of years during which the Agreement should run. In the summer of last year (June, 1911) the Imperial Conference passed a resolution that it was desirable to establish a system of State-owned wireless stations; and the duty devolving upon him to carry that resolution into effect, he formed a Special Committee to deal with this particular question in addition to the Landing Rights Committee, because that Committee did not contain experts or representatives of the Dominions. The Post Office Committee, of which Mr. Samuel himself took the chair, consisted of about twenty gentlemen representing six or seven departments of the Government containing the wireless experts attached to all the various departments concerned—both those attached to the Admiralty, the War Office, and the Post Office—and also containing the High Commissioners of the Dominions. That Committee held three meetings, and on January 17th of this year the general terms substantially as they were now, but in outline, were before that Committee, and the Committee approved of those terms, subject to a proviso to which he would refer later. Afterwards the terms were laid before the Treasury, the Admiralty, the India Office, the South African Government, and the War Office, as well as the Post Office. *All* those departments formally expressed their approval of the terms; therefore was it not ludicrous, as well as wicked, to suggest that he was in a position to show undue personal favour to any company in this matter?

Royalties

Dealing with the question of royalty, Mr. Samuel stated that on August 7th he pointed out that if the Government were not using the Marconi patents—if the patents expired—from that date the Government ceased to pay any royalty, and that was provided for in the contract in accordance with clause 16, paragraph 2, which read as follows:—

> "If and whenever during the continuance of the royalty period the Postmaster-General would have decided to use and work on such stations as aforesaid a system of wireless telegraphy which shall not make use of any valid and still unexpired patents owned exclusively by the Marconi Company and shall give notice in writing to that effect to the Company, then, as from the date of the giving of such notice, the royalty period shall be terminated."

The meaning of the clause was that as long as the Government used the Marconi patents —valid patents—they paid this royalty up to a period of 28 years, but if the Government ceased to use valid patents they ceased to pay the royalty.

Sir Henry Norman had criticised the specifications, but he (Mr. Samuel) was in position to state that they had been considered in detail—and were now being considered in detail—by engineers of the Post Office and of the Admiralty. He had employed the best engineers in the public service, and he must necessarily leave technical details of specifications to them. He had asked those engineers what it would cost supposing the Government had determined to erect stations for themselves on the same specifications, and the figure which those engineers had given him was

£60,800 each. That was the figure of the Post Office engineers and Admiralty engineers for erecting the stations in the same places, supposing it was done directly by the Government and they did not employ the Marconi Company.

Hon. members had asked "What are you buying for this royalty?" Mr. Samuel replied:

"I have pointed out that we were buying the use of all their patents so long as they are valid, and when they are not we cease to pay the royalty. We are buying much more than that. We are buying—and this is in the contract—'the unpatented inventions—the secret inventions'—which I am told are really of considerable importance. We are buying what is more valuable still, the experience of long-range wireless telegraphy which they alone have, as they are the only company in the world which has kept a continuous commercial service over distances approaching those which would be necessary. Not only that, but we are buying their assistance—the technical assistance of their engineers during the whole period the royalty runs. Not only are we buying existent patents, but all future inventions which the company either owns or uses; and further, when a period of 28 years comes to an end—the royalty having then at once come to an end—we are buying the right to use after that period any patent that may have been used, however new, in any of the stations without any extra payment. Lastly, we are buying the release for the Admiralty and the Post Office, without any extra payment, from the restricting covenants under which they are, under present agreement, not to reveal to any other Government departments any information they obtain in the working of the present patent."

Major Archer Shee had asked whether there was any proof of the speed at which the Marconi Company were able to work. The Marconi Company had given a demonstration of automatic working at a speed of 50 words per minute and over, which the officials considered to be satisfactory.

No Alternative to the Contract

Turning to the attack which had been made upon him on the ground that he signed this contract on behalf of the Government, the Postmaster-General asked the House to consider what were the alternatives that were open, and he proceeded as follows:

"It has—in the first place—been suggested that we might have called for open tenders from every company or syndicate that thought itself able to carry out this exceedingly difficult work. That point was referred by me at the very outset to the committee of 20 members of which I have spoken. After discussion it was decided not to call for tenders, because all the expert members of that committee said that it was necessary to have proof that the people could do this work, and the Marconi Company were the only company in the world that was carrying on operations of this nature. . . . That, then, was the reason, and the reason why we did not call for tenders. We felt we could not speculate in this matter; that we must be sure of our ground, and what the contractors undertook to do we must have reasonable ground of certainty they would be able to perform."

After explaining the reasons why neither the Post Office nor the Admiralty were able to undertake this work, Mr. Samuel drew attention to a quotation by Sir Henry Norman from a pamphlet issued by the Poulsen company and added: "I think it is necessary for me to show what my adviser at that time, November, 1911, reported to me. He reports—

"'It is quite clear that the high-speed installation in its present form is not suitable for any sort of commercial work.'

My expert advisers tell me that we could not be sure, or have any certainty at all, that the Poulsen syndicate would be able to cover the distances which would be required by this contract by day." Mr. Samuel next referred to the statement that the Poulsen system had been able to maintain communication between San Francisco and Honolulu—a distance of 2,000 miles. "In wireless telegraphy," he added, "it is perfectly easy to send over long ranges by night. As long ago as 1903 Mr. Marconi was able to cross the Atlantic during the night with wireless telegraphy, and to send satisfactory messages. It was only seven years afterwards—in November, 1910—after the expenditure of great sums of money, that he succeeded in maintaining continuous communication across the Atlantic by day.

A Terminological Inexactitude

The hon. member," added Mr. Samuel, "would have been far more candid with the House if he had told them that the company had made no claim to communicate by day. As soon as I knew that the Poulsen people had established any sort of communication of that nature, I sent an adviser from the Post Office to San Francisco to test it, and there is no

evidence that they can maintain that long distance by day——

SIR H. NORMAN: I think the right hon. gentleman will probably desire, when he reflects, to express regret to me for what he has just said, because in quoting that experiment I added "under extremely favourable atmospheric conditions."

MR. HERBERT SAMUEL: Why did not the hon. gentleman say by night? "By night" is two short words.

SIR H. NORMAN: Favourable atmospheric conditions mean by night.

MR. SAMUEL: Favourable conditions mean there are no atmospheric disturbances.

"A chain of wireless stations without assistance must work by day and night—must work over long ranges. And only recently the experts on wireless in the Post Office—whose advice I could not ignore—had reported to me that it was not safe to assume, without proof, that the Poulsen syndicate were able to apply fresh power to their system to work 2,000 miles by day. It is not a question of being able to do it by night, but it is a question of being able to do it by day."

The Imperial Aspect

Towards the end of his speech Mr. Samuel informed the House that he was going to do something unusual. The most secret body in England—not excepting the Cabinet—is the Committee of Imperial Defence. He had the permission of the Prime Minister to divulge a secret, as such grave allegations had been made in this matter—that as long ago as May 31st, 1911, a sub-committee of the Committee of Imperial Defence considered this question of long range wireless stations, which, he added, was of far greater strategic than commercial importance, and had always been considered so by the Government. He (Mr. Samuel) was not a member of that committee, which resolved, on May 31st, 1911, that the six stations ought to be built, and that they ought to be built as soon as possible, that sites ought to be marked out, and the work ought to be put in hand upon them before the end of the year. On December 14th the matter was discussed before the Committee of Imperial Defence itself, and the members of that committee strongly advocated the urgency of carrying out that work. Eight months after the first resolutions of that sub-committee, in the following January, those first resolutions having been arrived at in May, and further urgency having been expressed in December, I had to decide whether the country ought to wait for a period—certainly of a year—before this contract should be made, and further, there was no certainty that at the end of that year the stations would communicate at all. It was merely a speculation and a mere gamble. "Suppose," he said, "by any evil chance a year or two had gone by and this country had unhappily been engaged in some European war. We have never had a great naval war in the days of electrical communication. The cables would very possibly have been cut, and large sections of our Empire might have been isolated from other sections. There would have been no means of giving orders from the garrisons, and no means of obtaining news. The nation would have said: 'Where are our wireless stations? Why is it that other Powers are erecting wireless stations, and the British Empire has no wireless stations? Have we no Committee of Imperial Defence? Let us have an inquiry into this.' The inquiry would have been held, and the committee would have reported that in May, 1911, a sub-committee of the Imperial Defence Committee had resolved that this was a matter of urgency, and should have been put in hand before the end of that year. Then the world would have asked, 'Whose duty was it to carry out this resolution?' 'It was the duty of the Postmaster-General.' 'Why did he not do it?' 'Because the experts were arguing as to whether this system was a little better than that system, and as to whether they could not save £10,000 here or £10,000 there.' 'What a Government!' it would have been said, 'and what a Ministry to have been unable to see the real importance of this thing, and to listen to members who say that six months or a year really do not matter!'

Promise and Performance

"Under these circumstances," Mr. Samuel asked, "is there any man in this House who says I ought to have signed a contract with the Poulsen Syndicate last July, or with the Goldschmidt people, or anyone else, rather than signing that with the Marconi Company? All sorts of experiments are now being made and improvements already coming on. I have secured the right of the Government to use these improvements as fast as they can be effected. I was not going to wait until they had been effected before establishing these stations. Suppose I had at that time in March signed an agreement with the Poulsen Syndicate. What would have happened? That syndicate of Danish gentlemen is not carrying on any commercial work here. There is a completely separate body which works its patents in America. I do not say it would have been improper at all, but they would first have gone to the City to raise capital on the strength of the contract to carry out the work. Then the Marconi Company would have brought an

action against them for infringement of patents, as the American company has brought an action against another company in America for infringing a patent, which action is pending in the Courts of California. Meantime, I should have been called upon as the Minister responsible to come to this House and ask it to approve of my contract. Hon. members would have said to me, 'Who is this syndicate of Danish gentlemen with whom you are entering into this contract and who are now in the City raising money in order to fulfil it? Have they proved that they can cover this distance at all?' I should have to say, 'Oh, no; but they assert they can, and very likely they may.' I should have been asked, 'Have they any staff of engineers able to put these stations in hand and complete them quickly?' I should have been compelled to reply, 'No, as far as I know they have no staff approaching anything like the scale necessary.' I should next have been asked, 'Are you sure their patents are valid?' I should have said, 'No, we believe them to be valid, but they have not been tested, and the Marconi Company are now disputing them in the Law Courts.' I should have been asked, 'Did your permanent officials advise you to make this contract?' I should have had to answer, 'No, my permanent officials unanimously urged me not to do so.' Under these circumstances, is there any man in the House, no matter how prejudiced he may be, who is now prepared to get up and say I was wrong in refusing to make that contract in January, and in taking the only other course possible?" Then, finally, the right hon. gentleman asked, "Is there any charge left against the Government? There is no response. Well, Mr. Speaker, I have done."

A great ovation marked the close of this speech. On the following day almost the entire Press of the country referred to the debate in the House of Commons, the comment referring almost exclusively to the personal aspects rather than to the merits of the scheme itself. The following are a few selections :—

Daily Telegraph :

"The discussion ought to put an end once and for all to the lying and malicious rumours which have been current for the last few months, and of late have been extremely prevalent. We welcome, therefore, the appointment of this Committee, and if individuals who have been most forward in disseminating the slanders in print can be summoned, so much the better. As for the contract itself, and the question whether the Government made a good or bad bargain, we shall await with patience the finding of the Select Committee."

Daily News and Leader :

"The public has a right to know on what precise material they (the critics) have based the charges with which a group of rather obscure weekly papers and a notorious monthly magazine have endeavoured to destroy the reputations for integrity of as many members of the Government as careless tongues, facile emphasis, and elastic innuendo could explicitly embrace. . . . Mr. Samuel's defence of the contract itself would probably content most impartial observers, as it certainly silenced the House last night. It is not a pleasant feature of the agitation that a great deal of it has been inspired less by a passion for pure administration than by zeal for some of the Marconi Company's rivals. But the broad fact, stated by the Postmaster-General last night, that while other companies said they could or hoped soon to be able to do more than the Marconi, none of them had in actual practice done as much, was not challenged from any side of the House."

Morning Post :

"In face of a clear and full statement of Sir Rufus Isaacs and Mr. Samuel, we may say with confidence that the honour of both these gentlemen, and the Government, remains unsmirched, and we may hope, therefore, to hear no more of this disagreeable side of the controversy."

Daily Mail :

"The mere fact that the contract was an excellent one for the Marconi Company is far from proving, as some people seem to argue, that it cannot also have been an excellent one for the Post Office and the nation. Business is not always a one-sided affair, and there are plenty of bargains which benefit both parties to them. . . . One has to remember that the Government as a demander and the company as a supplier were both in unusual positions—the Government urgently needed a service, which it was not as free to go without as a mere private firm without national responsibilities. On the other hand the Marconi Company had something like a monopoly of the power to render that service to its satisfaction—a monopoly, not of privilege, but of efficiency.

The Star :

"The Government acted very wisely in forcing the House to investigate the whole matter. They did exactly what their slanderers feared they would do. It would have suited the obscure gang who have poisoned the air to be allowed to go on poisoning it without being dragged out of

their holes into the light of day. Now they are going to be dragged out. We need not say that the merits of the Marconi Agreement must be left to the Select Committee. . . . We are content to wait for the result of the investigation. But we are bound to say that if the Select Committee confirms the impression produced by the debate it will be a great personal, political, and business triumph for the Government and for the Ministers immediately concerned."

Mr. T. P. O'Connor, M.P., in the "Star":

"If he (Mr. Samuel) had not been a strong and gifted man, if his cause besides had not been of unanswerable force, both politically, financially and personally, he might have been affrighted, for the campaign had gone on for weeks, and calumnies are as the lives of a hundred thousand locusts, and the world is ready to believe evil, and there were plenty of rival companies, and statements had been made which *prima facie* sounded convincing. . . . He (the Postmaster-General) took the whole case, point after point, after brief and scornful repudiation of the personal charges, and with the deadly effectiveness of a machine gun he strewed the floor of the House with the remains of the disproved charges. He showed that there was no monopoly, that the expiry of the patents left the Government under the contract perfectly free to end the contract at a moment's notice, that if he had chosen the Marconi system it was because no other system had yet proved itself, that the price given was the best he could have made, that he was perfectly free to take back the big stations which the company were to erect. Finally, he touched a deep note when, amid the rapid and awed stillness of the House—which becomes very silent always in its moments of deep emotion—he read out the urgent message of the Imperial Defence Committee asking that in the interest of the defence of the Empire—with the possibility at any moment of a terrible war in which every movement of every battleship and every hour a garrison in the remotest part of the Empire had to be immediately brought into contact by a wireless system, he demanded whether he could wait and wait until some other system than the Marconi could at some indefinite time offer the same proofs of efficiency and success."

Manchester Guardian:

"Mr. Samuel's speech . . . presents the case for the Post Office in a distinctly reassuring aspect. He showed that in choosing it [THE MARCONI SYSTEM] instead of any of its rivals he was guided by the best expert opinion in the Government service."

Leicester Daily Post and Mercury:

"Debates in the House of Commons are often misleading. The voice of the critic is apt to be louder than the voice of the friend, and a discussion may convey the erroneous idea that the only supporters of a proposal are to be found on the Treasury benches. This afternoon the Agreement did not seem to have a friend; when Mr. Herbert Samuel had finished, however, the Agreement was rehabilitated, and the critics were in a sad case. . . . If, as has been suggested, the Agreement intentionally favours the Marconi Company, one may think it strange—indeed, almost miraculous — that such wilful favouritism could have escaped the notice of all those interested authorities. . . . On the technical, scientific and business aspects of the matter there is really as little need for inquiry by Select Committee or otherwise as there is on the question of the personal integrity of Ministers."

Nottingham Express:

"Upon these pacific criticisms which have been urged against the arrangement between the Government and the Marconi Company it would be well to suspend judgment until the Committee's report has been made; but Mr. Samuel's account of the manner in which the Agreement was made seems to afford little ground for the suggestion that it was brought forward rashly or inconsiderately or without due regard to the interests of the State."

Aberdeen Free Press:

"Mr. Samuel's speech settled the opinion of the House of Commons on the Marconi Agreement. Some members have been in doubt as to its merits, but at the close of his defence the House was ready to accept it and to approve of it, and it was realised that the Agreement could go before a Select Committee with the certainty of standing any examination."

Glasgow Daily Herald:

"The Marconi Company is said by the advisers of the Government to have far more experience in the working of long distance wireless telegraphy than any other company. It has undoubtedly led the way in the commercial development of the invention, and it therefore has a claim on our consideration. Its successes in obtaining the contract for the proposed Imperial stations cannot be said, therefore, to have come as a surprise."

The Parliamentary Committee

THE members of the Select Committee of the House of Commons appointed by the Government to inquire into the transactions which preceded the completion of the agreement between the Marconi Wireless Telegraph Co., Ltd., and the Postmaster-General number fifteen; of these six represent the Liberal interests, six the Conservative, two the Irish Nationalists, and one Labour.

SIR ALBERT SPICER, BART., who is Chairman of the Committee, is head of Messrs. James Spicer & Sons, the well-known firm of stationers. He was educated at Mill Hill School, and afterwards was privately coached at Heidelburg. He has visited India, Australasia, and Samoa Islands on behalf of the important missionary societies. In 1892 he was elected Liberal Member of Parliament for Monmouth, and has represented Central Hackney since 1906. He is a Past President of the London Chamber of Commerce and a member of the Commercial Intelligence Advisory Committee of the Board of Trade.

MR. JAMES FALCONER has been Liberal Member for Forfarshire since 1909. He is an engineer, and was educated at Edinburgh University.

MR. GORDON HARVEY is one of Manchester's prominent cotton merchants, but has always taken the keenest interest in politics. Since 1906 he has represented Rochdale in the Liberal interest.

The HON. NEIL PRIMROSE is the youngest son of Lord Rosebery, and since 1910 has represented the Wisbech Division of Cambridgeshire as Liberal Member.

SIR HERBERT ROBERTS was created first Baronet in 1908. He has been Liberal Member for West Devonshire since 1892.

MR. HANDEL BOOTH, Member for Pontefract, completes the list of Liberal Members of the Committee.

MR. LEOPOLD AMERY is the Conservative Member for South Birmingham. After a brilliant college career he was elected Fellow of All Souls' College, Oxford, and was for some time engaged in journalism. He was editor of the "*Times* History of the War in South Africa."

LORD ROBERT CECIL, K.C., third son of the late Marquis of Salisbury, is a distinguished member of the Bar. He was for some time private secretary to his father. He is Conservative Member for Hitchin, Herts.

MR. GEORGE FABER, C.B., D.L., has represented Clapham as Conservative Member since 1910. He is a partner in the banking firm of Beckett & Co., Leeds, and a Justice of the Peace for Oxfordshire.

MR. DONALD MACMASTER, K.C., is Conservative Member for the Chertsey Division of Surrey. His early life was spent in Canada, and he was called to the Bar in Quebec in 1871, afterwards serving as Crown Prosecutor in several Canadian *causes célèbres*.

MR. HAROLD SMITH is Member for Warrington, and is a barrister by profession.

MR. HENRY TERRELL, also a King's Counsel, and Member for Gloucester since 1910, makes the sixth Conservative to be appointed to serve on the Inquiry.

The Irish Nationalists have two representatives: MR. JOHN MOONEY, Member for Newry, and MR. WILLIAM REDMOND, Member for East Clare since 1892.

Labour has one representative, MR. J. PARKER, who has been Member for Halifax since 1906, and is a Past President of the Trades Council and a member of the Chamber of Commerce.

Intercepted Messages

A Challenge Accepted

MR. J. A. BALCH, manager of the Mutual Telephone Company of America, in the following letter to the Honolulu *Star Bulletin*, accepts the challenge of the Federal Telegraph Company of America to give a Thousand Dollars if it can be demonstrated that any of the wireless messages sent over the Poulsen system can be intercepted by any but users of Poulsen instruments. In the letter below one of the messages which Mr. Balch claims the Kahuku station intercepted is omitted because of its length. The Mutual Telephone manager writes:—

In *The Commercial Pacific Advertiser* under date of September 4th, 1912, I noticed a statement, presumably coming from the officials of the Federal Telegraph Company, to the effect that the Poulsen system of wireless communication was a secret one, and offering a reward of $1,000 to any operator of a rival system of wireless communication who could intercept or capture such a message.

On behalf of the three operators employed at the Kahuku wireless station, this island (which station is a 10 kilowatt spark equipment, and belongs to the Mutual Telephone Co., Ltd., of which I am the superintendent), I hereby claim such reward; and, furthermore,

if the following intercepted messages are not sufficient proof, stand ready at any time to demonstrate how easy it is to intercept the messages sent out by the Federal Telegraph Company's station at Heeia, this island. Furthermore, such interception has been and will be effected by an ordinary spark system receiving equipment consisting of a Marconi loose-coupler opposed valve tuning coil and a Galena detector.

Here are a few of the intercepted messages as received at the Kahuku station :—

1. On July 24th, 1912, at 11.55 p.m., copied the following five :—Give us another period on Helix and half. We want to try another primary. 12.55 : We are using 29 in Helix and 2 composition. Do you want more composition ? Give us another period on one Helix and half. How do you get me now ? We are using 29 turns and 2 composition. Go ahead and give us another period on Helix and half.

2. Thursday, July 25th, 1912, 12.10 p.m. " PHU " (Poulsen) coming stronger, sent following message. Cunningham, PHC. Mr. Lewers is on the Coast, went up with Shriners and has not returned. Signed C. F. E. Go ahead, send a little faster. 12.55 repeated message to Cunningham, have long message here. Have you any ? Say, what number turns you using on Helix ? Go ahead.

4. September 5th, message to Jonas, San Francisco. Kindly let Advertiser have surely nightly scores baseball. Send all Pacific Army and Navy news. Movements Pacific Squadron. Hot Roosevelt, Taft, Wilson news liberal Japanese, Chinese (one or two words lost here. Last word is events).

5. September 5th. Here's important test message on which depends a great deal. Repeat it back to me. Sig. S.M. N.R. 4 HU S. M. 27 D.H. from HU September 5th to Matson, 268 Market Street, San Francisco, Federal Ischidrose Bengeltjes they Fruttase for Brocklint our berglehne cookmat heliorne harkvers this findest by Federal Ischidrose Complimentary also Cazzatello in full. Signed Castlecook.

6. HU S.M. D.H. to C N San Francisco, Ashburn W.U.T. After word promotion will reply local Mutual Company charge dollar and half for ten words cable count with fifteen cents additional to any of Islands. Nothing under dollar and half. Signed McCloskey.

7. Paid HU September 5th, 1912. To Hackfrisco, San Francisco. Mykoaksidu Hiogixivme Wekumaetfe Atugnuybu. No signature.

8. HU S.M. 18 D.D. September 5th, to C.N. San Francisco. Our four Hackfrisco San Francisco registers interchangeable as H. Hackfeld & Co., Ltd., 310 Sansome Street. Signed McCloskey.

Also the following message will prove that the spark stations on the coast have no difficulty in reading the Poulsen station at that point. This message copied by the PH (San Francisco station).

San Francisco, Aug. 28, 1912. S. B. Maddams, Honolulu.

One hundred dollars (XX) probably leave here first of month. Commercial man leaves to-morrow. Static is surely bad here but have improved receiving so that you are readable between 11 and 12 (not stating a.m. or p.m.) with increased power you should get when sending with loop grounded when receiving. Tell Mac that have not raised him 5907 73's to all.

C. F. E.

Sent from San Francisco station to Honolulu at 12.40 a.m. portion of another message states " John G. McCloskey leaves on Wilhelmina to-day to be manager."

Four years ago (October, 1908), on the completion of the Kahuku station, night communication was established between Hawaii and the mainland, and while this service has been an intermittent one, depending to a great extent on atmospheric conditions, still a reliable night communication has been something quite easy to establish at any time during the past four years. This, however, has been held in abeyance for the reason that I have not been able to see how such a service could be made to pay in competition with the reliable day or night cable service Honolulu is enjoying.

During 1911, tests were made from the Poulsen system in San Francisco to our Kahuku station, and while good results were secured on night communication, absolutely no signals could be received during the day hours.

During February, March and April of this year I had the opportunity of visiting several of the Poulsen stations—viz., San Francisco, Los Angeles, El Paso, Texas, and Chicago, Ill. Also going through many of the Marconi wireless stations along the eastern coast, my investigations of the merits of these rival systems left me thoroughly convinced of the superiority in every respect of the Marconi system ; also, I may further state, that suits for infringement of Marconi patent, number 763,772, and the Sir Oliver Lodge patent, owned by the Marconi Company, have recently been started by the Marconi Wireless Telegraph Company of America in the United States district court for the Northern District of California.

Yours truly,

JOHN A. BALCH.

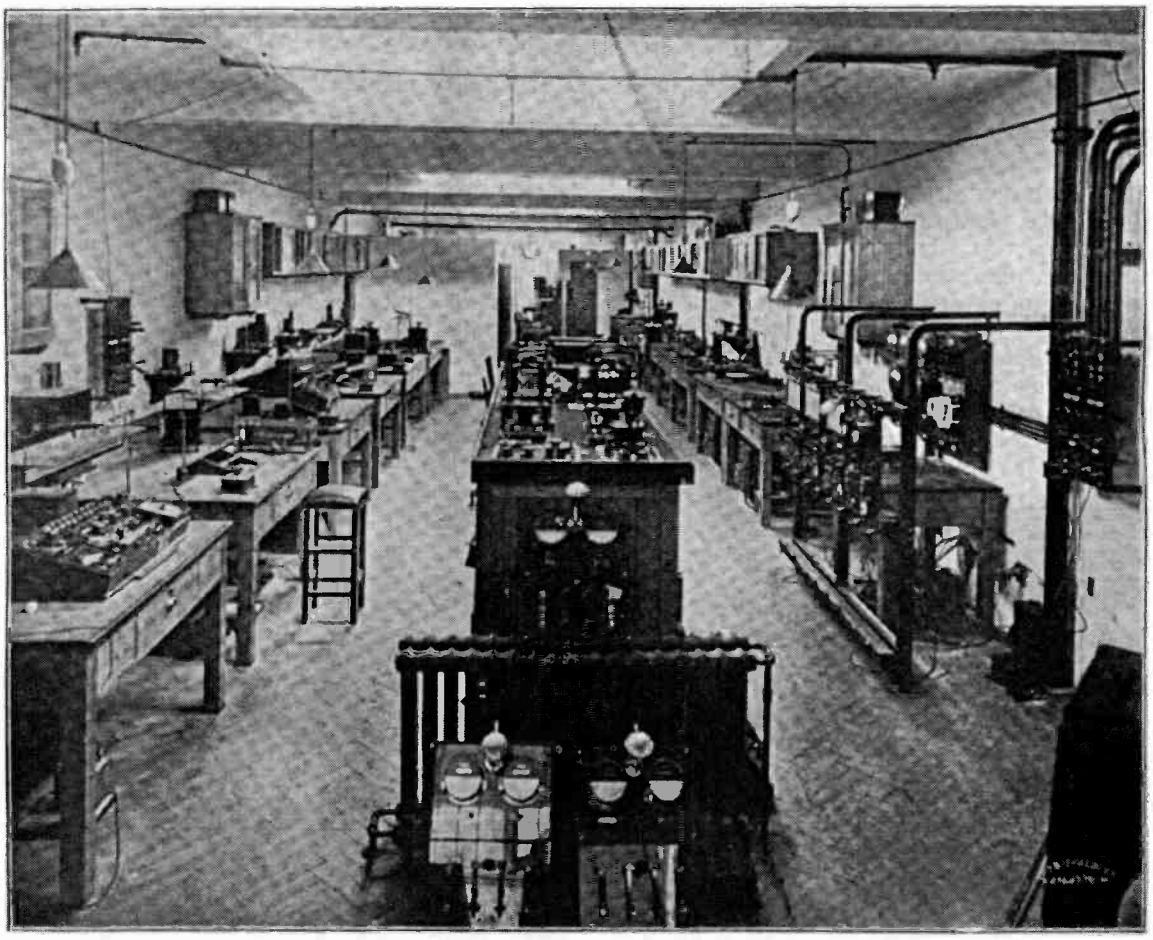
Testing Plant for Wireless Apparatus

WE have already described the structural features of the new Marconi works at Chelmsford, and have noted the various operations carried on there. The hygienic and cheerful atmosphere which pervades all the shops, and the modern features of the equipment, have been specially remarked. But there is one corner of these works over which we have not yet conducted our readers—the testing room. The arrangements here are absolutely sound-proof and free from vibration. They are supported on separate foundations of concrete, upon which are built external walls of brickwork covered by a flat ferro-concrete roof. On the outside of the roof of each cabin are four aerial switches worked by solenoids controlled from the inside of the cabins. A Duddell oscillograph, for pressures up to 25,000 volts, is another interesting feature of the instrument room. This instrument shows voltage and current wave forms, with or without sparking, for transmission, the distorting effect of the sparking being clearly visible. The wave-forms can be photographed in short lengths or on continuous strips by cinematograph camera. At one table there is a potentiometer fitted with a switch for changing at one operation from the D'Arsonval galvanometer to a vibration galvanometer, and also from the accumulator

The Instrument Test Room at the Marconi Works, Chelmsford.

of special interest owing to the completeness of the equipment and the special nature of the apparatus employed.

The instrument test room is reached either from the corridor near the main entrance to the works, the mounting shop, or the finished stores. On entering this room we notice at one end two silence cabins which are for working on the external aerials. An examination of these cabins shows them to be



Another view of the Instrument Test Room.

battery to the source of alternator-current supply. This instrument permits alternating-current measurements of currents, voltages, frequency, capacity, self-induction, and phase differences to be effected. At the next table is a Kelvin balance, Kelvin electrostatic voltmeter, and a Drysdale differential watt-meter for accurate measurements from 50 kw. to 0.01 watts. Another instrument which we might single out for mention is the Duddell vibration galvanometer, which is used with a Campbell inductometer to read inductances of 1 to 1,000 microhenrys within 0.1 per cent., the source of current being either a high-frequency "hummer" with periodicities of 1,000 to 2,000, or an alternator with a range up to 2,000 periods. There are air condensers for capacity testing, and a Cathode Ray oscillograph for obtaining photographic records of wave-forms with frequencies of the order of one million. For accurately testing the capacities of very small condensers in the region of 1/10,000th microfarad there is a Fleming-Clinton commutator which charges and discharges the condenser under test about 400 times per second.

Passing from the instrument test-room through the finished stores we reach the power test-room, where we find the large generating plant and switchboards in striking contrast to the delicate precision instruments which we have just left.

The generating plant in the power testing-room is capable of supplying the various forms of current required. The special machines are mounted on an overhead platform carried by steel joists on cast-iron columns. All of them are liberally built as regards copper, so as to run for long periods with only a small temperature rise, and the commutator and brush gear are specially constructed to avoid sparking at the very high speeds required.

A 2-kw. converter gives 100 volts at 50 periods. A 3-kw. motor generator gives 100 to 400 periods at 300 volts with a pure sine curve, while a ½-kw. motor is coupled to a high-periodicity generator giving from 500 to 2,000 periods with a maximum speed of

9,000 r.p.m. Another machine gives alternating at 10,000 volts, with a pure sine curve having 200 periods, and there is also a machine which consists of two direct-current generators in series to give 3,000 volts.

In addition to the main testing switchboard there is a switchboard for the a.c. supply-motor generators, and a number of distribution boards.

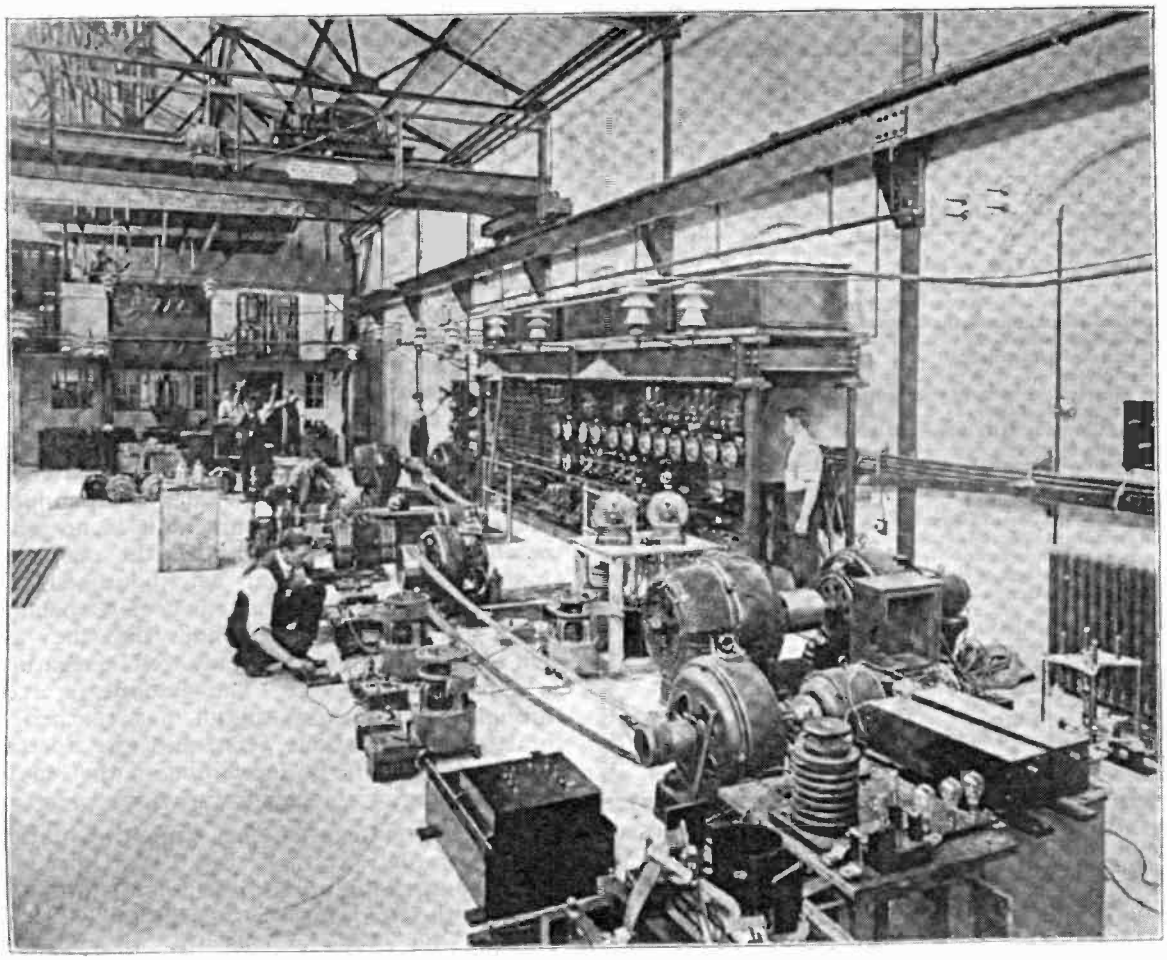
Mounted on the roof of the power test-room is a series of tin plates hung upon long porcelain insulators. These plates are in four parts, and form an artificial aerial of variable capacity, resistance and inductance. Another artificial aerial for measuring energy losses consists of four large stoneware oil baths containing galvanised steel plates.

A resistance calorimeter, used to represent the energy lost by radiation in aerials, consists of a continuous resistance wire bent backwards and forwards in a flat plane and woven together with asbestos cord, the sheet thus formed being bent round into the form of an incomplete cylinder, with the edges of the sheet 3 inches apart. The cylinder is contained in a copper vessel which drops into another copper vessel having a polished exterior the bright metal, with an air space between, the two being designed to avoid radiation losses. Tappings are taken off the resistance and brought through the top in thick glass tubes, and the oil is circulated by stirrers driven by a small motor. The apparatus will dissipate 20 kw., and will stand a pressure of 100,000 volts.

Adjoining the power test-room is the oil test-room, where the transmitting condensers used in installations of 300 watts up to 2 kw. are tested.

Adjoining the oil test-room is a small dark room for testing the capacities of condensers of the Leyden jar type. The major portion of the apparatus here is of a special nature, and is being designed by the staff of the Marconi Company for particular uses.

Before leaving the works a visit must be paid to the show rooms, where several complete wireless sets of different types and power are erected, and where demonstrations are given on the apparatus under working conditions.



The Power Test Room.

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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.

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The Share Market

London: October 24th.

Since our last issue the markets have been in a feverish condition, due to the general outbreak of hostilities in the Balkans, and to this was added last week an advance in the Bank rate from 4 to 5 per cent.

The shares of the various Marconi issues have not been much influenced by general conditions—in fact, as we go to press, (October 24) the prices are higher than last account: Ordinary, 5 1/16; Preference, 4 7/16; Canada, 20s. 9d.; Spanish, 1 1/16; America, 1 7/16.

The Phillips Memorial

The memorial at Godalming to John George Phillips, the wireless operator of the "Titanic," is to take the form of a cloister, with a small garden in the midst of it, and with seats sheltered from the wind and rain. The *Times*, commenting upon this proposal, warmly approves the decision of the committee, and adds that this is a memorial that will certainly be useful, and that may easily be made beautiful in a simple and quiet way, especially as the further wall is to consist of an arcading through which there will be a view of a broad water-meadow with wooded hills beyond it. The committee seem to have been aware of the obvious fact that a memorial is no memorial if everyone hastens to forget it as soon as it is set up. The cloister will be used, not ignored, and as long as it is used it will be associated with the name and story of Phillips.

The successful completion of the scheme, however, depends upon whether the necessary money can be obtained, the subscriptions to date amounting to little over £400. More money is required, however, and we hope that those who have held back from making any offer, waiting to see what kind of monument would be adopted, will now rally to the support of the scheme. The monument is in no sense merely a local one, for though the people of Godalming and the near neighbourhood feel that to perpetuate the memory of a splendid act of duty is a debt of honour that they are glad to acknowledge, yet it may well be regarded as a national concern. The amount received through THE MARCONIGRAPH has reached a total to date of about £100, and any further sums received will be forwarded to the Mayor of Godalming.

The telegraphists of the Argentine nation have forwarded through the Post Office, an address expressing admiration for Mr. Phillips, of which the following is a translation:—

To the Telegraphists of the United Kingdom.

Fellow Telegraphists,—The Telegraphists of the Argentine nation who sign this in the name of all their companions throughout the Republic, do so in order to join in the manifestations of sympathy and admiration, as well as the tributes which have been paid to the memory of the unfortunate telegraphist of the "Titanic," Jack Phillips, who gave an example to the world of devotion to duty, despising danger and remaining firm at his post until he rendered up his life, an English hero.

We desire that this humble token of homage may also be taken as an expression of the fraternal feeling which prevails between the telegraphists of both nations, and of the esteem in which the colleagues of the heroic Phillips are held, not only in Argentina, but throughout the world.

Assuring you of our most respectful consideration,

We are, etc.

Presentation to Mr. Bride

An interesting little ceremony took place at Marconi House, London, on Wednesday, October 23rd, when Mr. Harold S. Bride was presented by the Marconi International Marine Communication Co., Ltd., with a gold watch "in recognition of having done his duty, and done it bravely" on board the R.M.S. "Titanic." In handing the gift to Mr. Bride, Mr. Godfrey C. Isaacs, the managing director of the company, referred with extreme regret—a regret shared by all who attended the gathering—to the unfortunate circumstances which prevented Mr. Marconi being present. He assured Mr. Bride that the Marconi Company highly appreciated the way in which he had performed his duty. It was unnecessary to say anything about what that duty was: the whole world knew it. In the name of the company, and in the absence of Mr. Marconi, Mr. Isaacs handed to Mr. Bride a little souvenir in the shape of a gold watch in which was inscribed just the mere plain statement of fact. Mr. Isaacs hoped it would prove some satisfaction to the recipient, when he was older in years, to look back to his earlier days and remember that he did his duty. Mr. Bride made a brief response.

The Liverpool Shipwreck and Humane Society have sent to the Marconi Company a silver medal and illuminated address for Mr. Cottam, and these will be handed to Mr. Cottam on his arrival in England. The address reads:—

At a meeting of the committee of the Liverpool Shipwreck and Humane Society, held at the Underwriters' Room, Exchange Buildings, Liverpool, on the 4th day of July, 1912, it was resolved unanimously: "That the best thanks of the committee be presented to Mr. Thomas Cottam, wireless operator of the s.s. 'Carpathia,' for praiseworthy and humane service to the survivors of the R.M.S. 'Titanic,' which foundered April 15th, 1912."

Wireless Telegraphy in the Royal Marines

It is announced that an increase has been granted in the allowance to officers of the Royal Marines when employed as instructors of wireless telegraphy from 2s. 6d. to 3s. 6d. a day, such allowance to be payable only to officers serving in the Royal Marines prior to January 1, 1912.

South African Stations

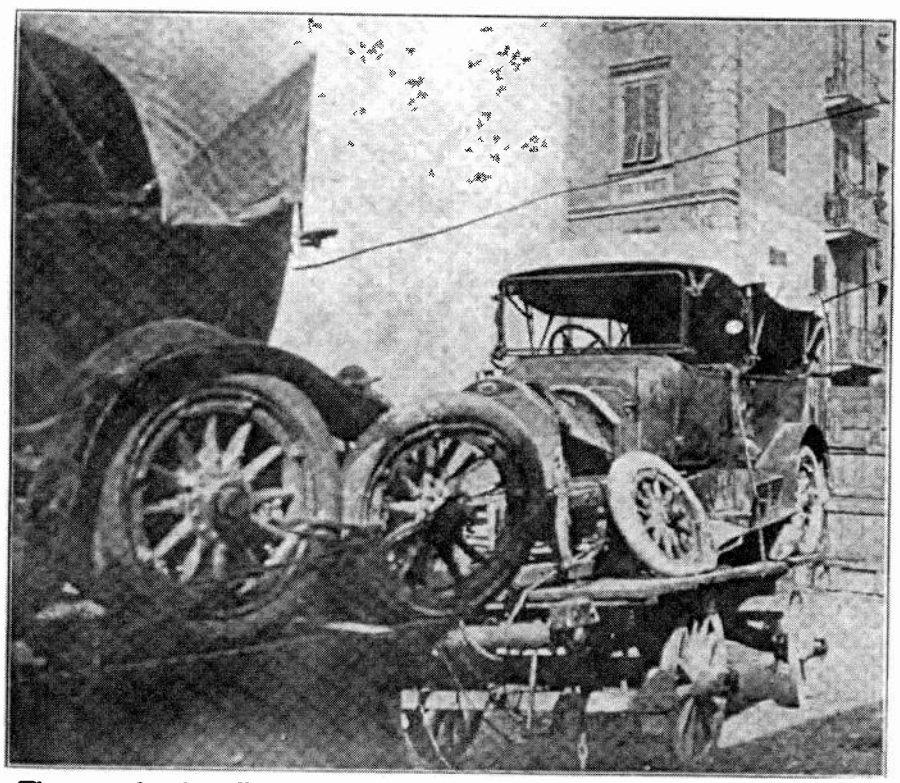
There is a statement in the report of Mr. J. Wilson, the Postmaster-General of the Union of South Africa, of a series of curious happenings in the science of wireless telegraphy. The Slangkop wireless station, between Cape Town and Cape Point, under favourable conditions gets into communication with the incoming mail steamer on Friday night, three days before the vessel reaches Table Bay, and is generally on the same night still in communication with the outgoing mail steamer. The normal range of the Durban station is about 250 miles by day and 1,000 miles by night, while the higher-power installation at Slangkop has a range of approximately 400 miles by day and 1,600 miles by night. These are the ranges guaranteed by the Marconi Company, but it is of interest to note that on several occasions these ranges have, at night time, been greatly exceeded at both stations; in fact, in one instance the Durban station received signals from a vessel in the Suez Canal, and the Slangkop station states that signals which it picked up one night were those of the Poldhu station in Cornwall which was working across the Atlantic to Glace Bay, Newfoundland. These are, of course, only "freak" results, and no use can be made of these extraordinary effects for commercial purposes. The number of wireless messages dealt with at Slangkop during the last seven months of 1911 was 2,907, of a revenue value of £792. The station at Durban, though not so favourably situated as the one at Slangkop in respect of traffic with passenger steamers, transacts a fair amount of business and continues to give good results. The number of messages for the period mentioned was 543, of a revenue value of £164.

The Accident to Mr. Marconi

THE report of Mr. Marconi's unfortunate motor-car accident at Spezia on September 25th has been received with world-wide sympathy. At the time of the accident Mr. Marconi, Mrs. Marconi, his secretary and chauffeur were travelling near Borghetto di Vara and were approaching a right-hand curve when another car, travelling at a rapid speed, suddenly appeared round the bend, and before Mr. Marconi, who was driving, had time to avoid it, the two cars collided "head on." All the occupants of the car received a severe shaking, but Mrs. Marconi, the secretary and the chauffeur happily escaped with nothing more serious than a few slight bruises. Mr. Marconi was, however, not so fortunate, for it was soon found that his right eye had sustained considerable injury. At the time it was impossible to gauge its exact nature, but that it would lead to no serious results was confidently hoped.

A telegram was immediately despatched to the Admiral in command at Spezia, who promptly sent his private car with a doctor and first-aid remedies, which arrived upon the scene within one hour of the accident, and conveyed Mr. and Mrs. Marconi to the Naval Hospital at Spezia. The road between Spezia and Borghetto is one of the most dangerous in Europe, the average gradient being one in fifteen; it crosses a range of mountains, and contains innumerable hairpin bends, yet, notwithstanding this, the car which the Admiral kindly despatched in response to the appeal for aid covered the 23 kilometers in twenty-three minutes.

At the Naval Hospital Mr. Marconi received the greatest kindness possible, and the authori-



The cars after the collision. The rear car was the one in which Mr. Marconi and his party were travelling.

ties took infinite pains to provide all the skill and resource at their disposal. An eminent specialist from Bologna was summoned immediately, and Professor Bajardi, of Turin, was consulted as soon as an examination of the eye was possible.

Owing to the extent of the inflammation the doctors were unable for some days to formulate any definite opinion as to the exact condition of the eye, but after the inflammation had partially subsided, hopes were entertained that the sight would be preserved, the eye being sensitive to light. As time went by, however, the chances of saving the eye became more and more remote, and subsequently, as the result of a consultation with Professor Fuchs of Vienna, Professor Bajardi and all the Naval Doctors came to the unanimous opinion that the sight of the eye was irrevocably lost, and that there was a likelihood of sympathetic ophthalmia affecting the left eye if the right was allowed to remain. An operation was therefore performed for removing the eye, and was entirely successful; the following bulletin, signed by Dr. Montano, the Director of the Naval Hospital, being issued on October 17th:

> "Professor Fuchs, of the University of Vienna, and Professor Bajardi, of the University of Turin, met in consultation this morning and decided that it was necessary to remove the injured eye in order to avoid sympathetic ophthalmia. They therefore performed the operation, which was successful. General physical and moral condition of the patient was good."

Within two days there was a wonderful improvement in the condition of Mr. Marconi, who, on October 14th, was able to leave his bed for two hours. He has since continued to make rapid recovery, and it is hoped that he will be able to leave the hospital at Spezia before these lines appear in print.

It is satisfactory to know that an accident which might have had much worse consequences is likely to leave no further ill effects than the loss already referred to. Inquiries as to the condition of Mr. Marconi have been received from all parts of the world, and it is gratifying to be able to state that he is making such excellent progress. Their Majesties the King and Queen of Italy, who were staying at San Rossore, near Piza, made a special journey to Spezia on October 11th, accompanied by the Duke of Abruzzi, to pay a visit to the illustrious scientist. Throughout this trying period Mr. Marconi's optimism has never failed him, and he is looking forward to resuming his scientific investigations in the near future.

Communication Between War Vessels and Merchant Ships

THE Board of Trade has issued the following statement to masters and owners of British merchant vessels:

The Board of Trade has been requested by the Lords Commissioners of the Admiralty to direct the attention of masters and owners of British merchant vessels to the necessity for arranging for periodical practices in wireless telegraphy communications between H.M. ships of war and ships of the British mercantile marine for the purpose of ensuring efficient and reliable communication when required.

It is therefore hoped that all British shipowners and masters whose ships are fitted with wireless telegraphy will co-operate to give effect to the following proposals: It is pointed out that the exercises must always be subject to the exigencies of H.M. service, and these practices should only be carried out when they will not interfere with commercial or naval work.

1. At 8.30 a.m. and 2.30 p.m. daily any single man-of-war (destroyers and small craft excluded), or one man-of-war in a fleet in company, detailed by the senior naval officer present, will adjust her wireless telegraphy transmitting and receiving apparatus to the commercial 600 metre wave-length and make the call "CCCC," followed by her own commercial call sign, indicating that she is prepared to carry out an exercise with any British merchant ship within range.

On a British merchant ship receiving this call she will answer and say whether or not she is prepared to proceed with the exercise. Should more than one merchant ship answer, the man-of-war will indicate which is to exercise and which is to wait.

The exercise will then proceed, but no messages are to be exchanged which are not authorised by the respective captains and masters of the ships practising. No message received during such exercises is to be forwarded beyond the ship actually receiving the message and no payment for any message can be made. The exercises are to be considered as strictly on service, and not for any commercial advantage

2. In all such exercises the man-of-war is to be considered the controlling ship.

3. The exercises will cease at 9.15 a.m. and 3.15 p.m. respectively, or before, at the discretion of the captains concerned.

4. These exercises are only to be carried out between vessels, neither of which is within 150 miles range of any commercial shore station using the 600 metre wave-length, and are to cease at once should one of H.M. ships so direct.

Unsolved Problems of Wireless Telegraphy

Discussed by Dr. Eccles, Prof. Howe, Lord Rayleigh, Prof. Kennelly, Prof. A. G. Webster, Mr. S. G. Brown, and Prof. Baily

THE discussion upon the scientific theory and outstanding problems of wireless telegraphy, introduced before the British Association by Professor J. A. Fleming (whose paper was published in the October MARCONIGRAPH), gave rise to an interesting discussion. The main points in Professor Fleming's paper were the "bending" of the waves to follow the contour of the earth, and the so-called "daylight effect" which makes it possible in certain circumstances to transmit signals for a very much greater distance by night than by day, using the same power. Dr. Fleming was followed by Captain H. R. Sankey, whose remarks were also published in last month's MARCONIGRAPH.

The next speaker was Dr. W. H. Eccles, who summarised a long communication describing some of the outstanding phenomena met with in the transmission of electric waves, artificial and natural, over great distances, and examining how far they might be explained on the hypothesis of refraction or reflection of electric waves by masses of ionised air. The favourable influence of the ionisation of our atmosphere by the sun on the propagation of electric waves round the globe was first drawn attention to in a paper read in June last before the Royal Society by Dr. Eccles, in which he showed that the presence in the atmosphere of charged ions of molecular magnitude produced such alterations of the velocity of electric waves through the medium as would have appreciable effect on waves that travelled over long distances. Ions of various sizes were, no doubt, produced by solar radiation.

Solar Radiation

The concentration of the ions due to solar radiation must increase as distance from the earth increased, and it was not unreasonable to assume that practically all the ions in the middle parts of the atmosphere were due to solar radiation. A consequence of this was that the velocity of electric waves would increase as height above the earth increased. It followed that a nearly vertical wave front would tilt forward as it travelled horizontally through the middle portion of the atmosphere, or, in other words, a ray travelling nearly horizontally in the middle atmosphere would follow a trajectory curved in the same sense as the earth's surface. In the lower atmosphere, where the ionisation and its rate of variation with height were small, the ray might not be bent appreciably. Thus, an electric ray starting from a point of the earth's surface in a direction inclined slightly upward, would pursue a straight path in the lower atmosphere and a slightly bent path with its concavity downward in the middle atmosphere. If its curvature here was on the average greater than that of the globe, the ray would be turned down to the lower atmosphere, and again traverse a straight line; but in the other event it went farther and farther from the earth's surface and was lost to us.

It was obvious that, at or above any particular place on the earth's surface, the ionisation in the middle and lower atmosphere increased up till noon and diminished after noon. At sunset most of the ions formed by the sun would disappear rapidly by recombination, and this would leave the atmosphere unionised except in so far as local electromotive force might have sifted positive from negative ions during the day. At sunrise there would be great formation of ions. Thus, at the boundary of light and darkness in the atmosphere, there was a more or less abrupt change in the electrical conditions of the medium through which waves had to pass. This region of twilight might be expected to have a much greater influence on the propagation of waves coming from a great distance than on that of waves coming from distances which were not large compared with the height of the well-ionised layers.

Upper Layers of the Atmosphere

Scarcely any of the phenomena to be described could be explained without assuming that there existed in our atmosphere some permanently ionised upper layers capable of reflecting electric waves. This hypothesis was put forward by Heaviside in 1900, but had as yet not been supported by any direct evidence. Besides the implicit evidence in favour of the hypothesis scattered through this communication, Dr. Eccles adduced some considerations

from quite another quarter. In 1901 Newcomb made photometric measurements in America of the total light received at the earth's surface from a clear sky on a moonless night, and compared it with the sum total of the measured light from the stars. He discovered that the light actually received greatly exceeded that from the stars. This result had been confirmed by other observers, notably in 1907–8 in Holland, by Yntema, who found the extra light to be perceptibly greater near the horizon than at the zenith. Yntema suggested in 1909 that the extra light might be due to a sort of permanent aurora in the upper atmosphere. It was well known that W. W. Campbell showed in 1895 that the green auroral line λ 5,770 could be seen on clear moonless nights in any part of the sky. This extra light had lately been measured on Mount Whitney by Abbott (August, 1910), with results similar to the preceding. Discussing this "earth light," as it was called, Dr. W. J. Humphreys, in the *Astrophysical Journal* of May, 1912, put forward and supported plausibly the new suggestion that the outermost layers of our atmosphere were kept permanently ionised by bombardment with dust of cosmical origin. An ionised upper layer such as this was exactly what was demanded by many of the facts of wireless telegraphy; but it was very doubtful whether Humphreys' views would be admitted by students of terrestrial magnetism.

In a very important discussion of the degree of conductivity required in the upper atmosphere to justify his theory of the diurnal variations of terrestrial magnetism, Professor Schuster arrived at a conductivity of the order 10^{-13} electromagnetic units at heights about 100 km. On this basis in the daytime the downward refraction of electric rays at the respective heights named would be so sharp as to be tantamount to reflection. Much lower conductivity than that demanded by Professor Schuster might suffice to produce beneficial bending of long waves round the earth by ionic refraction in the day.

Day and Night Signalling

Turning to the phenomena that had up to the present been revealed by long-distance transmission, the prime fact was the discovery by Marconi in 1902 of the difference between day and night signalling. He found that signals which were readable at night up to 2,000 miles across the Atlantic were not readable in daylight beyond 800 miles. The author explained this by supposing that at night the permanently ionised upper atmosphere acted as a reflecting surface somewhat in the manner of a whispering gallery, while in the day it was put out of action by the ionised middle atmosphere.

It was now common engineering knowledge that the evil effect of hilly country on day signals was very much less, being sometimes almost negligible on waves of, say, frequency 100,000, than those of frequency 1,000,000. How were these truths to be accounted for? It was only necessary to assume that in the night the Heaviside layer reflected waves of all frequencies equally well; that the sky was, in an electrical sense, lighted up by the radiation from the sending station and sent rays into the valleys beyond the mountains, the effectiveness of the transmission being greater when the stations were not too close under the hills. In the day the ionised middle atmosphere veiled the reflecting layer, and, to some extent, refracted the waves over the mountains. This refraction was 100 times more potent with a frequency of 100,000 than with a frequency of 1,000,000.

Transition from Day to Night

The transition from day to night conditions marked out a period of the greatest interest. The facts given by Marconi were as follows: Waves of length about 4,000 m. (75,000 frequency), crossing the Atlantic from west to east, yielded strong and steady signals all day at Clifden, which gradually weakened after sunset at Clifden, till a minimum strength was reached about 1½ hours after sunset. The signals at Clifden then gradually increased in intensity till after sunset at Cape Breton, when they attained a maximum which was occasionally very high. During the night they were very variable in strength, flickering from very weak to very strong. Slightly before sunrise at Clifden the signals grew stronger and sometimes passed quickly to a high maximum. They dwindled to a marked minimum about two hours later, and then returned to the normal day strength. The facts brought out by measurements on the Clifden signals received at the author's laboratory in London were as follows: During the day, signals were weak and not very steady; during twilight, they sank to a minimum intensity at about 20 minutes after sunset at London—that is, when the sun was setting at a place half-way between London and Clifden. After other and erratic fluctuations in strength, they kept increasing in intensity till well after sunset at Clifden. Sometimes, at about 10 minutes after that sunset, there came a short interval filled with huge flutterings of signal strength, the sounds in the telephones alternating from faint to loud with great rapidity, just as if the medium conveying the signals were stirred with a vast commotion; and then the signals quickly

settled to their normal night strength, which, it must be noted, was always greater than their normal day strength. Similar phenomena, less pronounced, might be witnessed at sunrise.

The Belt of Electrical Disturbance

It would be well to offer an explanation of these phenomena. In the first place, it was clear that when at sunset the rotation of the earth carried a region of the middle or upper atmosphere out of the sunlight, recombination of ions must take place on a vast scale. Similarly, at sunrise, formation of ions would take place. The regions in which these changes were occurring formed a great circular belt round the globe which was inclined to the meridian at an angle depending on the season. This belt of electrical disturbance was, of course, perpetually revolving round the globe. The ionisation occurring in the sunrise half of the belt, and the recombination occurring in the sunset half, might both be expected to take place with some degree of irregularity even in a still atmosphere, with the result that patches or banks of ionised air, analogous to the banks of fog met at sea, would transiently overhang the parts of the earth's surface that were in dusk. It was probable that these irregularities were greater in the sunset half of the belt than in the other, for it was not unlikely that considerable separation of ions of opposite sign might take place in the course of the day under local electromotive forces. In any event, the effect of such patches of heterogeneously ionised air on waves propagated through the region was, in view of the connection between the velocity of the waves and the concentration of the ions, to produce scattering by repeated refractions. Hence it was to be expected that the regularity of transmission through the steady ionised horizontal strata of the illuminated air would be greatly disturbed by the arrival of the twilight transitional patches, with the ultimate consequence that the signal sounds heard in the receiving telephones would be weakened. The author's own observations on the influence of ordinary cloud on signals proved that the ionically turbulent belt was above the ordinary cloud level, and thus it might be regarded as a sort of curtain enringing the earth and occupying the middle atmosphere without reaching the lower. It affected, therefore, the trajectories of waves received from great distances, and not those from small.

The natural electric waves that diverge from lightning strokes or other atmospheric discharges often travel long distances over the globe, and therefore exhibit the effect of the twilight belt. These natural electric wave trains make themselves evident in wireless telegraph apparatus by knocking or clicking sounds in the operators' telephones. These strays, as they are called for short, are in our latitude usually more frequent at night than in the day, both at land stations and at ship stations, and near sunrise and sunset the day conditions merge, of course, into the night conditions.

The Solar Eclipse

During the progress of the solar eclipse of April 17th last a record was made of the strays received at the author's laboratory in London. The apparatus was set so as to receive signals of wave-length 5,500 metres, which is approximately the wave-length of the radiation from Clifden. The strays were fairly numerous, and the results of the observations showed that the time integral per minute of the number and intensity of the strays was 10 units at 11.46 a.m., rose rapidly to a first maximum of 22 units at 11.55, fell to a minimum of 8 units at 12.4, rose again to a maximum of 28 units at 12.13, and fell rather slowly to 10 units, the normal day level, by 12.40. The message-bearing waves from Clifden were brief and irregular, so no measurements of their intensity were obtained; but it was very noticeable that they were loud when the strays were loud and *vice versa*, in rough proportion to the strays. These results were confirmed, so far as signals were concerned, by H. Schledermann, of the Danish Navy. The strength of the signals from Blaavands Huk Lighthouse in the North Sea was measured at Copenhagen Dockyard, 300 km. distant, and a "very remarkable strengthening of signals" was observed. The strongest signals were received a few minutes after the maximum of the eclipse. Schledermann does not mention the existence of any minimum.

The following rarely-observed phenomenon was noticed by Dr. Eccles during experiments on board a vessel off the coast of North America in August, 1909. Experiments were being made with apparatus designed for the determination of the direction from which signals were coming, and on various occasions on a particular day (but not on other days) the determination of the azimuth of a sending station 40 miles away differed in their extremes by nearly a point of the compass. It now seems not improbable that this might be caused by the presence of refracting banks of ionised air resting on the surface of the sea.

Arctic Observations

Mr. C. H. Taylor worked with some stations of the American Marconi Company near the Arctic circle some years ago throughout three winter months. He found that the aurora exercised a most profound effect on signals,

and always a favourable one. Sometimes when signals were too bad to read, the arrival of an aurora instantly brought good communication; in fact, if during reception the signals became feeble, the telegraphist would walk to the office door, glance into the night, and find, as expected, that the aurora had disappeared. The effects were greatest when the aurora extended all round the zenith. Since then it has been remarked that even as far south as Montreal freak ranges are most common on nights of brilliant auroral displays. If it be permissible to identify the upper conducting layer of Heaviside with the strata in which the aurora forms, this connection between auroræ and signals proves positively that the upper layers do come strongly into play even in the distance of about 100 miles worked over by Mr. Taylor. The sharpness of the coincidence of periods of good and bad signals respectively with aurora and no aurora cuts out the possibility that the aurora may in some way influence the transparency of the lower layers, and so affect signals indirectly, and this conclusion is borne out perfectly by such results as those of Simpson, which prove that no connection whatever can yet be found between auroræ and the electrical condition of the lower atmosphere. The question of the height of the aurora is of interest in this connection. Some observers have given the figure as 10 km. or even less; but the most recent and most trustworthy result is that of Störmer, who determined the height photographically as varying from 40 km. to 370 km. Accepting this, it seems to be proved that electric waves travelling 100 miles at night may be affected by the state of affairs in regions of the atmosphere more than 25 miles high. On the other hand, since there exists all over the world a connection between auroræ and terrestrial magnetic disturbances, we might expect that a magnetic storm in any latitude would influence the ease or difficulty of propagation of electric waves over long distances.

Source of Strays

One of the most interesting points suggested by this communication is the exact source of the strays received in London. Usually all strays are ascribed to lightning flashes between masses of charged air or between charged air and the earth, mainly for the reason that every lightning stroke produces a stray—one of the earliest observations in the history of wireless telegraphy—and that every lightning storm within a few hundred miles of a wireless telegraph station produces strays of intensity corresponding roughly with the distance of the station. But in temperate and colder climates strays are often abundant when there are no local storms. The general result of a long series of observations was that about 70 per cent. of the strays heard at Newcastle had the same origin, and were of about the same intensity as the corresponding ones heard in London; whence it follows that the source is at a distance great compared with the distance between the stations. This conclusion is, perhaps, to some extent confirmed by some observations of our Post Office officials to the effect that strays are simultaneously sparse or abundant at widely distributed stations in the British Isles (J. E. Taylor). So far as these results go, the discharges might or might not be extra-terrestrial. The former alternative appears unlikely to those who accept the electrical conductivity of the upper layers of the atmosphere; and the twilight and eclipse phenomena point to a source in the south, a question that ought to be settled by the use of directive antennæ.

Vector Diagrams

Professor G. W. O. Howe thought there was a certain haziness about exactly what these surface waves, referred to by Dr. Fleming, were, and he had found that in teaching wireless telegraphy to electrical engineers it was far better to approach the subject from the electrical engineering point of view, as this, in his opinion, made it a little clearer as to what the problems were that had to be solved. In an ordinary long-distance telephone transmission there were two parallel wires, and at one end there was some source of alternating current, and in the distance, perhaps two or three thousand miles away, a load. It was easy, by means of the usual Vector diagrams, to work backwards and find at every point the current and potential difference between the line, and in that way they could find that at one point of the line the current was going in one direction, and at another point in the other direction, and also could work out the variation in the current at different points. There was a negative charge at one point, then a positive charge, then a negative charge, and so on, and between them an electrostatic field.

Dr. Eccles' Theory Supported

Lord Rayleigh said that he had always, since he first heard of the wonderful results obtained by Marconi in signalling across the Atlantic, felt that there was a difficulty in explaining long-distance radio-telegraphy on the hypothesis that the earth was a perfect conductor and the air a simple dielectric, and that this was so seemed now to be accepted. Some authorities, however, professed to be unable to see the difficulty. One, for example, had pointed out that the lines of electric force were necessarily perpendicular to a conductor, and

thus occupied to the earth exactly the position they should have for the propagation of a wave around it. The same argument might, however, be applied to sound. Here the direction of motion was necessarily perpendicular to the surface of any solid body encountered, and thus, on the argument stated above, exactly in the direction necessary for the progagation around the obstacle. From this analogy it would be evident that the suggested explanation was inadequate. We had curious anomalies between day and night transmission, and between signalling north and south and east and west, and he thought the phenomena were, therefore, too complicated to be explained by Sommerfeld's surface waves, and he (the speaker) was inclined to look more to Dr. Eccles' theory. The complication in question seemed more likely to be due to changes going on in the atmosphere. He had been struck by the fact that the receiver and transmitter were differently arranged. This seemed in conflict with the principle of mechanical reciprocity, which was very generally valid. This principle was, however, based on the linearity of the relationships involved, and might not hold when the disturbances could not be treated as very small. It was here, perhaps, that the reason was to be found for the apparent fact that the best receiver was not also the best transmitter, as would be expected from the principle of reciprocity.

Sunrise and Sunset

Professor A. E. Kennelly, who spoke next, exhibited some diagrams showing the effect of sunrise and sunset and the difference in the strength of the signals by night and by day. To explain the effect of sunrise, the speaker said that the conductivity of the atmosphere exposed to sunlight depended upon the pressure. With air at a pressure of $_{1}{}_{0}$ mm. the conductivity was comparable to that of a good sulphuric-acid solution. Lines of equal pressure in the upper regions of the atmosphere were also of equal ionisation. Hence with the sun vertical these lines of equal ionisation would be level surfaces, and this would still be approximately the case if the sun rays were inclined at any angle substantially below the grazing angle, though the levels would be higher. At sunrise, however, the rays meeting the earth tangentially, the surfaces of equal ionisation rose up sharply, so as to meet these rays nearly perpendicularly, and he suggested that this sharp bend upwards of the surfaces of equal ionisation might be responsible for the sunrise effect.

The Analogy of Sound

Professor A. G. Webster thought a better conception of the difficulty of the problem of long-range wireless telegraphy would be obtained if they thought of sound, the transmission of which was so dependent on the homogeneity of the atmosphere. A siren might be audible 10 miles away, and inaudible at a distance of a couple of miles, though the eye could see the steam escaping from it. In radiotelegraphy the atmosphere, in view of the local effects of sun and weather, could not be expected to act as if it were homogeneous. To the mathematician, however, the subject was a diffraction phenomenon, but he treated it from the view of diffraction taken in books of optics, which was the kind convenient for mathematical treatment. In the case of sound, however, mathematics had proved quite incapable of determining the maxima and minima of sound round a megaphone, and the problem in radiotelegraphy was more complicated than it was in that of sound. With sound they had to deal with a scalar quantity, but in wireless telegraphy with a vector. It was, however, apparent that if the earth were a bad conductor, they were going to lose a lot. Moreover, the sea was homogeneous and the land not, so better transmission was natural over the former. The fact that daylight affected the transmission showed that there was a lot going on above the surface. The difficulty of the mathematician arose because the variables involved were complex quantities, and not real, as in the case of sound. Professor Sommerfeld had accordingly been obliged to make certain simplifications, and the question arose as to whether these were legitimate. It was true, of course, that he was a mathematician of the greatest skill. The analogy which Professor Fleming had drawn between Sommerfeld's two kinds of waves and the three kinds of earthquake waves was, the speaker thought, fallacious. The three earthquake waves all travelled with different velocities, but Sommerfeld's two waves had the same velocity. In all this work, however, the speaker thought it was marvellous the way in which Clerk Maxwell's equations were confirmed by experiment. He agreed with Professor Fleming that co-operation might do a lot to elucidate the question.

Wired Wireless Telegraphy

Major Squier, who was next called on, said that the United States War Department had thought it of interest to investigate the possibilities of what he might call wired wireless telegraphy, using frequencies much smaller than those used in wireless telegraphy and much higher than were used in ordinary telegraphy. The plan was to make their antennæ stretch the whole distance between the sending and the receiving station, and to pick up the signals there

by apparatus of the " wireless " type. It was found necessary to have some generator capable of yielding a sustained series of oscillations. This generator had a frequency of 100,000 cycles per second, but the machine could be run to give as little as 20,000 cycles per second. Driving this machine with a storage-battery, oscillation at the above rate could be sustained for hours at a time. The lines used in transmission were of known impedance, but, on putting the plant to work, it was found that the inductance was increased, and capacity had to be added to establish resonance. Making use of previous experience in wireless work, it was found quite easy to get good results. For a range of 400 miles the energy needed was very small as compared with ordinary radio-telegraphy, the line between Baltimore and New York being operated easily with 40 or 50 volts. The frequency being far beyond the limit of audition, it was possible to telephone simultaneously along the same wire by the ordinary battery system. A Fleming valve was used as a rectifier at the receiving end, and duplex telephony was easily practicable, one set of instruments being operated with these rapid oscillatory currents, and the other by the ordinary battery system. There was no interference whatever, and daylight did not have any prejudicial effect.

Some Anomalies

Mr. S. G. Brown said that in 1899 he had made many experiments in directed wireless telegraphy and in these he met with many anomalies. At times the transmission would, after being difficult, suddenly brighten up enormously without apparent reason. He stated that he had now produced a telephonic receiver which was twice as loud as the best Bell instrument yet made. With the latter, the sounds produced by the wireless waves were so faint that an ordinary person failed to hear them at first. He had also now got a relay which would pick up signals otherwise quite inaudible.

The Resistance of the Earth

Professor Baily remarked that Professor Fleming had recalled that the speaker had suggested some years ago that surface waves might be responsible for the long ranges attained in wireless telegraphy, and he believed that, whatever the relative value of Sommerfeld's and Eccles' hypotheses, these waves must actually exist, though as to how far they extended was another matter. He had made a number of experiments to determine the resistance of the earth, which showed that for a depth of several miles this was comparatively high, but even very slow oscillation would not penetrate to a depth of more than 50 to 100 miles. This was so little compared with the diameter of the earth that the latter might for ordinary purposes be taken as a conductor. At a depth of about 60 miles the conductivity increased very rapidly, so that below this limit the earth was a very good conductor.

A Musical Analogy

THE immense hold which wireless telegraphy has made upon the public interest is evidenced by the numerous allusions which are to be found in the whole range of present day literature, and in its effective use by many of our most eminent speakers to emphasise the point of their discourse for their hearers. As a particularly noteworthy instance must be mentioned the speech of Dr. William H. Cummings, which was made at a dinner given by the Authors' Club to the distinguished musician. In answering the toast of his health he spoke at some length on the birth of orchestral music, and in concluding his remarks pointed out that we were at present only on the fringe of the perception of sound. Much had yet to be learned, and John Stuart Mill's fear that the possibilities of our diatonic scales were exhausted, and that it would be impossible for composers to produce new music, had been proved by experience to be fallacious. As to the future of music, Dr. Cummings expressed the opinion that great discoveries and advances seemed inevitable. Already they noted that vibrating atoms had some mysterious attraction for each other; this was evidenced in the employment of wireless telegraphy. Probably the atom vibrated in harmonious ratios, and therefore they mutually attracted. Some day, perhaps, aided by electricity and newly-invented magnifying receivers, we might be able to hear and admire the symphonies and harmonics of the heavens. Space was all a-quiver with waves of radiant energy of various lengths which constituted the harp of life. We vibrated in sympathy with a few strings here and there: with the tiny X rays, actinic rays, light waves, heat waves, and the huge electro-magnetic waves of Hertz and Marconi; but there were spaces, numberless radiations, to which we were stone deaf. Some day, a thousand years hence it might be, we should know the full sweep of this magnificent harmony, and with it we should vibrate in accord with the Master Musician of it all.

Canadian Notes

THE annual report of the Marconi Wireless Telegraph Company of Canada, Ltd., opens with the announcement that the new contract with the Canadian Government was completed on April 5th, 1912. This contract places the company in a much more satisfactory position with regard to the stations owned by the Canadian Government in the Gulf of St. Lawrence and on the Atlantic Coast, securing to the company, as it does, the control, operation and proceeds of these stations for a period of twenty years, and, in addition, an increase in the total amount of subsidy paid by the Government for this service.

With regard to the stations owned by the Newfoundland Government, negotiations have been in progress during the entire year. In December, 1911, a representative of the company visited St. John's and obtained the assent of the Government to the Company's proposal. Further negotiations were necessary before a satisfactory form of agreement was obtained, but advice has recently been received that the Government has now accepted the agreement in its present form, which is entirely satisfactory to the company. The agreement mainly provides for the operation of several new stations for the Newfoundland Government on the Labrador coast, and for the extension during a further term of ten years of the existing agreement protecting the Marconi Company's exclusive rights in Newfoundland until the year 1926.

The shore stations now operated by the company on the East Coast of Canada under these two agreements are as follows :—

Labrador stations owned by the Newfoundland Government and operated by the company: Battle Harbour, Venison Island, American Tickle, Domino, Grady, Indian Harbour, Holton, Cape Harrison, and Mokkovik.

Newfoundland station owned and operated by the company under contract with the Newfoundland Government: Fogo.

Gulf of St. Lawrence stations owned by the Canadian Government and operated by the company: Belle Island, Point Amour, Point Rich, Harrington, Heath Point, Fame Point, Cape Ray, Magdalen Islands, Cape Bear, Clarke City, Father Point, Grosse Isle, Quebec, Three Rivers, Montreal.

Gulf of St. Lawrence stations owned by the company and operated by the company under contract with the Canadian Government: North Sydney, Pictou.

Atlantic Coast stations owned by the Canadian Government and operated by the company: Cape Race, Cape Sable, St. John, N.B.

Atlantic Coast stations owned and operated by the company: Halifax, N.S., Sable Island.

Transatlantic station owned and operated by the company: Glace Bay, N.S.

The traffic receipts for ship-to-shore business have continued to increase, as has also the inter-station traffic handled by the company. The total receipts for the portion of the company's business amounted during the year to $45,367.42, showing an increase of $2,677 over the previous year. Every endeavour is being made to extend this branch of the company's business, and the latest returns indicate that a much larger increase in receipts will be obtained from this source during the current year.

The number of vessels equipped with the Marconi system at the date of the last annual meeting was 536. While not in a position at the moment to give the exact number of vessels equipped at the present date, the directors feel that they are well within the mark in stating that the number has at least doubled during the interim.

During the present year the capacity of the Glace Bay station has been increased, and it is estimated that the traffic receipts will provide for current expenditure hereafter. It has been considered necessary to erect a duplex receiving station at Glace Bay. The initial cost of this duplex station will be about $75,000. The cost of operation of the combined station will be increased by about 20 per cent., but the capacity and the traffic receipts will be at least doubled.

Another agreement of almost equal importance is one between the British Marconi's Wireless Telegraph Co., Ltd., and the Marconi Wireless Telegraph Company of America, and the Western Union and Great North-Western Telegraph Companies. This agreement particularly bears on this company's Transatlantic business. The Transatlantic business of the company has in the past year been subjected to very close competition by the Land Telegraph Companies of Canada and the United States, which are all affiliated with various cable companies. The agreement with the Western Union and Great North-Western Telegraph Companies now provides for their handling Transatlantic Marconigrams, and for the acceptance and delivery by the telegraph companies' lines, offices and messengers on the same terms as those enjoyed by the cable companies. It is evident that as soon as the

capacity of the system has increased it will be possible to obtain sufficient traffic to greatly augment the revenue from Transatlantic business.

The company's system of stations is now being rapidly extended to the Great Lakes. The necessity for stations on the Great Lakes for ship-communication purposes has been urged on the Canadian Government by the company's officials for several years, and early this year the Government declared its intention of erecting a chain of stations to connect from Montreal to Port Arthur. The requirements of the Government were carefully considered by the company's engineers, and all the most modern features in wireless telegraphy are being embodied in these stations. The Government considered it advisable to have these stations operated under an extension to the contract of April 5th, 1911. A draft agreement has been prepared, satisfactory to both parties, and the Government has signified its intention of completing this agreement on the return of the Canadian Ministers from England. It provides at present for the operation of four stations, the payment of $3,500 per annum per station to the company, and for the company to retain for its own use a proportion averaging 85 per cent. of the traffic receipts. Five further stations required to complete the chain will be operated under the same terms as they are completed. The apparatus for all these stations is being supplied and installed by the company.

Mr. J. H. Lauer has been appointed manager and secretary of the Marconi Wireless Telegraph Co. of Canada. He was seven years secretary-treasurer and manager of the Builders' Exchange, Montreal, prior to taking up his present appointment. The wide experience gained by Mr. Lauer in labour conditions has been recognised both by the Provincial and Federal Governments on several occasions. In 1907 he was appointed by the Hon. Sir L. A. Jette, former Lieutenant-Governor of Quebec, member of the provincial board of conciliation to represent the employees of this province in labour disputes. In August, 1910, Mr. Lauer was appointed by the Hon. W. L. M. King a member of the board of conciliation to represent the Shipping Federation under the Lemieux Act in a dispute with ship owners and carpenters, and although his decision was contained in the minority report, it was accepted and acted upon both by workmen and employers. In 1910 Mr. Lauer was also appointed representative of the Shipping Federation for the city of Montreal for the term of five years on the permanent board of arbitration to consider all grievances which might arise between the 'longshoremen and the shipping companies. In addition to all these various duties he also organised the National Association of Builders' Exchanges in 1907.

Excellent progress is being made with the erection of the new Marconi sending and receiving station at Louisburg, Canada, and it is expected that it will be ready by the beginning of December. The work of taking down the high towers at the Glace Bay station is going on, and these will be replaced with smaller steel masts about twenty in number. Extensions to the power plant are being made at Glace Bay to supply the station at Louisburg. At the new station there will be from twenty-five to forty operators employed. The Louisburg station will, when completed, work direct with Poldhu, Cornwall, and all ocean-going steamers equipped with the system.

According to advices from Toronto, the various inland lake steamship companies would welcome the establishment by the Canadian Government of powerful shore stations to operate in connection with wireless telegraph apparatus on the lake steamers. Mr. B. W. Folger, of the Niagara Navigation Co., has informed a newspaper representative that his company would be willing to equip its boats with wireless apparatus if shore stations were established. They would not undertake, though, to build the shore stations themselves.

The Argentine Marconi Co.

The report of the Compania Marconi de Telegrafia sin Hilos del Rio Plata for the financial year ended May 31st last points out that within a short time the high-power station which the company are erecting will be completed. This station is destined to communicate direct with Coltano and other high-power stations in Europe, the United States, and elsewhere. Plans have already been prepared, and the land for the erection of the station has been acquired. It is also intended to instal a station at Punta Piedras, and another at Bernal, for ship and shore communication. These developments will ensure a direct and practical communication across the long distance between the Rio de la Plata and Europe. Mr. St. J. Steadman, who visited the country on behalf of the parent company, has assisted the company in overcoming difficulties, and there is in the report the expression of high esteem and gratitude for his services. The report continues that the important scientific experiments recently carried out by Dr. Marconi have placed wireless telegraphy on a high practical footing.

High-power Station at Buenos Aires

MR. SIDNEY ST. J. STEADMAN, who was sent by Marconi's Wireless Telegraph Co., Ltd., as their special representative to Buenos Aires, with the object of assisting the Argentine Marconi Company in its negotiations and arrangements with the Argentine Government for the erection of a high-power station to communicate with Europe, North America, China, Japan, and the Australasian Archipelago, gave a dinner to the directors of the Argentine Marconi Company and others on September 25th in celebration of the success of his mission. Among the guests were General Gregorio Velez, Minister of War, and Rear-Admiral Saenz Valiente.

In proposing the toast of the evening, Mr. Steadman alluded to the increasing population of Buenos Aires, now nearly 1,500,000, and to the extreme importance of its commercial as well as geographical position, and to the great volume of its agriculture, trade and shipping, and he acknowledged the cordial response which he had met with from the Ministers and principal officials of the Argentine Government, and particularly from the experts in radio-telegraphy employed by the Government.

Sir Reginald Tower, British Minister to Argentina, congratulated the directors of the Argentine Marconi Company upon the authority which they had obtained to erect the high-power station, as the result of which he anticipated that great benefits would be bestowed upon Buenos Aires and the republic.

The chairman of the Board of Directors of the Argentine Marconi Company, in responding to the toast of the evening, gave it as his opinion that the high-power station would be open to public service in less than twelve months from the present time.

Mr. Steadman mentioned that he had specially arranged, at the request of the Minister of Marine, that the high-power station should give every day the exact chronometrical time to ships at sea 1,000 miles south of Buenos Aires, and including Cape Horn, thus reducing shipwreck and loss of life.

A Pacific Coast Station

THE 25-kw. Marconi station being equipped near Fauntleroy Park, Seattle, will be ready for operation shortly. The station has a 320-foot tower and will be the most powerful on the North Pacific. The aerials consist of eight sections of eight wires, requiring nearly nine miles of wire. During the tests of the station, messages being sent by the Pacific Mail steamer "Mongolia," 320 miles west of Honolulu (a total distance of 2,700 miles) were easily picked up, and the wireless station at Olongapa, in the Philippine Islands, was heard working with vessels plying out of ports in the Orient. The equipment is so arranged that any part or all of the aerials may be used in transmitting or receiving messages. They may be tuned down to work with the steamers plying on Puget Sound or given power to get into communication with vessels plying the Pacific or with stations in Alaska, the Orient, or along the California coast.

Machine Tools for Experimenters

THE Engineering and Machinery Exhibition, which was open from the 4th to the 26th October, was remarkable for the collection of various machine tools brought together. The chief interest centred in the various working exhibits in the main area, where nearly every prominent firm of tool makers in this country showed lathes, shapers, wood-working machinery, boring mills and automatic machines operated as nearly as possible under their ordinary working conditions, many being engaged on the execution of actual orders or on the manufacture of stock parts for their own works.

Messrs. Drummond Bros. exhibited some dozen small lathes and other machines adapted equally for factory or experimental use, and the impression gathered from a visit to this attractive stand was that Messrs. Drummond have realised that the average experimenter requires machine tools of a very accurate design. That is one of the features which distinguished the tools inspected.

The Cambridge Scientific Instrument Company put forward many interesting examples of pyrometric apparatus, some in actual use recording the temperature of furnaces at work in the building. Another item on their stand was their latest type of oscillograph with permanent magnet, which can be used on 50,000-volt circuits; the ordinary sensitive vibrators can be used in this instrument or a heavier pattern which has been specially brought out for it, giving greater ease of repair.

To return to machine tools, the most marked development has taken place in the lathe, chiefly due to the use of high-speed steel-cutting tools, and to the abandonment of the cone-pulley and belt-shifting in favour of the all-gear head, so that full belt-speed can be employed for all diameters of work. The extended use of the turret head, combined with improved labour-saving devices, is another factor that makes for progress.

In the Arctic Circle

A MILD stir has been caused by the announcement, on October 1st, that the first wireless telegram from Dr. Mawson's Antarctic expedition in Adelie Land has reached Hobart, *via* Macquarie Island. Captain J. K. Davis, the commander of the expedition ship *Aurora*, stated in a letter to Sir E. Shackleton that, after refitting, the vessel was proceeding on a further scientific cruise, and would finally leave Hobart on December 26th to pick up Dr. Mawson and his companions. They should be due back from the Antarctic in March.

On the way out the *Aurora* will again visit the wireless station at Macquarie Island. Until the receipt of the recent telegram there had been no wireless communication between the members of the Mawson party and the Macquarie Island station.

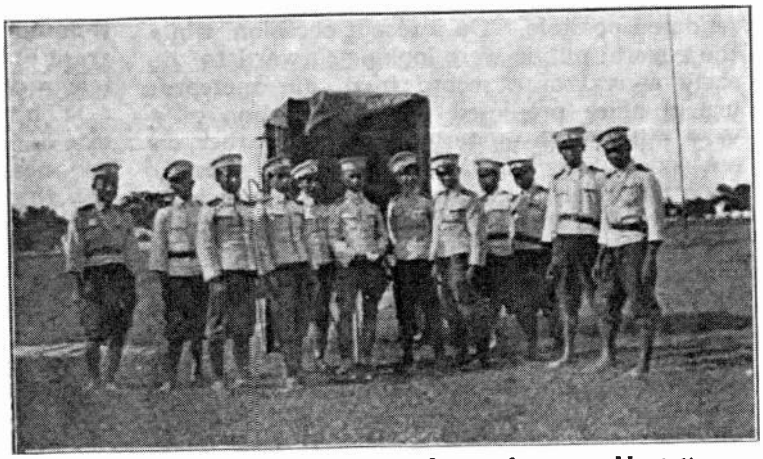
Captain Davis reports that he spent fourteen days at Macquarie Island, and that during the whole of this period only two hours' sunshine was recorded. The little party of five men left by Dr. Mawson in charge of the station were all well, and had been in daily wireless touch with Sydney.

This is by no means the only or the first occasion on which wireless telegraphy has penetrated the Arctic circle. Reference was made in a recent number of this magazine to the voyage of a United States revenue cutter, fitted with Marconi apparatus, to the Antarctic circle, from whose frontier communication was maintained with the mainland without any difficulty. In 1909 one of the vessels engaged in a seal-hunting expedition in the Arctic icefields—the s.s. *Florizel*—was fitted with wireless apparatus. In the following year, the s.s. *Eagle* was also fitted. Wireless signalling proved to be of such valuable service during the 1910 expedition of the Newfoundland sealing fleet that, previous to setting out on last year's expedition, several more vessels were equipped with Marconi apparatus.

H.S.H. Prince Alexander of Teck presided at the ceremony of distribution of awards to the foreign and British exhibitors at the Great White City, on Thursday, September 26th. The International Jury placed the Marconi Company in the list of principal exhibitors to receive diplomas.

Field Stations for Siam

THE Siamese Government have placed an order with Marconi's Wireless Telegraph Co., Ltd., for the supply of two knapsack stations. This type of station is intended to replace to a large extent visual signalling, and is suitable for many purposes, including the directing of gun fire. It has a range of about ten miles, and is carried in knapsacks strapped to the backs of soldiers. Four men, each carrying a load of between 20 and 30 lbs., are necessary to carry a complete station. A single mast, of extremely light though rigid construction, made chiefly of aluminium tube, is used to support an umbrella form of antenna, the antenna acting also as stays to the mast. The source of energy for a knapsack station may be either a primary or secondary battery, according to choice. If the latter be employed it is necessary that the accumulators should be systematically charged as required, and for this purpose a special field charging set which has a sufficient output to serve ten or twenty such stations, is made. These two stations are not the first portable stations which have been supplied to the Siamese Government, for in November of last year we described a series of demonstrations with portable stations which had been carried out in Siam. The accompanying illustration shows a group of Siamese officers and soldiers who are engaged in carrying out the demonstrations referred to.



Siamese Officers and Soldiers engaged in working portable stations.

A musical authority suggests that wireless installations may bring new music to this planet If it could be managed before the pantomime season we might yet escape the threatened deluge of ragtime.—*London Opinion.*

Meteorological Notes

So much progress has been made in getting Atlantic meteorological observations by wireless telegraphy that it has now become possible to add enormously to the area of the maps published in the weekly weather report. Until the close of last year the illustrations were limited to Europe and Algeria, but with 1912 the area has been extended westward so as to include the greater part of the Atlantic, from Iceland down to the Canary Islands, nearly the whole of Canada, and a large slice of the United States.

Over this vast region we can, with comparative ease, follow day by day the march of areas of cyclones and anticyclones.

As a general rule the systems move from America towards the south-east, east, or north-east, but there are many exceptions, not a few of the changes we experience in this country coming from the eastward instead of from the Atlantic. It is on the correct anticipation of the movements of these systems that the successful prediction of coming weather is rendered possible. On a recent occasion, while the general public were looking forward to the early arrival of a record frost, our meteorological office predicted the continuation of a very mild south-westerly type of weather on our side. This official confidence was based upon the wireless observations, which indicated pretty clearly that the situation on the Atlantic rendered it necessary for all weather systems coming from Canada to sheer off north-eastward from Newfoundland towards Greenland and Iceland, giving us their soft equatorial wind instead of their cold Polar current.

* * *

In his report on observations made during an official visit to Europe, Asia, and America, the Australian Commonwealth Meteorologist (Mr. H. A. Hunt) makes the following remarks on the employment of wireless telegraphy in meteorological work :

" Although the question of enlisting wireless telegraphy from ocean-going steamers and other stations as an adjunct for obtaining meteorological information was persistently inquired into in all the countries visited, yet the only service that apparently has made any use of these means of communication for weather purposes is the Indian Service ; but these messages are from fixed stations, viz., at Diamond Island, Port Blair, and from a pilot boat, and, moreover, the heights and instrumental errors are definitely known. Wireless messages are also shortly expected from Slipper and Ginger Island.

" An attempt was made by Dr. Polis, director of the meteorological observatory at Aachen, while crossing the Atlantic, to make inquiries into the American service to construct daily isobaric charts on board the ' Kaiserin Augusta Victoria ' from wireless messages received both from land and sea, and some difficulties were encountered.

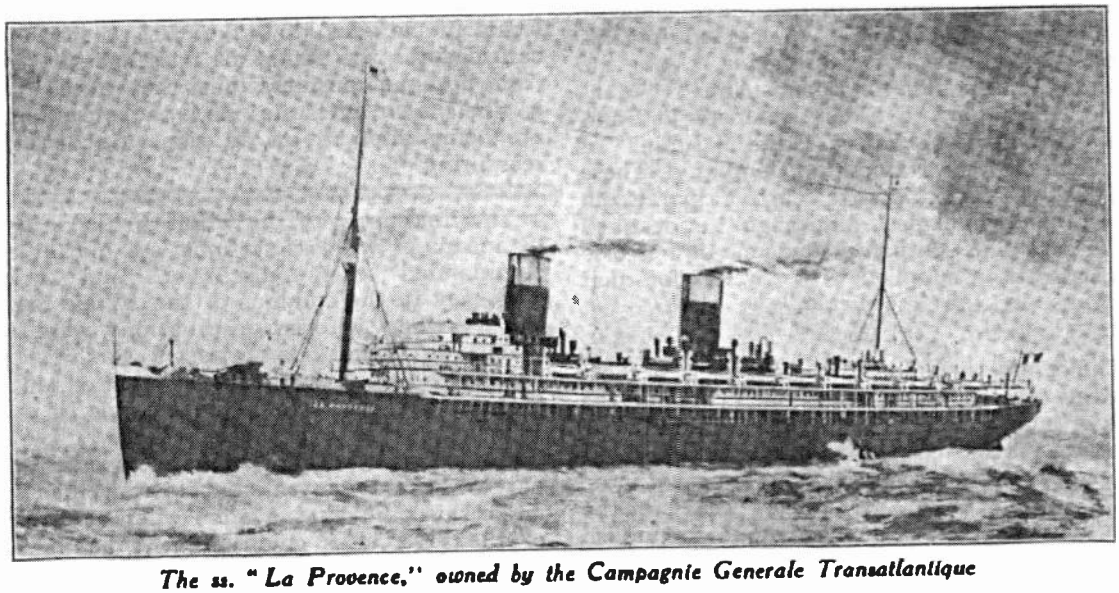
" However, at the International Conference held at Innsbruck in September, 1905, Dr. Shaw promised to make inquiries into the whole question, and he presented a report to the meeting of the science committee at Paris two years later, which generally voices the opinion and position of the subject in Europe. The inquiry resolved itself into two distinct parts :— (1) The administrative part.—The number of ships equipped with wireless telegraphic apparatus, and the terms upon which messages can be procured. (2) The meteorological part.—The arrangement of the meteorological message and the means of avoiding or detecting errors in observations or transmission. As regards (1) Marconi's Wireless Telegraph Co. publish regularly a list of ships with which communication can be made by wireless telegraphy through the agency of the ordinary telegraphic service of the post-office.

" The ordinary cost of messages is at the rate of 6d. per word, with a minimum of 6s. 6d. per message. At the rate of one message per day this works out at about £120 a year. We ought to aim at four or five messages per day at least, which would cost, say, £600. Probably we ought to expect to pay a sum approaching £1,000 for a service that would extend the effective area of our daily charts to the meridian of 15 degrees or 20 degrees W. of Greenwich, which is perhaps the range that we might expect to cover without retransmission of the messages."

We recently witnessed a remarkable series of fire extinguishing demonstrations with the well-known Kyl-Fyre Extinguisher. Petrol burning in a pail, on the ground, and in a pit of tar was extinguished instantly, whilst the manner in which the conflagration of a large wooden structure containing about 1,000 ft. of battens was extinguished after it had been allowed to get well alight supported the claims of the makers that the Kyl-Fyre extinguisher affords permanent protection from fire. The extinguisher should be of inestimable value where petrol engines and electrical machinery are used, as the powder which forms the extinguisher cannot harm the most delicate machinery, and, in addition, is a non-conductor of electricity.

Maritime Wireless Telegraphy

ONCE again wireless telegraphy has proved the means of saving life. Again it was a ship that was in danger of destruction, but this time it was not the winds or waves or floating berg that menaced the vessel; it was, perhaps, a greater peril than them all—it was fire—for when the flames break out little can be done to stop their ravages, and choice has to be made whether it shall be the cruel death by fire or the lingering death of exposure in an open boat with only a feeble hope of rescue. The steamship "Berkshire," belonging to the Merchants' and Miners' Transport Company, was voyaging from Savannah to Philadelphia with a large cargo of cotton and more than a hundred passengers on board. When she was a little north of Cape Hatteras fire broke out in the hold, and, owing to the inflammable nature of the cargo, it had assumed serious proportions before any attempt could be made to put it out, and when at last fire extinguishing apparatus was in working order the flames had taken such a hold on the vessel that the efforts of the crew were unavailing. All Friday night was spent in vain endeavour to save the ship. Holes were cut in the hatches and steam forced into the holds at high pressure. Meanwhile, the captain, seeing that fight was hopeless, gave the order to steam full speed ahead and make for Norfolk, Virginia, the nearest port, as it was impossible to beach the vessel anywhere in the neighbourhood of Cape Hatteras owing to the wild and rocky nature of the coast. Meanwhile repeated calls for aid were sent out by wireless, and these attracted the attention of the "Apache," of the Clyde Line, and other steamships, who were sent hurrying to the rescue. The "Apache" was the first to arrive, just as the captain of the "Berkshire," in order to avoid a panic, had ordered the passengers to take to the boats. It was not a moment too soon, for the flames were rapidly destroying the vessel. Later, the "Berkshire" was steered to a small cove and flooded with water, but only the hulk remains, as the body of the ship had been practically burnt out.



The ss. "La Provence," owned by the Campagnie Generale Transatlantique

The following vessels have this month been equipped with Marconi wireless apparatus. The India Office has two troopships, the "Dufferin" and the "Hardinge"; the one left Southampton this month for Bombay and the other for Karachi. Five boats of the P. & O. Steam Navigation Company have been fitted: the "Sumatra," "Simla," "Novara," "Plassy," and "Malta." All except the "Plassy" are passenger steamers, the "Simla" and "Malta" destined for Calcutta, and the "Novara" and "Sumatra" for Japan. The "Plassy" is at present being used as a troop-

ship, and was due to arrive at Bombay on October 31st.

The Royal Mail Steam Packet Company have one vessel, the "Darro," leaving Liverpool for Buenos Aires on November 8th, which has been fitted with the 1½-kw. emergency apparatus. Emergency apparatus has, however, been installed on two more of their ships, the "Thames" and the "Trent" (both of these vessels left Southampton in October and are bound for the West Indies); while another, the "Arzilla," has been fitted with ½-kw. and emergency apparatus, a plant especially adapted for use on cargo vessels, to which class she belongs. Her destination is Morocco. By order of the Adelaide Steamship Company, wireless has also been installed on the "Wandilla," engaged in trade around the Australian coast.

Several vessels plying between the United Kingdom and South America have likewise been fitted with complete wireless equipment. These include "La Correntina," of the Houlder Line, sailing for Buenos Aires; "Mandingo," belonging to Elder, Dempster & Company; and the "Kenuta" and "Junin" of the Pacific Steam Navigation Company. These two last vessels are due to reach Valparaiso in November, while the "Mandingo" is destined for Lagos. The Compania Mexicana de Petroleo have also been supplied with wireless for their oil transport, the "Cernicalo."

The commissions for all these vessels, excepting the cases specially mentioned, are for the 1½-kw. and emergency plants. Orders have also lately been received by the company to fit two cargo ships in course of building with the ½-kw. and emergency set, and 50 vessels of the Ellerman lines. Of these we hope to publish further particulars in December.

The committee of "Lloyd's Register" have just issued their annual shipping report. As usual, the information in this volume is very complete, and a careful study of the statistics contained therein is by no means a profitless labour. It is particularly interesting to note that the number of vessels fitted with wireless apparatus continues to increase, for the entries in the society's register up to June 30th of this year reach a total of thirteen hundred and ninety-two.

We referred in our September issue to the order received for equipping the s.s. "Mongolia" with wireless apparatus. The vessel has now been purchased by the Australian Government for their coast trade, and the name has been altered to "Western Australia."

There is a reminder of the progressive spirit which characterises the younger members of the Empire in the Australian Navigation Bill, of which the second reading was adopted at Melbourne on September 12th without a division. The provisions of this measure, dealing with compulsory boat drill, the equipment of wireless installations, and the like, were drafted before the "Titanic" disaster brought its rude awakening. It was passed by the Senate last year, but no one at that time dreamt that there would be such sad demonstration of the need of fresh regulations. In the case of many calamities the only consolation is that they provide lessons for the future. A long period of immunity from accident always encourages the hope that this will continue. When the disillusionment comes it is a great shock, and acts as a stimulus to speedy improvements. The steamship companies themselves are particularly anxious to take all possible precautions for the safety of passengers. Apart from humane considerations, they would do so in their own interests, and the steps which are being adopted on all sides are distinctly reassuring.

The linking up of the whole British Empire by means of wireless stations is a matter that commanded early discussion and urgent advocacy in the columns of the *United Service Gazette* when wireless installations were first placed on board His Majesty's warships, but the *Gazette* went further, and pointed out at that time that it would be possible, if every British merchant vessel classed A1 at Lloyd's was compelled to carry a wireless outfit as a part of her navigation safety arrangements, to make this a link in a system whereby all parts of the seven seas could at all times be kept in close contact with all five continents inhabited with civilised human beings. To-day we are getting very close to that ideal, when all our warships are being fitted with wireless apparatus, and we are within sight of the period when all ships of importance in our mercantile marine will be in a position to take in and send out or repeat wireless messages. When this is accomplished deep will call to deep in a way never before anticipated, and by direct and repeated messages the Admiralty or the owners of merchant vessels should be able at any time to "speak" one of their ships on any part of the high seas. With eyes and ears of this kind operating in time of war there would be no more wild chases after an enemy, such as Nelson experienced when he was pursuing his opponents in the Mediterranean and the West Indies.

The Telegraph in Fancy and Fact

ALL scientific discovery has had its origin in fancy. Long before investigation had proved the existence of the forces which were to work the magic, some great mind, projecting itself into futurity, would leap to a conclusion, and the dream would be conceived.

Such visionary science brings with it little comfort to the dreamer, for the workaday world occupies itself only with definite results, and troubles little about what may be. So truths, yet to be proved, are thrown back to the dreamer by the incredulous crowd which good-naturedly, but recklessly, dubs him another Don Quixote, tilting at scientific windmills. But in time the perspicuity of the dreamer is vindicated. Other men, perhaps not such original thinkers, but men with keen intellects and tireless energy, appreciate the theory and set themselves to prove its correctness, with the result that, after laborious research, the theme which was once the airy nothing of its pioneer takes up a local habitation and a name, and becomes an important factor in the work of the world which scorned it.

* * *

The progress of telegraphic discovery followed much upon the lines indicated above. The idea of setting up communication between man and man over vast distances is one that reaches far back into the ages: how far it is hazardous to guess; but that it was present in the mind of primitive man may be gathered from the fact that some of the cannibal tribes of interior Africa are known to have constructed with rubber and bamboo twigs an instrument which, when struck, gave out a musical note of great sweetness. Various tones could be produced on the instrument, and in the silence of the African forest a note would carry for a distance of from five to seven miles.

* * *

Certainly a distinct means of communication must have been established early in the world's history, for records are extant which tend to show that Menes the First, who reigned over Egypt about B.C. 5865, established in his Government a Department of Intelligence. It would be interesting to know how intercommunication between the parts of the Empire was effected. Possibly by a system of fire or heliography, but if any other means were used they were lost in the confusion which followed the dismemberment of the great empire, and more than forty centuries passed away before any other means than that of signal fire was adopted.

The discovery of electricity first suggested the idea of finding a means of using this power for the purposes of communication, and as early as 1729 Gray was experimenting with conductors, and not long after Lollett succeeded in sending a shock along a line of men and wires about 900 ft. long. Then in 1745 Bishop Watson, of Llandarf, proved, by sending a shock through 1,200 ft. of wire, that transmission was practically instantaneous. This was the first intimation of the speed at which electricity travelled.

The first idea to apply practically the intelligence thus gained appears in a letter written in 1753 to the *Scott's Magazine*. The writer suggested a series of insulated wires equally numbered to the letters of the alphabet with marked balls, or alternatively light bells of different tones, suspended from the ends of the wires. The vibration caused by the electric current would indicate the message. But it was not until 24 years later that the hint was acted upon.

* * *

Let us turn, however, from the electric telegraph to a system of telegraphing which arose in the latter part of the eighteenth century, and bid fair to eclipse that of electric transmission. This was the semaphore, invented by Claud Chappe. The plan consisted of mounting on a high tower an upright post, to which pivot horizontal bars or arms capable of being placed at various angles were pivoted. The movements of the arms would indicate different letters, numbers, words, or sentences, and there could be 98 such movements. The towers were to be placed short distances apart, and so an effective method of semaphore transmission arranged. The French Assembly of 1794 was the first to adopt this system for Government use, and their example was followed by all the important Governments of Europe. The most important line was constructed from the Austrian frontier through Warsaw to St. Petersburg by order of Nicholas I. It covered 1,000 miles, and cost several millions of pounds.

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This expedient acted rather as a set-back to electric enterprise, for although Reusser in 1794 suggested a method by which a current would illuminate the letters of the alphabet, etc., and Cavallo in 1795 went a step farther by suggesting a combination of sparks and pauses, little interest was taken in the matter. Bentancourt, however, should not be forgotten. In 1796 he constructed a single wire from Madrid to Aranjuez, a distance of 20 miles. The current was generated by Leyden jars, and the reading was effected by the diversion of pith balls. A little later only one wire was used in operating the apparatus. Here, again,

affairs were brought to a standstill by the lack of interest. For instance, the British Post Office, when approached on the idea of substituting the one-wire pith-ball system for the semaphore, issued the reply that "Telegraphs of any kind are now wholly unnecessary, and no other than the one now in use could be adopted."

* * *

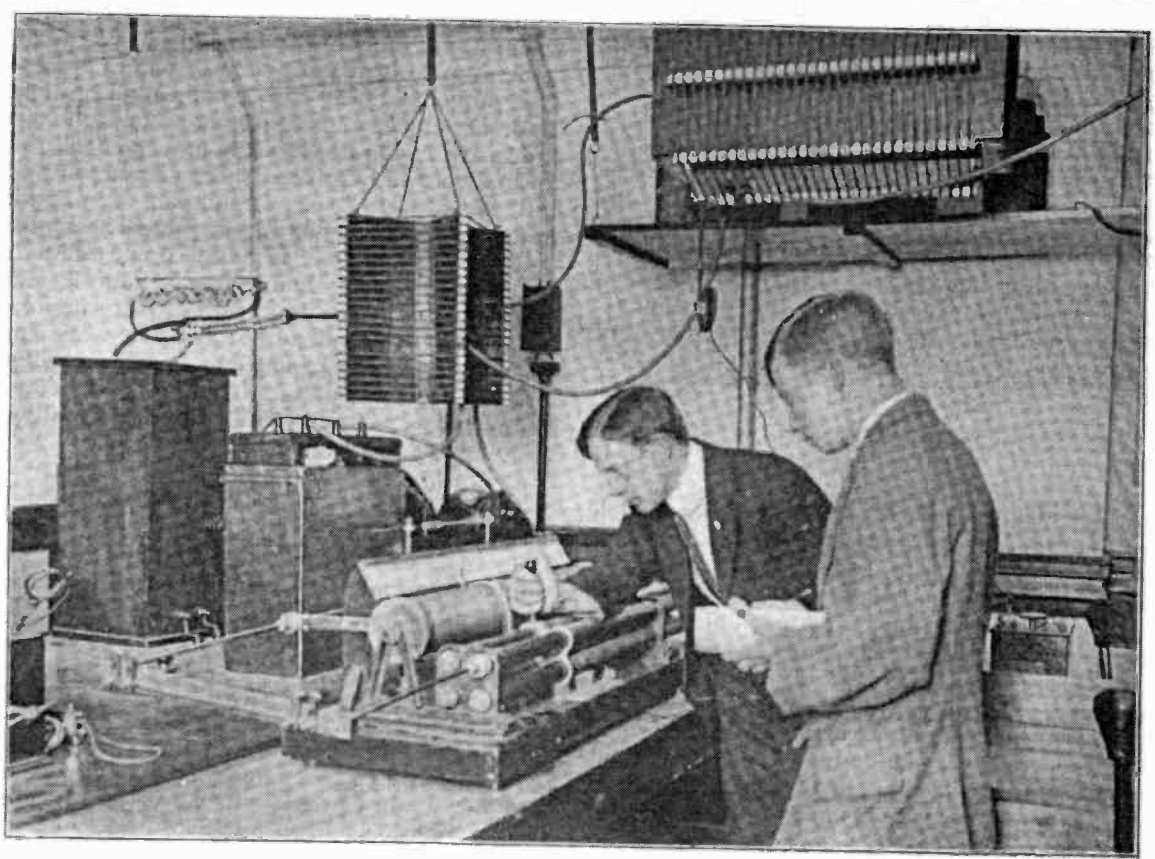
Telegraphy, however, was soon to receive its greatest impetus. On April 27th, 1791, was born Samuel Morse. In 1832 this clever man, who was by vocation an artist, became interested in telegraphy through a Dr. Jackson, who described to him some experiments in electricity which he had witnessed in Paris.

Morse was fired with enthusiasm for the possibilities of electricity, and before many days had passed had devised a full set of instruments to carry messages, and had formulated a code; but it was not until 1837 that the patent papers for the invention were filed. Interest was created on his behalf in the Washington Congress, and money voted for building an experimental line of telegraph. After several failures the line was, with the help of Ezra Cornell, completed, and with Morse at one end, and his friend and helper, Vail, at the other, the famous message, "What hath God wrought," was successfully transmitted and received.

The first commercial use, however, of the electrical telegraph was the announcement sent from Baltimore to the Congress at Washington, that James K. Polk had been elected to the Presidency.

* * *

But Morse did not stop at perfecting the telegraphic code. He was convinced of the possibility of establishing a means of telegraphic communication without wires, for, writing on December 23rd, 1844, to the Secretary of the United States Treasury on the subject of his experiments, he remarked: "The simple fact was then ascertained that electricity could be made to cross a river without other conductors than the water itself." Many years were to pass, however, before such an idea, despite various efforts made in this direction, could be realised. Professor Hertz's discovery of electro-magnetic waves in 1887 was the prime mover in bringing about the final achievement of wireless communication established by the inventive genius of Marconi.



Pupils studying the Fleming Cymometer at the Marconi School in New York.

Monthly Miscellany

In the course of the debate in the House of Commons upon the report of the court of inquiry into the loss of the "Titanic," Mr. Buxton, the President of the Board of Trade, said he thought the time had come when wireless should be compulsory on passenger ships, and, perhaps, on a certain class of cargo ship. He had had a Bill prepared dealing with the subject, and had only postponed its introduction because of international negotiations which were taking place, but he would not postpone it further if those negotiations were unduly delayed. Mr. Buxton suggested that compulsion would be accompanied by some assistance in the way of getting installations at lower cost, and he hoped, when he introduced the Bill, to be in a position to make an announcement upon that subject which would be calculated to reassure the ship-owning interests.

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It has been announced that the most important resolution passed by the German Seamen's Conference, which recently concluded, is that wireless telegraphy shall be installed upon all passenger steamers carrying at least 75 persons, including the crew, as well as upon all trading vessels carrying at least 60 persons. The telegraphic installation is to reach at least 100 sea miles. As this decision involves an alteration for the current regulations regarding the prevention of accidents at sea, it requires the assent of the Imperial Insurance Office, which will doubtless be given. The present step does not anticipate the measures that may be proposed at the International Conference for the discussion of safety at sea which is to be held, and which is expected to adopt further provisions relating to the installation of the wireless system. The decision passed by the Seamen's Conference does not apply to German steamers cruising in home waters or in the Mediterranean, but only to those sailing across the Atlantic and farther afield.

* * * *

Others besides military and naval authorities are finding a use for wireless. Mr. Max Allen has put "a real Marconi installation" to effective purpose in a drama entitled "For Love and the Navy," which has been successfully produced at the New Middlesex Theatre, London. There are sufficient thrills to satisfy the most *blasé* sensation taster, and the pulse is quickened to fever pitch by the tap, tap, tap of the key sending off its message of love and hate and all the other ingredients of melodrama.

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Since the United States Government appointment of Miss Mabel Kelso to the position of wireless operator on the liner "Mariposa," at San Francisco, and also the opening up unofficially of wireless telegraphy to women operators both in Canada and the United States, the question has been raised at Congress as to whether a woman should be entrusted with the protection of lives in this responsible position. The Department of Commerce and Labour, at the time of Miss Kelso's appointment, held that there was nothing in the present law to prevent women from assuming charge of a wireless apparatus. Miss Edith Coombs has been appointed wireless operator on the steamer "Roanoke" which sailed recently from San Francisco to Portland and Astoria. Miss Coombs is the second woman operator on the Pacific coast. It appears that there has been some opposition to Miss Coombs going to sea as a wireless operator on the ground that gallantry on the part of the men of the vessel would not allow her to remain at her post during an accident. But Miss Coombs insists that the travelling public need have no fear as to their safety on her account, as she has decided to remain at her post of duty until "the last flickering spark of electricity" can be sent from the vessel. If necessary, she declares her intention to remain on board with the captain until the last soul has been cared for and the signals of distress sent. "Ladies first" will not apply to Miss Coombs.

* * * *

It was an ill day for evildoers when wireless was invented. Many a criminal had been able to escape the punishment that was his due by a speedy voyage across the expanse of water. Had he stayed on land telegraphy and the whole machinery of the law would, in all probability, force him to disclose his secret, but in a Transatlantic voyage (and that was the usual route taken by malefactors) the only dangers to be guarded against were—one, recognition, and the other the report of the crime reaching the ship on which the criminal had chosen to escape. It was easy enough to evade the former possibility, and as for the latter, well, when once the boat had weighed anchor it was ten chances to one that nothing more would be heard of the criminal. But, as Monsieur le Medécin remarked in Molière's famous play, "Nous avons change tout cela."

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A passenger vessel is as much in communication with the affairs of man on the high seas as it is lying in the harbour, and the arm of the law can use this invisible power to bring the wrongdoer to justice. An instance of the potency of this detective weapon was supplied by a famous murder case, and not long ago an Italian captain used this means to secure some notable criminals whom he found were pas-

sengers on his boat, so that some gentlemen who for a long time had been wanted by the Italian police found that quite a little reception had been arranged to welcome their arrival at their journey's end.

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Now another case has just come to light, but this time the drama was enacted across the Herring Pond, and the *dramatis personæ* were the representative of an Italian house and a stylishly dressed young man of Toronto. The former, while at Toronto, had occasion to seek advice with regard to cashing a letter of credit. As a result his pocket was shortly afterwards deftly picked, and he found himself almost penniless. There was only one thing to be done—to return home and explain to his firm, and forthwith he booked steerage passage on the "Oceanic," and looked forward to a dull passage home. But the voyage was not to be so dull as he imagined, for shortly after he left New York he chanced to espy the man whom he had every reason to suspect of being the thief strolling the second-class section of the ship. It was not long before he told his tale to the captain, and, with the connivance of the ship's company, he that night resumed his acquaintance with his amiable friend. The circumstances were rather dramatic; in fact, only the intervention of onlookers prevented the battle becoming more than one of words. However, it was pretty evident that the victim knew his man, and in the end it was decided to send a Marconigram to Plymouth, with the result that when the "Oceanic" arrived there on October 19th there were detectives ready to receive them and to take them to a police station, where the accused man was detained.

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The up-to-date hostess has also discovered the advantages of wireless, for as she voyages over the high seas she invites her guests through the medium of the invisible ether, and makes all necessary arrangements for a little dinner party to take place as soon as she arrives at her destination; only, if the experience of Mrs. Frank Gould teaches anything, it is that the Customs authorities have to be reckoned with. Mrs. Gould, it will be remembered, had made arrangements by wireless for a dinner party, which was to take place on the evening of her arrival in New York. She was prepared for any social emergency, for had she not in many trunks thousands of pounds' worth of Parisian confections? The only trouble occurred on landing, when the New York Customs officials detained the whole of the baggage of Mr. and Mrs. Frank Gould and their party. Not even the smallest fraction of their contents could be landed, and the travellers were totally unprepared for such an emergency. The party had perforce to be abandoned, but wireless telegraphy was in no way to be blamed for this unfortunate *contre-temps*.

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How does the idea of engaging your servants by wireless strike you? That is the latest expedient of the ladies in New Zealand. It seems that this serious domestic problem is as little capable of solution in the Antipodes as it is in our own isle, but the brighter spirits among the mistresses of New Zealand have cut the Gordian knot of their own difficulties by a most ingenious *coup*, and as victors in the domestic fight are rewarded with the services of English maids. News reached Wellington that the "Turakina," which was due to arrive shortly from London, had on board between twenty and thirty girls willing to enter domestic service. That was satisfactory as far as it went, but the crowd of prospective employers was out of all proportion to the number anxious to be employed. When the vessel reached its destination a number of anxious matrons were waiting ready to offer employment to the new arrivals. They were doomed to disappointment. The majority of the girls had been booked long before the "Turakina" reached Wellington. The aggrieved ladies demanded how this might be, and learned to their immense chagrin that some of the more wideawake of their neighbours had sent Marconigrams to the ship, with the result that most of the girls were "placed" by this means. We are sorry that anyone should have been disappointed, but think the enterprise of the successful competitors was thoroughly deserving of reward.

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The council of the Organised Sailors' Associations in Germany have given much consideration to the question of the perfection of signals which might be used in the case of accidents at sea. News and warnings for sailors, they point out, only achieve their purpose if they reach the commander of the ships without any delay. This is especially necessary in case shore and sea signals suddenly disappear from their stations on account of storms; and reference is made to mishaps to the fireships "Sandettie" and "Haaks," the former of which was destroyed in a collision, and the latter having gone adrift. The council state that wireless telegraphy now enables them to meet all the requirements with regard to quick transmission, and they urge in the interests of navigation the desirability that news and warnings for sailors should be transmitted as soon as they are known to ships at sea by means of wireless telegraphy.

Personal

Mr. E. W. Salis, who has been appointed to represent Marconi's Wireless Telegraph Co., Ltd., in Brazil, was born in Ireland in 1874, and is the son of the late Major-General Salis-Schwabe, C.B. He was educated at Marlborough College, and from there proceeded to take up the engineering and chemistry courses at the City of London and Guilds Institute. He worked to such good purpose that he obtained a diploma in both these subjects. On the termination of his college career he spent a short time in the business of Messrs. Salis-Schwabe, Ltd., of Manchester, until he was appointed a member of a private commission which was sent by the Home Secretary to inquire into the prison system of Siberia. Mr.

Mr. E. W. Salis.

Salis eagerly availed himself of this opportunity of travel, for not content with traversing the whole of that difficult country by sledge—the Trans-Siberian Railway had not then been constructed—he travelled extensively in Japan, China, and Borneo. In 1893 he returned to Russia and settled in Vladivostock, where he carried on an important business for nine years in addition to his appointments as British Commercial Agent and Vice-Consul. On the outbreak of the Russo-Japanese War he once again visited China, and acted on behalf of the Transvaal Chamber of Mines in recruiting labour for South Africa. In 1906 he was appointed manager of the Manaos Harbour Company on the Amazon, and held the position for five years, and it was during his term of office that the erection of a Marconi station on the land of the company was planned and carried out. It is not surprising that Mr. Salis, who has had such advantages of travel, should be a good linguist; he is equally at home, whether he is speaking French, Russian, or Portuguese, but his pursuit of varied knowledge has in no way eclipsed his earlier love of science.

Mr. Joseph Lewis was married at St. Mary's Church, Ealing, recently, to Miss Katherine Lilian Jones, of Canterbury. Mr. Lewis was educated at Leicester House School, Carshalton, and at the London Polytechnic. He then joined the Indo-European Telegraph Company, and after undergoing a course of training at their school was appointed telegraphist at their London office. After two years' service he migrated to wireless telegraphy, and joined the Marconi Company on June 15th, 1902, when he was sent to Crookhaven wireless station. He remained at this station for about three years, being in charge for some time. He was then appointed to take charge of the installation on the s.s. "Minnetonka," of the Allan Transport Line, and after six months' service he was sent to Trieste to assist in the fitting and to take charge of the installation on board the s.s. "Ultonia." Twelve months later he was transferred to the "Kaiser Wilhelm der Grosse," being selected for duty on that vessel on account of the exceptionally heavy telegraphic work which it was expected would result from the presence on board of the Russian Peace Envoy and numerous special newspaper correspondents who were on their way to America in connection with the settlement of the Russo-Japanese war. The trip was

Mr. J. Lewis.

a most successful one in every respect, and thousands of words were transmitted in the course of the voyage to the various newspapers. Mr. Lewis then entered the employ of the Compagnie de Télégraphie sans Fil, of Brussels, and was in charge of the wireless apparatus on nearly all the vessels of the great German shipping lines. During the last six months of his service with the Belgian company he was engaged as travelling inspector and instructor, and was eventually retransferred to the parent company towards the end of 1910. After making one trip on the "Adriatic" as officer in charge he was appointed junior inspector, and three months later he was promoted to the post of inspector in the London office of the Marconi Company. On the completion of a voyage to South Africa in charge of the wireless station on the "Balmoral Castle" he was appointed to a position in the London office.

Mr. Ewart James Watts, the Marconi Company's engineer in the Far East, was married on Monday, September 13th, to Miss W. Wynne, at the British Consulate, Yokohama, Japan.

Mr. A. H. Morse, late of the United Wireless Telegraph Company, which has been absorbed by the Marconi Company, has now joined the staff of the latter company. Mr. Morse was engaged in the construction of wireless stations in Canada, Alaska, and the United States of America until February, 1910, when he was appointed Superintendent of the European division of the United Wireless Telegraph Company, with headquarters in London. Prior to 1906, he was for several years engaged in the construction of ordinary telegraphs in South and West Africa.

Movements of Engineers

S. R. Groser has relieved E. S. D. Marden at the Canary Islands, and is carrying out extensions to the Teneriffe and Las Palmas stations.

C. H. Hughes has been transferred from the Spanish Marconi Company to the English Company, and is engaged on the erection of the Cape Finisterre Station.

B. S. Benning, from Poldhu, has been attached to the constructional staff for erection of two 200-h.p. and three 10-h.p. Marconi stations for the Chilian Government, and sails for Chili on October 31st.

F. E. Burrowes has completed the Marconi station at Port Stanley, Falkland Islands, and is now on passage home.

H. M. Burrows, from sick leave, has returned to duty in the London office in connection with the Imperial high-power stations.

W. B. Cole has completed the erection of a Double-Coil Marconi station at Portheurnow for the Eastern Telegraph Company, and is returning to general duty in the London office.

C. E. Hughes has been relieved at the Marconi station at Vigo, and is now attached to the constructional staff on the erection of new Marconi stations in Spain.

C. James is progressing satisfactorily with the erection of the Marconi station at Accra, West Africa, to the order of the Crown Agents for the Colonies, and is expected to finish in November.

R. G. Kindersley, from Poldhu, is continuing special experimental work at Chelmsford.

J. J. Leary, superintending engineer in charge of the Chilian contract for two large and three small Marconi stations, sails for Chili, with the balance of the staff to be engaged on this work, on October 31st.

E. S. D. Marden, from the London office, has been temporarily attached to Poldhu Station.

H. Nicholls, from Poldhu, has been attached to the constructional staff on the Chilian contract as assistant engineer and operator, and sails for Chili on October 31st.

D. Paton, from Broomfield, sails for Chili on November 15th to take up an appointment in the Naval School under the Chilian Government.

R. F. Pitcairn, from Poldhu, transferred to Clifden for further experience of high-power stations.

C. G. Rattray, from sick leave, has returned to duty in the London office.

H. J. Round has returned from special duty at Coltano, Italy, and is now engaged on experimental work at Chelmsford.

H. Sauve is being relieved at Barcelona Marconi station, and will be attached to the constructional staff on the erection of new Marconi stations in Spain.

A. G. Savill has completed the testing of the Rome station, and inspection of "Averoff" and other ship stations in Greece, and has returned to general work in the London office.

C. H. Taylor, deputy chief engineer of Marconi's Wireless Telegraph Company, left for New York on October 5th to take charge of the erection of high-power transoceanic stations being erected by the Parent Company for the American Marconi Company.

Movements of Operators

S. K. Alston, from the "Asturias" to the "Itassuce."

A. C. Arnold, from the "Karina" to the "Aidan."

W. F. Atkinson, from the "Canadian" to the "Kenuta."

J. E. Auvache, from the "Inkosi" to the "Indrapura."

G. F. Angill, from the London School to the "Minnetonka."

F. Avery, from the London School to the "Plassy."

A. G. Angill, from the London School to the "Majestic."

F. M. Bailey, from the "Worcestershire" to the "Arabic."

J. Bamford, from the "Guarany" to the "Himalaya."

C. H. Banner, from the "Edinburgh Castle" to the "Kinfauns Castle."

R. J. Basson, from the "Minnetonka" to the "Gloucester Castle."

A. S. Beattie, from the "Araguaya" to the "Commonwealth."

A. Bolster, from the "Scandinavian" to the "Montrose."

S. V. Branton, from the "Ionian" to the "Alnwick Castle."

A. C. Brown, from the "Belgic" to the "Canadian"

W. J. Brown, from the "Viking" to the "Oxfordshire."

T. R. Burrows, from the "Carthaginian" to the "Tritonia."

R. W. Burton, from the "Minnewaska" to the "Sumatra."

W. H. Chick, from the "Letitia" to the "Garth Castle."

F. R. Collier, from the "Oronsa" to the "Hildebrand."

K. S. Cowhey, from the "Campania" to the "Empress of Britain."

W. G. Cox, from the "Italia" to the "Marathon."

J. A. Craigie, from the "Orita" to the "Cymric."

C. H. Crosman, from the "Asian" to the "Orita."

G. G. Chapman, from the "Sarnia" to the "Vauban."

J. W. Carleton, from the London School to the "Cameronia."

B. A. Carter, from the London School to the "Ionian."

D. R. Cormack, from the London School to the "Numidian."

D. Donnelly, from the Liverpool School to the "Victorian."

B. Dawson, from the London School to the "Zealandic."

R. O. Ellis, from the "Inkosi" to the "Sicilia."

T. Fagan, from the "Victorian" to the "Asian."

G. K. Fagg, from the "Corsican" to the "Norman."

W. Gale, from the "Saxon" to the "Plassy."

A. Gibson, from the "Nigeria" to the "Huanchaco."

A. D. Hathaway, from the "Pancras" to the "Asian."

W. J. Hicks, from the "Intaba" to the "Hantonia."

T. F. Hokden, from the "Empress of Ireland" to the "Carmania."

J. O. Howard, from the "Teutonic" to the "Akabo."

H. P. Hunt, from the "California" to the "Guelph."

H. J. Horwood, from the London School to the "Arcadian."

E. N. Hewitt, from the Liverpool School to the "Devonian."

W. C. Halliday, from the London School to the "Arzila."

Football

The Marconi Football Club (London) opened the season in good style on Saturday, October 19th, by defeating the Clement Talbot Club by one goal to nil in the first match of the Western Suburban League. The victors enjoyed the advantage of playing at home, and the only goal of the match was scored by Sharpley from a free kick taken by Smith ten minutes before the interval. The second half was very fast, and both goals had narrow escapes; but the defences held out until the final whistle was blown, leaving the Marconi club the winners of a keenly contested and enjoyable game.

Mr. Godfrey C. Isaacs presided at a smoking concert held during the evening to open the football season, and in response to a vote of thanks proposed by Mr. Andrew Gray, he told some amusing stories against himself as a golfer, for which pastime he confessed he had very little time. A splendid musical programme was contributed to by Messrs. H. W. Merriman, A. C. Truman, W. H. Smith, A. J. Clarke, Cecil Marsh, W. S. Purser (with his banjo), Jack Green, and Archie Harvey (with his Japanese fiddle). Mr. H. F. White was at the piano.