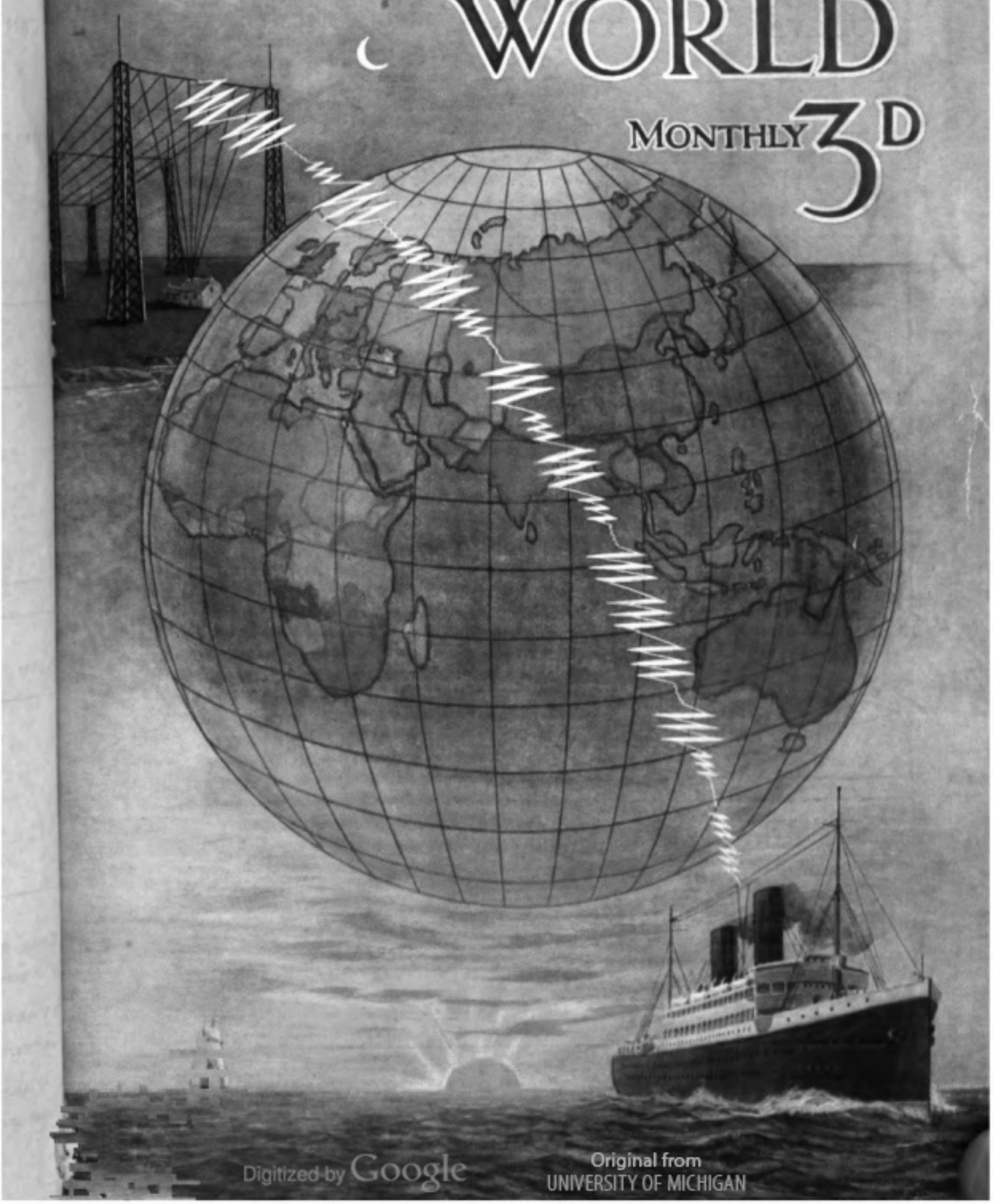
Vol. I. No. 7. (NEW SERIES). Registered at the G.P.O. for transmission to Canada by Canadian Magazine Post. OCTOBER, 1913

WIRELESS WORLD

MONTHLY 3D



The Wireless World.

With which is incorporated "The Marconigraph."

An Illustrated Magazine for all interested in WIRELESS TELEGRAPHY, published monthly by THE MARCONI PRESS AGENCY, LTD., Marconi House, Strand, London, W.C.

Registered for transmission by Magazine Post to Canada.

Telegraphic Address: "Expanse, London." Telephone No.: City 8710 (Ten Lines).
Codes used: Marconi, A.B.C. (4th edition), Western Union.

Subscription Rate... ... ... 5s. per annum, post free.
Single Copies ... ... 3d. each, by post 5d.
Subscription Rate in the United States ... ... $1.25 per annum, post free.
Do. in Canada and Newfoundland ... $1 per annum, post free.
Europe ... ... fr. 6 per annum, post free.

All communications relating to Subscriptions, Advertisements, and other business matters, to be addressed to "The Publisher, 'The Wireless World,' Marconi House, Strand, London, W.C."

All Editorial communications to be addressed to "The Editor, 'The Wireless World,' Marconi House, Strand, London, W.C."

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
WIRELESS WORLD
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Vol. 1.—No. 7. (New Series) October, 1913. Subscription 5/0 per annum post free. Price 3d. Post Free 5d.

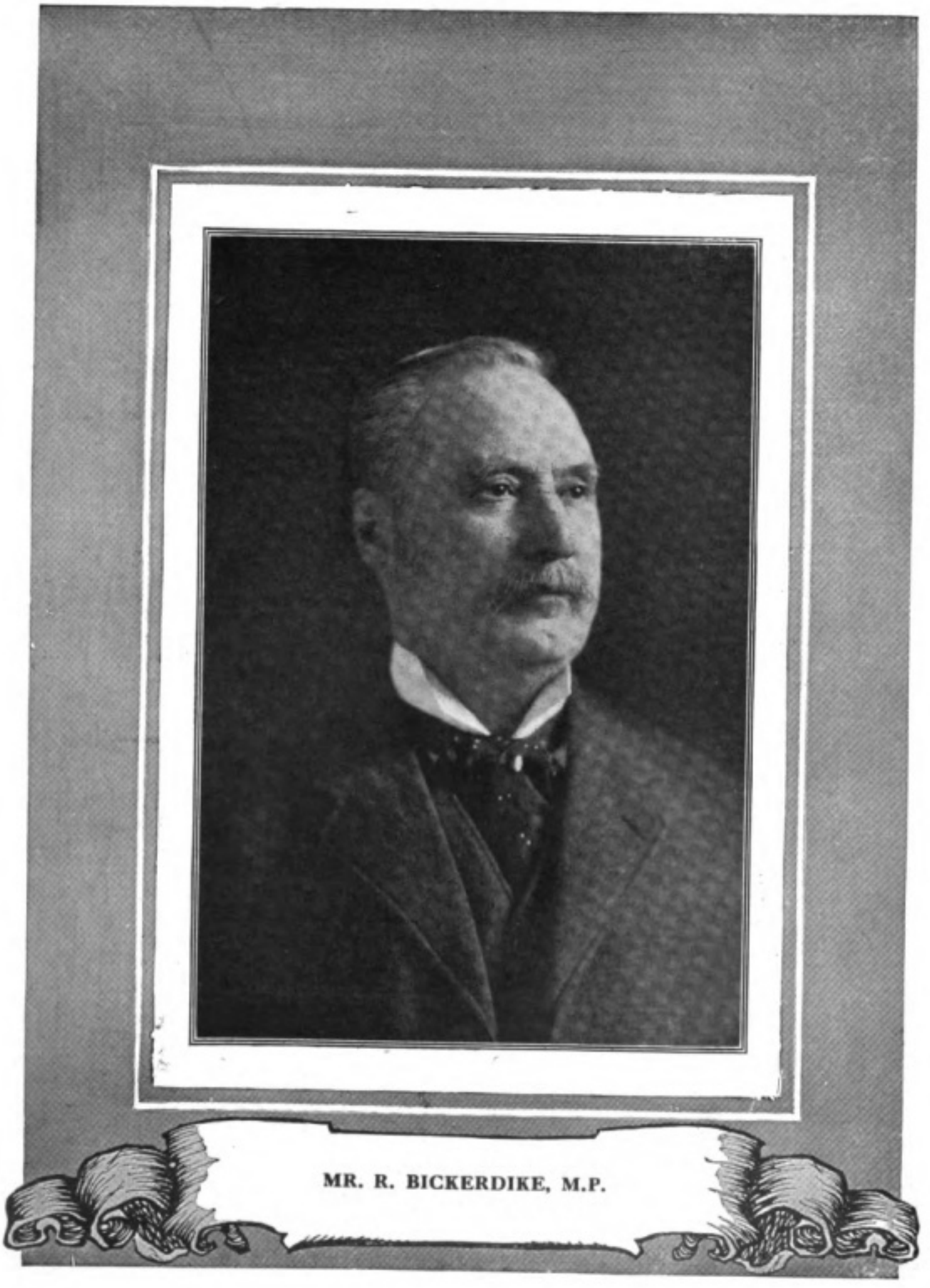
Safety on Railways

REMEMBERING what wireless telegraphy has already done in saving life and ships at sea, it is not unnaturally asked whether this remarkable invention cannot be employed in connection with our railways, and thus minimise the danger of accidents, of which the Aisgill disaster last month is a terrible example.

The advance which wireless telegraphy has made within a comparatively short period discourages any attempt to fix limits to its application. It has become a vital aid to the safety of shipping and an instrument of ever-increasing value to social and commercial life. Will equal success attend the efforts which are now being made to introduce it on railways? The matter is still in a more or less experimental stage, and it is impossible therefore to answer the question with absolute confidence.

Some guidance should be furnished by the trials which are now in progress on the Lackawanna Railroad, in America, and of which we give a few particulars on another page. The problem there is being approached in a scientific manner, and from the advanced state of the art it is fair to presume that the element of chance in the attainment of results will be largely reduced if not entirely eliminated. The distance to be covered by the wireless in this instance is comparatively short, and if the system proves to be as successful as it is hoped it will be, it will mean a great deal to the railway services. The section of the road to be equipped is one which is frequently visited by storms, and wire communication suffers more or less in consequence. In order to be independent of such conditions, the railway officials find hope for relief in the wireless, and if they succeed in accomplishing what they have undertaken a great stride will have been made in the development of the science of railway-train movement.

The far-reaching effect of this undertaking is at once apparent, for comfort, convenience and increased safety must follow from the successful operation of this remarkable innovation. For instance, in approaching a station, a conductor of a train will be able to notify the agent there that he is in need of an extra car, and transmit similar information which will enable the station authorities to be ready to make the necessary changes or repairs immediately upon the train's arrival. It would be possible also to transmit news and other items of interest to a train while in motion. Whilst these advantages will be especially appreciated in North America, where railway journeys are often of several days' duration, travellers in this country, and on the long-distance railways of Europe, will not fail to note what remarkable possibilities are likely to be opened out by the successful accomplishment of the new application of wireless telegraphy. As a means of safety, the wireless service should prove of inestimable advantage, and in combination with other precautionary measures should still further diminish the danger of modern travel.



MR. R. BICKERDIKE, M.P.

Personalities in the Wireless World

ROBERT BICKERDIKE, ESQ., M.P.

(Director of The Marconi Wireless Telegraph Company of Canada, Limited.)

THERE is always a certain class of unsuccessful man who is ready to disparage the abilities of his more fortunate *confrère*. "Money," he says, "is not necessarily apportioned to the most deserving. The game of Life's chances is played with loaded dice, and success falls to the man who has influence at his back. Further, this influence is obtained, not so much by personal qualities, as by force of circumstances." He forgets that though influence may gain a man his position, it cannot make him keep it, and furthermore, that it is a man's own personality which gains him the influence, for friendship, be it either commercial or private, depends on a number of good qualities, and cannot be bought at a price.

An instance of such a man is Mr. Robert Bickerdike, the director of several of Canada's most important industrial and commercial enterprises. Mr. Bickerdike is the son of the late Thomas and Agnes Forster Cowan Bickerdike, and is by birth and ancestry an Englishman. He was born at Kingston, Ontario, on August 17th, 1843, and was educated in the schools of his native town. He started his business career in Montreal, Quebec, and after gaining a preliminary knowledge of affairs, took over a live-stock exporting business. This he built up so rapidly and successfully that he soon became the largest live-stock exporter in Canada. After a time, however, he retired from this industry and devoted himself to finance, underwriting, and insurance. It says volumes for his business capacity that he was equally successful in these new ventures. As years passed he became more and more drawn into the political arena, and these dual interests have kept him one of the busiest men in Canada.

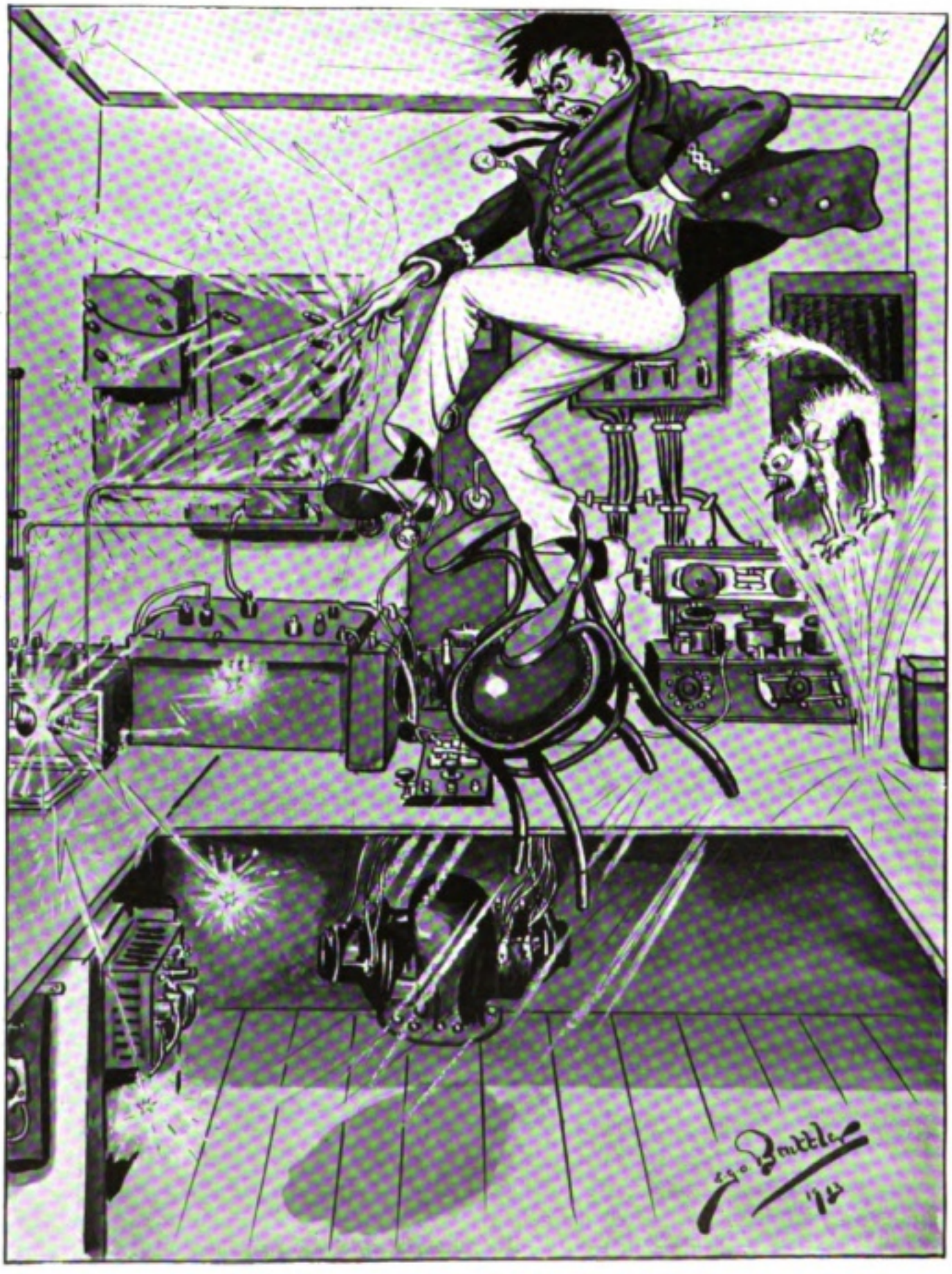
In 1897 Mr. Bickerdike was elected to the Quebec Legislature, and later he became a member of the Canadian House of Commons, a position which he still occupies, and which he successfully contested in the elections of 1900, 1908, and 1911. His business interests cover a vast field. Besides being a director of the Marconi Wireless Telegraph Co., of Canada, Ltd., he is vice-president of the National Real Estate and Investment Co.; Ex-President of the Montreal Board of Trade, and Ex-Active Chairman of the Montreal Harbour Commissioners. He is a director of the Canada Life Assurance Co., the Western Assurance Co., the British America Insurance Co.; the Imperial Guarantee and Accident Insurance Co., and of the Mount Royal Investment Co. He is also president of the Canada Securities Corporation and other similar concerns. Formerly he was Vice-President of the Bank of Hochelaga.

But Mr. Bickerdike does not confine himself to business; he devotes some of his time to the welfare of his fellow citizens in Montreal, and is Life-Governor of the Montreal General Hospital, and Hon. President of the Montreal Western Hospital.

His social interests include membership of the Rideau Club of Ottawa, and the Canadian, Montreal, and Canada Clubs of Montreal.

CARTOON OF THE MONTH

Wireless Terms Illustrated



VII.—The Booster

Lightships

IMPRESSIONS OF A VOYAGE IN A RELIEF SHIP. LIFE AND WORK ON BOARD. "DROPPING THE SKIPPER." THE WIRELESS SERVICE

ONE-HALF of the world does not know how the other half lives. This saying is trite because it is so true, but its truth does not come home to one so forcibly as when visiting a lightship. Wireless, as most of our readers no doubt know, is installed on several lightships round the English coast, and it was with a view to obtaining some idea of its advantages and use that application was made to Trinity House for permission to board one of their vessels. The authorities not only were kind enough to grant this permission, but they arranged for a representative of this magazine to make a journey with their relief-ship, which carries provisions, coals, etc., to the stations once a month, so that he might visit several of their stations.

A start was made from Harwich at 6 o'clock on the Monday morning. The relief-ship was already laden with commodities, the hold was filled with a large and miscellaneous collection of goods, while on deck was stored a big consignment of coal, innumerable kegs of water, and a somewhat smaller supply of cans of oil.

By good fortune the weather conditions were perfect, there was not a cloud in the sky and the sea was only broken by summer ripples. We weighed anchor strictly to time and, carefully steering alongside the gunboat flotillas which were moored in the mouth of the harbour, made our way into the open sea. Never had life seemed so pleasant, with the freshness of the morning heightened by the saltness of the sea air and the early golden light making the old world town of Harwich, with its clustered gables, red-tiled roofs, white-washed walls and dark, half-ruined sheds, like some Turner landscape with its sober grandeur lit up here and there by patches of brilliant colour. Soon the harbour was left far behind us as we made our way past the Essex coast and Clacton, where the green fields and the low white cliffs showed up vividly against the margin of blue waters. Gradually, too, that disappeared and we were alone on the wide

The "Tongue" Lightship, which is fitted with Wireless Telegraphy.

sea making our way rapidly in a southerly direction to the "Gunfleet" lighthouse. This is quite a small station built on piles, and it looked very lonely situated so far out to sea, much lonelier indeed than the lightships, for they are bigger of bulk and look more capable of self help, though their greater security is probably more apparent than real. It was, of course, impossible for the relief-ship to come close to the iron girders which supported the short conical tower of the "Gunfleet," and so the consignment of goods was transferred to the ship's boats and thence hauled up to the storehouse of this human crow's-nest.

I was given a place with the coals in the jolly-boat, and after a somewhat dizzy ascent on narrow iron ladders found myself in the tower. The lower floor consists of three rooms, each the size of the proverbial pill box.

Photo] [Lighthouse Mission, Belfast.
"Frying Pan" Shoals Light Vessel, off the coast of N. Carolina, U.S.A.

Lightship architecture must be an art of its own, whereof the chief requirement is to pack the greatest amount of convenience into the smallest possible space. For instance, the living-room in this establishment contained a stove, a sink, a pump, a dresser, a table, and a variety of cupboards, yet in shape it was an irregular triangle and there was scarcely a place where it was not possible by stretching out one's arms to touch the wall on either side. The sleeping apartment was even smaller, the bunks ranged one above the other with just room for lockers underneath; in the floor of this room was a small trapdoor which covered the fresh water tank. This tank was funnel-shaped so as to avoid any waste storage of this precious liquid. Precious indeed it is, for it adds much to the labour of provisioning these places. Thirty barrels per month was the amount allotted to the "Gunfleet," and although the crew worked with a will and a skill born of experience, it was some considerable time before the carriage and the emptying of the water kegs into the lighthouse tank was effected. In the meantime there were other provisions to be received and accounted for—the portions of rations allotted to each man sealed in little wooden kegs, the oil for the lantern (this is stored in great tanks that have a compartment all to themselves), then the coal, and last, but not least in the men's eyes, bundles of magazines and paper books, and, most precious of all, a little square box marked with the mark of Trinity House Library containing some twenty novels. This book-store, as may be imagined, does much to relieve the tedium of the lightshipman's secluded existence. Every month the relief-ship brings to the vessel it is relieving a similar square wooden box and takes away the former consignment.

While the lading and unlading was in progress I journeyed up another narrow staircase to see the lantern. Its mechanism was fluently and ably explained to me by the man in charge, who took, not unnaturally, a very great pride in his machine. It was one of the newest type and is fed by oil which by a new process is vaporised into gas, so that it can be used with an incandescent mantle. These mantles are of Brobdingnagian dimensions and give out a light of something like 80,000 candle-power, and should this not be sufficiently effective the bracket can be fitted with three mantles in order to give a more powerful beam. Everything, of course, was spotlessly clean and shining, not a fraction of dust or a spot of oil to be seen anywhere, nor was there

Photo] [Lighthouse Mission, Belfast.
"Diamond Shoal" Lightship, off the coast of N. Carolina, U.S.A.

any smell of oil clinging in the air as is so often found with machinery of this sort.

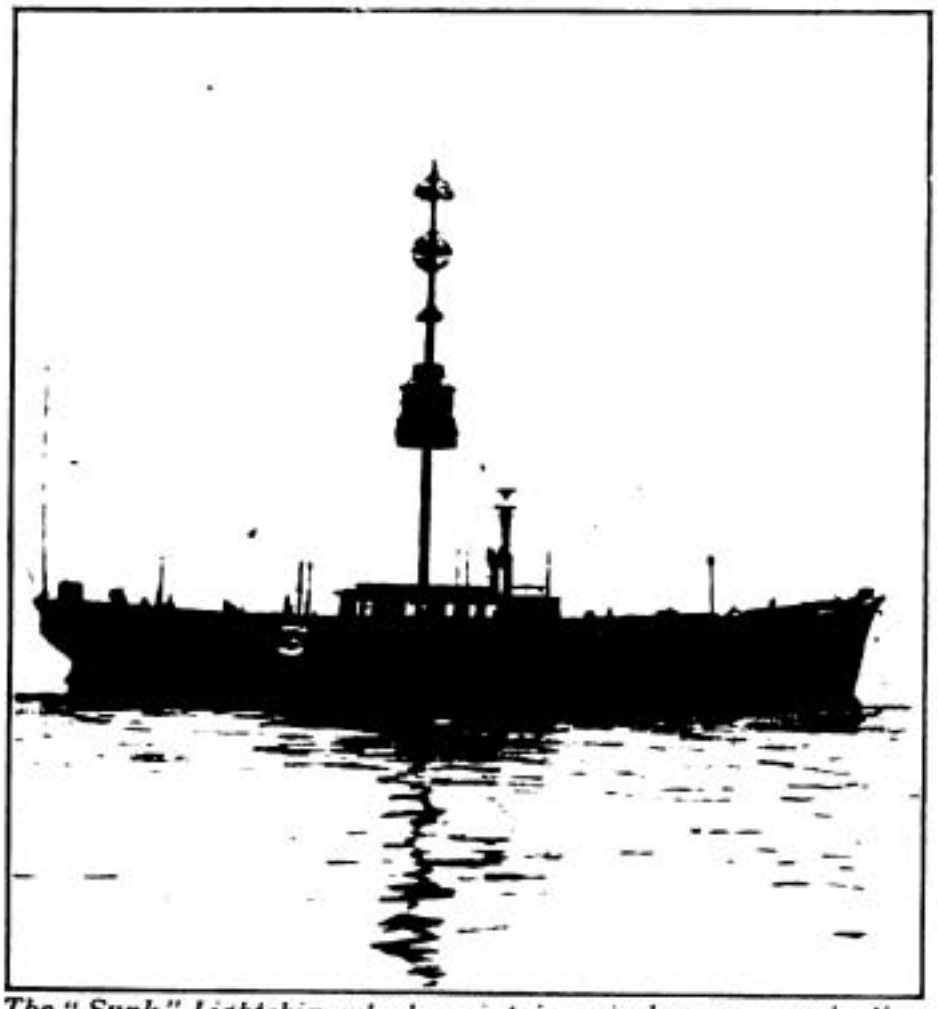
But perhaps the most fascinating parts of a lighthouse lantern are the prism reflectors. Imagine a triangular prism of undeterminate length wound round and round and round in a huge coil. That is how each side of the lantern is composed, and the result is that the strong rays of light are focussed into one brilliant central core which flashes out into miles of darkness. Each side of the lantern has such a core, and it is according to the disposition of the sides that the flashes of light are regulated. Each lightship has its own system of flashes so that any ship passing within its range can tell by the time of the flashes what lightship she is passing, and therefore what navigation dangers to be ware of. The movement is regulated automatically by clockwork which is wound up by weights and further there is attached a mechanism which rings a bell to warn the minder when the spring is running down.

The Wirelcss Apparatus on the "Tongue" Lightship.

When we put off again into the jolly-boat for the ship we had left one of our members on the "Gunfleet," but were recruited by another. This is the routine which is usually carried out. Each member of the station, whether it be lighthouse or lightship, remains on board for two months and then is given shore duty for one. This is a necessary provision, for it enables the man to see something of his relatives and home, or he would otherwise be condemned to a life of solitude which would out-Selkirk that great hero of solitude himself. When ashore there is sufficient work in the stores and on the relief-ship to keep the men "on leave" employed, but their evenings and Sundays are at their own disposal and, as can well be imagined, the time ashore is a time to be looked forward to and to be dwelt upon during the two months spent aboard.

From the "Gunfleet" we journeyed to the "Sunk," a distance of something over ten miles, though to the inexperienced mariner it seems much more for no land is visible, as the Naze, which is the nearest point, is about twelve miles away. As the sea was calm the relief-ship was able to draw alongside the "Sunk," and this meant a saving of over an hour in the transferring of the cargo.

The feature of the "Sunk" is the Marconi installation which links the vessel with the North Foreland. The installation was in charge of a member of the crew, and it speaks volumes for the intelligence of the men engaged in this service that they are able to manipulate the delicate instruments with accuracy and skill. The "Sunk's" "Sparks" was quite equal to all technical terms and details. Three times, he said, he



The "Sunk" Lightship, which maintains wireless communication with North Foreland.

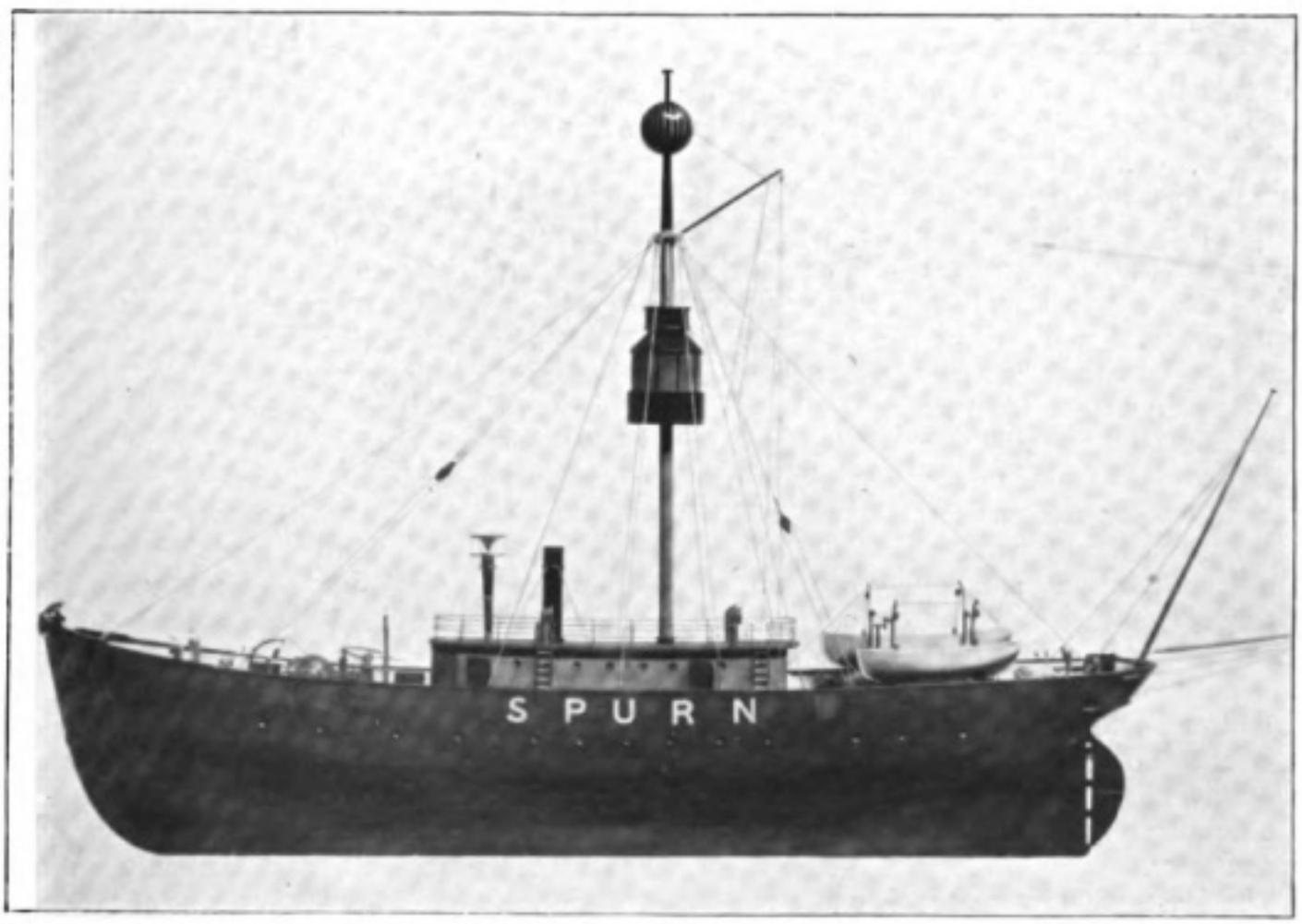
had sent the S.O.S. message, and in each case it had resulted in successful rescue, and this is a very good record for a station which was only installed in 1910. The apparatus is fitted up in the master's cabin, for at the time the "Sunk" was built wireless telegraphy and its installation never entered into the scheme of things and so was not given a special place in the ship. As far as the effective working of the station is concerned this is no disadvantage, but it is a little trying for the skipper, who is liable at all times to be called up even when he is off duty. As a continuous wireless watch is unnecessary, the hours for calling up the "Sunk" are eleven, three and seven, unless a previous arrangement has been entered into. Such arrangements are not infrequent, as they afford excellent opportunities for engaging in experimental work and practice. On this particular day it had been arranged that the "Sunk" should communicate with the "Dudgeon," another lightship also fitted with wireless, which is stationed off the Goodwin Sands. The operator was expecting a call at 4 o'clock in the afternoon when the general work of the day would be done and he could give himself up to this part of his work, which was also his hobby; at the same time he gains some little advantage by his energy, for he is allowed twopence an hour extra pay all the time he is transmitting or receiving. Such time is indicated on an automatic recorder which is forwarded at due intervals to Trinity House, in order that his account may be checked up.

But now the signal was given for us to board the relief-ship as the relief work was complete. A hasty scramble on board, the throb of the engines as they restarted, a call of "Let go there!" the dip of the Trinity House ensigns at the stern, and we were once more standing out to sea. Then came a long sea journey of over thirty miles to the "Outer Gabbard," the loneliest of the lightships off this part of the coast. It is placed to mark a ridge of sandbanks, which before the time of such safeguards was the scene of many a wreck. It could be sighted a long way off, its mainmast carrying the lantern surmounted by a skeleton cone. This was the sign of the "Outer Gabbard," for just as each lightship's lantern-flashes mark its identity so these cones serve the same purpose by day. The "Sunk" was surmounted with a skeleton sphere and the "Shipwash," the next lightship we were to visit had, if I remember rightly, a cylinder. Should the lightship come adrift these signs are taken down, so that the derelict vessel may not falsify the bearings of any passing ship. By one other means these ships can announce themselves, and that is the syren, for each apparatus has a different note and the blast is timed to go off at different prescribed times.

But the journey to the "Outer Gabbard" gave me time to talk to the men that we had taken off the vessels we had visited. At first they were a little nervous, but the uneventful life on the desolate sea is sufficient to account for this. After an unbroken solitude of a month the calling of a relief-ship is something of an event, while the presence of a stranger

on a ship makes it an event of awful moment. Nevertheless, a cigarette or a joke soon dispelled the reserve, and when the men found they had an interested listener they were quite willing to tell their experiences. All of them liked the life, and many of them had hobbies which were of absorbing interest to the individual. In one particular case the man had taken up the work of a coppersmith, another was a carpenter of no mean order and often his talent had been put to very good use on his ship. Music, too, finds devotees even on the ocean wave, and one of the men whom we brought out to resume his work on the lightship carried with him as chief of his impedimenta a mandoline — the musical season was about to open on his ship.

The "Outer Gabbard" was particularly interesting on account of its syren, which is of enormous power. It possesses three funnels pointing away from the land to three points of the compass, and when it is working each gives a phenomenal blast so that vessels coming in any direction can hear and take their bearings. It is worked in conjunction with the lantern and, as has been mentioned before, gives its note at definite intervals. This is regulated by clockwork apparatus similar to the lantern; so, too, is the syren within the horn, which, by revolving at a certain speed, gives the required note. It is very easy with extra pressure to cause the revolutions to increase, and this, of course, pitches the note higher, so that if the mechanism were badly regulated any passing vessel would be unable to distinguish the note as belonging to the "Outer Gabbard." On a small central pivot, which revolves with the revolutions of the syren inside the megaphones, the engineer attached a chronometer and the power was switched on. Instantly came a deafening blast which made the ship quiver and seemed to batter in the drum of an unaccustomed ear. The pivot sped round at a terrific rate. It should have made seven hundred revolutions, instead it approached nearer eight hundred; that meant that the note was tuned too high, so by mysterious proddings and pokings, screwings and unscrewings, the pressure was released till the right number of revolutions was indicated. The men on board are quite accustomed to



The "Spurn" Lightship.

the deafening sound, in fact they prefer the noise to silence, for when the signal is blowing they get twopence an hour extra. Just as in the case of the wireless, the time that the fog-horn is working is registered automatically and payment assessed by the central office. The men tell a tale of one old seaman, "Charlie," who was unable to read and write and was on board a lightship. At one time he happened to be near a petty clerk who was making up the account of his vessel and heard that worthy mention something about "twopence discount in the shilling, how much for one pound's worth of goods?" "Three and fourpence," replied Charlie promptly, and his companions, who were always chaffing him on his illiteracy, were astounded. It was some time before the phenomena was explained, and then Charlie himself revealed the secret. He had learned by experience that if the fog-horn were blowing for twenty hours he would get three and fourpence extra pay, he knew that the rate was twopence an hour, so twenty twopences were three and fourpence. That he had by heart, and when the question cropped up he was able to answer it off the reel.

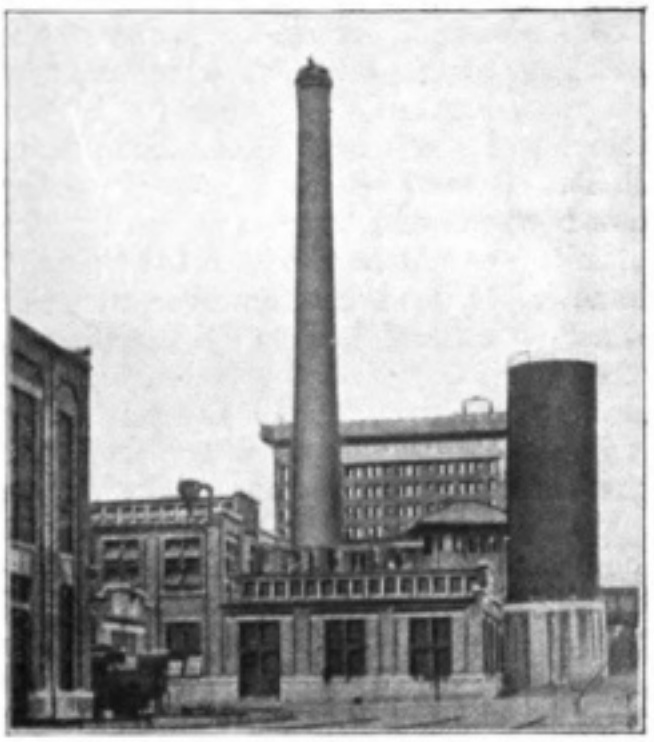
But an interesting little incident took place on our departure from the "Outer Gabbard." On this occasion the master was quitting his lightship for good and all, for his sixty-five years of active life were completed, and was saying good-bye to marine service. He felt a little upset at his going, for the giving up of the old routine would mean such a break in his life. But he was not allowed to give way to his feelings, for his comrades contrived to prove to him that he was the envied of his fellows and kept up a running conversation of chaff until the vessels were too far away for hearing. "See you in a new 'at in the park," one of them shouted as a last send off, and the old man replied by waving his sailor's cap in the air. All the men seem to be very chummy, and this is as it should be considering they spend so long in each other's company with no outside interests. They all have nicknames, and often a man never knows his fellow by his surname and only as "Bob" or "Gunnie" or "Silver," or some such designation which the possessor has been dubbed by some wag of the crew.

The last lightship we touched at was the "Shipwash," which communicates with Orfordness by telephone. The cable is fixed to her bows and runs through a central gangway to the master's cabin, but the interesting part about its installation is the elaborate arrangement for insuring proper working connection. A lightship is an unstable thing at the best of times, at the worst it is a veritable flotsam, and a gale would soon cause the cable to snap if the ship were not anchored down particularly safely. This has been done, however, and 1,380 yards of chain cable have been attached to the hull. Four separate lengths are united on a hollow swivel through the centre of which the telephone cable passes. The lengths of the chain cable are stretched to the four points of the compass, so that the vessel is as far as it can be made immovable. But the tension on the chains is enormous. The motion of the waves causes them to rub together and bump on the sand, with the result that before long the oval links of quite a new chain will become circular under the strain. In time, of course, these links wear out, and every three years there is the whole paraphernalia of chain renewal to be gone through again. Even this, however, cannot insure the ship being stationary, and it has been known to lurch so that the telephone cable has broken. That is a terrible *débâcle*, for the wire, in breaking, springs back and rolls together in coils and, as a consequence, when the repairing ship comes along to make good the damage, prolonged preliminaries are necessary in order to find the broken end of the wire. The conditions being so it seems hardly likely that any more telephone systems will be installed, for wireless is infinitely cheaper and infinitely more reliable. Indeed, it seems that when the time comes that all lightships are equipped with wireless, the fortunate crews who will then be engaged on this important duty of safeguarding navigation will not be able to realise the time when they were absolutely cut off from the world, or when it was a ticklish business to communicate to shore, with the chances ten to one that in dirty weather they would not be able to communicate at all. Wireless bids fair to revolutionise the life on board a lightship, for it will bring the voice of the world to these present solitudes, where now the only cry is that of the sea-gull, and the only action, outside the ship, is the movement of the sea.

Railways of the Future

An Experiment with Wireless Telegraphy

WE are now able to give our readers some additional information regarding the experiment with wireless telegraphy which, as we announced recently, is being made on the trains of the Lackawanna Railroad. The railway company have entered into a contract with the American Marconi Company for the installation of a 2-kw. high-frequency spark set at Scranton, Pa., and another at Binghampton, N.Y., and for one 1-kw. set to be installed in a special compartment built into one of the day coaches of the Lackawanna.



Scranton Tower which will be used for the suspension of aerial.

A horizontal antenna will be constructed over the entire train, and the immediate experiments will be confined to the maintenance of communication between Scranton and Binghampton and the moving train. This work will be mainly experimental, but successful results will be followed by the erection of wireless apparatus at Elmira, Buffalo, and Hoboken.

At Scranton, on the 175-feet brick stack at the works of the railway company, a steeplejack has placed a pulley and halyards from the top of which will be suspended an antenna some 700 feet long, terminating in the Scranton depot building of the Delaware, Lackawanna Railroad. A similar antenna is being erected at Binghampton.

It is hoped that the success of these experiments will demonstrate the practicability of the scheme.

Mr. W. L. Foley, Superintendent of Telegraphs, is confident of the success of the enterprise. He states that, in common with all other railroad men who have had to do with telegraph equipment, he had been continually impressed, not only with the great cost of keeping up the old style of line, but also with the fact that it is usually out of commission during the times when it is most needed, as in cases of storm and flood. He realised also the limitations of the present service, especially in relation to safety. "Every old railroad operator," he added, "knows by experience the nightmare of the man at the key—two trains heading for each other between stations and no means of stopping them; sometimes this may result from carelessness, but often it comes about in a way that no man can foresee or forestall, and in such conditions wireless will prove invaluable, for by its use the despatcher will be able to catch a train anywhere on the road."

Superintendent Frank Cizek, of the Syracuse and Utica divisions, is as confident as Mr. Foley of the success of the undertaking. He gives the following description of the apparatus which is now being tested.

"The power will be supplied by a special motor generator set, developing 100 volts at 500 cycles and capable of two kilowatts when using an extreme wave-length of 800 meters.

"In order to maintain communication with rapidly moving trains, tuning apparatus of the most delicate construction is required to enable the operator continuously to adjust to required wave-length without interfering with his regular duties.

"The operator is equipped with a double receiver, similar to those used by telephone operators, except that they are wound to a resistance of 3,000 ohms instead of 75. For transmission he uses a key similar to the ordinary telegraph key, except that it is much heavier. The current passing through a wireless key is so great that it would melt an ordinary telegraph key in a few seconds."

SCIENTIFIC NOTES

CURRENT RUSHES IN TRANSFORMER CIRCUITS.—It is well known, and sometimes painfully brought home, that at the closing of a transformer circuit there may be produced sudden rushes of current which reach values many times that of the normal current. When the induction is high and the saturation weak these rushes are particularly violent. It is equally well known that the rush can be diminished by the introduction of resistance in the circuit at the moment of closing. M. Rogowski, in the *Archiven für Elektrotechnik*, has given an analysis of the phenomenon, and has established a differential equation for it. This equation is difficult to solve because the intensity of the current and the induction are not connected by linear expressions. To obviate this difficulty, and to obtain an analytical expression which agrees sufficiently well with the curve of magnetisation and at the same time permits the integration of the differential equation, M. Rogowski replaces the curve by a broken line composed of three parts, the first corresponding to the straight ascending branch, the second to the knee of the curve, and the third to the region of saturation. For each of these three parts there is an approximate proportionality between the value of field intensity—that is to say, the number of ampère turns per centimetre—and the differences of the induction at the beginning and at the end of that particular part. The author determines the coefficients of proportionality and the values of induction by the help of a magnetisation curve, and thus establishes three separate differential equations, each of which represents the influence of induction in the corresponding part. These equations can easily be solved. It is seen that even for small values of resistance the current rush decreases rapidly. For very small values of the ratio between the ohmic drop and the induced electro-motive force the influence of the remanent magnetism is eliminated.

* * *

THE RECIPROCAL EFFECT OF TWO NEIGHBOURING AERIALS.—M. C. Tissot contributes an exceedingly interesting paper on this subject to the *Journal* of the Académie des Sciences, in which he recalls certain results obtained some years ago and deals with them very fully. The original results were obtained in some experiments carried out for the purpose of tracing the resonance-curve of a direct-coupled transmitting aerial. The energy received was measured by a bolometer connected to a receiving aerial A, and this aerial A was varied in length (presumably in such a manner that its effective height remained constant) so as to be in and out of tune with the transmitted wave. In order to keep a control on the constancy of the emitted waves, in the first experiments a fixed receiving aerial B, near to A, was employed with a second bolometer in series with it. B was, of course, tuned to the emitted wave, and any variation in the transmitter would be shown on the second bolometer. It was found, however, that this method of control had to be abandoned, owing to the fact that the bolometer of B underwent variations *quite independent of variations in the transmitter* and due entirely to the changes in length of the neighbouring aerial A. It was noticed that when the aerials A and B were both single-wire aerials the energy absorbed by the fixed aerial B reached a minimum when the neighbouring aerial A was brought into resonance with the transmitted wave; but —and here comes the interesting phenomenon—when the aerial A was *multiple* the minimum of energy received by the single-wire aerial B corresponded to a certain decrease of the aerial A to a tune less than that of the transmitted wave.

* * *

The first result (*i.e.*, with single-wire aerials) is easily explained when we remember that the aerial A drains for its own advantage a portion of the energy of the field which is the greater the nearer A is to resonance; and the amount of energy thus absorbed by A reduces to a corresponding extent the energy received by B. But this is only a rough way of looking at the matter. The phenomenon depends, actually, on the respective value of the quantity of energy

taken up by each of the aerials and on the modification which each one produces on the primitive field of their own radiation.

* * *

Now the radiation of an aerial (and reciprocally its *absorbing power*) is intimately connected to its electrical dimensions. It depends particularly on the factor $1/L.\frac{l}{\rho}$ (where L is the inductance, l the length, and ρ the radius vector of the field), which enters into the expression for the field in the immediate neighbourhood of a linear oscillator. It is because this factor has a higher value for multiple-wire aerial than for a single-wire aerial that a multiple aerial takes up more energy from the field produced by in-coming waves than a simple aerial. This has been shown by M. Tissot elsewhere.

The lack of symmetry indicated by the above-named experiments becomes clearly comprehensible by a consideration of the above factor. When the aerial A is a multiple one, so that the factor has an important influence, the effect of throwing A out of tune with the in-coming waves depends on the nature of the "out-of-tune"-ness or a-syntony, in the following manner :—

1. When the a-syntony is in the direction *above* the resonance-point, so that the actual length of A is *longer* than that corresponding to the wave of the transmitter, it produces two effects tending to make the variable system *less* absorbent ; in the first place it puts the aerial out of resonance, and in the second place it increases the ratio l/ρ.

(2) When the a-syntony is in the direction *below* the resonance-point, so that the length of A is *shorter* than that corresponding to the wave of the transmitter, it produces two effects : in the first place it decreases the absorptive power by putting the aerial out of resonance, but in the second place it decreases it by diminishing the ratio l/ρ.

It is clear that in (1) the two effects are additive and in (2) they are in opposition, with the result of dis-symmetry, so that even with two identical receiving aerials the minimum of reception for the aerial of fixed tune would not occur exactly when the variable aerial comes into resonance with the transmitted wave, but when that aerial is slightly out of tune in the direction of too short a wave-length.*

* * *

In the case where the tune of the aerial is modified by the introduction of inductance coils, instead of by varying the actual length of the aerial, we are led to an analogous interpretation which becomes simplified by the use of the expression "radiation resistance" of the aerial. (A definition of this expression was given in the "Questions and Answers" column of THE MARCONIGRAPH of January, 1913.) It can be shown that the disturbance produced in the incident field by a receiving aerial (of negligible ohmic resistance) is inversely proportional to the expression

$$\sqrt{1+\left[\frac{L\omega}{R}\left(1-\frac{\omega_0^2}{\omega^2}\right)\right]^2}$$

where ω_0 represents the incident wave-frequency, ω the natural frequency of the aerial affected, L the self-inductance of the receptive system, and R_e its Radiation resistance.

R_e varies in proportion to the square of the ratio l/λ of the actual length of the aerial to the wave-length of the system. Moreover, when an aerial is modified by the introduction of a coil of self-inductance,

$$L\omega \text{ varies as } \sqrt{L}$$

In increasing the self-inductance (a-syntony in the direction of too *long* a wave-length) both the expressions

$$\left(1-\frac{\omega_0^2}{\omega^2}\right) \text{ and } L\omega/R_e$$

are increased. In decreasing the self-inductance (a-syntony in the direction of too *short* a wave-length), the expression

$$\left(1-\frac{\omega_0^2}{\omega^2}\right) \text{ is increased, but } L\omega/R_e$$

is decreased. The result therefore is a dis-symmetry similar to that described above. In order, however, for the dis-symmetry to become clearly apparent, it is necessary that in adjusting the respective self-inductances or tuning-coils a variation of $L\omega/R_e$ should be produced which is greater for one aerial than for the other. Such is the case when one of the aerials is multiple and the other simple.

* This conclusion, though fitting in with the observed results, seems hardly to be justified by the argument as it stands ; for although the two effects of a-syntony on the short side are opposed to each other, they would still have a resultant tending to decrease the absorptive power below its value at syntony, *unless* the increasing effect is equal to or greater than the decreasing effect. Since the decreasing effect of a-syntony is a matter of decrement, it would appear that the damping of the incident wave would have an influence on the result obtained.

The British Association

Birmingham Meeting

SIR OLIVER LODGE ON "CONTINUITY." RADIO-TELEGRAPHIC INVESTIGATIONS. ATMOSPHERIC CONDITIONS AND STRENGTH OF SIGNALS. ELECTRO-MAGNETIC WAVES. RADIATION.

AT this time of the day it is hardly necessary to say anything concerning the place which the British Association has gained for itself in the world of science. It is recognised as the leading deliberative body of its kind, and its meetings are attended by savants from all parts of the world, who rejoice in so excellent an opportunity of acquainting themselves with the latest movements in modern thought, and are proud to bring offerings to the feast of wisdom that the gathering invariably provides. Since its inception the Association has vastly increased the scope of influence of its operations, and this year's meeting, which opened at Birmingham on September 10th, was one of the most interesting in its history. Very appropriately, Sir Oliver Lodge, Principal of Birmingham University, prominent among the most broad-minded and enterprising of men of science, was President, and his inaugural discourse had excited in anticipation no small amount of speculation, for although Sir Oliver is widely known as an eminent physicist, his name is no less familiar as that of a convinced and avowed believer in the value of psychical research. He is a past President of the Society for Psychical Research, and this fact, coupled with the sceptical attitude of many men of science towards psychical phenomena, piqued the curiosity of the public as to the line which the new President would adopt and heightened interest in the occasion.

The main subject of the address, however, was concerned with other matters, though the President did not shrink towards the close of his remarks from a confession of faith in the utility of psychical research; and in a notable passage he declared his conviction "that memory and affection are not limited to that association with matter by which alone they can manifest themselves here and now, and that personality persists beyond bodily death."

Whilst the address well maintained the high traditions of the occasion, it contained no record or forecast of epoch-making discoveries in the realm of physics or invention, as so many of its predecessors have done; it was not even, as others have been, a brilliant exposition of the latest advances which pure or applied science have achieved. Rather was it in the nature of an admonition to students and savants as to the limitations which available methods and means of research impose upon humanity in its investigation of the greatest problems of life; a warning against dogmatism and against the too ready negation of beliefs and speculations, the demonstration of which is outside the realm of scientific investigation and experiment.

TENDENCIES OF THE AGE.

Sir Oliver devoted himself in the main to an examination of the principle of continuity. His argument was that a marked feature of the present scientific era is the discovery of and interest in various kinds of atomism, so that continuity seems in danger of being lost sight of. Other tendencies are towards comprehensive negative generalisations from a limited point of view, and to take refuge in rather vague forms of statement and to shrink from closer examination of the puzzling and the obscure; while yet another is to deny the existence of anything which makes no appeal to the organs of sense, and no ready response to experiment.

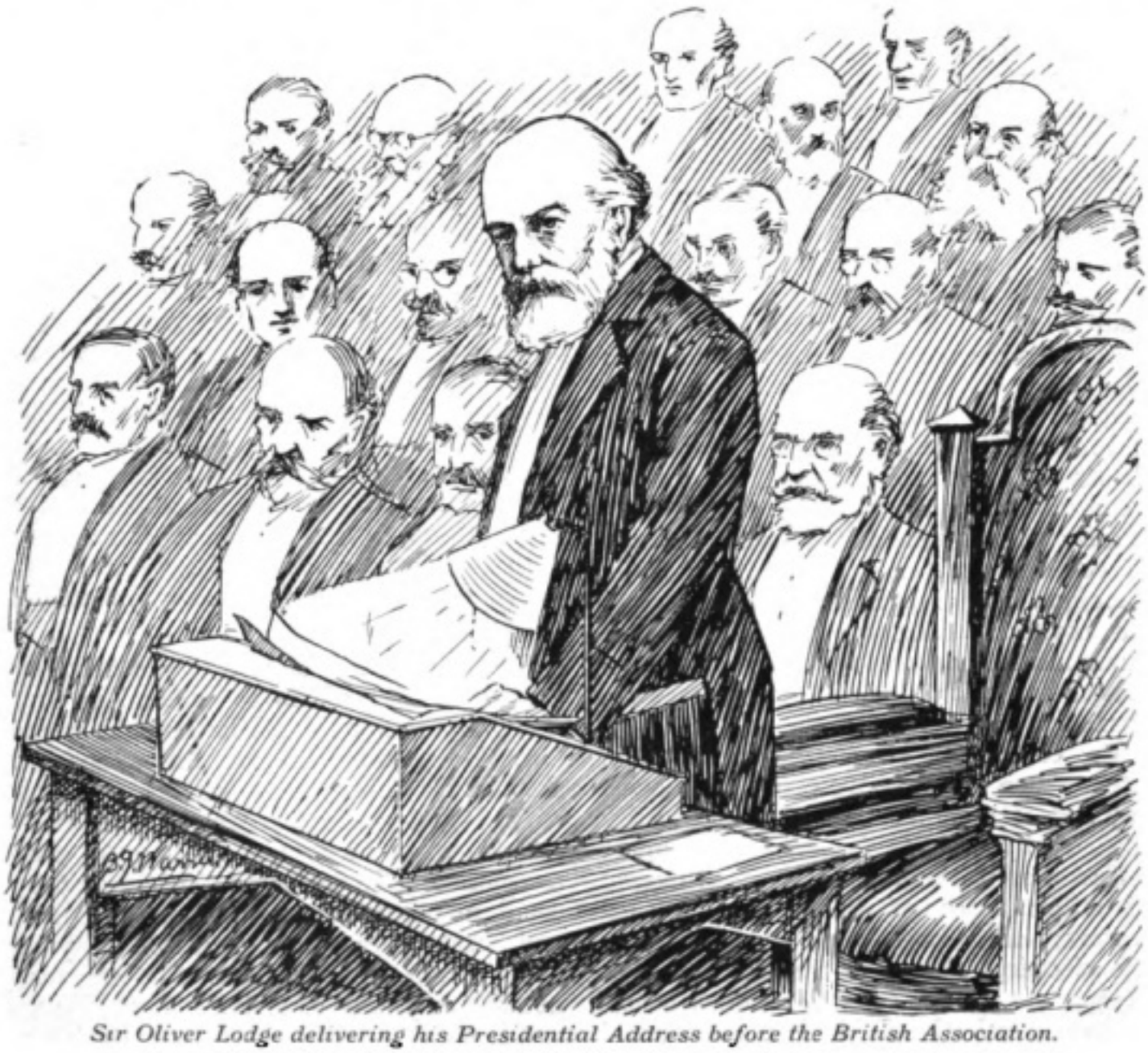
Against these tendencies Sir Oliver contended. He urged a belief in ultimate continuity as essential to science; he regarded scientific concentration as an inadequate basis for philosophic generalisa-

tion, he believed that obscure phenomena might be expressed simply if properly faced, and he pointed out that the non-appearance of anything perfectly uniform and omnipresent was only what should be expected, and was no argument against its real substantial existence.

Proceeding to unfold his argument, he said that there was a critical examination of scientific foundations generally going on, refrain from imagining itself the whole—perhaps it was not even the best part—of human nature. Not by philosophers only, but by scientific men also, ancient postulates were being torn up by the roots.

THE UNIT OF MATTER.

He urged that we should remain with, or go back to, Newton. He saw no reason against retaining all Newton's laws, dis-



Sir Oliver Lodge delivering his Presidential Address before the British Association.

and a kind of philosophic scepticism was in the ascendant, resulting in a mistrust of purely intellectual processes, and in a recognition of the limited scope of science. For the nature of man was a large thing, and intellect only a part of it : a recent part, too, which therefore necessarily, though not consciously, suffered from some of the defects of newness and crudity, and should carding nothing, but supplementing them in the light of further knowledge. On the modern sceptical attitude he quoted Poincaré. If, he continued, they had to summarise the main trend of physical controversy at present, he felt inclined to urge that it largely turned on the question as to which way ultimate victory lay in the fight between continuity and discontinuity. The

modern tendency was to emphasise the discontinuous and atomic character of everything. Matter had long been atomic in the same sense as anthropology was atomic.

The unit of matter was the atom as the unit of humanity was the individual. Whether man or woman or children, they could be counted as so many "souls," and atoms of matter counted too. Electricity itself — *i.e.*, electric charge — strangely enough had proved itself to be atomic. Even magnetism had been suspected of being atomic, and biology might be said to be becoming atomic. So far from nature not making jumps, it became doubtful if she did anything else. Her hitherto placid course, more closely examined, seemed to look like a kind of steeplechase. Yet undoubtedly continuity was the backbone of evolution, as taught by all biologists. He himself was an upholder of ultimate continuity, and a believer in the ether of space.

In his view we had learnt as follows: The ether is the universal connecting medium which binds the universe together and makes it a coherent whole, instead of a chaotic collection of independent isolated fragments. It is the vehicle of transmission of all manner of force, from gravitation down to cohesion and chemical affinity; it is, therefore, the storehouse of potential energy. He could not imagine the exertion of mechanical force across empty space, no matter how minute; a continuous medium seemed to him essential

He could not admit discontinuity in either space or time, nor could he imagine any sort of experiment which would justify such a hypothesis, for surely we must realise that we knew nothing experimental of either space or time. The physical discovery of the twentieth century so far was the electrical theory of matter, and that theory was bound to have curious consequences; and already it had contributed to some uprooting and uncertainty. But the theory was a positive achievement, and had positive results. The ether of space was at least the great engine of continuity. It might be much more, for without it there could hardly be a material universe at all. And yet it was possible for people to deny its existence, because it was unrelated to any of our senses except sight, and to that only in an indirect and not easily recognised fashion.

SCIENTISTS AND SUPERSTITION.

The President passed on to consider the question of vitalism as applied to biology, and while repudiating the use of vital force as a term implying inconsistency with the laws of chemistry and physics, drew attention to the limitations of the science, and argued that while there was plenty of physics and chemistry and mechanics about every vital action for complete understanding of it something beyond physics and chemistry was needed. While justifying the hostility of scientific men to superstition, he pointed out that the term might occasionally be applied to practices of which the theory was unknown. Matter was what appealed to our senses here and now; materialism was appropriate to the material world, but everything beyond that belonged to another region, and must be reached by other methods. To explain the psychical in terms of physics and chemistry was simply impossible. He protested against the exclusion of life and mind from science, and held that if men of science dogmatised in a negative direction and said they could reduce everything to physics and chemistry, they gibbeted themselves as ludicrously narrow pedants and were falling far short of the richness and fulness of the human birthright.

Sir Oliver Lodge devoted the concluding portion of his address to contending that the psychic region could be brought under law. He recorded his own conviction and that of his co-workers that the facts examined had convinced him that memory and affection were not limited to that association with matter by which alone they could manifest themselves here and now, and that personality persisted beyond bodily death. The methods of science were not the only way of arriving at the truth, and it could not be seriously supposed that Truth was arrived at on this planet only a few centuries ago. Genuine religion had its roots deep down in the heart of humanity and in the reality of things, and it was not surprising that the methods of science failed to grasp it. The actions of the Deity made no appeal to any special sense, only a universal appeal, and the methods of science were incompetent to detect complete uniformity.

RADIO COMMITTEE'S REPORT

The work of the various sections of the Association is to some extent overshadowed in the popular mind by the Presidential address; nevertheless, a good deal of quiet and unostentatious work for the encouragement of research and the extension of scientific knowledge is carried out. At the Dundee meeting last year a committee consisting of Sir Oliver Lodge (*Chairman*), Dr. W. H. Eccles (*Secretary*), Mr. Sidney G. Brown, Dr. Erskine Murray, Professors J. A. Fleming, G. W. O. Howe, and H. M. Macdonald, Captain H. Riall Sankey, and Professor Silvanus Thompson was appointed for the purpose of conducting radiotelegraphic investigations.

At a meeting held on June 13th, 1913, the Committee came to the conclusion that the most urgent and most profitable work they could promote was the investigation of the following large-scale phenomena :—

1. The influence of sunrise and sunset, of daylight and darkness, and of meteorological conditions, on the propagation of electric waves over long distances;
2. The origin and the laws of "strays" —*i.e.*, natural electric waves.

These are subjects which seem particularly suitable for the British Association, since they are such as cannot be efficiently pursued by unco-ordinated individual effort.

In order to promote the necessary widespread observations, the Committee propose to draw up a simple scheme of instructions which will be circulated to amateurs throughout this country, and also, with the permission of the companies concerned, to operators on ships. These instructions would include directions for simultaneous observations of, for example, the strength of the time-signals from such stations as the Eiffel Tower, and the average strength and frequency of strays. The observations would subsequently be classified and reduced by this Committee; and it is felt that this work would open up at once an almost unexplored, and exceedingly promising, branch of research—one which cannot be entered upon in any other way. It is, of course, essential that the work should be carried out over a very large area and by very numerous observers; and after full consideration of this fact the Committee resolved to apply for a grant of £200 to enable the work to be started in a thorough manner.

INFLUENCE OF THE ATMOSPHERE UPON SIGNALS.

In Section G, Professor E. W. Marchant read a paper on the "Effect of Atmospheric Conditions on the Strength of Signals received at Liverpool from Paris and some other place, together with an account of the Diurnal Variations in the Energy received." Measurements had been made over a considerable period of time, but those described by Professor Marchant dealt mainly with observations during the month of July. The most accurate observations had been obtained with signals sent out by the observatory at the Eiffel Tower at 10.45 a.m. and 11.45 p.m. The method adopted in the earlier tests was to use a "Perikon" detector in series with galvanometer and telephones, the measurement of strength being made by the cumulative deflection due to a series of known signals. This method was not found satisfactory with the Paris signals for which the antenna current used was known, and in the later tests an Einthoven String Galvanometer was employed by which the strength of signal for each individual spark at Paris could be observed to within $\pm$ 5 per cent. The results obtained show that there is a maximum variation from 0·6 to 1·3 in the strength of the signals received on different days in the same month; the average strength of signal being assumed to be 1·1, and that the current received on a fine, clear night is about 1·7 times as strong as that received in the daytime.

Although no certain relationship can yet be regarded as established between the strength of a signal and the weather conditions at the sending and receiving stations, so far observation has shown that rain in Paris always corresponds with a diminution in strength of received signal. In one case, with a wind of 6 metres per second velocity, blowing in a N.W. direction, the signal-strength fell to half its normal value. The most favourable condition for signalling appears to be a cloudy sky at both sending and receiving stations, the signals being weaker when the sky is clear or covered with light clouds. Rain at the receiving station appears to have a comparatively small influence on the strength of the received signals.

The result of a set of special signals sent from the Eiffel Tower on the evening of Saturday, July 26th, 1913 (by the courteous arrangement of Comm. Ferrié), at intervals of 30 minutes, between 7 and 10 p.m. (which includes the time of sunset), shows that the increase in strength of night signals occurs just after sunset, there being a sudden increase in strength of about 70 per cent. This change is quite sudden, there being comparatively little alteration in signal-strength until the sun has set and no perceptible increase in strength afterwards. There appears to be some evidence that signals are slightly stronger just after sunset than during normal night conditions.

ELECTRO-MAGNETIC WAVES.

In a paper dealing with the "Nature of the Electro-magnetic Waves employed in Radio-telegraphy and the Mode of their Propagation," Professor G. W. O. Howe said:

A very clear conception of the nature of the electro-magnetic waves employed in radio-telegraphy can be obtained by considering those electro-magnetic waves which exist in the space between the two conductors of a single-phase transmission line. If the conductors are flat, parallel strips, close together, and connected at the sending end to the terminals of an alternator, there is a certain value of the non-inductive load at the receiving end which will absorb the arriving energy without any reflection. Under these conditions the current and voltage are in phase all along the line, and the same is true if the line is assumed to be of infinite length. Line resistance and leakage are assumed to be negligible. It follows from this that the electric and magnetic fields at any point have their maximum values at the same moment. Instead of two parallel strips transmitting energy in one direction, two parallel discs of infinite extent can be imagined with the alternating P.D. applied between their centres. Energy would then be transmitted radially in all directions in the plane between the discs. The earth could take the place of the lower disc, while the upper one could be represented by a conducting horizontal plane some distance above the earth. The waves produced would be truly cylindrical, whereas those employed in radio-telegraphy are spherical. If, now, the upper disc is replaced by an inverted conducting cone of infinite extent, with its apex almost in contact with the earth, the alternating P.D. being applied between the apex and the earth, the electro-magnetic waves will be almost identical with those employed in radio-telegraphy and will vary in the same way with the distance from the sending station. This imaginary multi-directional transmission line, consisting of a lower plane (the earth) and an inverted cone, lends itself to simple calculation, because, like an ordinary transmission line, and unlike the two parallel discs, it has a constant inductance and capacity per mile. It can be shown that if the angle between the cone and the earth is 70 degrees, the relations between the magnetic and electric fields near the earth's surface and the total energy radiated are identical with those existing in the ordinary radio-telegraphic wave. As in the transmission line already considered, the current and P.D. will be in phase at every point, and therefore, contrary to the usually accepted view, the horizontal magnetic field and the vertical electric field due to a sending antenna are not 90 degrees out of phase, but are approximately in phase, except in the immediate neighbourhood of the antenna. This also follows from the fundamental equations of a progressive, as distinct from a stationary, electro-magnetic wave.

DR. ECCLES' THEORY.

Dr. W. H. Eccles, in a paper on "Atmospheric Refraction and Absorption as Affecting Transmission in Wireless Telegraphy," said that the fact that signals might travel at night over very long distances suggested the influence of reflection rather than refraction, while in the daytime the indication was that those signals of great wave-length travelled best on a refraction basis. He developed the theory that he has brought forward elsewhere, that as a result of the ionisation in the upper layers of the atmosphere the rays which started horizontally followed a curved path with their concavity towards the earth. He indicated some lines on which this theory had been developed.

Professor J. A. Fleming, in opening the discussion on the three papers abstracted above, emphasised the need for research. He did not consider that Dr. Eccles's theory

although a great deal was to be said for it, explained everything, and inclined to the view that there was some effect produced by waves which travelled through the earth. He strongly advocated the appointment of a Radio-Telegraphic Committee to investigate the problem.

Professor Nicholson held that the atmosphere took an important part in conducting the waves, and supported Dr. Eccles's theory. Mr. Rivers Moore pleaded for the co-operation of amateur wireless telegraphists, who would be able to undertake researches that were not possible in the case of postal operators, owing to the exigencies of the public service. Professor E. Wilson argued in favour of a more thorough organisation of experimental work, and Dr. Eccles, speaking on behalf of the Radio-Telegraphic Committee of the Association, said that the work of organising amateurs and others was already in hand, and he hoped that the scheme would be in working order early next year.

CONTACTS BETWEEN ELECTRICAL CONDUCTORS.

In Section A, Dr. W. H. Eccles read a paper entitled: "Contacts between Electrical Conductors," of which the following is an abstract.

When a current is passed across a "loose contact" the relation between the applied electro-motive force and the current produced is, in general, not a linear one, and no sufficient explanation of the observed phenomena has hitherto been offered. The present author investigates whether the behaviour of contacts can be accounted for by purely thermal actions in the matter near the contact. The Joule, the Peltier, and the Thomson effects will all play a part, and the alterations of resistivity with temperature, as well as alterations of the geometrical configuration of the surfaces in contact, caused by thermal expansion, ought all to be taken into account. These thermal effects are, of course, most noticeable in contacts between bad conductors of electricity and of heat, as, *e.g.*, the natural crystalline oxides and sulphides.

It is advantageous to separate contacts into two classes: First, those between like substances; second, those between unlike substances. In the first class there is in general no thermoelectric action, and the non-linearity of the relation between applied e.m.f. and current is mainly due to resistivity changes produced by Joulean heating. In the second class there is in general some thermoelectric action imposed on the resistivity-temperature phenomenon; and in the case of the crystalline substances mentioned the thermoelectric actions may be the more important.

For the first class, theory yields a cubic equation connecting e.m.f. and current. Experiments are adduced by the author which show that the thermal explanation is in many cases sufficient. In the second class, thermoelectric theory yields a quantic equation. The curve connecting e.m.f. and current takes very various shapes according to the signs and the relative magnitudes of the Peltier and Thomson coefficients in the substances forming the contact. The author has measured these coefficients in some typical substances and has thus carried out a comparison between the theoretical curves and the experimental curves of contacts between pairs of these substances. The evidence gathered in this way tends in the main to support the theory.

RADIATION.

Only one more of the many interesting features of the meetings can be touched upon in the present article, that is the discussion on radiation in the Mathematical and Physical Science Section on September 12th. Some years ago Lord Rayleigh and Mr. H. G. Jeans established that the law of radiation as deduced from ordinary electro-dynamics was impossible. In connection with this difficulty that had been reached, Planck made the assumption that energy could only be radiated in definite elements or units, and the history of the subject has since largely been the verification of Planck's view experimentally. In other words, there has been a growing tendency to regard energy as consisting of units or *quanta*, or what Sir J. J. Thomson has described as "pint-pots," as opposed to the older view that energy could be radiated generally without such definite units. The discussion last month showed a remarkable tendency towards reconciliation between these different views, and the attempt was made to reconcile Planck's views and the deductions made from them with the views that generally obtain as a result of

tackling the problems in accordance with the classical laws of electro-dynamics. Mr. Jeans, in opening the discussion, drew attention to the difficulty into which physicists had been landed by attempting to explain radiation by the laws of Newton and Maxwell, and held that the tendency now was to start with the facts and attempt to get at the laws. His address was a long one, and in it he laid down the general basis on which the modern views have been established, arguing in favour of energy being transmitted by "sudden jumps" rather than by continuous undulations. Professor Lorentz (Leyden), who followed him, expressed the hope that it would be possible to explain black radiation, while adhering to the older theories of mechanics, but he emphasised that new ideas had to be introduced. There must be some kind of discontinuity, new or apparent, something that went on by jumps. He followed Planck in assuming something as a link between matter and ether, which he termed a resonator. He did not see that to abandon the ether would make matters much better, and he thought there was not much difference whether one spoke of ether or vacuum. The physicists of the sixteenth century and Lord Kelvin would not have doubted the existence of the ether. Had he done so Kelvin could never have written his well-known treatise on the duties of the ether, for a thing that did not exist could not have duties. He discussed the exact attitude which he took up on the question of *quanta* of energy, and said that it would be lamentable if one had to give up the electro-magnetic theory for the ether, the working out of which it had been the great glory of Clerk Maxwell to establish. There was general agreement with him from members of the section when he remarked in conclusion that all was still extremely difficult.

Sir Oliver Lodge interposed at this stage of the debate to emphasise that the laws of electricity inside the electron must be different from those outside of it, otherwise the system would spontaneously explode. It was obvious, he said, that nothing in the nature of finality could be reached at that meeting, and he, therefore, invited those interested to come to a symposium to be held at his house to consider the matter.

After Professor Pringsheim had discussed the subject from the experimental standpoint and Dr. Bohr had spoken, Professor Love said that he was surprised at the acceptance of the theory of *quanta* when he considered the nature of the evidence on which it was based. It had been accepted largely, he thought, because of the close agreement between the experimental results and the calculations on which they were based, but it seemed to him that there must be hundreds of thousands of formulæ that would fit the fact as well as Planck's. He hoped that the ordinary laws of electro-dynamics had not got to be supplanted by any idea like the atomicity of energy. Lord Rayleigh said that they had been in pretty deep water that morning, and that if it were a case of likes and dislikes he should like to stick to the electro-magnetic theory and avoid these "jerks." Sir Joseph Larmor asked whether the new ideas could not be reconciled with the old, or must they be content that the old views should become obsolete. The debate at any rate had shown that the classical equation for radiation in the free state could stand. As regards what happened when electrons came into collision with atoms it was very different. He reminded the audience that it was Professor Lorentz who had first pointed out that Planck's formulæ involved the atomicity of energy.

PHOTO-TELEGRAPHY

In the article which Professor Korn contributed to the September number of THE WIRELESS WORLD on the transmission of photo telegraphs and drawings by wireless telegraphy, the imprints under two of the illustrations are apt to be misleading and to produce wrong ideas concerning the results of Professor Korn's invention. The three photographs reproduced in the magazine were specimens of transmission through ordinary wires, as was stated under two of them.

Fig. 3, which is a reproduction of the portrait of the aviator M. Brindejonc de Moulinais, was a transmission through an artificial conductor; Fig. 2, which represented Colonel Mangin, was sent through a telephone line.

In bringing this correction to our notice, Professor Korn asks us to mention that the quality of wireless results in photo-telegraphy cannot yet enter into competition with that of photo telegraphic transmission through ordinary wires.

Wireless Telegraphy in Trinidad

A description of the new Government Station which has been erected on this the most important of the West Indian Islands.

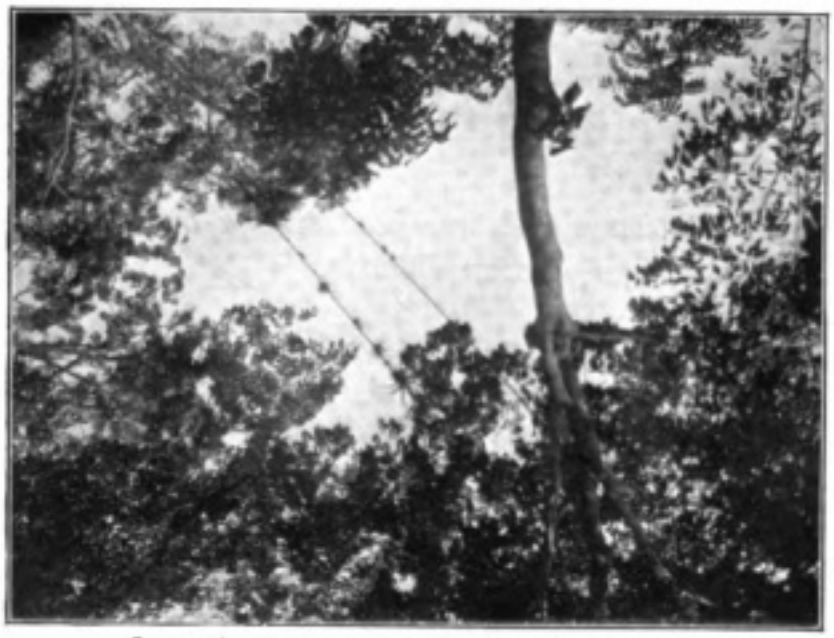
The first mast of the Trinidad Wireless Station ready for hoisting.

THE equipment of a new Government wireless station is in progress at Trinidad. It is to consist of a standard Marconi 5-kilowatt station, with a guaranteed daylight range of 350 nautical miles, but this, of course, will be greatly exceeded when the conditions are favourable, and at night time the wave-length can be estimated at from anything between 600 and 2,000 metres. This is not the first station to be erected at Trinidad, but the earlier one has for some time been inadequate for the growing importance of this, the chief island of the West Indies. It is not yet decided what will happen to the old station, but it will probably be retained for purposes of communication with Tobago, another island of the West Indian group, and Trinidad's most important possession—valuable by reason of its extensive cocoa and cocoa-nut estates. The new station is erected principally for the purpose of communication with ships at sea, but it will also be in touch with the wireless stations in British Guiana, with those in North America, and the Carribean Seas.

For a long time the necessity of such a station was recognised by all who had anything to do with the place, for Trinidad is becoming not only an important centre of commerce and shipping, but it is also an increasingly popular tourist resort. Many are the visitors that flock there during the months of December, January, and February, for the climate at that time of the year is warm and healthy without being unduly hot—the temperature never goes lower than 75 during the day, while the nights are cool and refreshing. In the summer, however, things are different, for from February the temperature increases, till in June it is almost tropical. Then comes the wet season, which lasts for nearly three months, and during this time the climatic conditions are hardly pleasant. Heavy showers are frequent, and these may last from five minutes to over an hour, when the rain comes down in perfect deluges, making the streets into floods and low-lying ground into swamps. As soon as the rain is over, the sun shines out in all its brilliance, with the result that the earth literally "steams," and then is the time for malaria and the evils of the tropics.

Another fact which lends importance to Trinidad is that it is the chief depot of the Royal Mail Steam Packet Company, whose vessels make this the first call on their route to South America. Besides this, it is the junction for all shipping to the West Indian Colonies, and goods and passengers destined for St. Lucia, St. Vincent or Guiana, must first make a land here.

The presence of oil in large quantities in Trinidad had been suspected for many years, but early in the twentieth century the Government undertook a geological survey which revealed the presence of several likely borings. Three companies were immediately formed to make experiments and the sites



Luxuriant vegetation destroying a cable.

to renew their contracts, while not a few settle themselves permanently in the island, but they never mix with the native race.

Trinidad was discovered by Columbus in 1496, and it remained a Spanish possession till 1797, although its former capital, San José de Oruna, was burned by Sir Walter Raleigh in 1595. It became a British possession after its capture by the British expedition from Martinique in 1797, and it was finally acknowledged as such in 1802 by the Treaty of Amiens.

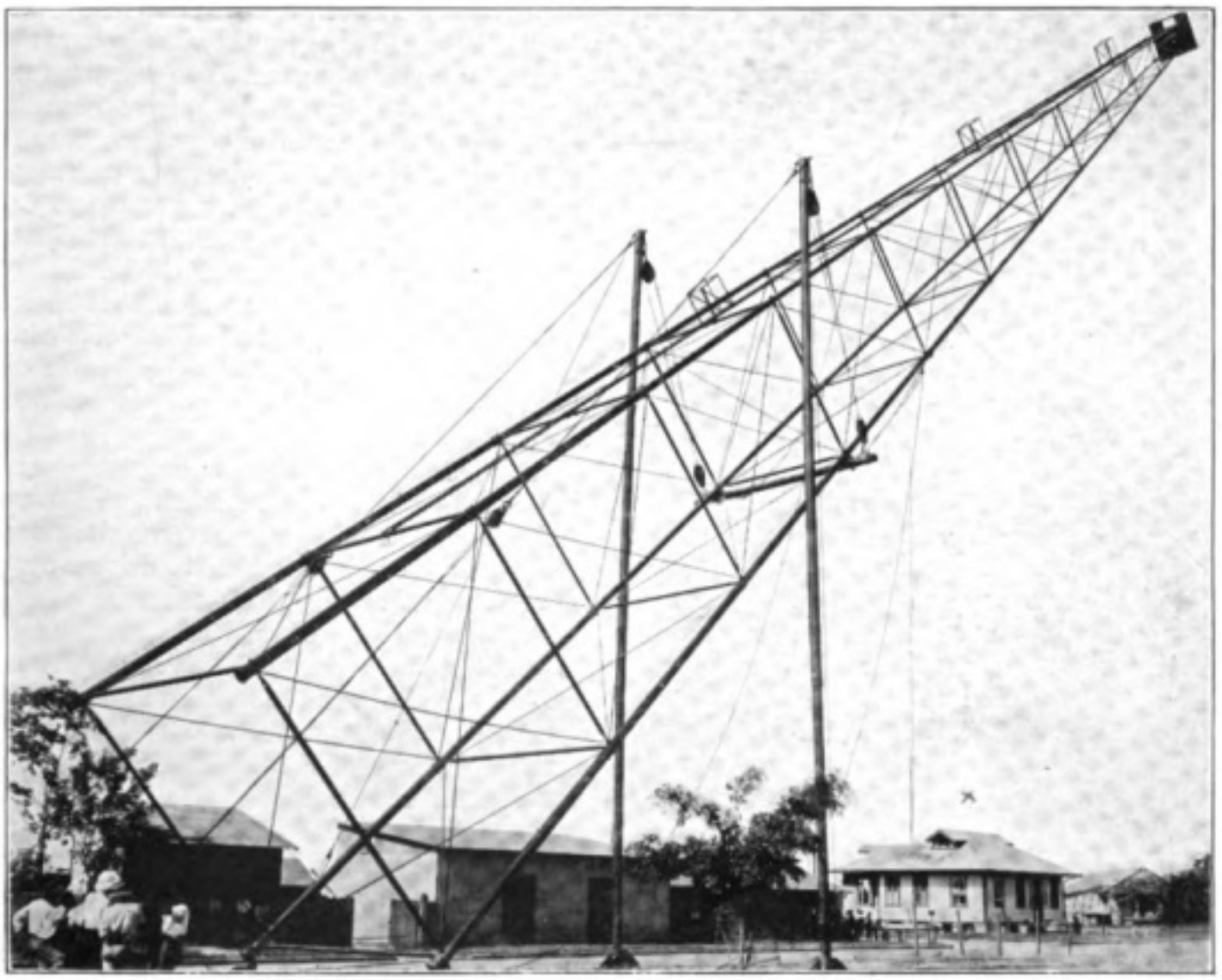
The island is remarkable for its natural beauty. To the north runs a range of high mountains,

The wonderful Asphalt Lake, Trinidad.

they have bought for their operations are situated at La Brae, Point Fortin and Guayagnayara, and the commercial exploitation of this commodity is being pushed rapidly forward. The success of Trinidad enterprise is due in a large measure to the excellent system of contract labour which is in vogue here. Under it as many as 100,000 coolies have been introduced almost exclusively from India. They are protected by vigilant inspection from all injustice, and are engaged on equitable terms for five years, then reshipped free of charge to their Indian homes. Many of them, however, often prefer

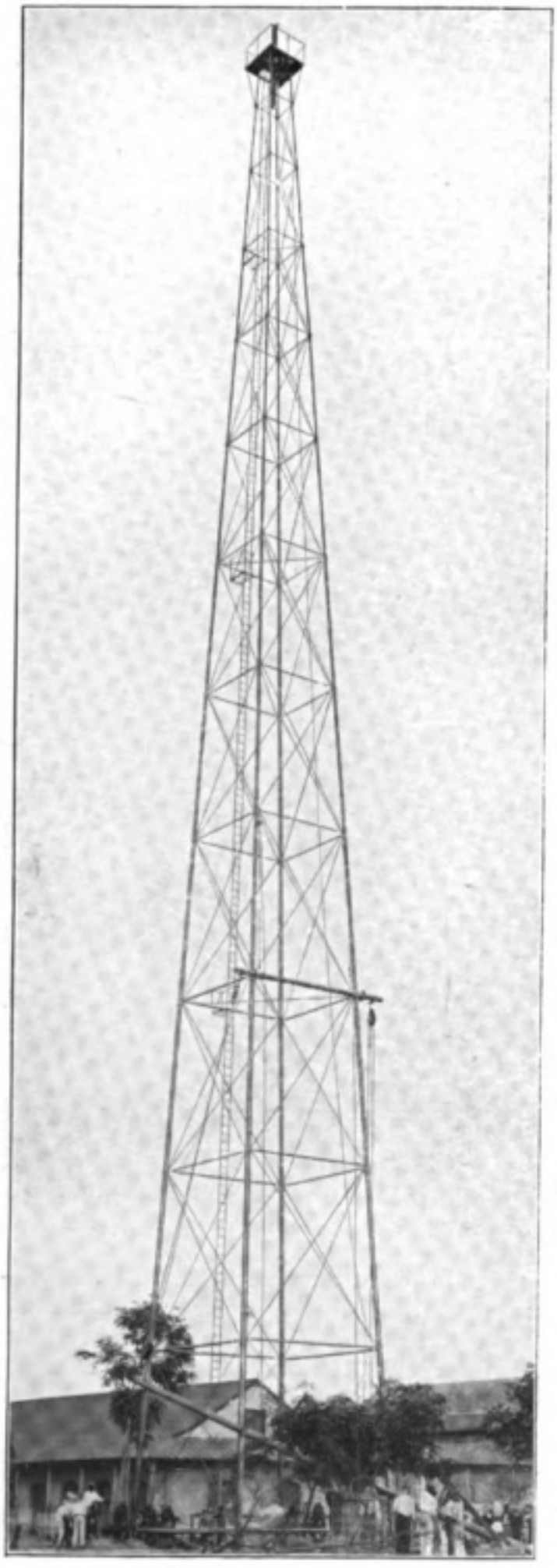
One of Trinadad's famous cocoa plantations.

clothed with tropical vegetation, and this borders a central plain which is very fertile, bearing abundant sugar, cocoa, and cocoanut crops. Here is a description of the island by a well-known traveller: "About half-an-hour's walk from the town brings one to the banks of a beautiful river in the forest. Silk-cotton trees with tall, stately stems rising to a height of 100 feet before the lowest branch is reached, tower above the throng of bread-fruit trees, mangoes, tamarinds, bamboo, coffee and cocoa trees. The ground is covered with all kinds of ferns, with palms, grasses, and innumerable species of undergrowth, whilst masses of creepers cover even the tallest trees, climbing the trunks and spreading over the branches, then falling in festoons to the ground. Through all this wealth of gigantic vegetation the river winds, now very little more than a brook, rippling over the stones with a cool and refreshing sound, but often rising some twenty feet in a few hours and becoming a roaring torrent. Sitting on a rock at the side of the water I gazed long upon the scene before me. Some coolies were bathing in a beautiful pool at the bend of the river, their bronze colouring making a fine contrast to the green of the forest behind them. Meanwhile dragonflies of all colours are whirling about in the air and skimming over the surface of the water. Gorgeous butterflies two or three times the size of any to be seen in England flutter past incessantly. Humming-birds hardly any larger than butterflies, with plumage of a brilliant emerald green, fly from branch to branch sucking the honey from the blossoms. Little fishes innumerable are darting about in the pools."



Hoisting the mast (which had previously been fitted together) by means of strong pulleys.

But the most striking natural feature of the place is the great pitch lake of La Brae. It is a source of revenue to the Government, who receive a royalty on all the asphalt exported therefrom. The lake



The mast in position.

itself is circular in shape, and about one mile across, with an approximate area of 100 acres. The centre is an almost liquid mass, bubbling and viscous, the latter increasing towards the edges, where the pitch is almost hard. The hot sun has the effect of somewhat softening the pitch, so that anything thrown on the surface readily makes an impression. This surface is very uneven, containing many small hills where the pitch has been forced up, allowing water to collect in the channels. After pitch has been removed from the lake to a depth of about a foot, the soft, viscous mass below rises to fill the hole, and again the surface hardens.

Attempts have been made to calculate the quantity of asphalt in the lake, but no definite statement can be made on the point, as there is no certainty as to the depth to which the pitch descends. Although the industry has been carried on for some years, there is but a slight alteration in the level of the lake.

The road to La Brae has been constructed on a bed of asphalt, and the latter has commenced to move very slowly away from the lake, much in the same way as a glacier slides down a mountain.

At present only the towers of the new Marconi station are completed. These are 200 ft. high and 550 ft. apart. The alternator for the wireless installation is driven by a direct-current motor which takes its supply from a battery of accumulators. The battery is charged by a dynamo driven by an oil engine. The towers, the wireless station, and the wireless plant and apparatus have been erected in Port of Spain, Trinidad, by the Director of Public Works, Mr. A. G. Bell. The contractors for the installation were Marconi's Wireless Telegraph Company. The supervision of the installation was carried out by Messrs. Preece, Cardew & Snell, consulting engineers, of Westminster.

The towers, as will be observed from the illustrations, are of tubular type, and an interesting fact in their erection is that the second of them was placed in position in the extremely short time of two hours. The peculiar construction of the towers, which were so planned that they could be put together horizontally before being raised to the vertical, alone made this feat possible. The actual hoisting of the tower into the vertical position was effected by means of two long tubular derricks and winches set on the permanent foundations.

Wireless Apparatus at Ghent

VISITORS to the Ghent Exhibition cannot fail to have noticed the stand of the Antwerp Telephone and Electrical Works in the Electrical Section, known as the "Palais des Lumières," which contains an interesting display of three Marconi stations, in addition to a fine display of telephone apparatus manufactured at the famous Antwerp works.

A complete 1½-kw. station is shown, together with emergency gear. It is with this type of apparatus that the majority of liners and large passenger vessels traversing the great ocean highways are equipped, and as the installation at Ghent is fitted up just as the standard equipment is fitted on board ship, it is attracting considerable attention. The only other stations shown are a ½-kw. landing station and a knapsack station.

Among the instruments arranged on tables about the stand are various measuring instruments, including the Marconi wavemeter and decremeter. There is also a crystal receiver and a wireless direction finder—an instrument which has added appreciably to the large debt which humanity owes to wireless telegraphy by promising still further to increase the safety of life at sea.

Marconi Apparatus at the Ghent Exhibition.

Much interesting literature is available on the stand for those who desire to learn something about the apparatus which is set out for inspection, and we can recommend, as a useful souvenir of a visit, a copy of THE WIRELESS WORLD or the YEAR-BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, 1913.

Progress of American Marconi Stations

The programme provides for long distance stations in the vicinity of New York to communicate direct with Europe and with South America. Other stations will give communication with the East from San Francisco. The programme is well on the way towards completion.

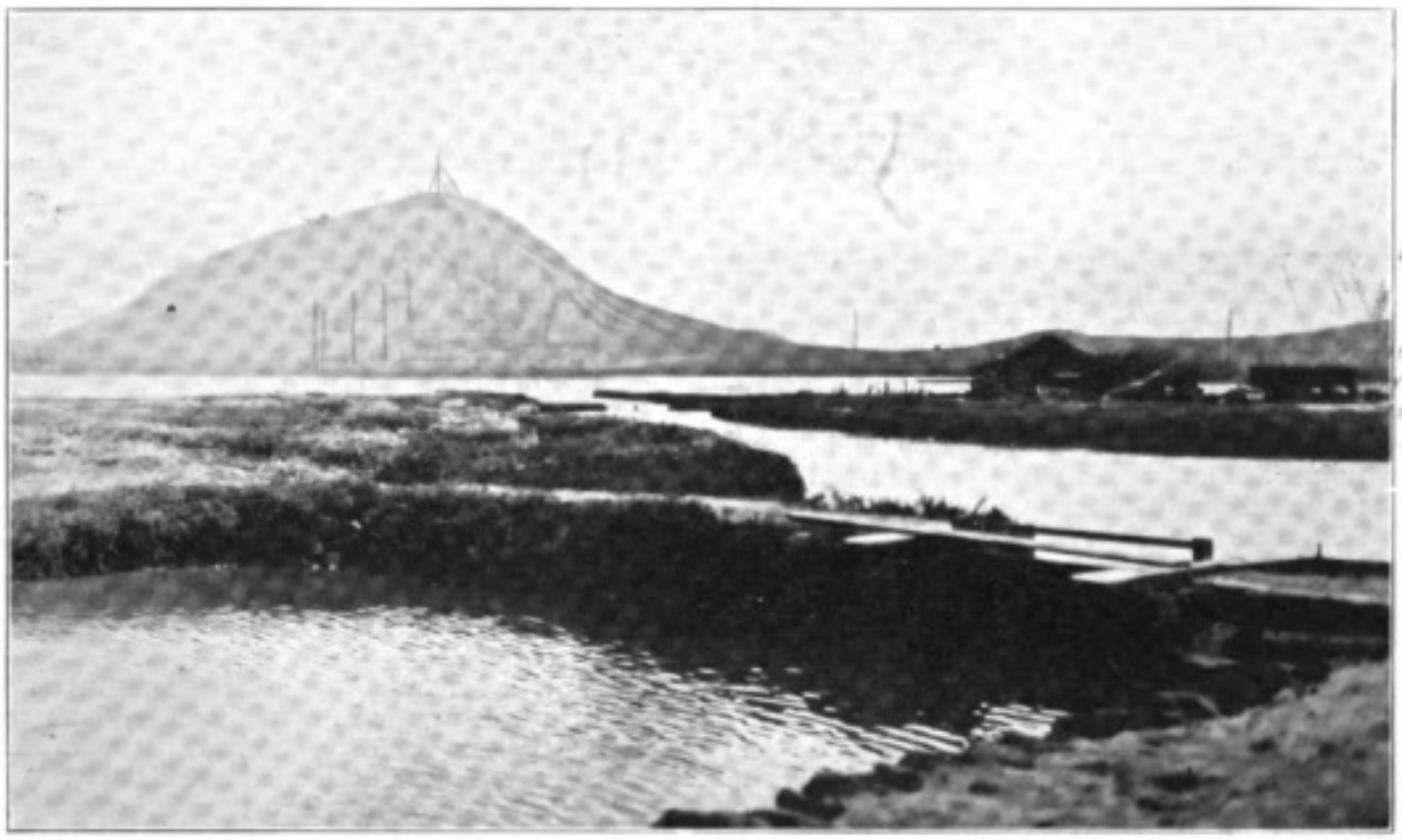
TWELVE months ago we published in the *Marconigraph* (October, 1912) particulars of an important scheme for the construction of high-power stations which the American Marconi Company had adopted. This scheme comprised stations for bringing Great Britain and the United States into more direct communication by means of wireless telegraphy, as well as stations for an American-Eastern circuit which is destined eventually to reach the Philippines and Japan. The work of erection at many of the stations is now well on the way towards completion, and before very long we should witness the fulfilment of one of the most remarkable undertakings in the history of telegraphic communication.

The station intended for the trans-Atlantic service will be near New York City, at Belmar, N.J. The Hawaiian station will be one of the most powerful of the group of stations which the American Marconi Company have in hand, and it will be capable of working with San Francisco and the Philippine Islands. The Hawaiian station stands on a broad stretch of land which slopes down towards the sea from the south-western base of the Koko crater (Oahu), and its location gains importance from the fact that it will serve as a relay for the transmission of messages from the Pacific coast to the Orient. The station will be duplex, that at Koko Head being used for receiving, and at Kahuku, 50 miles distant, being used for transmitting. At Koko Head five masts each 320 feet high and 1,000 feet apart in a straight line, are being erected for carrying the San Francisco aerial; 6 other masts each 450 feet high and 1,000 feet apart are being erected for carrying the Yokohama aerial. The transmitting station at Kahuku will have three steam-driven generators, each of 500 horse-power, one for working to the Pacific Coast stations, one for working with Japan, and a third for emergency use. The

San Francisco Transmitting Station.

latter may be used for working either way, both to the coast and to the Orient, and will be installed in such a manner that in case of a breakdown of the power apparatus the spare set may be quickly substituted, and thus prevent any delay in the handling of the traffic.

For working to San Francisco 32 aerials each about a mile in length will be supported 300 feet above the ground by means of a double row of masts, of which there will be 12 in all. A similar arrangement of aerials of somewhat greater length supported by 14 masts, each 450 feet high, will be used for working with Japan. The completion of the Marconi station on the Hawaiian Islands will mark the beginning of a new era in wireless communication between the Islands and the outside world. While situated in the middle of the Pacific Ocean, isolated as it was from the rest of the world except for a single cable and a wireless station which works only with ships, Hawaii will be able to throw off this isolation with the coming of the Marconi system, getting into more complete touch with the rest of the world and drawn into closer relations with the country of which it is a territory.



Koko Crater, from the West Side of Kaupes Pond.

The American Marconi Company have also in hand the erection of a station at Ketchikan and another at Juneau, which will be in direct communication with Seattle. Mr. J. R. Irwin, Superintendent of the northern division of the Marconi Wireless Telegraph Company of America, left recently for the purpose of selecting the sites. The Ketchikan station will be erected at Charcoal Point about two miles from the city, and will have a 2-kilowatt plant. The early completion of this station will be of considerable importance to shippers who are interested in the North Country.

Direct wireless communication between America and Asia now is an accomplished fact, the United States army signal corps station here having opened nightly communication on July 20th with the Russian station at Anadyr, Siberia, 500 miles west of Nome.

The Progress of Wireless Telegraphy

OUTLINED BY MR. MARCONI

At the Annual Meeting of

MARCONI'S WIRELESS TELEGRAPH CO., LTD.

"WHEN I had the pleasure of presiding at the meeting last year, I was able then to congratulate you upon the substantial development of the Company's business for the preceding year, and to inform you that I anticipated that the business of the year 1912 would show further increase, a prophecy which was fully justified and which I am sure you will agree has been substantially realised."

With these words, Mr. Marconi opened his address to the shareholders of Marconi's Wireless Telegraph Co., Ltd., at their annual meeting on August 22nd. He thought it desirable to dissipate some erroneous impressions respecting the sale of shares, and emphasised the fact that the Company did not buy and sell shares in the ordinary sense of words.

Such share transactions as were entered into were closely allied; in fact, it would be difficult to separate many of them from business which would come under the heading of contracts. To give an example: speaking in a general way, the Company might enter into an agreement to erect certain stations or do certain work, all of which, of course, was the legitimate business for which it might not be convenient at the time to pay the Company in cash. In such cases they might receive payment in shares. In due course they would dispose of a number of these shares and turn them into cash. The fact, however, was that the money which had been received for those shares was a payment for contracts executed, services rendered, or whatever the particular consideration may have been.

During the past year, as was well known, and was stated in the directors' report, the Company had benefited in this way, and accordingly they thought it prudent to take advantage of the occasion and allocate £100,000 to a General Reserve Account.

The Imperial Scheme.

Turning to the Imperial Wireless Scheme, Mr. Marconi said that when he addressed the shareholders last he little thought that they were on the eve of a campaign of a nature which he thought had never before been experienced by any private enterprise. He then added:

"I would remind you that wireless telegraphy has become an industry of considerable importance, and we are, and for many years have been, the only British company maintaining British supremacy throughout the world in this industry, and always in the keenest competition with foreign companies.

"We manufacture on a very large scale in this country, and give employment to an immense number of British workmen.

"I think that it should not be so easily forgotten that, while this Company is carrying on a remunerative business for its shareholders and establishing a large British industry, it is also accomplishing work of the highest importance for civilisation by facilitating and cheapening telegraphic communication between England, its Colonies, and foreign nations, besides greatly reducing the peril of ships at sea. Has it been our fault and have we been deserving of the treatment to which we have been submitted because we have been the only company to maintain British supremacy in this wireless industry?

"It has required the most strenuous efforts on the part of our managers and administrators to protect our interests abroad during all this period, and I am glad to say that we have succeeded in doing so. But it must not be supposed that much of the programme which we had in immediate contemplation when we addressed you last year has not suffered some delay. Our accounts speak of the progress which we have made, but that progress would have been far greater to-day had it not been for the circumstances to which I have just referred.

"When our tender for the construction of the Imperial stations was accepted in March last year, we considered, as we had every right to do, that we had entered into a definite contract requiring only such minor modifications, if any, that we might be willing to agree to in the actual wording of the agreement itself and to the formalities of ratification by Parliament. I used the word 'formalities,' for I cannot learn of any instance when a contract has been negotiated by a number of Government Departments, all of which were in continuous consultation, each putting forward proposals and suggestions and doing its utmost to obtain everything it thought it could reasonably demand and support, and finally, all being parties to the striking of a definite bargain. I cannot learn of an instance where Parliament has ever before had recourse to the sledge-hammer power which it possesses of placing a private enterprise in such a position that its only alternative to

making further concessions demanded of it would be the imperilling of its reputation and business throughout the world.

"Such has been the anxious and responsible position which your directors have had to face, and it is therefore with no small degree of relief and satisfaction that we have been able to inform you that, notwithstanding Parliamentary intervention, we do not believe that the altered conditions of the contract will prove of any material disadvantage to the Company, but thanks only to the strong position which our Company holds.

"We have also great hopes that the Company, having emerged successfully from such a severe and ruthless attack, its reputation abroad will have been not only maintained but enhanced."

Important Brazilian Concession.

Turning to the operations of the Company in different parts of the world, Mr. Marconi said:

"Our business generally continues to make most satisfactory progress, and I have the greatest satisfaction in being able to inform you that since the issue of our report we have received a cable from our representative in Brazil informing us that a concession to which we attach the greatest importance has been signed by the President. Ever since the commencement of 1910, when our negotiations were opened, we have devoted ourselves assiduously to securing the means of opening up telegraph communication between Rio de Janeiro and other busy commercial centres of the great Brazilian Republic and Europe. There is no telegraphic service to which we attach greater importance, and you will be pleased to learn that we have obtained this concession for a period of fifty years.

"At the earliest possible moment we shall form a new Brazilian company which will purchase from us our long-distance rights together with this concession, and every effort will be made to construct the stations with the least possible delay. The new company will no doubt enter into an agreement with the American Company by which the station to be built at Para will conduct a service with New York and other parts of the United States. We hope that this work will be the start of a new network of stations opening up cheaper telegraphic communication between the South American States, Europe, the United States, and other parts of the world, which should not only secure to this Company a substantial, increasing and lasting revenue, but add considerably in value both to our interests in the American and other of our subsidiary companies. We regard the completion of these negotiations as the laying of the foundation stone of one of the most important edifices in the world of wireless telegraphy, which will further cement the business which the Company is creating independently of any competition and irrespective of any patent rights."

Progress of Subsidiary Companies.

The steady progress of the several subsidiary companies was most satisfactory, and each year was nearer to the time when, with the completion of long-distance stations either under construction or about to be constructed, the Company would realise the principal source of profit, and the one to which they attached most importance, to be derived from wireless telegraphy.

In this connection, Mr. Marconi added, shareholders would be pleased to learn that the construction of the long-distance Norwegian station had been commenced, and the consideration and wholehearted assistance which the Company were receiving from the Norwegian Government and the officials in its employ would not only enable them to complete the work within the shortest period possible, but added zeal and a pleasure to all those who were employed in carrying it out.

The report issued recently of the Marconi International Marine Communication Co., Ltd., had placed shareholders in the position of having all information in respect of the progress of that company. The works were supplying this Company with installations as quickly as they could turn them out, and it was no easy matter for them to keep pace with the demand. The continuous increase of business necessitated the issue of a further portion of the authorised capital of that company. The shares to which the Wireless Company was entitled were issued to the shareholders at the price of 5s. premium and were well applied for. The business of the company was sound and continuously increasing, and Mr. Marconi said he had every hope that the dividend for 1913 would show an increase over the 10 per cent. paid for the preceding year. He had reason to believe that the directors of that company intend in the future to pay six-monthly dividends, an interim at the end of the year, and a final upon completion of the accounts.

The Russian Company was also making most satisfactory progress, and its business had far outgrown its capital. A resolution had been passed authorising the increase of the capital, but under the terms of Russian Company Law, Government consent has first to be obtained. The necessary authority had now been given to the extent of 600,000 roubles, and further authority was asked for a like sum. The shares of the Company being 100 roubles, the directors had in contemplation arrangements under which the shares would be available for conversion into £1 shares in a Trust Company in order to have a market value for them in this country.

A new subsidiary company had been formed in Australia. During the year a very large business had been done with the Italian Government, and the Company continued to enjoy their full support and confidence.

Other important negotiations were pending.

A new company was about to be registered under the style of "The Betulander Automatic Telephone Company, Limited," which would purchase from the Marconi Company the patent rights and take over the contracts and negotiations which had already been entered into in numerous countries respecting automatic telephones.

The magazine entitled the *Marconigraph*, with which most shareholders were familiar, having developed into a really important publication, its title had been changed to that of THE WIRELESS WORLD, and it had a circulation of about 20,000 copies per month.

The Publicity Department had also produced during this year the first YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, a publication which had met with considerable success and would be an annual production.

Electric Waves.

Although, said Mr. Marconi, there was no doubt that Wireless Telegraphy was in a condition of rapid development, he thought that it could safely be said that this method of communication was based, and would continue to be based, on the production and utilisation of electric waves.

Continuing, he said:

"There seems to be a prevalent misconception in the lay mind that continuous waves are in some way essentially different from the discontinuous waves produced by what are called spark systems. Such a view is quite erroneous. The Marconi Company possesses methods of its own which permit it to utilise where and when it thinks desirable either a spark system or a continuous wave system, and this was demonstrated to the members of the Advisory Committee appointed by the Government during the tests carried out for them between Clifden and Glace Bay.

"My system of continuous waves is now installed and in working order at the Transatlantic Station at Clifden.

"Important tests are now being conducted, but considerable work and time are required before it will be possible to determine in a definite manner whether the continuous wave system possesses advantages for long-distance transmission over the discontinuous, or which is called the spark system.

"In any event, I think it well to make it quite clear that the Company possesses efficient method for utilising either system.

"As in the past, we have this year applied for several, and what I believe to be valuable, patents which embrace further important improvements in the transmitting and receiving apparatus.

"I should like, without in any way desiring to belittle the attempts made by others to establish communication by means of wireless telegraphy across the Atlantic, to point out to shareholders that the achievement of telegraphing across the Atlantic is not such an easy matter as it may appear, and I think that the public and even distinguished inventors have erred on the side of optimism with regard to what they expected would shortly be done.

Unfulfilled Promises.

"During the last few months we have read in the public Press that communication was shortly to be established between Europe and America by means of the Poulsen or Goldschmidt system. I should like to remind you that Prof. Fessenden, writing in the *Electrician* issue of February 22nd, 1907, said that in January, 1906—that is well over seven years from this date—he received messages in Scotland from Massachusetts with an expenditure of less than 1 kilowatt of electrical energy. Again, Dr. Poulsen, in the *Electrician* of November 15th, 1907, nearly six years ago, said: 'The engineers of the company are very confident that they will succeed in printing transatlantic messages, and are positive that they will not be limited to telephonic reception.' Then again, with regard to the De Forest system, we have the following extract from the *Electrical Review* of April 6th, 1906—seven years ago: 'The daily Press announces that the De Forest Wireless Telegraph Company has sent messages from its station at Coney Island to Ireland, a distance of 3,200 miles. On one night 1,000 words were transmitted, of which 572 were received and recorded.' It is further added that 'when the correct pitch to use for Ireland has been ascertained, commercial work will be started across the Atlantic. It is then proposed to send messages from San Francisco to Ireland, with two relay stations.' None of these systems I have just mentioned has yet succeeded in establishing a service of any kind across the Atlantic, notwithstanding these statements which were made six or seven years ago."

The Dividend.

Mr. Marconi said there was no doubt some little disappointment at the Company not declaring a second interim dividend in December last, and also that they should have decided to recommend a final dividend for last year of 10 per cent. on both classes of shares, which represented 17 per cent. for the Preference and 20 per cent. upon the Ordinary. The unforeseen circumstances, however, which occurred since his last address had dictated a policy of prudence with which he felt sure shareholders would not quarrel.

In such a new industry developments were continuous and led frequently to sudden and substantial demands upon resources, and they had thought it wise, therefore, not only to carry to Reserve the sum of £100,000, but also to carry forward to next Account £146,000.

He hoped that circumstances such as had prevailed this year would not recur, and they should therefore be able in the future to hold their General Meeting a month or two earlier than they had been able to do on the present occasion.

At the end of each year they should be in a position to estimate approximately the profit earned during the year, and so decide upon any interim dividend which should be declared and paid at that period. By adopting this course, assuming their business continued to progress as they hope, distributions would take place six-monthly. Concluding, Mr. Marconi said:

"Your managing director, Mr. Godfrey Isaacs, has been subjected to a great number of most ungenerous insinuations—(hear, hear)—which never could have been made by anyone personally acquainted with him, and which could not be and are not believed by anyone who knows him or who has worked with him. (Hear, hear.)

"But it would appear in this country, as in most others, when politics are introduced an atmosphere prevails in which there would seem to be let loose some pernicious element destructive of the equilibrium of an otherwise well-balanced mind. (Laughter and applause.)

"I think Mr. Isaacs merits the most sincere congratulations of the shareholders on having carried on the business so successfully during the past year under the great difficulties which I have referred to, and considering what a great amount of time was taken up in defending the interests of the Company and even in protecting his own honour and reputation, all of which he has done so effectively. (Hear, hear.)

"Mr. Samuel, H.M. Postmaster-General, speaking in the House of Commons, stated: 'I could wish no worse fate for any of my critics than that in the next world they should be condemned to conduct in perpetuity negotiations of this character under these circumstances.' (Laughter.) I can truthfully state that I am sure that Mr. Isaacs on his part could express identical feelings.

"I now wish to move: 'That the Report of the Directors, submitted together with the annexed statement of Accounts at December 31st, 1912, duly audited, be received, approved and adopted.'"

The Past Year.

Mr. Godfrey C. Isaacs (Managing Director), who on rising to second the resolution was received with applause, said:

"It would be idle for me for a moment to pretend to you that the troubles which we have gone through during the past year have not been of an extremely painful nature to me. (Hear, hear.) You are perfectly well aware that all manner of suggestions and insinuations of the most sinister nature have been levelled at me, and it has required all the assistance, the support, the confidence, the loyalty, and the encouragement which I have received, firstly from our illustrious chairman, secondly from every single member of my Board, thirdly from every manager and head of department throughout the whole of this great Marconi organisation, and fourthly, and to which I attach no small degree of satisfaction, the immense number of letters which I have received from shareholders not only throughout this country, but I think I may say throughout the whole world, in which they have expressed their deep sympathy and their absolute confidence. Under those circumstances, and largely due to those circumstances, one has been able to face a condition of things which became well-nigh otherwise intolerable. But, ladies and gentlemen, we have had during this past year a trouble far more serious, and which occasioned me and many of us much greater anxiety than that to which I have just alluded. I refer to the most unfortunate accident which befel our Chairman. I am quite sure that everybody who has known him, or who has heard of him—and in saying that I think I might say almost every living soul throughout the world—sympathised with him and were as anxious as we were to hear of his progress. It is with a very considerable degree of satisfaction that we are thankful to-day that our Chairman has returned to us I might say certainly not the worse for his accident, and in so far as I am able to gauge, and as far as I thoroughly believe, with even greater inspiration than was his before."

Wireless Telephony.

During the last six or eight months, said Mr. Isaacs, he (Mr. Marconi) had taken out a very large number of very important patents—patents which he felt sure were going to play a part at least as important, if perhaps even not more important, than the patents which he had taken out in the past. They would no doubt see further important developments in the industry in which they were engaged, and in which they looked to him to continue to pioneer, and he was quite confident that so long as Mr. Marconi was with them, they, the Marconi Company, would continue to pioneer that great science of which he was the inventor.

Mr. Isaacs added:

"We all know that through Mr. Marconi's genius when we go to sea we are able to receive telegrams with our morning cup of tea from those whom we have left behind. I am not very fond of prophesying, but I am going to venture on this occasion to prophesy that the date is not far distant when with our cup of tea in the morning we may hear the ring of the bell, and, taking our telephone from its hook, we may talk to those whom we have left behind; we may tell what sort of night we have passed, and learn what sort of a night they have passed, and be able to speak of the disposition we may feel towards our coming breakfast. (Laughter.) The Marconi Company has not made it a habit—and I think in that they have perhaps been influenced by the modesty which we have all learned so much to love of our Chairman—to boast at any time of the work it was doing or contemplated doing. I suppose you have all read, as I have frequently read, paragraphs in the papers speaking of the wonderful things which were being done by those whose names perhaps most of you do not know in connection with wireless telephony. Well, all I want to tell you is that whatever you have read in the papers as having been done by wireless telephony, the Marconi Company has done more. But until the Marconi Company is prepared to say exactly what definite results in a practical way can be obtained from wireless telephony it will remain silent. We shall perhaps at an early date be able to turn wireless telephony to practical commercial account, and it will then be time enough to speak."

Some of our shareholders, he said, had perhaps been a little disappointed in connection with the progress, which was slower than they would hav liked, of one or two associated companies, but he would ask them to remember that in an industry of this nature a little time was required in any country for the development of that industry and turn it to profitable commercial account. There were innumerable difficulties to be surmounted, particularly when it was remembered that for the most part one had to negotiate with governments abroad. Mr. Isaacs expressed the thanks of the Company to the managers and heads of departments, and the whole of the staff, and to their different representatives and agents abroad, who had given during the past year the greatest possible assistance in very trying times. The pension scheme was on the eve of completion, and the company were providing a sufficiently substantial sum

towards that pension scheme to warrant the directors not asking the shareholders to authorise something in addition in the shape of a bonus.

The Future of the Company.

In conclusion, Mr. Isaacs said :

"I do not think there remains anything further for me to say to you at this moment other than, perhaps, to repeat what our Chairman has told you, namely, that our business continues to progress in a very satisfactory way, and that our principal attention is directed to the creation of what we believe will be the most profitable side of wireless telegraphy in the shape of constructing and conducting long-distance telegraph services throughout the world. I think that every month we are coming nearer to realising that end. In the course of a little time, when many of the stations which are now under construction, and in a little time more when many of the stations which are about to be constructed are completed, you will realise that we have created a sound, substantial and profitable business which will be entirely independent of whether or not others are able to introduce something which Mr. Marconi has not previously thought of in connection with wireless telegraphy. It now only remains for me to second the resolution submitted by the Chairman."

Few questions were asked, after which the resolution was put to the meeting and carried unanimously.

The Chairman : I now move : "That a final dividend for the year ending December 31st, 1912, of 10 per centum on the 250,000 Cumulative Participating Preference shares be paid on October 1st, 1913, to the members who are on the register as present holders thereof." Also, "That a final dividend for the year ending December 31st, 1912, of 10 per centum on the Ordinary shares be paid on October 1st, 1913, to the members who are on the register as present holders thereof."

Capt. H. Riall Sankey : I beg to second both resolutions.

The resolutions were carried unanimously.

Mr. Isaacs : I have pleasure in moving : "That the retiring Directors, Commendatore Guglielmo Marconi, Mr. Alfonso Marconi, and Capt. H. Riall Sankey be re-elected Directors of the Company.

Mr. H. S. Saunders seconded the resolution, which was carried unanimously.

The Chairman : I have now to declare formally : "That an interim dividend in respect of the year 1913, of 7 per centum on the 250,000 Cumulative Participating Preference shares, will be paid on October 1st, 1913 to the members who are on the register as present holders thereof."

Mr. Mooney : Mr. Chairman, will you permit me to perform what is a very pleasant duty ? I have never been at a meeting where there was less dissension amongst the shareholders as to the management of the business, and I beg to propose that the thanks of the shareholders of the Company are due and are hereby given to the Board of Directors for their extremely capable management of the affairs of the Company. I think that I am particularly qualified to propose that. For many years I have been the friend of Mr. Marconi—I hope he will allow me to call him such—being almost one of the first to join the Company, and I have seen Mr. Marconi working in it for fully sixteen years. During that time he has worked in season and out of season, day and night, in the interests of the Company, for the completion, so far as it has been completed, of the success of the Company up to the present time. No man could have given more work or more knowledge, for not only is Mr. Marconi a great scientist, but, when it came to a question of managing the business for an interim he took upon himself the position of Managing Director, and proved himself a very fine business man. I have not known Mr. Isaacs quite so long as the Chairman, but we can all judge from the present position of the Company what work he has done in conjunction with Mr. Marconi. I should like to say a great deal if time permitted about the other members of the Board, some of whom sat on it with me in years past. At any rate, I can tell you that they have had to work harder in the years past than they have to now, I am pleased to say, the Company being now in quieter waters so far as the question of being overtaken by a competitor is concerned. Then I should like to say a lot about our worthy Secretary, whom I have known for many years. I should also like to speak about the various members of the staff, who I know are loyal, earnest, hard-working, and capable. I have the greatest possible pleasure in proposing this resolution.

This was carried unanimously, and a brief response by the Chairman terminated the proceedings.

Wireless Telegraphy in Argentina.

Some interesting particulars of the progress in connection with the establishment of a high-power station in Argentina are given in the report of the directors of the Compania Marconi de Telegrafia sin Hilos del Rio de la Plata (Argentine Marconi Company) for the year ending May 31st, 1913, which was presented at the annual meeting of the Company held on August 29th. The station is intended to maintain direct communication with a similar station to be constructed in England, a distance of about 6,000 miles. Direct communication will be maintained with Europe at all hours of the day and night without interruption. Sites have been acquired in the vicinity of Punta Piedras, where both the transmitting and receiving stations will be erected. Arrangements have been made with the Buenos Aires and Great Southern Railway for the construction of a branch line which is to connect the main line with the station. During the past financial year the directors, in conformity with Article 13 of the Statutes, appointed Mr. Florence O'Driscoll, Mr. Carlos Pereira Pinto and Dr. Julio Puyrredon to fill vacancies on the board of directors.

Share Market.

LONDON, *September 22nd*, 1913.

The market in the various Marconi issues has been fairly active during the past month, and a very considerable investment business has been done.

The present prices show little change since we last went to press—Ordinary $4\frac{1}{8}$, Preference $3\frac{7}{16}$, Canadian 12/-, Spanish $\frac{9}{16}$, American $1\frac{1}{8}$.

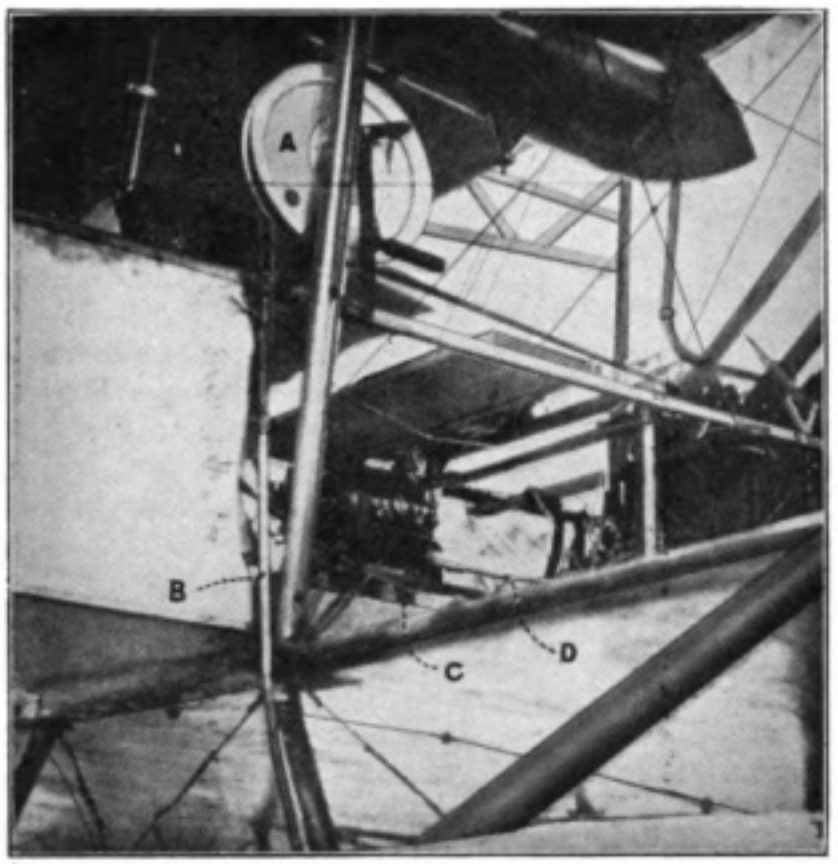
Wireless and Aircraft

THE one gleam of hope arising from the sad airship tragedy in the North Sea, which occurred on the night of September 9th, is the demonstration that wireless telegraphy is destined to become an important factor of safety in connection with aircraft. The victim of that tragedy was the German naval airship LI., which was destroyed with a loss of 14 men, eighteen miles to the north of Heligoland. The vessel, which was in charge of Captain Hanne, was caught in a storm of considerable violence that set in without warning, and she was hurled to the surface of the sea and wrecked; she sank an hour later.

In the gangways of this airship was built a room for wireless telegraphy, and, according to accounts appearing in the Press, the airship was in wireless communication with Heligoland and with the torpedo-boat flotilla. Further, it seems certain that when the storm grew threatening, Captain Hanne sent out messages for assistance. Unfortunately this assistance arrived too late to rescue all the officers and members of the crew of the ill-fated vessel, but that the wireless service enabled the airship to get into touch with land and with other vessels is a sufficiently convincing proof of its usefulness.

A good deal of work has been done in the direction of applying wireless telegraphy to aircraft, which has demonstrated in so unmistakable a manner its potentialities as a life-saving medium. But wireless has already been found useful on airships for checking chronometers and finding the position of the ship by the three-point problem of surveying.

The applications of this remarkable agency are now so widespread that much progress has been made in directions which in the ordinary way receive but little recognition, and its application to aircraft one of them. The advantage of being able to communicate with land or other stations whilst in the air has been exemplified on many occasions, notably in the case of the now almost forgotten Wellman flight, when an unsuccessful attempt was made to cross the Atlantic some years ago. The tragedy of the North Sea is another instance of what wireless telegraphy is capable of, although it must be remembered that it has other useful functions to perform which are essential to the safety and proper navigation of aircraft. This point was emphasised by Col. J. D. Fullerton in a paper which he read before the Royal United Service institution, dealing with aeronautical progress, and in which he referred to the usefulness of wireless telegraphy on board airships for checking chronometers and finding the position of the ship by the three-point problem of surveying.



General View of Aircraft Station ready for service, as employed on a Zeppelin Airship. (a) Aerial drum; (b) Insulating tube for Antenna; (c) Alternating current generator; (d) Flexible shaft.

NOTES OF THE MONTH

WIRELESS TELEGRAPHY IN THE TROPICS. THE ADEN-BERBERA SERVICE. WIRELESS SCHEME TO LINK FRANCE WITH THE FRENCH COLONIES. THE METEOROLOGICAL OFFICE REPORT. IMPERIAL UNITY. WIRELESS AND EXPLORATION.

IF the full details of the recent events in Somaliland were known, they would probably indicate that wireless telegraphy had been of some assistance, if only in the direction of allaying the fears of the people of Berbera by summoning reinforcements from Aden. Two medium-power stations have been completed at these points, and these formed the subject of an article in the April number of THE WIRELESS WORLD. The annual report of the Somaliland Protectorate, which was issued during the past month, gives some further particulars of the Aden-Berbera wireless service, which was satisfactorily maintained throughout the year without breakdown. According to the report, the apparatus and machinery are standing the strain of the tropical temperature and atmosphere remarkably well, depreciation being at a very low rate. Mr. Archer, the Acting Commissioner, points out, however, that electrical plant and instruments are subjected to very considerable strain, owing to the general high temperature and the quantity of fine sand which penetrates and collects almost everywhere during the Kharif season. It has, therefore, been decided to duplicate, at both Berbera and Aden, all apparatus in which the liability to serious breakdown exists.

* * *

In May the Berbera radio-apparatus and machinery were transferred to a new stone building erected as a radio-station. Great advantages have been derived from the transfer, which was effected without any prolonged interruption in the service. Arrangements have been made to install rotary disc high-frequency dischargers capable of producing a musical signal of a note equivalent to 600 vibrations per second. This is expected to overcome very considerably the difficulty experienced when communicating during the times when atmospheric or static electric charge effects prevail.

At the Aden station a twenty-four hours' service is maintained, while at Berbera, in addition to the day service, the station opens at 8 p.m., to establish communication with any ship within night range.

* * *

All ships fitted with wireless apparatus and passing to and from Europe and the East establish communication with both Aden and Berbera, and maintain "touch" for varying periods from twenty-four hours upwards. The number of communications established with each station during the year 1912–1913 was 897. During the year under review there has been a slight falling off in the number of messages received, namely, 3,215, as against 3,287 of the previous year. The service is considerably used by warships, captains of liners, and shipping agents, besides the travelling public. Arrangements have been made to install a small wireless station at Bulhar to replace the land line to Berbera, which has been a continual source of trouble throughout the year, and has proved unsuitable. The station when completed should have no difficulty in communicating with the wireless station at Berbera under the worst atmospheric conditions. It is expected that a considerable saving in upkeep and a more efficient service will be the result of the change. It is not intended that the Bulhar wireless station should communicate with ships, and therefore a short and a little used wave-length has been selected. However, the station will, during working hours, be prepared to receive distress signals and to communicate with any ship requiring assistance.

* * *

The Budget Commission of the Chamber of Deputies have framed a Bill proposing the establishment of a wireless telegraphy system between France and the French Colonies at an estimated cost of £631,800. The Bill provides for the erection of a station in the South of

France which will communicate with chains of stations extending to the Far East, Africa, and South America, and to the Pacific. The stations in the Eastern chain comprise: Tunis, Djibouti, Pondichéry, Saigon, and Madagascar. In the African and South American chains it is proposed to erect stations in: Morocco, St. Louis, Tombouctou, and Bangui. The Pacific chain will comprise the following stations: Morocco, St. Louis, Martinique, Tahiti, Marquises, Nauméa, and Saigon. A station will also be erected in the East of France to communicate with North America.

* * *

The annual report of the Meteorological Committee published during the past month contains much that is interesting, but that which will, in all probability, attract the greatest attention is the reference to the part played by wireless telegraphy in modern weather forecasting. It is pointed out that during the twelve months ending with March, 1913, 5,385 wireless reports were received from Atlantic liners. The numbers in the several months ranged from 500 in September to 377 in February. The number of messages is greater by nearly 450 than the corresponding figure for the twelve months ending with March, 1912. During the year, 81 wireless telegrams were received from the ships of His Majesty's Navy. The arrangements for the receipt of wireless messages from H.M. ships have been revised. In order to avoid the unnecessary dispatch of reports by ships in close proximity to the telegraphic reporting stations on the coast, arrangements have been made to restrict the reports to ships south of latitude 48°. These reports are often of great value, as they are generally received from the Bay of Biscay, and the office does not receive reports from ships of the mercantile marine crossing the Bay. The value of these was distinctly proved by their effect upon the forecasts, for most satisfactory results have been achieved. There can be no doubt that weather forecasts are now more accurate than was formerly the case, and the figures given above should enable the public to realise that wireless telegraphy is an important factor in the improvement.

* * *

When so much has been done by modern science to make straight the path of Imperial unity and progress it appears almost impossible to conceive of a closer relationship due to increased facilities of intercourse. Yet even in this branch of Imperial service, where the maximum of achievement seems so nearly attained, another record has been made in inter-colonial communication. Of course it was effected by means of wireless, and the feat was something for those who accomplished it to be proud of, for they maintained communication over a distance of more than 10,000 miles during the week ending September 13th. By the medium of the flagship *Australia*, travelling from Durban to Albany, a message from the Governor of New Zealand to Lord Gladstone at Pretoria, through Cape Town, was sent from Wellington to the high-power station at Sydney, thence to Perth, thence *viâ* the *Australia*, in mid-ocean, to Durban. Lord Denman also sent a message asking that his greetings should be conveyed to Lord Gladstone, adding that he was glad to learn that South Africa and Australia were in touch by means of the flagship of the Commonwealth.

* * *

Wireless telegraphy is now recognised as a *sine qua non* of all exploratory expeditions. This is the only possible channel of communication which can link them with the outside world, and what this means, both to the explorers themselves and to those who are waiting anxiously, it may be, for news of them, only those who have experienced the desolation of exploration can describe. But the despatches received by the Press from the Mawson Expedition at Adelie Land, in the Antarctic, give some idea of the important part it plays in modern expeditions. Now another instance of its efficacy is to hand, for a wireless message has just been received at Sydney, by Mr. Glynn, the Commonwealth Minister for External Affairs, from Judge Murray, the Lieutenant-Governor of Papua, that the Massey Baker expedition has safely returned to civilisation.

Mr. Massey Baker is the resident magistrate of the western division of Papua, and some months ago he left Daru in order to explore a tract of country hitherto entirely unknown to white men, and among other interesting discoveries, a vast lake, over 100 miles in circumference, was located. Beside this lake a large number of bodies were found, and it is supposed that they were the victims of a tribal fight.

D

A Pawn in the Game

(Serial Story)

By BERNARD C. WHITE

CHARACTERS IN THE STORY.

CHARLES SUMMERS.—*Inventor and engineer. Son of the Vicar of Sotheby, and affianced to Gwen Thrale, daughter of the squire. His most recent invention is an airship worked by wireless, which is likely to revolutionise aerial warfare. Negotiations are proceeding with the War Office for its purchase from the inventor.*

GWEN THRALE.—*Charles Summers' fiancée, a bright, intelligent and original girl, the idolised daughter of the squire, and secretly a member of a Fabian Society. She coaxes Summers to teach her "wireless," and soon becomes a proficient operator and a bit of an engineer.*

DOSS AND SUK.—*Pedlars, for ever on the prowl, and the universally recognised purveyors of village gossip. They are discovered and "tapped" by——*

M. DUPONT AND HERR BEULNER.—*Foreigners, making a prolonged visit to England. Ostensibly they belong to the leisured and wealthy class; but in reality they are secret agents for a foreign Government sent over to England for the purpose of securing military or naval secrets. Their attention is directed to Summers' work, and they determine to get possession of the airship's plans.*

CHAPTER VI. (*contd*).

"MAISTER SUMMERS lookt mortal grave an' say sutthin' to 'im low like, an' jest then the train cum in an' I couldna' hear na more, but as it wer leavin' the station one of them leaned out of the window and cried out, 'By Thursday, then,' an' Maister Summers he shouted back, 'Yes, the 10th. I'll post it Wednesday, and you'll get it Wednesday evenin' or Thursday mornen at latest, for I won't leave the office until I've cleared it off, and what's more, I'll post it myself.' There, now, zur, I beant old Suk if that ain't news, for I believe Maister Summers be going to sell that thing for a pot of money, and then these aristocrats will send their devil cars to frighten us puir folk who can't defend themselves."

Dupont was deeply interested in this recital. He drew in his breath with short gasps, which sometimes became low whistles. This was a good sovereign's worth of news, but he didn't quite know how to make the best of it.

Anyway he must act at once if he was to act at all, and there would be no harm in following out his first plan; so he approached Suk for help in the scheme. What he asked her to do was something extremely simple. She was to call at the Vicarage at half-past eleven next morning, *exact to time*, and ask to see Miss Summers. "Understand," he added, "you must find some excuse. You must say something that is—here, Beulner, what do I want to say?—*Raisonable*—yes, you must say something raisonable, you understand me, and you must not fail, for if you do you will lose more gold, and besides, I shall be able to do you great harm. You understand?"

Yes, Suk understood. She inwardly cursed the coercive tone of Dupont's last remark, but she knew which side her bread was buttered, and she was not the one to throw up such chances of earning unexpected wealth for the want of controlling her temper; so she nodded and bit her lip.

Dupont made her repeat the arrangements, so that everything might be clear, and once he was satisfied she knew the part she had to play in the manœuvres, he went back again to Beulner. Then he explained his scheme to him, and it was received with approval.

Beulner learned his part in the game to a nicety. Early on Monday morning Beulner

set out for what was apparently a day's solitary rambling. About eight o'clock he was to be seen in a Norfolk suit with a camera slung in a satchel over his shoulder, and a packet of what was apparently sandwiches under his arm, making his way through Sotheby towards the Downs. As chance would have it, he met Summers on his way going to business. They exchanged greetings, and Beulner took the opportunity of remarking that he was going for a day's botanising and general lazying about, pointing to his sandwiches as corroboration of his intentions. Summers, making some pleasant remark, passed on, and Beulner proceeded up the hill, past Sotheby Vicarage. He came to the open Downs, then turning down a side road which ran parallel with Sotheby highway, he took up a position on a bank which overlooked the only road leading from Thrale Hall to the Vicarage. There he got out a book, threw himself on a grassy bank, and generally lazed away the time. But he did little reading. In reality he was very much on the alert, keeping a constant eye on the road, and carefully scrutinising what passed up and down. This was not a difficult task, for only one or two solitary pedestrians made their way across it, and a tradesman's cart or two passed in behind the gates. Meanwhile Dupont was waiting in the "Granby," till the clock hands showed ten minutes to eleven. Then he made his way to Sotheby Vicarage. After ringing the bell, he asked the maid if he could see Miss Summers, and waited in the hall till that lady appeared. Then he explained the reason of his call. He had lost a pearl pin—a very precious heirloom, which, if not recovered, would be a great grief to him, not only from the intrinsic value of the thing, but for sentimental reasons. He asked to be allowed to look around the garden and in the drawing-room to see if he could find it. Of course Miss Summers raised no objection. Further, she helped him in his search, but all efforts proved unavailing. The carpet was swept, the chairs were overhauled, the flower beds and round the gravel paths carefully scrutinised, but all to no purpose; and, as the fruitless search proceeded, Dupont became gloomier and gloomier, till he looked like a man who had staked his all and had lost. Miss Summers could see that he was bitterly disappointed, and she—kindly soul—was most anxious that he should find the pearl. Was he sure that he had lost it after he arrived? Oh, yes, Dupont could swear to that, for his friend had remarked about it just before they entered the Vicarage drive, and he himself had discovered his loss when he got to the "Granby." He had not called on the Sunday because he knew they would like the time to themselves, for to the English people Sunday was sacred, it must not be touched, and visitors were *ennuyeux*. Miss Summers thoroughly approved his kind thought—now was there anywhere else he had been that afternoon? Yes, there was Charles's den, but unfortunately it was locked, and Charles, she knew, had the key. Dupont was then in despair. He had to go back to town that evening. For several days he would be away, and he had so hoped to get possession of his treasure. By the way, he remembered he had a number of keys with him, and, what was more to the point, a *passe-partout*. Would she give him permission to try it? Yes, Miss Summers had no objection. She was sure Charles wouldn't mind under the circumstances, and so the lock was tried and successfully negotiated. She and Dupont entered, and recommenced the search. The Frenchman was now very flurried. He kept looking at his watch, saying he could not stay very much longer, as he must keep this important appointment in town. If only he could find his pearl, if only he could! Miss Summers was searching diligently. Could it have fallen on the floor? Was it likely to be on the table, or near the airship? It was such a little thing, and so difficult to find; in fact, it was like searching for a needle in a bundle of hay.

At this moment the servant came in. She had been searching for Miss Summers everywhere. Suk the Pedlar had called, and wanted to see the lady. Mrs. Linn's grandchild had cut itself sore, and was bleeding to death. They could not get a doctor, and could Miss Summers give her some medicine and a bandage? Yes, of course Miss Summers could. She was looked upon as the first-aid woman of the district, a kind of vice-doctor and district nurse, and amateur chemist for all the poor people. This was not an uncommon request,

but like most requests of its kind it had to be attended to quickly. With a word of excuse to Dupont, she hurried out to her medicine chest. Now was the Frenchman's time. Quickly he went to the long table and seized some unused paper and envelopes. These he shoved into a big book with which he had come provided. There was still time to spare. Could he get at the correspondence? He knew it couldn't be very far away, and viciously he pulled at the table drawer. It was unlocked, and he soon found two neat piles of papers, the one containing letters received, and the other copies of letters sent away. He turned his attention to the latter bundle, and hurriedly skimmed the earlier documents. Dupont might not be very fluent in his English speech, but he knew the language vastly better than most Frenchmen, and it only took him a few seconds to read through the few letters before he came to the one he wanted. It referred to a visit from Major Thorpe on Friday, June the 25th, and corroborated his promise to write an official specification of his airship, and send it to the War Office by the following Thursday. In it the writer asked for these few days' grace as he was anxious to get some expert advice on technical matters, but he hoped to see the consulting engineer on the following Wednesday, and if everything was satisfactory he would post the plans himself *in London* that same evening, so that there should be no possibility of undue delay. But a letter a little lower in the file was the one which Dupont had most hoped to find. It was to the engineer in Victoria Street, making the appointment for the Wednesday. The Frenchman heaved a sigh of relief. He had got what he wanted, but the strain of the enterprise had been great, and its success had been in the balance. Still, he was not out of the wood yet. He must now make his escape. Quickly pushing back the drawer, he resumed his fruitless search, and appeared to be intently studying every corner of the floor when Miss Summers appeared again.

"Oh, Miss Summers," he cried, "it is all to no purpose. I cannot find the pearl. I am in despair; nevertheless, I hope still, for surely it must be here somewhere. Perhaps you will remember me and my loss, so that if you find it at some time you will let me know. I will give you my address, or, if you care, there is Mrs. Bundross at the 'Granby Hotel,' whom I will tell, and who will tell me, I hope, the news of its refinding when next I come again. It will not be, I fear, for many days, but I do know that however long I be, the jewel will be in most safe hands."

Certainly there was nothing more to be done, and Miss Summers could only once again deplore the fruitlessness of the search. When she had at last seen the unlucky stranger out, she continued her interrupted morning's work.

Dupont was soon back at the "Granby Hotel." Then he took the grey car, and went round the high road to where he knew Beulner would be waiting for him. The outpost had been unnecessary. Miss Thrale had not yet made her appearance, and nobody of consequence had passed; so the would-be botanist joined his companion in the car, and soon the grey machine was making its way to London.

When Charles came home in the evening, he was told Miss Summers's version of the day's event. At first he listened quietly, but as his sister proceeded his face grew sterner and sterner. He clenched his hands, and Miss Summers had never seen him so angry. He lost control of himself: a thing he had never before been known to do. He declared that those men were damned scoundrels, and that they were no good; and as for the pearl, he was sure it was all a damned lie. He didn't know what they were up to, but he believed they wanted to find out about his work. What the deuce did she let the snivelling Frenchman in for? What was the good of his putting a strong lock on the door if any fool of a foreigner was to open it with a skeleton key? The thing that made him most suspicious was the fact that that infernal old scoundrel Suk had turned up again. He had chivvied her off before, and told her to go about her business, and here she was back again just at the most inconvenient moment; and as for widow Linns, he would go round and find out whether she had a grandson, and whether anything was the matter with him. He bounced off white with rage, taking great strides down the path, and slammed the gate after him as he made his way to the end of the village.

In a short time he returned and faced his sister. He had seen the Widow Linn's grandson fast asleep in bed and sound in wind and limb. The two looked at each other hard, but made no word of comment. They both realised that they had been the victims of a cunningly laid plot.

CHAPTER VII.

THEY PLAY TO WIN.

The next few days passed like a nightmare to Summers. He was sure that a trick had been played upon him, but its exact nature was a mystery to him. A rigorous search of things in his lab. failed to give any clue. Apparently everything was in its right place and not even a sheet of paper appeared to have been disturbed by the intruder. A second visit to Mrs. Linn and a judicious inquiry as to how the report had circulated regarding her grandson's accident failed equally in results. Furthermore, Doss and Suk had been careful to leave no trace of their whereabouts, and as far as Sotheby was concerned, they had vanished into thin air. Charles, therefore, had to content himself with leaving the matter in this unsatisfactory state, but fortunately for his peace of mind his time was too occupied to allow him to dwell on the mystery. His specifications for the Government needed considerable revision before they could be sent off. This occupied all his time till the Tuesday afternoon before the day appointed when he was to consult the engineer. It had been arranged that after his visit to London he should take a much-needed holiday in the North, and it was likely that if the weather continued fine he would be away for a week or so; he had therefore arranged to spend the evening at Thrale Hall. Ostensibly it was to say goodbye, but his mind was more concerned with the perplexities of the moment than with the mere fulfilment of courtesies. He dared not leave the neighbourhood without first telling Gwen to be on her guard, and hitherto, since the affair of Dupont, it had been impossible for him to see her alone even for a few moments. Of course she knew about the excitement in a general way, for Miss Summers had speedily poured her own garbled tale of mystery into her friend's sympathetic ear. Summers, however, wanted her to have his own version of the matter. So it happened that when the anticipated "quiet talk" took place, it was not spent in the manner fondly imagined by the outsiders who, as onlookers, flattered themselves that they saw "most of the game." Instead, practically the whole time was given up to very businesslike talk, and the comparing of notes between two very serious wireless collaborators. It failed, however, to throw any fresh light on the subject or deduce any definite motive for the trick. Certainly the general purpose of Dupont's action was clear enough. He had some particular reason for finding out more about the airship. But if so, why did he leave untouched important papers which he might have confiscated without any fear of discovery? Could they only answer that question the way would be easier, and their course of action clear. But it was exactly at this point that they were baffled. It did not strike them that Dupont wanted the specifications to be approved by the consulting engineer before he appropriated them to his own uses. In the end they agreed that the only thing to do was to keep quiet about the whole affair, and Gwen promised neither to refer to the subject again before Miss Summers, nor, if she should meet the two foreigners while Charles was away, to show them by the slightest difference of manner that their secret motives were even suspected.

Time proved these precautions to be quite unnecessary, the grey motor-car came nowhere near Sotheby. Its owners were busy in London, very busy indeed, making elaborate preparations for the Wednesday when Summers was to send off his draft to the War Office.

Early on the day appointed by Charles for his interview with the engineer, a dark foreigner with an enormous black beard, a ragged Inverness coat, and a slouch hat, was seen strolling up Victoria Street. In his hand he carried a stout ash stick, which he from time to time tapped on the kerb in negligent fashion, as though he were sauntering along this high road without any particular aim, but merely as a poor Continental cousin come over to see the great city, and to receive impressions. He sauntered round St. Anne's Church, tried the doors, and found them locked, so sauntered on again and entered Caxton Hall. Apparently the exhibition there failed to interest him, and he soon came

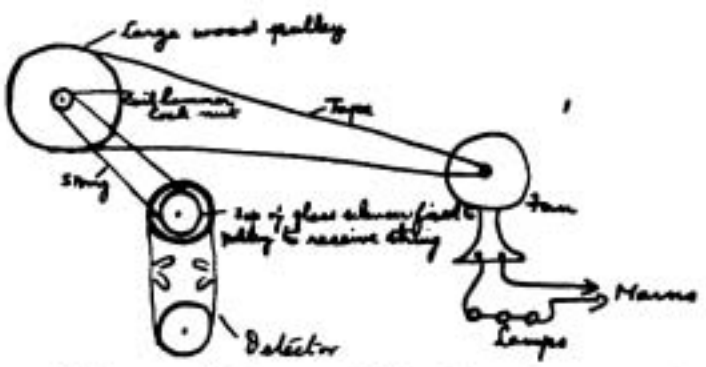
out again. Then he bought a paper, made his way to a friendly restaurant and took a prolonged lunch—an elaborate *petit déjeuner* of coffee, rolls and butter. Meanwhile he read scraps of news or looked out of the window on the crowd below. At last he saw something that interested him, for he folded up his paper, and without finishing the already buttered slice of roll, asked for his bill and went out. This time he walked faster, with a springy and alert step, picking his way among the pedestrians with a nervousness which betokened some secret excitement, and if anything a tendency to be shifty. Soon the cause of his interest was apparent. Just in front of him was a young man in a grey suit and a grey squash hat, taking long strides, and trying to look the energetic Londoner he was not. He carried the long blue envelope beloved of officialdom, and a glance at the stern and bronzed face showed him to be Charles. Soon he turned into one of the tall houses which make up the professional part of the street, and then the bearded foreigner slackened his pace again, resuming his nonchalant air, and began looking into the shop windows. This brought him to a turning down which he slipped, and he had not long passed into the comparative quietude of the side street when he met a friend, tall and greasy and rather sinister looking, with the hang-dog expression of a man who is a failure. The newcomer thrust his head forward as he came up to speak to Dupont, for our friend in the Inverness was none other than he. The conversation was of a private character, for neither spoke above a whisper, though had they shouted at the top of their voices their words would scarcely have been audible above the noise of the passing motor 'buses in the adjacent street. The conversation ended, Dupont disappeared, and it was the tall lean man who now walked slowly up and down Victoria Street, as though waiting for a friend. To the outsider he must have appeared particularly early, or the friend particularly late in coming, for he waited a quarter, half an hour, three-quarters of an hour, ere the person in question turned up. The newcomer was a dapper little man, short and stout, in a grey suit and grey bowler hat, with a white stock tie in which was stuck a large pin. Field glasses and a pair of dazzling white spats completed the get up. At a glance he would have been pronounced sporty, and the two looked a queer couple as they stood still and talked. Presently they went over to an A.B.C., and stayed a long half hour discussing a mild cup of coffee. Whatever the conversation was the little man appeared to be bored, or else he had something on his mind, for he would not always answer his companion's questions, and his small bright eyes would travel hither and thither in all directions, as though he were anxious to think of everything else but the "friend" beside him. Still, even the conversation of the best of friends cannot be continued indefinitely, and after a time the two rose up to go. They made their way down the same side street, as had the French artist, and here they shook hands and parted. The stout, horsey man then retraced his steps, but he seemed to find time hang heavily, for he idled along in a very lethargic and bored fashion. Presently, however, he became more animated, and, approaching the street kerb, made an elaborate bow. It was to an elderly woman driving in a rather smart barouche. She was apparently going to shop at the stores, and in her lap was a little toy spaniel. She was evidently a widow, for she wore thick mourning veils thrown back over her large hat. She called to the coachman to stop, and the carriage was drawn up to the side of the road where the little man with one foot on the step talked for a considerable time. Finally he made another bow and the carriage drove off, to be shortly pulled up again at the stores, where the lady gave her dog to the porter to guard, and disappeared within. Just before she did so, she turned back to see if her acquaintance was still visible, but he had already disappeared. She thereupon turned briskly and entered the lift and asked for the first floor. She spent some time in the jewellery department making a purchase or two, but chiefly examining things and looking about her. Then she adjourned to the restaurant, and taking a seat at a small table in the window, asked for a glass of milk. This she sipped in leisurely fashion, and after it was finished continued to sit with her elbows resting lightly on the table and her fingers playing restlessly with her rings, as though she were deep in thought. Presently she rose and looked out of the window, preserving always the same pre-occupied air. After a time, however, her eyes lost their expression of vacancy and she leaned slightly forward as though watching somebody.

(To be continued.)

EMERGENCY REPAIRS TO DETECTORS.

A. G. P. writes as follows :

" Last voyage, the spring of my magnetic detector having smashed, and the clockwork therefore being useless, I remedied the accident in the following way : I drove the iron band by means of an electric fan, and had an additional large pulley between the fan and the detector to make the iron band travel slower, but it still travelled too fast, so I experimented with various lamps until I got the right resistance in the fan to make the iron band go at the proper speed. I found that I got much better signals with the band travelling about half as fast again as it would usually when driven by clockwork. I may add that I did not get the slightest induction in my 'phones from the fan. I am sending this note because I think it might be a good hint to other operators who have the misfortune to have their detectors breaking in the middle of the ocean. Accompanying this is a rough diagram."



We are glad to publish the above, as the method adopted shows a desirable ingenuity and resource. An electric fan is a most useful piece of apparatus in an emergency. We have seen a 100-kw. station transmitting quite happily with a signalling-switch made out of such a fan and some hack-saw blades. With regard to the stronger signals produced by an increased speed of band, this is a phenomenon which is met with from time to time. The mass of iron passing per second through the coils of the detector should, strictly speaking, be adjusted to a large number of conditions, including the strength of the magnets and their distance, the actual strength of the signals, and their frequency. The standard speed is the one which has been found to give the best results with average signals ; so, under some conditions, better results can be obtained by an alteration in speed.

ATMOSPHERICS.

W. P. S. writes :

" For some time past I have been making observations of the phenomenon known to the wireless telegraphist as atmospherics, and of atmospheric conditions generally as affecting radiotelegraphy ; but such isolated observations from a moving station are of less value relatively than meteorological observations from one point only would be. One very striking occurrence came under my notice, of which I have never seen any mention in print, though possibly it has been observed before. When working comparatively long distances at night, and particularly in the Southern Indian Ocean, we are often troubled by the strength of the received signals varying greatly, one moment being quite strong and in a few seconds weakening to such an extent as to be nearly or quite inaudible. One night while off the New South Wales coast all signals were varying in this manner, and for a few minutes I could hear two stations working. First the signals from one station weakened while the signals from the other came in stronger. Then in a few seconds the condition was reversed, the one being strong and the other weak. The whole process was repeated several times within a minute. It gave me the impression that the wave-conducting medium was surging rapidly to and fro, thus making the distance to be travelled by the waves greater or less and consequently altering the strength of the received signals.

" It has occurred to me that a systematic and world-wide series of observations of atmospheric conditions as regarding radiotelegraphy and a comparison of these observations with meteorological and solar phenomena would lead to interesting and valuable results. The scientific world is greatly interested in the propagation of electro-magnetic waves and the medium through which these waves are transmitted. It would, therefore, seem that the production of some such systematic observations would be welcome to them. The Marconi Company alone, with its vast army in every part of the world, could undertake to collect such information. I believe that the results obtained would fully justify the inauguration of such a systematic survey."

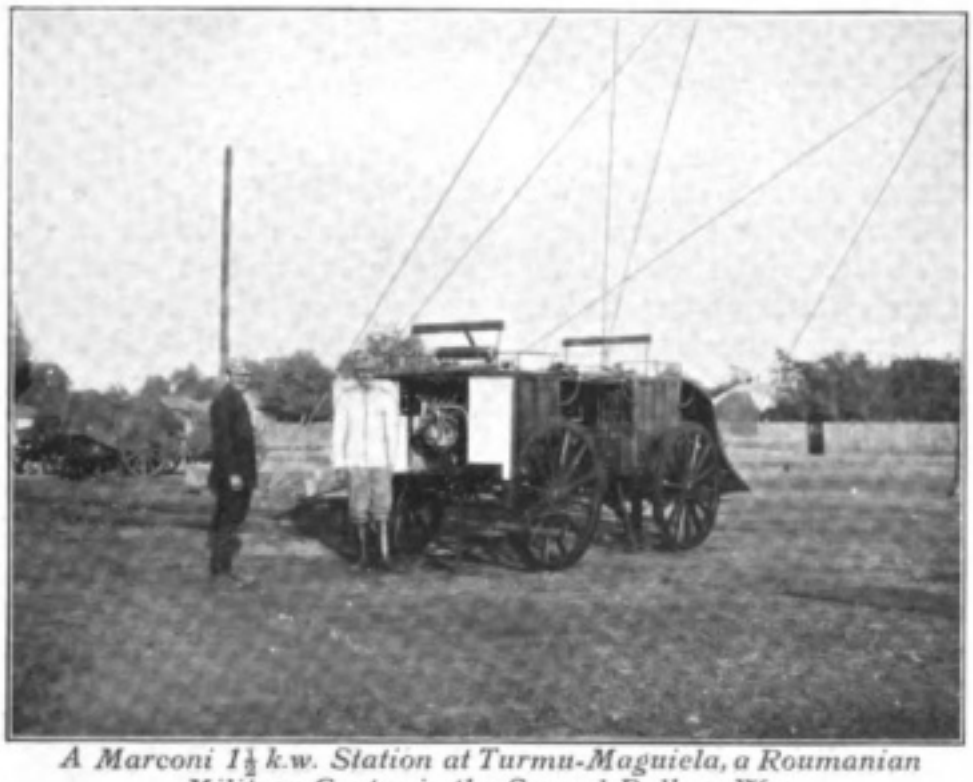
Lessons from the Balkan War

WIRELESS IN WARFARE. FIELD STATIONS FOR THE ROUMANIAN ARMY. THEIR INFLUENCE IN THE WAR.

ROUMANIA was foremost among the Allies in the second Balkan War as regards her wireless equipment. To an already excellent service she had recently added fourteen 1½-kw. stations and six knapsack stations. All the arrangements for the equipment were in the hands of the Marconi Company, and the whole of the material used was shipped direct from their works in England.

A group of General Staff Officers of the Roumanian Army at Plevna with the Marconi Station. The Officers include Lt.-Colonel Mihail, Commandant Jonescu, Captain Stoenescu and Sub.-Lt. Vasiliu.

Extensive trials were made of the apparatus as soon as it was unpacked, and before transmission to the seat of war. One of the stations was set up just outside Bucharest, and the other points of communication were Sinaia and Buzen, the three forming as it were the apices of a triangle, with the distance between each practically 120 kilometres. These stations were in constant communication with each other for over twenty-four hours, and throughout the time there was little divergence in the strength of the signals.



A Marconi 1½ k.w. Station at Turmu-Maguiela, a Roumanian Military Centre in the Second Balkan War.

As a test for the ability of the stations to stand rough usage, the station at Buzen was sent by road from Bucharest—a journey fraught with many dangers to delicate machinery, for in places the road is little more than a cart track, but the fact that communication was set up within an hour of its arrival speaks for itself. As soon as these tests were completed the station at Buzen was removed to Barlad, where it had been arranged to open communications with Bucharest. This was successfully accomplished, and the distance covered was about 250 kilometres,

or 150 English miles. One of the stations was stationed at Plevna, and the others were directed to the chief centres of military activity.

Leeds "Wireless" Troops for the Army Manœuvres.

THE Northern Command Telegraph Companies (Leeds Engineers) were ordered to supply a complete wireless detachment for the army manœuvres. Three years ago the Airline Company took part in the big manœuvres, and this was followed in 1911 by a most successful selection from the Cable Company, whilst last year the present adjutant (Capt. T. H. L. Spaight) acted as O.C. Signals of a composite signalling detachment, which included a few picked members of the Northern Command.

It was the original intention of the War Office authorities to call upon the newly-styled Northern Signal Companies for a detachment from each of the three units, but it was eventually decided that the Wireless Company only should take part in the manœuvres in the Northampton district. This company consisted of one officer in command (Capt. R. L. Denham), 16 other ranks, 11 horses, with a wireless waggon equipment and a light waggon. The detachment left Leeds for Daventry, where they joined the White (defending) force. They were attached to the army troops of the army headquarters at the advanced base, and returned to Leeds a week later.

Two other wireless waggon sets and two pack sets were also attached to the defending force, but the Leeds detachment worked its wireless station on the longest length of waves—viz., 850 metres—the other being fixed at 750 and 500 metres respectively. It is generally recognised that the efficiency of the Leeds "Wireless" Company is of a very high order. The class of work carried through at Yarmouth last year and on the Yorkshire Wolds in August, where many previous records were easily beaten, gave great satisfaction to the West Riding Association at York, and also to headquarters.

With a total established strength of 436 of all ranks and 12 supernumerary motor-cyclists, the actual numbers at the end of last month reached 364.

Capt. Spaight, whose extended period of service as adjutant recently expired has just been granted a further extension of six months.

Antarctic Journalism

Interesting news has come from the Antarctic, *via* Wireless. Dr. Mawson, the leader of the Antarctic Expedition which was sent out by the Australian Government, and which is making extensive explorations in Adelie Land, has just issued the first number of a monthly journal entitled the *Adelie Blizzard*. This is the first enterprise of such a nature to be undertaken in the Antarctic, and is no insignificant publication either, for the *Adelie Blizzard* can boast 28 pages of matter.

The 5-kw. Marconi station, which was erected at Port Stanley, Falkland Islands, is frequently in communication with the station at Cape Sao Thome, Brazil, a distance of 2,200 miles. As an example of detector efficiency, it may be mentioned that Port Stanley is able to hear Lima, Peru, every night, the distance being 3,000 miles. This achievement is all the more remarkable, when we remember that Lima is situated immediately under the Andes, and screened from Port Stanley.

At a recent conference between J. Daniels, the Secretary of the Navy, and Captain George R. Clark, Commandant of the United States naval training station at Great Lakes, Ill., it was decided that a high-power radio station and plant should be erected at the latter place. The Great Lakes station is near Lake Bluff, Ill., on the shore of Lake Michigan, about 30 miles north of Chicago.

The French Army manœuvres are being held this year in the south of France in the region between the Garonne and the Baise, one of its tributaries.

The two opposing armies will be commanded by General Pau and General Chaumer. The Air Services will be used to the fullest extent by both armies, and a trial is to be given to the organisation for distributing by wireless from the Eiffel Tower forecasts of weather conditions for the guidance of the Air Services.

Administrative Notes

New British Station.

A Post Office wireless coast station has been erected at Fishguard and opened for commercial work, from midnight, Monday, September 8th. The station at Rosslare was closed on and from that date, and the staff transferred to Fishguard. The call signal of the Rosslare station, namely, "GRL," is used for the new station at Fishguard.

* * *

United States Naval Stations.

THE following Naval Radio Shore Stations in the United States will now transmit messages at the rate of 6d. per word cable count, with a minimum charge for ten words: Charleston, South Columbia; St. Augustine, Florida; Jupiter, Florida; Key West, Florida; Pensacola, Florida; Guantanamo Bay, Cuba; San Juan, Porto Rico; Colon, Canal Zone; Balboa, Canal Zone; Taloosh Island, Washington; North Head, Washington; Cape Blanco, Oregon; Eureka, California; Point Arguello, California; San Diego, California.

* * *

School of Wireless Telegraphy for Spain.

The Spanish Government has recently passed a Bill into law which provides for the organisation of a school of wireless telegraphy with the object of instructing pupils, whether already in the telegraph service or not, in the theory and practice of radiotelegraphy, and to fit them for service either on shore or ship stations of private companies.

There will be three courses of study, the first one lasting six months. The pupils will then have to pass a test consisting of the transmission of at least 20 words per minute for not less than five nor more than ten minutes, with an allowance of 1 per cent. of uncorrected mistakes.

The second course will last three months, and will comprise a course of study of the apparatus used in radiotelegraphy, the tuning of same for different wave lengths, commutation, etc., the regulations regarding the exchange of wireless messages, and the adjustment of slight irregularities.

A higher and final course will also be given for those wishing to further pursue their studies. Foreign languages also figure in the curriculum of the school.

* * *

Amateur Regulations in Germany.

Regulations have been adopted in Germany concerning the installation and working of wireless telegraph receiving stations. The license, which may be revoked at any time, applies only to the use of stations for receiving time signals from Norddeich, which uses a wave of 1,650 m.

The installation must fulfil the following technical requirements:

(*a*) The receiving apparatus shall be adjusted so that the owner of the station may alter the syntonisation only within the immediate vicinity of the prescribed wave-length. The adjustable wave-lengths shall not differ by more than 5 per cent. above or below the prescribed wave-length.

(*b*) The antenna shall not be larger than is necessary for the intended reception.

(*c*) The single parts of the oscillatory circuits, also of the antenna circuit, shall be connected firmly and permanently with each other by being soldered together; exceptions are only admissible at the connecting terminals of the detectors and of the telephone receivers.

(*d*) The soldered joints shall be enclosed in casing containing all the parts of the apparatus, and this must be sealed, so that only the handle of the tuning device and the connecting terminals of the detectors and of the telephones are accessible to the owner. For the connection of the antenna wire, a sound insulating wrapper shall be used.

(*e*) No subsequent connection of circuits or tuning devices shall be permitted.

The controlling officials of the Imperial Telegraph Administration, of the Imperial Naval Administration, and of the Administration of the Army are permitted at any

time to enter the rooms where the apparatus is kept, and to inspect all the arrangements appertaining to the installation. The licensee is under an obligation not to divulge signals which he may intercept, and the license may be withdrawn if this regulation is not observed. The station must be removed or the working suspended at such times as may be required by officials of the aforenamed departments.

* * *

Compulsory Wireless Law in Portugal

The Draft Law relating to the compulsory equipment of ships with wireless telegraphy, which was presented to the Portuguese Parliament on June 25th by the Minister of Marine, and which was forthwith approved, provides (Article 1) that within three months of the "approval of the Regulations for the execution of the present law no Portuguese steam vessel, with accommodation for more than fifty passengers (including crew), shall be permitted to sail from any port without having installed a wireless telegraphic apparatus, in good working order, and capable of dispatching and receiving radio-telegrams within a radius which must never be less than 100 miles." Steamers trading between ports situated at distances of less than 200 miles apart are exempt from the operation of this law. In the case of steamers trading with colonies that have coast stations, but which only occasionally return to the home waters, the installations must be completed within six months. The station must be in charge of one or more qualified telegraph operators, who work under the supervision of the captain and carry out such instructions as he may consider desirable for the good working of the service (Article 3). The captain of the vessel is liable to a heavy monetary fine and the suspension for one year of his master's certificate for failure to comply with Article 1, and to a fine and imprisonment in the case of failure to comply with Article 3. Should a vessel meet with disaster, or be lost, as a result of lack of vigilance on the part of the telegraph staff, and if this fault be due to any negligence on the part of the captain in carrying out the requirements of the Act relating to radio-telegraph service, it shall be punished by a fine which may be accompanied with the suspension of his master's certificate for from one to five years, according to the seriousness of the disaster. All apparatus intended for Portuguese vessels will be exempt from Customs and Municipal duty.

* * *

New Zealand Wireless Stations

An interesting portion of the report for 1912 of the New Zealand Post and Telegraph Department, which was circulated recently, deals with the development of wireless telegraphy in New Zealand. The report, after dealing with the opening during the year of stations on Tinakori Hills and on the chief post office, Auckland, and the equipment of the steamer *Tutanegai*, goes on to say: "The erection of the Chatham Islands wireless station of 2½ kw. is proceeding, and communication will be established shortly. The high-power station at Awanui of 30 kw. has been completed It will be capable of communicating with Sydney at any hour. This station is provided with a tower 394 feet in height, from which an umbrella-shaped aerial spreads from summit to base over an area of about 90 acres. A similar station at Awarua, near Bluff, is also completed. These stations are undergoing departmental tests. The report adds:

"At the International Radio-telegraphic Convention at London, in June, 1912, the question of the regulation of wireless communication was reviewed. The convention emphasised the need of a closer observance of the regulation requiring ships to communicate with the nearest coast station so as to minimise the interference peculiar to wireless communications and to permit of a greater number of radio-telegraphic messages being exchanged simultaneously. The use of minimum power for the distance to be covered has also been enjoined for the same reason. In exceptional cases maximum power may be used and a station other than the nearest one may be communicated with if a special wave-length be employed. The general trend of the amended regulations is in the direction of limiting long-distance working from one ship to another and between a ship and a coast station in order to circumscribe the area of disturbance. Ships are to be graded in three classes, and to observe prescribed hours of attendance, principally to ensure distress signals being observed. The amended regulations come into force in July, 1913."

Maritime Wireless Telegraphy

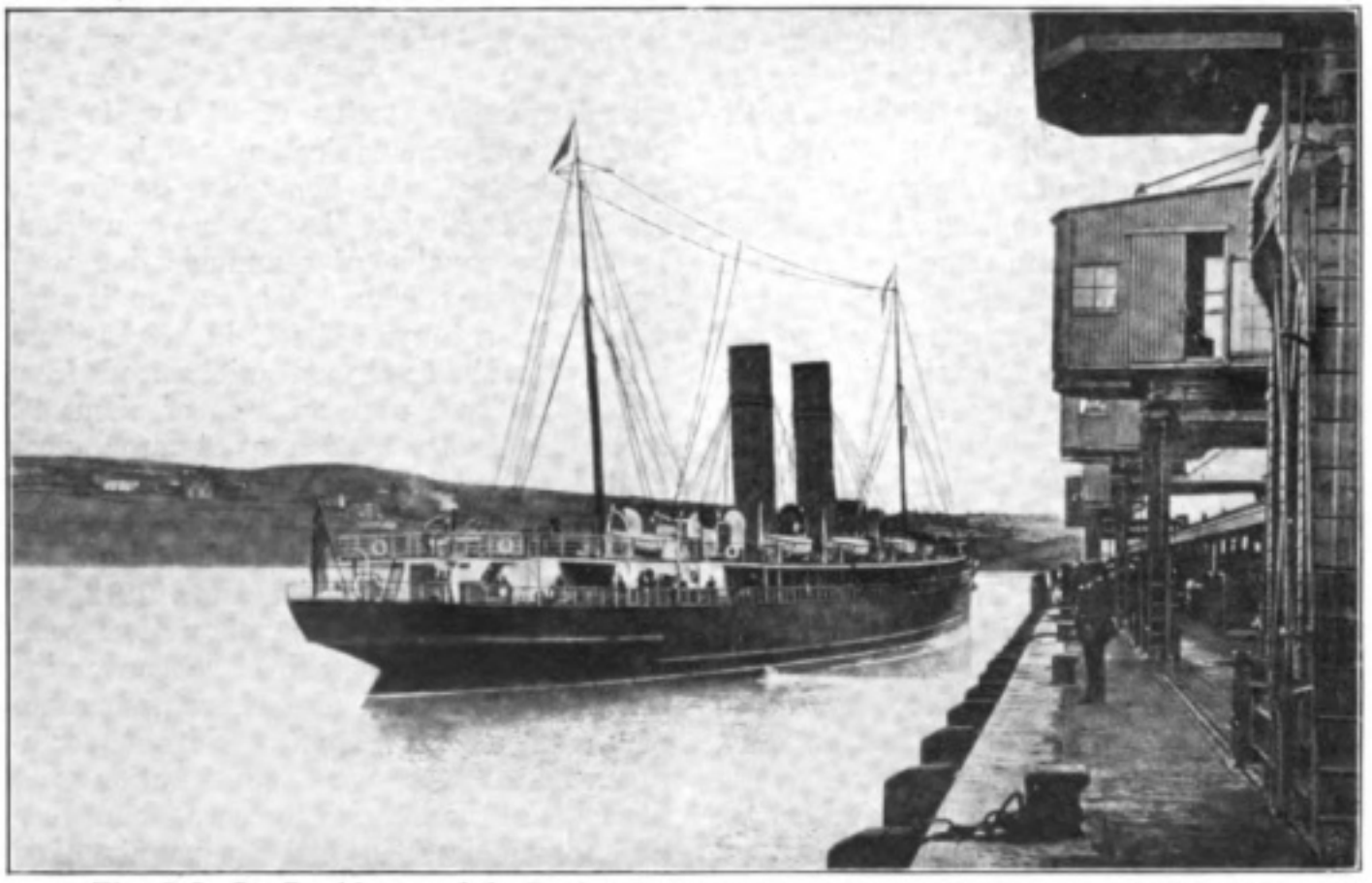
THE tall masts now fitted in the larger racing yachts are popularly known as "Marconi" masts, because of their resemblance to wireless telegraph masts. We understand that the first was fitted last year in the Nicholson-designed *Istria*, 15-metre cutter. The elongation of the top-mast permits of the top-sail yard being entirely dispensed with. The upper section of the top-mast is fitted into the mid-section, which in turn is fixed into a socket in the mainmast proper. While "Marconi" masts have been very generally adopted by the larger British racing yachts, it is not yet finally demonstrated that the undoubted advantages they afford in certain circumstances more than compensate their drawbacks in others. The 19-metre yacht *Norada*, so successful at the Clyde Regattas, though her "Marconi" was simply added to her previously fitted top-mast, has now removed that extension, and carries her jackyard top-sail with the top-sail yard, as formerly.

* * *

The port authorities at Rotterdam have just installed a wireless station for the use of the river police, the apparatus being fitted at the central bureau and on the police steamers. The object of the installation is to facilitate the rapid despatch of assistance in the event of collisions or accidents, and to aid in the pursuit of river pirates. It will be possible to communicate with the river police boats as far up as Maassluis.

* * *

The steamer *Matunga* recently arrived at Sydney from New Guinea. The passengers, speaking of the fire which occurred on the *Matunga* on the passage from Cairns to Port Moresby, paid a tribute to the skill of the captain, officers, and engineers. There was no panic on board, and many of the passengers were unaware of any untoward incident until the danger was passed. The wireless operator, at the first word of warning, was at his post, and communicated with Port Moresby, where boats were in readiness to come to the *Matunga* if required. Fortunately the outbreak was suppressed with only the loss of a portion of the mails. As a mark of recognition of the skill displayed in getting



The S.S. St. David, one of the Packet Boats sailing between Rosslare and Fishguard, recently equipped with wireless.

the fire under control, the passengers presented gold medals to the officers, including the wireless operator.

* * *

An addition to the facilities at Fishguard Harbour, which will be of great convenience alike to the travelling public and the Great Western Railway Company, came into operation on September 8th, when a new wireless telegraph station, which has been erected on the top of the cliffs, near the Harbour Village, was opened. The station is the outcome of an arrangement under which the company have constructed the building and the Post Office equipped it and undertake the working of it. It consists of a one-story building containing a power and instrument room, together with accommodation for the staff. The high mast, reared above the cliffs, forms a landmark for miles around. The equipment of the station is on the Marconi principle, with instruments capable of transmitting and receiving messages within a radius of 500 miles, the necessary power being obtained from the Great Western Railway Company's generating station at the harbour. Particulars of the station appear on page 450.

With the provision of the land station, opportunity has also been taken to equip the company's turbine steamers, *St. David*, *St. Patrick*, and *St. Andrew*, with wireless apparatus. The Marconi system is adopted with a range of 100 miles. The plant is installed in a cabin on the bridge deck of the boats, so as to be readily accessible to passengers desirous of despatching messages.

* * *

The s.s. *Krakatau*, of the Stoomvaart Maatschappij Nederland, which stranded on the Misniaria reef, near Jeddah, suffered severe damage. The bow was buckled, and hold No. I leaked. The 1,618 passengers were removed from the ship by a vessel of the same line which received the call for help by means of wireless telegraphy. The *Krakatau* is a cargo boat fitted with ½-kw. Marconi station.

* * *

The value of wireless telegraphy for summoning medical aid in cases of illness on board ship is being more and more appreciated. Only recently the operator on the S.S. *Empress of Asia* reported a case where a fireman on board the White Star cargo steamer, the *Cevic*, was medically attended by the doctor on his own vessel. On the receipt of information regarding the symptoms of the patient and the contents of the *Cevic's* medicine chest, the doctor diagnosed the illness, prescribed the proper medicines, and continued to watch over the invalid's welfare till his aid was no longer required.

* * *

Another case of wireless aid in illness is that of Lady Fry, widow of the late Sir Theodore Fry, who was taken ill on the Royal Mail yacht *Arcadian*, when returning from a cruise in the Norwegian Fjords. In response to a wireless message from the *Arcadian*, when nearing the English coast, Lady Fry's physician and nurse met the vessel on arrival, and an operation was immediately performed which has been completely successful.

* * *

One of the engineers of the White Star liner *Tropic*, bound from Liverpool to Australia, was recently landed at Plymouth for medical treatment. He had a splinter of steel in his eye. Soon after the accident occurred the *Durham Castle*, which was homeward bound from South African ports to Plymouth, was found to be in the vicinity, and in response to the wireless call the liner's captain agreed to take the injured man home to England, so that the hospital treatment could be obtained at the first possible moment.

* * *

Lord Haldane made conspicuous use of wireless telegraphy when returning from America on board the *Lusitania*, for in response to an inquiry forwarded by the *Daily Mail*, he made the definite statement that his remarkable speech on "Higher Nationality —a Study of Law and Ethics," before the American Bar Association of Montreal, was intended to be a definite statement of Great Britain's policy and as such to be accepted throughout the world. The exact message published in our contemporary ran :

[BY WIRELESS.]

SS. *Lusitania*, Thursday.

To the Editor of the "Daily Mail."

A speech delivered by a Minister of the Crown communicating a message from his Sovereign to the peoples of America and Canada cannot be regarded as the speech of a private person. HALDANE.

Collection of Meteorological Data

NEW WIRELESS SERVICE

ON August 1st the Scheveningen Port Coast station inaugurated a daily service of meteorological data which is transmitted to ships on request. The telegram contains the data collected from the meteorological stations: Helder, Flushing, Gris Nez, The Hague (with an indication of the state of the sea); Yarmouth, Shields, Skudesnaes, Sylt (without indication of the state of the sea).

The data given by each station consist of two groups of 5 figures made up on the basis of a table BBBWW SHTTG.

BBB gives the atmospheric pressure in millimetres and tenths of millimetres, omitting the hundreds figure of the millimetres;

WW shows the direction of the wind according to the compass-card (see table A below);

S shows the force of the wind according to the Beaufort scale (see table B below);

H gives the state of the sky and the weather according to the code of table C below;

TT gives the temperature in degrees Centigrade. Temperatures below zero are indicated by the addition of the number fifty to the number showing the degrees of frost, so that, for example, a temperature of —14 degrees is shown as 64;

G shows the state of the sea according to table D below. When the state of the sea is not shown, the second group of the station in question contains only four figures.

Where necessary, the groups of figures are followed by an advice regarding the storm signal.

TABLE A.

02 = NNE	18 = SSW
04 = NE	20 = SW
06 = ENE	22 = WSW
08 = E	24 = W
10 = ESE	26 = WNW
12 = SE	28 = NW
14 = SSE	30 = NNW
16 = S	32 = N

00 = calm.

TABLE B.

0 = nil or calm	5 = fairly strong
1 = light air	6 = strong
2 = light breeze	7 = very strong
3 = gentle breeze	8 = gale
4 = moderate	9 = hurricane

TABLE C.

0 = fine	5 = rain
1 = slightly cloudy	6 = snow
2 = cloudy	7 = misty
3 = very cloudy	8 = fog
4 = overcast	9 = storm

TABLE D.

0 = calm	5 = rough
1 = very smooth	6 = very rough
2 = smooth	7 = high
3 = slight	8 = very high
4 = moderate	9 = phenomenal

GOVERNMENT STORM WARNINGS BY WIRELESS.—The United States Agricultural and Navy departments are now sending wireless storm warnings and general weather forecasts to ships at sea. Bulletins are sent out from the navy wireless stations at Radio, Va., and Key West, Fla., a few minutes after 10 o'clock every night. These bulletins consist of two parts. The first gives, in code letters and figures, the actual weather conditions, at 8 p.m. (75th meridian time), at Sydney, Nova Scotia, Nantucket, Atlantic City, Hatteras, Charleston, Key West, Pensacola, and Bermuda, followed by a special forecast of the probable winds to be experienced one hundred miles off shore. The second part gives the storm warnings covering a period of forty-eight hours from the time of issue, and at the end of the forecast is given a statement of the location and movement of any barometric depressions that may be likely to affect the winds over the ocean. The broadcast distribution of wireless weather bulletins by the stations at Arlington and Key West is a part of the purpose for which these stations were originally designed.

Contract News

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

Name of Vessel.	Owners.	Installation.	Remarks.
Aquitania	Cunard Steamship Co. ..	5 kw. and emergency	The latest of this company's magnificent Atlantic liners. It is still in process of building.
Flintshire	R.M.S.P. Co.	1½ kw. and emergency	Destination undecided.
Garm	Norwegian Government ..	,,	A Norwegian torpedo-boat destroyer.
Salmo	Thos. Wilson, Sons & Co. ..	,,	On passenger service between Grimsby and Gottenburg.
Viking	Amazon Telegraph Co ..	,,	Cable ship.
Desabla	Andrew Weir & Co. ..	,,	Transport vessels on world-wide service.
Barneson	,, ,, ..	,,	
Star of India	J. Corrie & Co.	,,	These transport vessels carry on an extensive service between England, Australia, and New Zealand, touching at all the most important ports, as well as at the Falkland Isles.
Star of Australia ..	,, ,, ...	,,	
Star of Victoria ..	,, ,, ...	,,	
Star of England ..	,, ,, ...	,,	
Charles E. Harwood ..	Petroleum Carriers, Ltd. ..	½ kw. and emergency	A further order from this important line of petroleum carriers.

The Société Anonyme Internationale de Télégraphie sans Fil have equipped the following Vessels.

Ship.	Owners.	Installation.	Call Letters	Remarks.
Van Lansberge	K.P.M.	1½ kw. and emergency	PMG	Registered at Batavia.
Westerdijk	Nnam	,,	PGZ	Registered at Rotterdam.
Kiruna	R.L.O.	,,	SFN	Registered at Pitea.
Bergensfjord	Norske Amerika Linie ..	,,	LFB	Registered at Christiania.

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

Name of Vessel.	Owners.	Installation.	Call Letters.	Remarks.
Alsatian	Allan Steamship Co. ..	1½ kw. and emergency	GYH	Passenger vessel sailing between Liverpool and Montreal.
Barala	British India Steam Navigation Co.	,,	GCM	Trading round Indian Coast with limited number of passengers.
Andes	Royal Mail Steam Packet Co.	,,	MRQ	Passenger vessel recently constructed for sailing between Southampton and Buenos Aires.
San Gregorio	Eagle Oil Transport Co. ..	,,	MAC	Oil transport.
Somali	Peninsular & Oriental ..	,,	MIW	Transport on Admiralty Service, running between Southampton and Hong Kong.
Kandahar	Bucknall Steamship Lines ..	½ kw. and emergency	MAB	Transport vessels with world-wide service.
Koranna	,, ,, ,, ..	,,	GYV	
St. Patrick	The Great Western Railway	,,	GYM	Passenger and cargo vessels plying between Fishguard and Rosslare.
St. David	,, ,, ,,	,,	GYL	
St. Andrew	,, ,, ,,	,,	GYJ	
Vitruvia	Gow, Harrison & Co. ..	,,	GYS	Transport vessel on world-wide service.
Edward L. Doheny ..	The Petroleum Carriers, Ltd.	,,	GYR	Tank steamer sailing to South American ports.

INSTRUCTION IN WIRELESS TELEGRAPHY

The Wavemeter

(Sixth Article.)

[The first article of this series appeared in the May number of THE WIRELESS WORLD, in which number there also appeared particulars of the examinations to be held when the course is completed, and full details of the prizes offered by the Marconi Company to successful candidates. A further announcement appears on page 461.]

42. WE showed in our last article how, when a closed oscillating circuit is coupled to an open oscillating circuit for the purpose of exciting the latter, the result was the production of two distinct waves, one longer and one shorter than the normal wave-length of either circuit taken separately, and that the closer two circuits were coupled together, the greater the difference between the two resulting wave-lengths.

For convenience the degree of coupling between two oscillatory circuits is expressed as a percentage of its full coupling.

If two oscillatory circuits were fully coupled, the two resulting waves would be so far apart that the lower wave would be sensibly zero and the only wave-length left would be $\sqrt{2}$ times the wave-length of the two circuits taken separately.

In practice such conditions do not occur, it being usual to have a coupling of not more than about 15 per cent. between the primary oscillating circuit and the aerial circuit.

As a matter of fact, with commercial stations, a regulation has been laid down by the International Wireless Convention that no station is allowed to use a closer coupling than 15 per cent.

43. **Calculation of the Degree of Coupling.**—Since the difference between the two resulting wave-lengths of coupled circuits depends upon the degree of coupling between the circuits, it follows that we can calculate the coupling if we know the values of these two waves, and the following formula, although not exact, will give a very near approximation of the percentage of coupling.

If k = percentage of coupling between two circuits and λ 1 is the wave-length of the longer of the two resulting waves, λ 2 the wave-length of the shorter of the two resulting waves, and λ 0 the wave-length of each of the circuits taken separately, then

$$k = \frac{\lambda 1 - \lambda 2}{\lambda 0} \times 100$$

Let us apply this formula to a practical case.

On a certain vessel a wireless installation had been fitted, and when the primary oscillating circuit was coupled to the aerial (each having been previously tuned separately to 600 metres) it was found that the resulting wave-lengths were 570 metres and 630 metres respectively.

From this it can be calculated that the

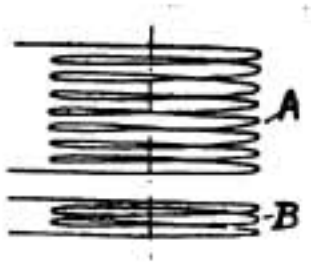


Fig. 1.

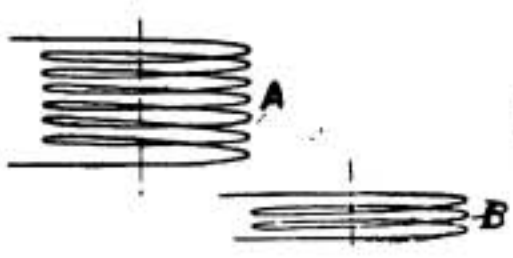


Fig. 2.

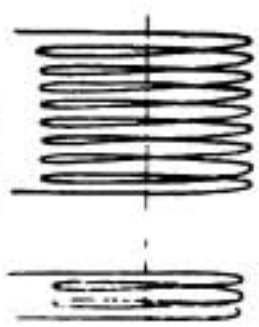


Fig. 3.

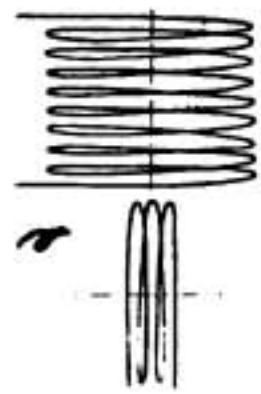


Fig. 4.

coupling between the two circuits was 10 per cent.

$$k = \frac{630 - 570}{600} \times 100$$

$$= \frac{60 \times 100}{600} = 10$$

44. **Methods of Varying the Couplings between the Inductance Windings of two Oscillatory Circuits.**—The method most commonly used to vary the coupling between the primary circuit and the aerial circuit of a transmitter, is to **slide the secondary winding away from the primary winding.**

This method is illustrated in Figs. 1 and 2, where A is the inductive winding of the open oscillating circuit, that is to say, the jigger secondary, and B the inductive winding of the closed oscillating circuit, that is to say, the jigger primary.

When one of these two coils is immediately above the other, as shown in Fig. 1, the coupling between the two is at its maximum, but when the secondary winding is moved until it occupies a position near the edge of the primary winding, as shown in Fig. 2, the coupling is at its minimum.

Another method of adjusting the coupling between two circuits is to **alter the relative angular position between the axes of the two windings.**

When these two axes are in line, the coupling is at its maximum, and when they are at right angles to one another the coupling is at its minimum.

This method is illustrated in Figs. 3 and 4. In Fig. 3 the axes of the two coils are in line, and therefore the coupling is at its maximum, whereas in Fig. 4 the axes of the two coils are at right angles to one another, and therefore the coupling is at its minimum.

45. **The Wavemeter.**—The wavemeter is an instrument, as its name implies, used **for measuring the length of the wave or waves emitted by a transmitter or other oscillating circuit.**

It consists essentially of a closed oscillatory circuit whose wave-length can be varied over a large range of values by the adjustment of the inductance or the capacity which together form that circuit.

In practice it is usual to vary only the capacity of the circuit, keeping the inductance a constant value throughout. This for various practical reasons is found to be more convenient than adjusting the inductance. Fig. 5 shows such an oscillatory circuit, where L is the fixed inductance and C the variable condenser.

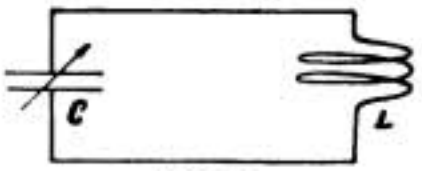


Fig. 5.

We have already learnt that **the wave-length of an oscillatory circuit depends upon the product of the capacity and the inductance of that circuit;** it follows, therefore, that **as we increase or decrease the capacity of the adjustable condenser, so do we increase or decrease the wave-length of the circuit.**

Practical considerations limit the maximum and minimum values of the capacity to which the condenser can be adjusted, and therefore limit the maximum and minimum wave-lengths to which the circuit can be tuned.

An adjustable condenser of convenient size will allow the wave-length of the circuit to be adjusted to about eight times its minimum wave-length; that is to say, if the inductance is so wound that the minimum wave-length easily obtainable is say 100 metres, the maximum wave-length to which the circuit can be adjusted will be about 800 metres.

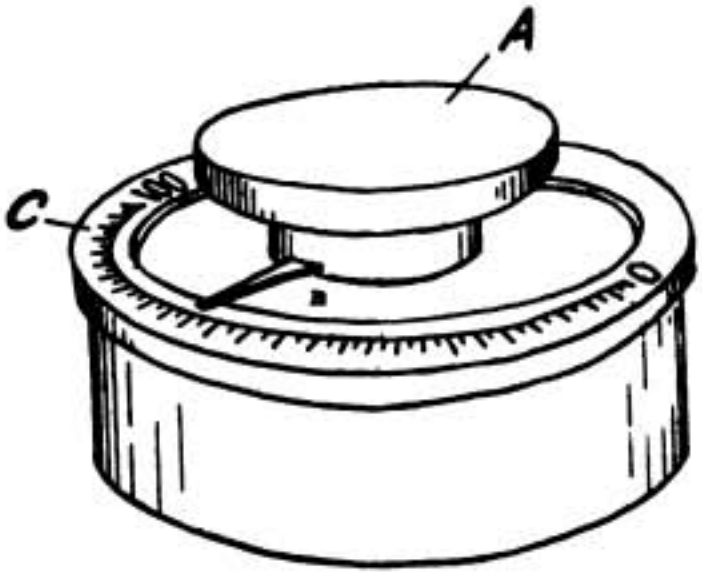


Fig. 6.

An illustration of a variable condenser is shown in Fig. 6. The principle on which it is constructed will be described later, but for the present it is sufficient to know that its

capacity is varied by turning the handle A. Fixed to this handle is a pointer B, which passes over a scale, C. This scale is carried half-way round the circumference of the condenser, and is divided into a number of small divisions which are marked from 0 to 100. When the handle of the condenser is so turned that the pointer indicates the figure 0, the capacity of the condenser is at its minimum, and as the pointer passes up the scale the capacity of the condenser increases proportionately until it arrives at its maximum capacity when the pointer indicates the figure 100.

It is not, of course, necessary when using the instrument to know what are the values of the capacity corresponding to the different scale readings of the condenser. It is only necessary to know what are the values of the wave-length of the circuit corresponding to the various positions of the condenser. In other words **the condenser should be "calibrated" in wave-lengths.**

With each instrument a curve or chart is supplied which gives the values of the wave-lengths of that particular instrument for every position of the condenser.

By the use of this chart we can either set the condenser so that the circuit is adjusted to any desired wave-length within the limits of the instrument, or *vice versa*, we can find out to what wave-length the instrument has been adjusted by referring first to the condenser reading and then reading off the chart the value of the wave-length corresponding to that condenser reading.

46. **Method of Using the Wavemeter.**—The method of using the wavemeter for measuring the wave-length that is being emitted by, say, the aerial of a wireless telegraph station, is as follows : .

The wavemeter is first brought sufficiently near to some part of the aerial circuit, preferably near the earth wire, so that the oscillatory currents passing up and down the aerial induce similar currents in the inductance coil of the wavemeter. The condenser of the wavemeter is then adjusted until the wave-length of its circuit is in tune with the wave emitted by the aerial.

By noting the scale reading to which the condenser is adjusted, and by referring to the calibration chart of the instrument, we immediately find the value of the wave-length to which the wavemeter has been adjusted, and since this is in tune with the aerial, this value is also the value of the wave-length of the aerial.

47. **Method of Telling when the Wavemeter is in Tune with the Circuit being Measured.**—In carrying out this operation there is one point that we have not yet explained. **How are we to know when the wavemeter is in tune with the aerial?** To explain this we must refer back to paragraph 36, in which we showed that when two oscillatory circuits are coupled together, one of which is set oscillating, similar oscillations are induced in the second circuit, provided that two circuits are in tune ; that if they are out of tune, although a certain amount of current is still induced in the second circuit, this current will be comparatively feeble and erratic, but will rapidly rise as the circuits are brought nearer and nearer into tune, reaching a maximum when the two circuits are quite in tune.

When we bring the wavemeter near the aerial, we are in effect coupling the wavemeter circuit to the aerial circuit, and we shall obtain similar phenomena.

It follows, therefore, that the aerial currents will induce similar currents in the oscillatory circuit of the wavemeter, and that if we vary the adjustment of the condenser of the wavemeter circuit, we shall come to a point when this circuit is in tune with the aerial, and we shall then get a maximum current induced in the circuit.

48. **The Use of Telephones as Current Detectors.**—We have, therefore, only to find a means of measuring the current in the wavemeter circuit in order to tell when it is in tune with the aerial.

It is not necessary to know the actual value of the current, but only its comparative value, so that a detector which will respond proportionally to the amount of current passing through it will suit our purpose.

The telephone receiver is a very suitable instrument for this purpose ; for one thing, it is extremely sensitive to even the very smallest current passing through it, and for another thing by judging the loudness of the sound in the telephone, we can judge the comparative amount of current passing through it.

There are two conditions, however, that

are necessary for the use of a telephone as a current detector; the first is, that the current passing through it must be an **interrupted** current in order to produce a buzz instead of a single click, and the second is that the current passing through it must either be a **uni-directional current** or a **low frequency alternating current.** A high frequency alternating current will not affect the telephones.

The current induced in the wavemeter is a high frequency current, and, therefore, unless it can be converted into a uni-directional current, or a low frequency alternating current, it will not affect the telephones.

49. **The Use of Crystals.**—It is found that certain crystals, such as carborundum, have the property of rectifying high frequency oscillating currents. They really act as non-return valves, allowing the current to pass through them in one direction only, which is equivalent to converting the high frequency current into a uni-directional current.

These crystals, however, have an extremely high resistance, and we showed in paragraph 38 how the effect of putting a high resistance in an oscillatory circuit was to destroy the oscillatory properties of that circuit. For this reason the crystal cannot be inserted directly in the oscillatory circuit, but a little thought will show us that it is not necessary to insert either the crystal or the telephones directly in the oscillatory circuit.

The current in the oscillatory circuit, as we know, charges up the condenser of that circuit to a certain voltage, and the voltage to which it is charged is proportional to the current, that is to say, the greater the current

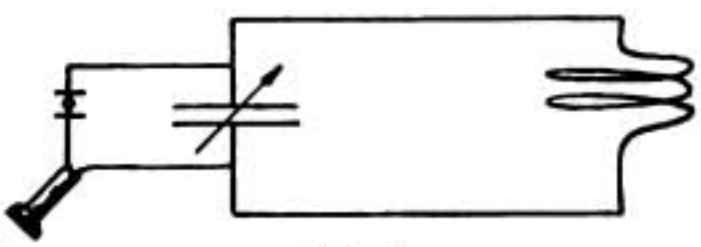
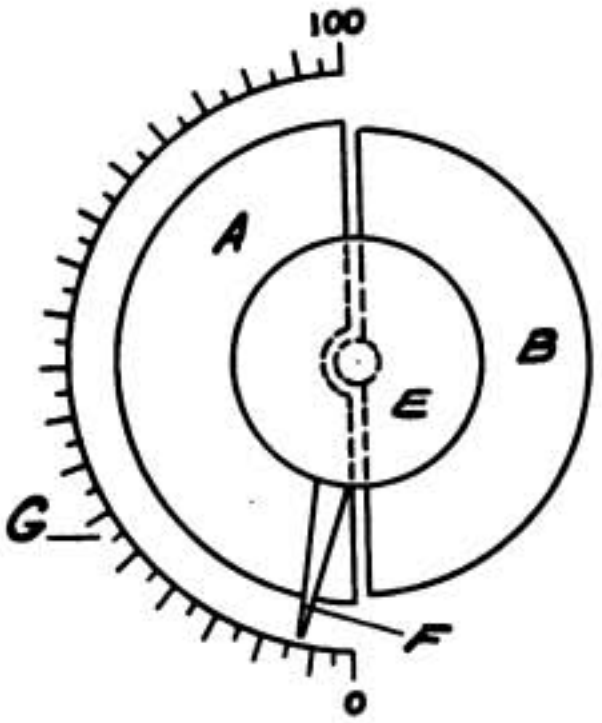


Fig. 7.

induced in the inductance coil the higher the voltage to which the condenser will be charged.

If, therefore, we place our crystal in series with the telephone **across** the condenser, as shown in Fig. 7, we shall not in any way interfere with the oscillatory properties of the oscillatory circuit, but we shall get a certain current passing through the crystal and the telephones, the amount of which will be proportional to the voltage to which the condenser is charged, and therefore proportional to the amount of current induced in the oscillatory circuit. Moreover, the crystal will rectify this current, so that in effect we shall get a direct current passing through our telephones. This current also will be an interrupted current, the number of interruptions per second being the same as the number of sparks per second which the induction coil exciting the aerial is producing. We shall therefore get a buzz or note in the telephone corresponding exactly to that produced by the spark of the transmitter, and proportional in its loudness to the amount of current induced in the inductance coil of the wavemeter.

The loudness of the sound in the telephones will then depend upon two things:



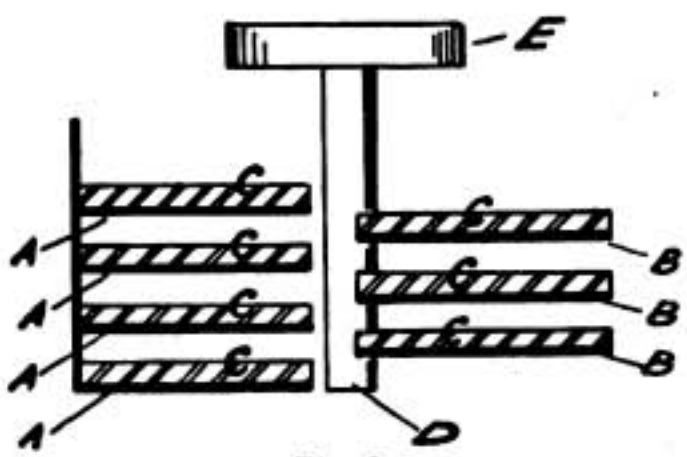
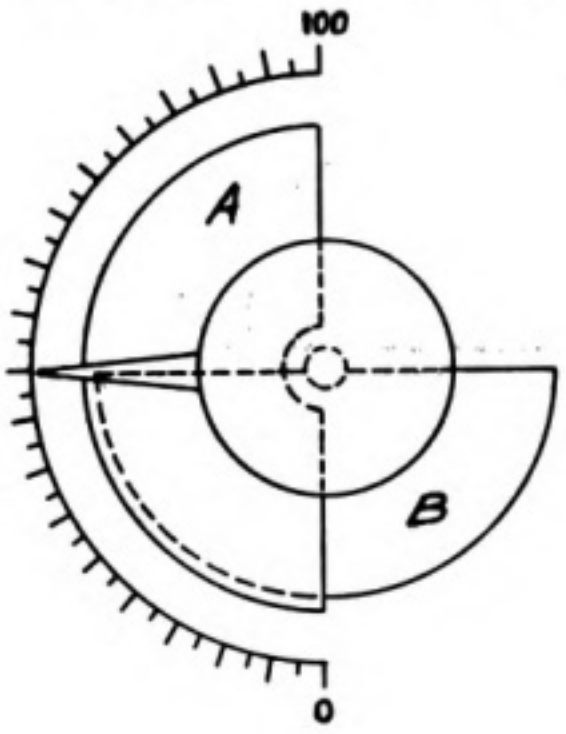


Fig. 8.

(1) the nearness of the inductance coil of the wavemeter to the aerial, and (2) the closeness of the wave-length of the wavemeter circuit to that of the aerial circuit which is exciting



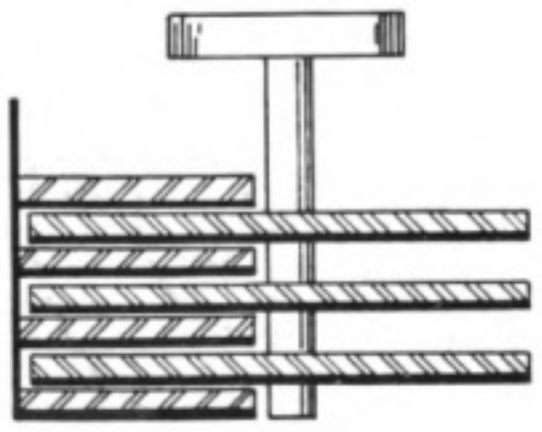


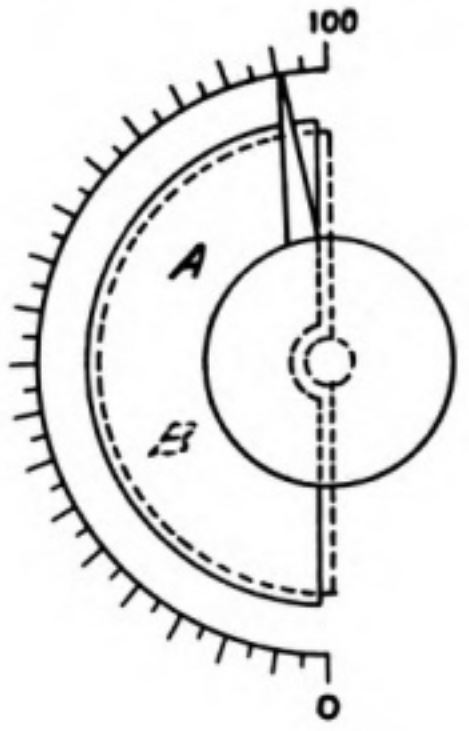
Fig. 9.

it. Of these the first is kept constant by not altering the position of the wavemeter while the test is being made. It is clear, therefore, that if we vary the adjustable condenser of the wavemeter circuit, and at the same time listen to the sound in the telephones, when this sound is loudest, the wavemeter circuit is in tune with the aerial, and by noting the position of the condenser thus obtained, and referring this reading to our calibration chart we find the value of the corresponding wave-length, and therefore the length of the wave emitted by the aerial.

50. **Construction of an Adjustable Condenser.**—The construction of an adjustable condenser is illustrated in Figs, 8, 9, and 10 A number of semi-circular metal plates, A, are connected together, and held rigidly parallel to one another and at a sufficient distance apart to allow the second set of metal plates, B, to pass in between them. Fixed to the upper sides of both the A plates and the B plates are ebonite plates, C, of the same shape.

The second set of metal plates, B, are held together on a spindle, D, which can be rotated by the handle, E, which is fixed to one end of the spindle.

The fixed plates, A, form one side of the condenser, and the movable plates, B, form the other side of the condenser, the



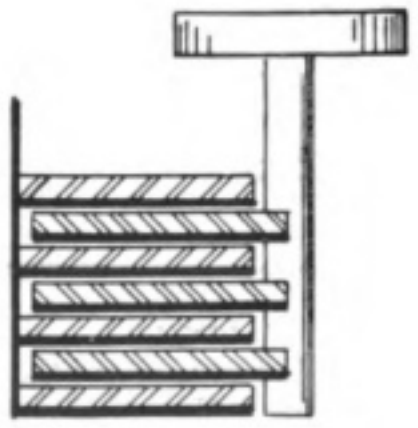


Fig. 10.

dielectric of the condenser being formed by the ebonite plates, C. When these plates are in the positions shown in Fig. 8, the capacity of the condenser is practically zero, but if

the movable plates, B, are rotated until they interleave themselves with the A plates, and occupy the position as shown in Fig. 9, the capacity of the condenser is increased to half its maximum capacity, as half the surface of the A plates is acting through the dielectric on to half the surface of the B plates; and finally if the B plates be still further rotated until they occupy positions entirely under the A plates as shown in Fig. 10, the capacity of the condenser is at its maximum. It is only necessary to fix to the moving plates a pointer, F, which can pass across the scale, G, and thus denote the exact position of the plates.

Our Prize Scheme

The articles which are at present appearing in THE WIRELESS WORLD in connection with our scheme of instruction in wireless telegraphy have aroused a great deal of interest among those who are qualified to sit in examination for the valuable prizes and certificates which the Marconi Company have generously offered to candidates who pass the approved test. Full particulars of the prize scheme were announced in our April and May issues, in the first of which we published letters from Lieut.-General Sir Robert Baden-Powell and Major-General Edward C. Bethune, cordially approving the scheme. The articles (of which the sixth appears in this issue) have been so framed that anyone having no previous knowledge of electricity will be able, if the articles are followed carefully each month, to understand fully the practical working of a portable wireless telegraph apparatus, in theory and practice, and with a little experience in working will be able to operate such a set successfully.

Those who have not yet applied themselves to the study of the series of articles which commenced in May last should apply immediately for back numbers of this magazine (May to September), and lose no further time in taking up the subject. The prize-winners will not only enrich themselves, but some of them will place the units or troops to which they belong in the enviable possession of a complete wireless telegraph station. Apart from the prizes and certificates, every student of our course must derive some personal advantage from the knowledge that he gains.

Methods of Signalling.

By "SCOUT."

Wireless takes its place amongst the various methods of signalling. All these have certain advantages, and their respective "pro's" and "con's." But as regards independence of weather conditions and light, wireless stands unique. If comparison is to be carried further, a telegraph line must be continuous; it is exposed to damage by weather or an enemy. In wireless two terminal stations only are required; science has employed ether as its connecting link.

Signalling should be divided into two classes—long-distance and short-distance signalling. The former would comprise wireless and line telegraph; the latter, heliograph, lamp, sound, and flag. Unfortunately neither of these can be relied on. Absence of sun reduces a possible 30 mile range with helio to no service. "Fog" puts the lamp out and darkness keeps the flag in its case. But the elements are not always against us, and, in the majority of cases we are masters of the situation. We Scouts are working our way through all methods, possibly a long way off "top dog," but time is on our side and keenness will pull us through.

With regard to wireless and line telegraph it is only a question of expense. Scout stations must, of necessity, be cheap ones, but the operator who can transmit 5 miles would be equally efficient at 500, if his station served. The mechanical work necessary for a wireless station has been often made by Scouts; possibly the only part bought would be the phones.

The conditions required for a Scout wireless station are briefly these: it should be a portable station and capable of transmitting at least 5 miles under all circumstances; the limit of distance is desirable on account of the cost of providing a station to work over long distances. Scouts should be very careful not to infringe the rules on which their licences have been granted and to follow closely the regulations for wireless operators. Their claims for consideration have been favourably considered by those in authority, and a special "call sign" has been allotted to them—"XBS." This call should always be used.

GALENA FOR DETECTORS.

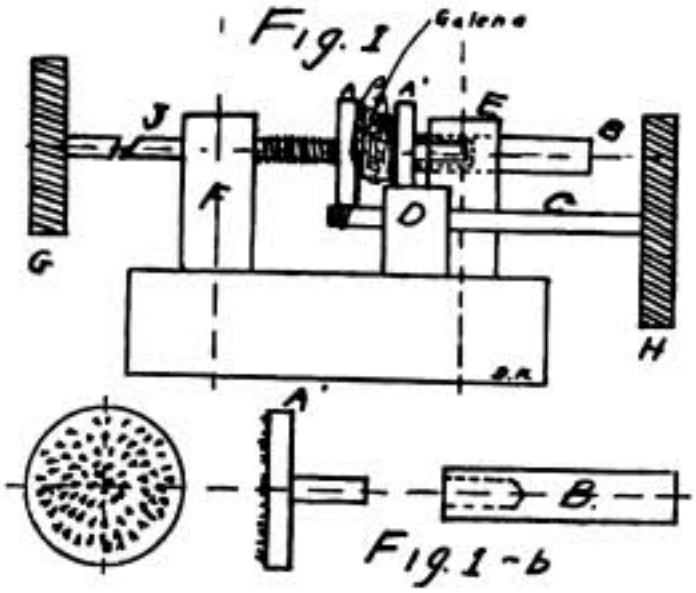
By D. B. McGOWN.

(*The author has in use at his station a detector in which galena is used. As the practice is not a common one among amateurs, his experiences, described in the following article, should prove interesting.*)

GALENA does not enjoy a very good reputation among the majority of wireless telegraphy experimenters, but if properly used it should give results as good as, if not better than, those obtained with any other form of crystal detector, or almost any type of receiving instrument.

It is not uncommon for experimenters to take a piece of galena and clamp it tight between two flat surfaces, or under a sharp point, and, as the signals are in consequence inaudible, to complain of the insensitiveness of their galena. Others run a heavy battery current through it, and, although this is not as bad as many forms of treatment to which the mineral is subjected, it is sufficient to prevent it giving the best results it is capable of. If experimenters would use and adjust galena properly, they would at once realise its value as a detector mineral.

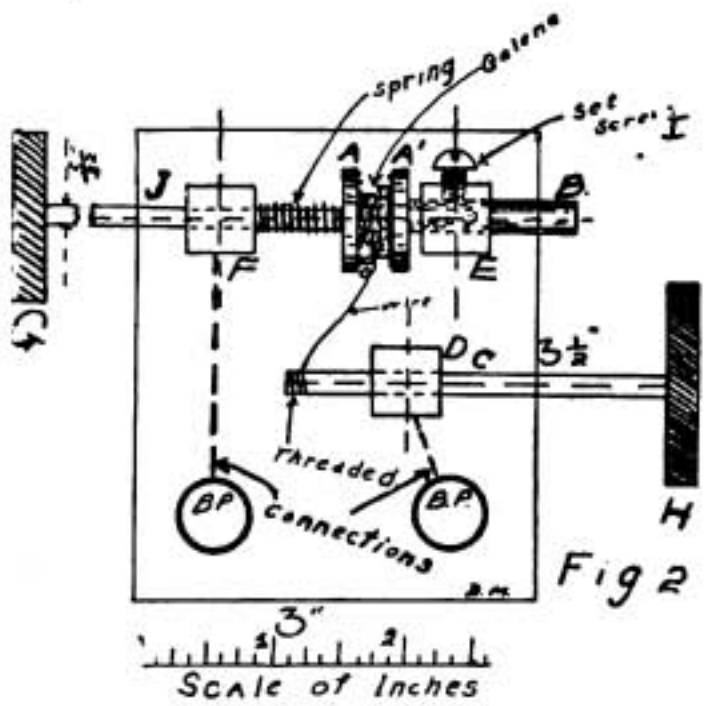
I have found that to get the best results from galena it is necessary to use a *light*



contact—the material of which this contact is made being of less importance than the lightness of the contact. For this purpose a short piece of 36 or 38 gauge copper wire should be fastened at one end, and the other allowed to rest by its own weight on the galena.

The contact points may be of various types, and a piece of graphite (not more than the point of a lead pencil) or a small piece of tungsten makes a sensitive combination. For local work a plain piece of copper wire is as good as anything ; it is robust, and not easily affected by a transmitting spark.

The following is a description of a detector for galena which I have found to be efficient,



and the construction of which is shown in the accompanying diagrams.

In these diagrams F and E are threaded as shown, and screwed to the bottom of the base ; the discs, A–A′, which are the clamps for the galena, are turned from ¾-in. brass rod. A is joined to rod, J, but A′, as shown in Fig. 1*b*, is left to turn freely, the short stem on A′ fitting into the hole threaded in B. Rod C is provided with a rubber knob, H, one end of which is threaded to give the contact wire a firm hold ; the hole in D is bored sufficient to make the rod bind. The rod should not revolve too freely, nor should it fit too tightly ; it should be just firm enough to turn easily by means of the knob, H. A spring is wound upon J so that A–A′ are forced together. The object of the set screw, I, in the upright, E, is simply to make B firm. The binding posts, B P, in Fig. 2, may be placed wherever convenient. The whole is then mounted either on a polished marble or a hard rubber base ; the former may be recommended as it gives a substantial appearance to the instrument, and is cheaper than rubber, but if marble is used great care should be

taken to obtain a slab which is free from all mineral veins, as these greatly reduce the insulating value of the marble. Should any trouble be experienced in fastening knobs G and H, a good method is to heat the rod, and then rub sealing-wax over it. The rod should be warm enough to make the sealing-wax liquid, and should then be forced into the knob.

Another method is to tap the hole in the knob and thread the knob to fit, it is then screwed on with sealing-wax. In this way no trouble will be experienced from knobs falling off. To adjust the instrument clamp a piece of galena between A and A', then bring the wire over until it touches the mineral. The crystal may be turned to and fro, and even clear around, and any spot may be touched by moving rod C. In this way a good spot may be discovered.

This detector may appear clumsy at first, but a little practice will soon show that it possesses many advantages, and that it is easy to adjust. It is important that the galena should be of good quality. If the portion available has been lying for any length of time in a space which is not air-tight, it should be broken, and a fresh surface obtained. The surface of the galena should never be touched with the hands or any portion of the skin, as enough natural oil will gather on the surface of the mineral to effectively insulate it against weak signals. If signals cannot be heard through the first piece of galena tried, the mineral should be broken up until either a sensitive piece is obtained or until it is too small for use. The best galena will have a " wavy " appearance. It is almost impossible to describe a good piece of galena, but experimenters should have no difficulty in picking this out for themselves.

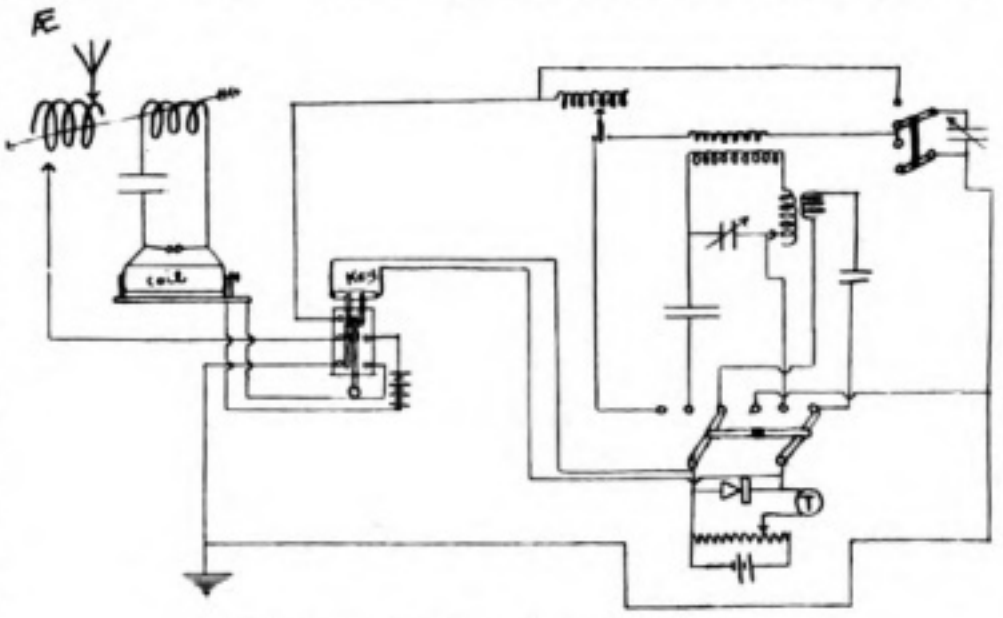


Diagram of Connections, " U.D.X."

AN AMATEUR'S STATION.

By " U.D.X."

The accompanying illustrations of my wireless station might interest amateurs.

I am using storage battery power of 8 volt, a 2-inch home-made coil taking 2½ amps., and fitted with a hammer break, which I have found is best for small coils. I am able to send 20 to 25 miles, my wave-length being 450 metres. The high-tension condenser has a capacity of ·0062 m.f.'s, composed of copper foil and half-plate photographic plates. The sending jigger primary is ¼ copper tubing, and the secondary $\frac{7}{18}$ lighting cable. The sparkgap is

" U.D.X." Station.

of mild steel. I get a fine musical note.

My receiving apparatus is composed of 3 circuits—plain open circuit for picking signals quickly, and by a switch I can change over to jigger, and to get still finer tuning I have an aperiodic circuit. I also have a portable receiving set made on the same lines, but not shown in the photo-graphs.

The aerial consists of four wires of 16 s.w.g. bare copper separated 2 feet apart. The mast at the free end is 65 feet high, and that at the receiving end 40 feet; the distance between the two being 240 feet, and the total length of the aerial 279 feet. My earth is composed of ordinary wire netting buried about the garden 1 foot deep.

The oak box containing the receiving apparatus is made to close up when not in use; one of my variable condensers is placed on the lid, which is pivoted, and has spring contacts for the condenser.

AMATEUR NOTES.

OUR remarks in a recent issue concerning the charge of one guinea which the Postmaster-General has decided to make when granting amateur licences has brought a protest from an esteemed correspondent who signs himself "Wireworm." It is not the fee itself to which our correspondent objects, it is the decision to apply it to amateur stations which exist only for "receiving."

What he overlooks, however, is that to permit the erection of this class of station without any control or inspection would be to provide a loophole for abuse, which would in the end result in much more stringent regulations. We think that he rather exaggerates the freedom which the average "Britisher" enjoys "of doing what he likes in his own house," and we fail to see that the proposed charge will result in any further infraction upon the rights and liberties of the "Britisher" on his own hearth. At the same time "Wireworm" points out the difficulty of enforcing the regulations regarding licences in the case of users of receiving sets, and he instances a hypothetical case which we hope he will not endeavour to fulfil with a view of testing the ability of the Postmaster-General to enforce the regulations. He states:

"We have heard lately of bedsteads and gas pipes being successfully used as substitutes for receiving aerials. Suppose I go a little bit further and discover that I get Paris, using only domestic appliances (such as a bedstead on an upper floor as an aerial, the wires of a piano suitably connected as a tuning coil, a nest of cake tins with buttered paper between them as a condenser, a piece of washing soda and a darning needle as a detector, and my tongue in place of the 'phones), must I obtain a licence from the Postmaster-General before I dare use such apparatus to get the time from E. L.? A few more discoveries (!) in 'wireless' and we shall require to get a licence from the Postmaster-General before we furnish a house, and we shall have inspectors inspecting our pots and pans to see that they conform to the wireless regulations!"

* * *

The United States of America claims to be the birthplace of the Amateur Wireless Club. At all events the movement has fostered very considerably in the United States, and there is in existence a large number of clubs, all of them carrying on very useful and very instructive work. One of these clubs, the Radio Club of Manhattan, has intimated its wish to exchange suggestions with amateur wireless societies in Great Britain and we feel sure that the interchange of ideas between the clubs of the respective countries will be mutually beneficial. The Manhattan Club was formed for the purpose of bringing together amateurs residing in the city of New York and coaching those who wished to pass the Government examination for amateur radio licences. Only those who hold a first grade amateur licence or who intend taking the qualifying examination are eligible for membership. No member is admitted under the age of 18, and one of the qualifying conditions is ability to transmit and receive in Continental Morse Code at a speed of not less than 15 words per minute.

* * *

A meeting of the Liverpool and District Amateur Wireless Association was held on September 11th, the chair being taken by Mr. J. Jardine. Several new members were enrolled. The question under consideration was the matter of "Receiving Outfits," and Mr. Jardine gave a description of his receiv-

ing set, by means of which he is able to obtain good results, and to a great extent obviate local jambing. Mr. Frith exhibited a small model receiving outfit, contained in a case 8¾ inches by 1¾ inches by 5¼ inches, and holding inductance, silicon detector, blocking condenser, and a double pair of headgear 'phones, 3,000 ohms; a very compact outfit, suitable for field work. Mr. J. T. Thompson, J.P., Mayor of Birkenhead, has consented to become a Vice-President of the Association.

* * *

A number of experimenters in wireless telegraphy living in Barnsley district met recently for the purpose of forming a local wireless association. As a result of this gathering the Barnsley Amateur Wireless Association came into existence, with Mr. C. H. Matthews as Chairman and Mr. C. Pickering as Hon. Sec.

* * *

A general meeting of the Dublin Wireless Club was held recently. Dr. Spencer Sheill occupied the chair. Mr. Britton gave an account of the committee's visit to the proposed new premises of the club, placed at its disposal by the treasurer, Mr. Lewis. It was decided that two 35 to 40 ft. poles should be used, and Mr. Britton offered to supply the manual labour and to superintend the erection of the same. Messrs. Carter, Draper and Campbell each contributed £1 towards the cost of the aerials, etc. Three new members were elected.

* * *

A meeting of the Northampton and District Wireless Club was held recently, when about 30 amateurs were present. The Postmaster-General's charge of one guinea was discussed, and in this connection several letters from other clubs were read. Mr. H. B. Lees-Smith, Mr. F. C. McCurdy, and Mr. H. Mansfield (the M.P.'s for the district), have promised to mention the matter in the House of Commons.

* * *

The first licence for a wireless telegraph station in the Taunton district has been granted by the Postmaster-General for St. Andrew's Drill Hall, Rowbarton, Taunton, used by the parochial company of the Church Lads' Brigade. The wireless station is situate in the reading room of the drill hall, where the apparatus for receiving the waves is fixed. The apparatus has been made entirely by the Rev. Francis M. Trefusis, curate of St. Andrew's and assistant chaplain of the Church Lads' Brigade Company, who is a son of the Bishop of Crediton. The aerial is over 80 ft. from the ground. The instruments have been working satisfactorily, and the first public demonstration was given at the Church Lads' Brigade fete and gala on September 4th. The station will be used continuously during the coming winter for teaching members of the Church Lads' Brigade Company wireless telegraphy.

* * *

The first case of violation under the Federal wireless law was brought before the Federal District Court, New York, July 7th. Elman B. Myers, the defendant, is charged with operating, without a Federal licence, a wireless apparatus of sufficient power to carry on radio communication beyond the borders of New York State. The case will be tried before a jury.

* * *

Amateur wireless telegraphy has developed to such an extent that a directory of wireless stations has now been published by Messrs. A. W. Gamage, Ltd., for private circulation only. The list contains the names of some 500 stations—only a portion of the total number licensed. However, the list is very interesting, and it should be useful to beginners by enabling them to get into touch with other enthusiasts.

* * *

A meeting was held recently in Edinburgh by a number of students who are interested in wireless telegraphy. About fifty attended, and decided to form themselves into a club called "The Edinburgh Wireless Club." Office-bearers were elected as follows: Mr. William D. Owen, president, and Mr. A. Ellis vice-president. Committee: Messrs. J. G. Aitken, W. S. Cruikshank, A. P. Kelly, J. Easson, J. D. Fergusson, and A. C. Heaven. Secretary, Mr. G. S. Creighton, 25 Rankeillor Street

QUESTIONS AND ANSWERS

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

A. M. B. (Hunstanton).—Take your aerial at an angle to keep it away from wall of neighbouring building. Could you not go on opposite side of your house? High buildings close to aerial are bad for screening.

J. T. L. (Northampton) proposes erecting a receiving station, and asks for instructions.—*Answer.*—You can use two parallel wires separated by 5 feet spreaders, each wire being No. 18 copper (telephone wire) bare. Read our Instructional Articles. Range depends on surroundings, on apparatus, and on your own skill and knowledge.

SIGNAL (Treharris) asks for information as to the source of some signals which he receives regularly at certain times, which he gives, and with certain characteristics, which he also gives. It is contrary to our custom to answer such queries as this; in this particular case the station is so well known that he need only ask some other amateur.

A. W. (Glasgow).—The impedance presented by a circuit containing resistance, R, capacity, C, and inductance, L, to a frequency, n, is $\sqrt{R^2+(Lp-\frac{1}{Cp})^2}$ where p denotes 2π. If the quantity inside the bracket is equal to zero, the impedance becomes simply the ordinary resistance: this is the condition for resonance, used in wireless circuits. And if $Lp-\frac{1}{Cp}$ equals zero, it follows that $n=\frac{1}{2\pi\sqrt{CL}}$ and 2π equals 2×3.14. Hence the value given.

R. F. D.—Since the wave-length depends on inductance and capacity in the transmitting circuit, how is it that one can obtain a variation in the note of the spark without varying the wave-length?—*Answer.*—You are mixing up wave-frequency (governing the wave-length) with wave-train frequency (group-frequency) which determines the *note*. The two things are quite separate, and can be varied independently. Read our instructional articles, and study carefully reply to B.R.L. in the May number, and to "Brum" in August number.

M. S. (London).—The thickness of aerial wires has little importance for small-power transmitting and for receiving. On the other hand, we do not like your idea of letting up a kite with twine which has a thin wire twisted round it. The difficulties you will experience when you come to wind up the two together will be serious. We advise you either to use a fairly thick wire as kite-wire and aerial combined, or—if you have an assistant—to use twine for the kite-line and suspend a thinnish aerial wire from a suitable point on that twine. This plan has the advantage that the kite can rise to quieter levels of air than it could do if it had to carry the aerial all the way with it.

F. D. M.—(1) Is it possible to work a Morse writer in conjunction with a crystal detector; if so, how is it done? (2) Is it better to lead in from the lower end of the aerial, supposing one end to be higher than the other.

Answer.—(1) The average signal met with in ordinary wireless gives, when rectified by a crystal detector, something a good deal less than a microampere. To utilise such a very small current to work a Morse inker requires a very special relay, and though we have seen a home-made relay which would work on half a microampere, such a piece of apparatus is not as a rule within the scope of an amateur. Several highly sensitive relays, of various ingenious principles, have recently appeared on the market; but these are somewhat costly and require expert treatment, and even they are more suited to a siphon-recorder than to a Morse inker. With large receiving aerial and strong signals, a much larger current may be obtained, and a less sensitive relay made to operate an inker. There is scope for much experiment in this direction. (2) Depends on the position of the receiving room with reference to the two ends; the down-lead should not be taken back too much *under* the horizontal part of the aerial. Try for yourself.

W. A. M. asks: (1) For telephones with a total resistance of 100 ohms, would an induction coil of 1 ohm primary and 100 ohms secondary resistance work as a "step-down" transformer with a crystal detector? (2) What would be the best crystal to use for the lowest resistance; and (3) would it be possible to send about 200 yards with a shocking coil with the contact-pillar connected to a good earth, and no aerial?

Answer.—(1) We doubt if much improvement will be found by the use of a transformer with so low a secondary resistance as 100 ohms in the place of the directly-connected telephones. A small ignition coil—such as is used for many motor-cars or motor-cycles—would be much better, even if not in good enough condition for its original purpose.

(2) We do not care to recommend any crystal except the carborundum crystal. Some carborundum crystals can be found which have no resistance. One of the lowest-resistance crystal combinations is the Galena-Graphite couple; you might experiment with that.

(3) You would be getting back to pre-Marconi days. In point of fact, a 10-inch spark-coil has actually been used in this way to communicate over two miles. But if you have an objection to the ordinary aerial jutting up into the air, why not try the Marconi directional aerial in the particular form where it is lying on the ground?

F. Y. L. (Newbury).—(1) Is there any method of adapting a receiving set consisting of an inductance, crystal detector, condenser, and 'phones to take down fast messages automatically? (2) Is there any danger from lightning in having my aerial stretched over my house. My earth runs down the side of the house to the spout of a pump (indoors), and branches off to a plate consisting of a cycle gear-wheel buried 4 feet down. Of course, I have switches to cut out my instruments. (3) Why can I hear certain stations when my aerial lead is disconnected from my instruments, but my earth still connected? (4) The best exam. or exams. to take in electrical engineering

and the best way to prepare for them.—*Answers.*—(1) Hardly within the scope of amateurs, unless the signals are very exceptionally strong. (2) The gear-wheel has its points, but as an earth is hardly satisfactory. Bury some galvanised-iron sheeting. Do not trust to your piping if you want to be really safe, but take a wire direct to the sheeting. Keep your aerial always earthed, breaking it by a one-hundredth inch gap when you are receiving, then violent atmospheric discharges will pass to earth through the gap instead of through your receiving apparatus. (3) A certain amount of the energy from a transmitting station is in the form of earth-waves, and if such a station is near at hand these waves may be detected. Also, your receiving gear appears to be in an upper story, so that your earth-lead acts in the way of an aerial to intercept the æther waves. (4) Enter for a course at one of the London technical colleges affiliated to London University. You might prepare for their entrance examinations by one of the "Correspondence" courses.

W. A. A. (Hull) has an induction coil of the non-trembler type, and wants to know whether he could get a continuous spark if he used a small 3-phase alternator; and, if so, what voltage he should use, and whether any part of the primary circuit would have to be shunted by a condenser. If he *must* employ a 3-phase alternator, let him leave two phases alone (open-circuited) and utilise the remaining one. No condenser necessary. The voltage might be 12 at a maximum, and to start with it should be reduced very much by a variable resistance in the field, and gradually increased till the best spark is produced. The coil should be protected by fuses suitably proportioned to the carrying capacity of the winding. No definite information can be given with so little data.

BRUM.—Referring to our reply under this heading in the August number, this correspondent asks for information on the following point: We state that the uni-directional impulses charge up the condenser which discharges through the telephone; why should there be no discharge until each separate train is completed? Is it that the high-frequency of the rectified oscillations is such as to make each train into virtually a small amount of *continuous* D.C.?—*Answer.*—Yes. We do not mean that the condenser waits for the completion of each train before commencing to discharge; it merely acts as a reservoir into which the rectified impulses flow and accumulate, and out of which there is a path—the telephone coil—by which they can overflow in a steady stream, although it forms no path for them (owing to its impedance) while they are in the form of high-frequency pulses.

L. J. W. (Ashbourne) is replanning his aerial, and asks advice as to lengthening it by increasing the distance between poles. His horizontal part is 65 feet high and 123 feet long, and at present his lead-in comes from the nearer end, thus forming an inverted L aerial (twin). He asks which would be best, that or a T; and he wants it for receiving from long-distance stations, and also for transmitting on 300 metre wave. If he increases to a 200 feet L, he will probably find it too long for his 300 metre wave, and will have to put a condenser in series. On the other hand the extra length will mean less tuning inductance for receiving long waves, and will give better signals. A T of the same total length would give him a very good aerial for transmitting his 300 metre wave, but would need more inductance for receiving long waves. If he slings a second aerial for transmitting only, he will have to insulate his long aerial during sending.

G. W. H. (Constantinople) noticing our remarks about using a long jigger-secondary, coupled at its lower end to the jigger-primary, for high-resistance detectors, proposes to extend his secondary (thus using a smaller tuning-capacity across it) by winding it in more than one layer. We advise him on no account to do this; apart from the serious question of capacity from layer to layer, this plan does away with one of the objects of a long secondary—the keeping away of the high-potential end from the earth-connected circuits. In the distant land where he lives, he has only with great difficulty obtained a suitable ebonite former for his secondary; so that to extend his windings in a single layer, he had better dispense with ebonite and use a cardboard tube, or a wooden cylinder, winding on it several layers of paraffined or shellaced paper to provide good insulation. He also asks for a list showing the order of magnitude of the resistances of the various crystal receivers in common use. We advise him to adhere to the carborundum with battery and potentiometer—either a high or a low-resistance carborundum to suit his taste—but for his satisfaction we give the following list, in descending order of resistances: high-resistance carborundum, silicon, bornite-zincite, copper pyrites-zincite, tellurium-zincite, galena-graphite. Low-resistance carborundum may come anywhere between high-resistance carborundum and bornite-zincite.

J. L. M.—*Twelve-mile Range.*—I wish to communicate 12 miles away. Can I do so with this apparatus? Aerial: Umbrella type, 60 feet long by 18 feet high. It has two wires "straight away," and is mounted on the top of a house 35 feet high. Receiver: One 70 ohm. 'phone, and a silicon-gold detector. Transmitter: ½-inch spark coil, and a Leyden jar condenser with ·0001 microfarad capacity. Would it be better to use a condenser with a capacity of ·00034 microfarad? What gauge of wire should I use (1) for the transmitting helix; (2) for the tuning coil; and (3) for the aerial? How much would I need for Nos. (1) and (2)?

Answer.—Your aerial seems all right; possibly rather low, especially if there are water-tanks or other earthed masses of metal in the roof of the house. Good insulation is most important, particularly for transmitting. Your receiver is connected quite wrongly: you cannot hope to get good signals when you put a high resistance, such as a crystal, in series with your aerial-earth circuit. If you do not wish to go to the trouble of making the best arrangement—a proper receiving jigger with separate windings, designed for the particular crystal in use—you might try a tuning-coil with two sliders, used as an auto-jigger in conjunction with a variable condenser (small) as shown. With regard to your transmitter, your connections give what is practically the old, crude "plain-aerial" arrangement. The condenser, used as you show it, has no effect on the tuning, but merely alters the character of the spark; its value is best found by experiment, but it is not likely to be more than half a standard "jar." What kind of jar have you, to give you a value of only ·0001 microfarad? If you want to be less prehistoric than "plain aerial," make up a proper transmitting jigger. It is impossible to give the capacity which you will require. Use as large a one as possible without reducing your spark below, say, 1 m/m. Tune this with the primary of your jigger to the wave-length specified in your licence. This should not be more than twice the natural wave-length of your aerial—which should be one of the first things for you to ascertain. Tune up the aerial, with the jigger-secondary, and, if necessary, with external tuning-inductance, to the same wave. Use a wave-meter. 3/22 insulated cable will do well for the windings of the jigger, which might be wound on formers about 5 inches square, with some arrangement by which you can vary the distance between the coils, and so the coupling. It is impossible to give actual quantities of wire, as this depends on the capacity of your primary condenser, on your aerial, and on your wave-length. You must find out for yourself by experiment. You could wind your receiving tuning-inductance with No. 26 s.w.g. wire.

H. C. B. (Norwich).—(1) Is it possible to calculate the capacity of an aerial when its size and shape are known? (2) What is the formula for finding the antenna energy in

watts? (3) What is the connection between the antenna energy and the range of the station? (4) Is it necessary to have a licence in order to use a receiving apparatus only?—*Answers.*—(1) Only in the simplest cases, with any degree of accuracy. See Dr. Fleming's "Principles," Chapters II. IV. and VIII., etc. (2) See reply under heading "Radiation Resistance" in *Marconigraph* (January, 1913, page 455). Pedersen's modification of Lodge's formula gives for the radiated energy the following expression: 0·4 × (effective amps. in earth-lead)^2 × $\frac{l^4}{\lambda^2}$ kilowatts where λ is the wave-length and l is the effective height of the aerial. The term "effective height" is defined by Lodge thus: "If the earth were a perfect conductor, the effective height would be twice the apparent height." (3) A very controversial point, and one which cannot be discussed in these columns. There are, besides, very many considerations to be taken into account, such as the nature of the intervening land, etc. (4) Yes. Apply to the Postmaster-General for application forms. There will be a charge of one guinea.

R. I. S. R. (London).—I have a vertical single-wire aerial 40 feet long; if its natural wave-length is four times its length, it will be 160 feet—*i.e.*, nearly 49 metres. If I now calculate the inductance and capacity of the aerial from the formulæ for these quantities at high frequencies, and then calculate from these values (using $\lambda_{cms} = 2\pi\sqrt{L_{cms} \times C_{cms}}$), I get $\lambda = 78$ metres, which is considerably greater than the value given above. Also, in the latter case, λ will vary with the diameter of the wire, although only slightly perhaps.—*Answer.*—The formula you give for capacity $\left(C_{cms} = \frac{l}{4\cdot6052 \log_{10} \frac{4l}{d}}\right)$ is correct, but you give for inductance

$$L_{cms} = 2l\left(\log_{10}\frac{4l}{d}\right) \times 2\cdot3026$$

which is quite wrong; it should be

$$L_{cms} = 2l\left(2\cdot3026 \log_{10}\frac{4l}{d} - 1\right).$$

The value C is the *actual* capacity; to obtain the *equivalent* capacity (which is what you want) you must multiply this by $2/\pi$—i.e., by ·637. Then, substituting in the formula for the wave-length, you will obtain a value about 60 metres. This gives you a factor of about 4·9 by which to multiply the length of your aerial, and this factor, as a matter of fact, is the one to be used in all calculations involving the above formula. This is very nearly the factor given by Prof. Macdonald in his mathematical investigation. In actual practice, the value varies from 4 (in the case of a single long *very thin* wire) to 5 or over.

W. S. (Paisley) is dissatisfied with his results when he reads of the records obtained by other amateurs—such as Paris with the 'phones 40 feet away, ships 1,000 miles away, and so on. The average height of the horizontal portion of his aerial is only 47 feet without allowing for sag, and he gets Paris (at night with the 'phones 1 foot from ears), Norddeich, Cleethorpes, Liverpool (night and day), Poldhu, Scheveningen and a few others, not yet identified, at night.

We do not think this is a record to be ashamed of; as for the rival results which make him envious, we do not wish to discredit them in any way, but we would remind W. S. that "freak" nights are by no means uncommon, and their results startling. He asks for any suggestions how he could improve matters in his case. One weak spot is the lowness of one end of his T aerial—only 27 feet—compared with 67 feet at the other end. If possible, he should increase this 27 feet, and thus add to the average height. Moreover, since he is anxious to receive long waves, he might convert his aerial from a T to an inverted L, thus decreasing the additional inductance required for tuning. He tunes his aerial-earth circuit to the long waves by a parallel condenser; this is not always an efficient way, and he might dispense with that condenser and have additional tuning inductance. Tuning on the secondary he finds not at all sharp; his secondary is 22 d.c.c. wound for a length of 5 inches on 12 inches diameter drum, and his tuning condenser has maximum value ·0005 mfd.

With such a short, wide secondary it is impossible to get the "free high-potential end" which we have so often advocated. W. S. might try a much longer secondary with smaller diameter, such as would just enter his primary, which would thus be coupled only to the low-potential end, leaving the other end well apart from the earthed primary. The crystal would be connected to the high-potential end, then through the telephones to the low-potential end—*i.e.*, the end coupled to the primary. Using the same condenser and the same size of wire, the secondary would have to be about 12 inches long if a 7-inch former were used. The coupling could be varied by raising or lowering the secondary in the primary

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R. J. H. B. (London).—(1) Your aerial is fairly good, the weak point being nearness to walls and roof. The free ends should *not* be joined together as you show them. If you could extend each wire horizontally along roof at right angles to plane of paper, you would increase the wave-length and thus decrease the additional inductance required for tuning to the long waves; this would improve matters. (2) Water-drain will be a fairly good earth for receiving and not bad for transmitting on small powers, if it goes well underground. But are you sure that it is not earthenware below ground? Nearly always a continuous wire lead is advisable in preference to pipes; these often have various joints and jointing-material to break their continuity. We deprecate the use of gas-pipes for transmitting-earth because a spark might easily explode any gas which might be leaking and accumulating below floors, etc. (3) 1,000 ohms is quite reasonable, though not so high as might be desired. (4) The ii's are divisions between 3-letter code signals. We do not see how those signals can "sound like a weather report" if every three letters are punctuated by ii. (5) and (6) We never reply to questions of this kind. (7) Considering your environment, you would probably require a 2-inch coil.

S. H. D. (Westcliff).—In your answer this month to the inquiry of your correspondent S. S., you say it is quite possible to record the Eiffel Tower messages with a Morse Inker by means of a coherer and relay. Is this answer applicable to my installation? I have a Horophone fixed in connection with an aerial 60 feet high consisting of four strands of copper wire in parallel, each about 40 feet long.

The Paris signals are fairly distinct in the telephone, but as the instrument is fixed in my shop the entrance and exit of customers often interrupt the signals.

Answer.—If your crystal (in your present apparatus) is a good one and properly adjusted, and your circuit is in tune, and yet the Paris signals are only "fairly distinct," you would probably have some difficulty in getting a coherer and Morse Inker to work well. A good crystal receiver is much more sensitive than a coherer. Could you not put your receiver in a back room where customers would not be entering? Unless you can improve your aerial, or your "tuning," so that a good crystal will give you really loud signals, it is not advisable to try a coherer. If you can so improve your apparatus—as a last resource you might heighten your aerial (and make sure that each wire is really of the same length and not only "about")—as to give really loud signals, then you might try a coherer, which you could obtain from any dealer in "amateur wireless apparatus." You had better "read up" coherer-receivers in some elementary book. We fear your "horophone" circuits are not well adapted to a coherer. Cleethorpes sends practically all day and all night, at half-hour intervals, Poldhu at 11.30 at night.

THE "WIRELESS WORLD" PURCHASE BUREAU

THE difficulty of obtaining personal supplies has often been a serious disadvantage to wireless telegraph engineers, operators, and others, whose calling takes them away for lengthy periods to remote quarters of the globe. Clothing, footwear, books, scientific instruments, and other articles which help to lighten the monotony of an often desolate country, are not easily obtainable unless the prospective purchaser has a trading account with a number of tradesmen in this country. Even if this is the case, there remains another difficulty which is not easily surmounted, for tradesmen are generally unwilling to accept coinage of many of those countries to which wireless engineers are sent. A case which came to our notice recently illustrates this difficulty.

An engineer who was sent to one of the South American States had occasion to order a pair of special boots, which were necessary on account of the rainy season then approaching. He was unable to obtain English money and was hundreds of miles away from the office of the British Consul. The only course open to him was to send local money with his order. He had despatched his order so that the boots should reach him in time for the rainy season, but instead of the boots there came a very polite letter from the firm regretting their inability to accept the notes which he had enclosed with his order.

This difficulty is typical of many which have been brought to our notice, and we have therefore evolved a scheme which should be a great convenience for a large portion of our readers. All that is necessary for a Marconi engineer or operator to do when ordering supplies, is simply to write to us, giving particulars of his requirements, together with an order for the purchase money upon the company who will deduct the amount from his salary cheque.

At the same time he should write to the Marconi company, mentioning that he has given us authority to make such purchase and intimating that the cost of such purchases is to be deducted from his salary. The receipt of the suppliers of the goods will be understood to be a full and sufficient discharge of his salary to that amount.

Anyone desiring to make use of our services should notify and give us authority to act for him before he goes abroad.

Again, if he has made arrangements for his salary to be paid into a bank or to someone nominated to receive it while he is away, he should notify to his nominee that he has authorised the company to deduct from his cheque the amount of payment for purchases made on his behalf through us. In every case the goods will be purchased at the best possible price, and will be sent carefully packed at cost price, plus postage or cartage.

Wireless telegraphy has been established in the Bahamas. The radio-telegraphic station, which is situated at Fort Charlotte, Nassau, has been formally inaugurated by his Excellency Sir G. B. Haddon-Smith, the Governor, the first message being one sent to the King.

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Regulations have recently been issued regarding the installation of wireless apparatus on steamers registered in New Zealand and authorised to carry not less than 50 passengers, or engaged in foreign or intercolonial trade. They provide for the employment of skilled operators, and the apparatus must be capable of transmitting and receiving messages over a distance of at least 100 miles at any time of the day.

Since the last announcement in THE WIRELESS WORLD the Marconi Philatelic Society has held several meetings, all of which have been extremely satisfactory, both as regards attendance and the interest displayed. Holidays prevented a meeting being held in August, but now that the general routine has been resumed it is hoped that a good many of the members will be present at the next meeting, which takes place on October 7th.

As is generally known, the meetings are held for the purpose of discussing matters of interest to stamp collectors—such as new issues, etc.—and for the examination and exchange of duplicate stamps. They are due to take place on the first and third Fridays in each month, commencing with the next meeting in October. One very pleasing feature of the Society's membership is the enrolment of several wireless operators; but the Secretary is anxious to get into touch with the members of the Engineering and Operating staffs, whose work affords them such splendid facilities both for increasing their own collection and for helping the interests of the Society.

Any stamps sent for exchange purposes should be forwarded to the Secretary, Mr. W. J. Everett, at Marconi House, and should reach him not later than the day before the meeting.

Patent Record.

The following patents have been applied for since we closed for press with the September number of this magazine :

No. 18,326. August 12th. Marconi's Wireless Telegraph Co. and H. J. Round. Wireless telegraph receivers.

No. 18,502. August 14th. G. Marconi and W. S. Entwistle. Transformers for high frequency currents.

No. 18,939. August 20th. Ludwig Mach. Apparatus for detecting heat radiations.

No. 18,961. August 21st. A. B. Williams and Wm. Alex. Solomon. Electro-magnetic relays for use in connection with W. T. installations and for other purposes.

No. 18,962. August 21st. A. B. Williams and Wm. Alex. Solomon. Spark gaps for use in connection with W. T. installation.

No. 19,855. September 2nd. Guilio C. L. V. Ulivi. Apparatus for projecting electro-magnetic rays to a distance.

No. 19,911. September 3rd. Percy G. Webb and Joseph Krammer. Apparatus for wireless telephony.

No. 19,966. September 4th. Wm. P. Thompson (for Soc. Anon. des Télégraphes Edouard Belin). Method of and apparatus for the transmission of messages and designs such as photographs, cliches, and the like.

No. 20,097. September 5th. Guilio C. L. V. Ulivi. Apparatus for projecting electro-magnetic rays to a distance.

Marconi Athletic Club.

The cricket season has drawn to a close. On the whole the weather has been favourable, and most of the Saturday matches have been played on good hard wickets.

During the season, 17 matches were played, with the following results : Won, 3 ; Lost, 13 ; Drawn, 1.

The cricket throughout the season was very enjoyable. Many of the matches were keenly contested and resulted in a close finish. The poor percentage of wins is undoubtedly due to the fact that so many changes were made in the team week by week, so that the club was unable to get together a winning combination. Below is the record of the most successful batsmen :

	Innings	Runs	Times not out	Highest Innings	Average
Wheeler, S. H.	8	111	1	42	15·86
Menear, J. F.	10	137	1	27*	15·22
Wagstaff, E. J.	12	177	–	56	14·75
Delange,	6	58	1	29*	11·60
Williams, R.	9	91	–	35	10·11

* Signifies not out.

The most successful bowler was Mr. E. J. Wagstaff, with 47 wickets for 314 runs (average 6·68). Mr. S. B. Balcombe was next in order of merit with the bowling, 37 wickets for 469 runs (average 12·67) ; Mr. F. W. Bates was third, with 21 wickets for 289 runs (average 13·76).

The club was well served by Mr. R. Williams's excellent wicket-keeping.

The return match—London Office *v.* Chelmsford Works—was played at Chelmsford on Saturday, September 6th, and a very enjoyable game resulted in a win for the Works team by 26 runs.

Messrs. Eales, 34, and Warner, 29, carried off the batting honours for the Works team, and Mr. Eales also proved himself the most destructive bowler, securing 7 wickets.

The most successful batsmen for the Office team were Messrs. Williams, 13 ; Bates, 13 ; Menear, 12 ; Wheeler, 11 ; whilst Messrs. Bates and Balcombe were the most successful bowlers.

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The football season opened on September 20th with a match between the club team and the Marconi House School. October 4th should be a great day in the season's events, for then the club plays Dartmouth Athletic Club, in the competition for the London Junior Cup. On the 11th instant a league match has been arranged with Winchester Athletic Club, and on the 18th with Aster Football Club. Last year the Marconi Club had a very successful season, and it is to be hoped that they will not only keep up their reputation, but add thereto, and for this the hearty co-operation is required of all the members of Marconi House, not only as players, but as supporters. Both the captain and vice-captain, Mr. J. F. Menear and Mr. F. B. Lord, have resigned, and it will be necessary to call a general meeting to elect their successors.

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The tennis courts have been well occupied during the latter part of the summer. The handsome Challenge Cup presented by Mr. D. Willock, of the Electric Construction Co., for singles competition, on the all against all principle, has proved a great incentive to singles play, and has provoked many keen contests. The competition has only recently concluded, and the result has not yet been announced.

The tennis match against the Chelmsford Works team on Saturday, August 30th, was an event of great interest to our tennis section. Three doubles and four singles were played, the home team being fortunate enough to gain the victory in each event.

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In spite of the fact that during the last few months outdoor interests have been in the ascendant, the Musical Society has kept the even tenour of its way in a most laudable manner. Every Tuesday evening has been devoted to musical practice, and its effect is already discernible in the increased confidence and unity of the orchestra. At present there are twenty available members, but double-bass, trombone and flute players are much wanted. Will any member of Marconi House come forward to fill up the deficiency ? He will be made greatly welcome by the secretary and members of the Musical Society.