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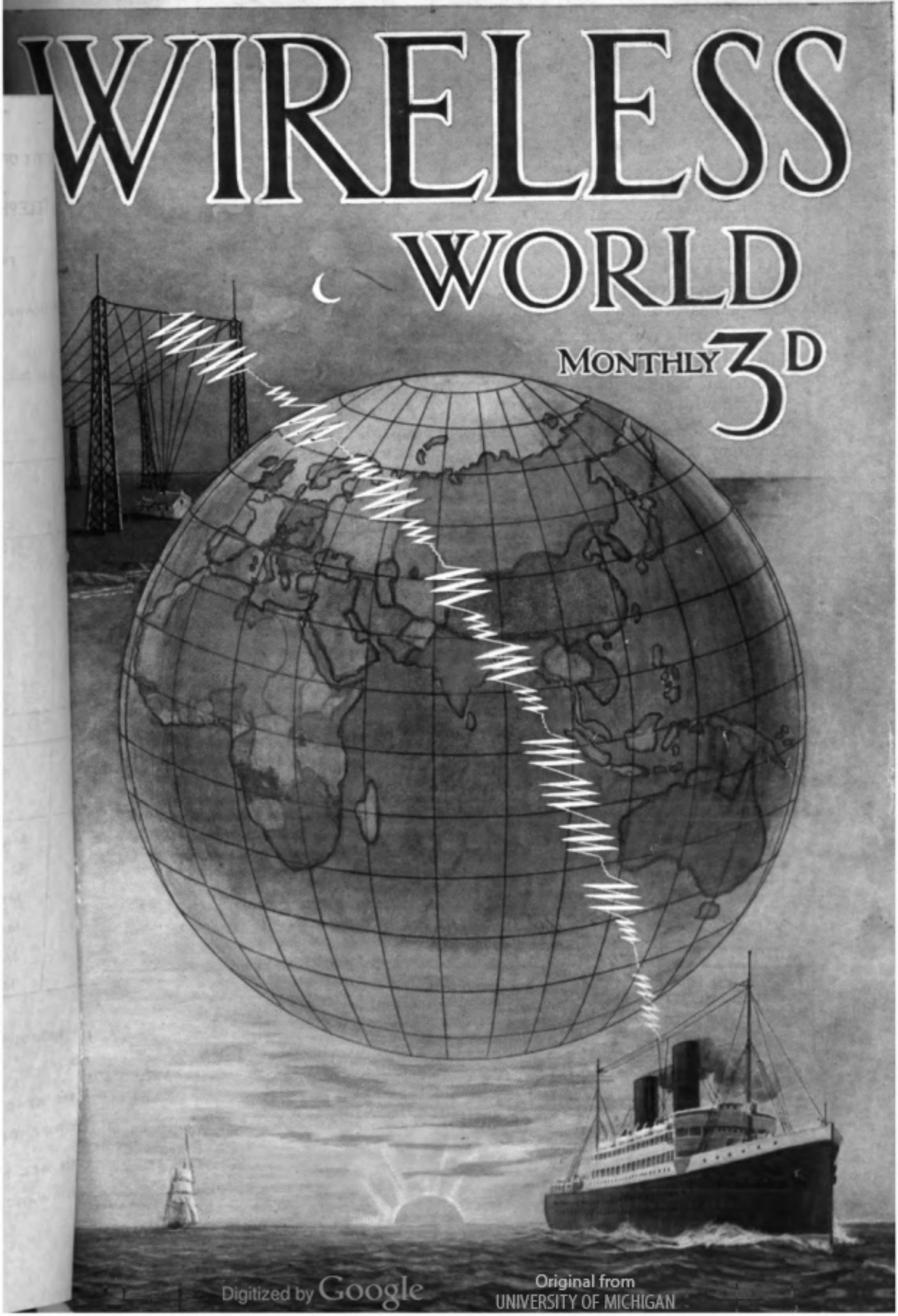
WIRELESS WORLD

MONTHLY 3D



THE
WIRELESS WORLD
with which is incorporated
The MARCONIGRAPH

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Wireless and Weather Forecasting

THE means for the advance of civilisation which Mr. Marconi has placed in the hands of science is demonstrating its value in more astonishing and definite forms every day. Even the Arctic explorer, immured behind the barrier of a thousand miles of ocean, and the winter walls that shut him in, is in communication with the outer world, and can send daily messages as to what is happening around him. A striking example of the value of this, not merely to science and commerce, but to humanity, is furnished by the work of Dr. Mawson in Polar regions. The Australian Government Meteorologist (Mr. Hunt), since March 24th, has been in constant touch with Dr. Mawson, hibernating in Adelie Land, and has received *via* Macquarie Island a series of messages of great interest to those devoted to the science of the weather. Mr. Hunt indicates that the length of time during which such messages have as yet been received is insufficient to form the basis of any final assertion as to the actual effect of weather in the Antarctic upon weather in Australia. Everyone knows that the result of scientific observation in the far southern regions has established the weather connection between Australia and the land surrounding the Pole; but the details of the natural processes generating there, and operating in the Commonwealth in the shape of storms and cyclonic visitations, cannot be ascertained so far in a way useful to the weather prophet. We are, however, rapidly passing from the region of surmise and theorising into the realm of ascertained fact. It only needs an extension of the system of wireless telegraphy, with appropriate recording stations along the Antarctic continent to the west of Adelie Land, and thence to such a strategic centre as, say, the Kerguelen Group, which in turn might be linked up with the Leeuwin, to establish a system of communication of immense value to meteorological science in southern regions. Forecasting weather is a strictly limited business to-day, but the knowledge of the part played by the Antarctic region in the manufacture of Australian weather conditions has been sensibly advanced by the wireless messages from Dr. Mawson. The value of wireless telegraphy as an aid to meteorology may not be immediately obvious to the average man; but the sceptic should remember that there is a side to all scientific investigations that makes its appeal to the few long before it justifies itself in the region of practical life, and this matter of wireless telegraphy in its usefulness to meteorology will undoubtedly be appreciated by the many when it becomes expressed in terms of commercial advantage.

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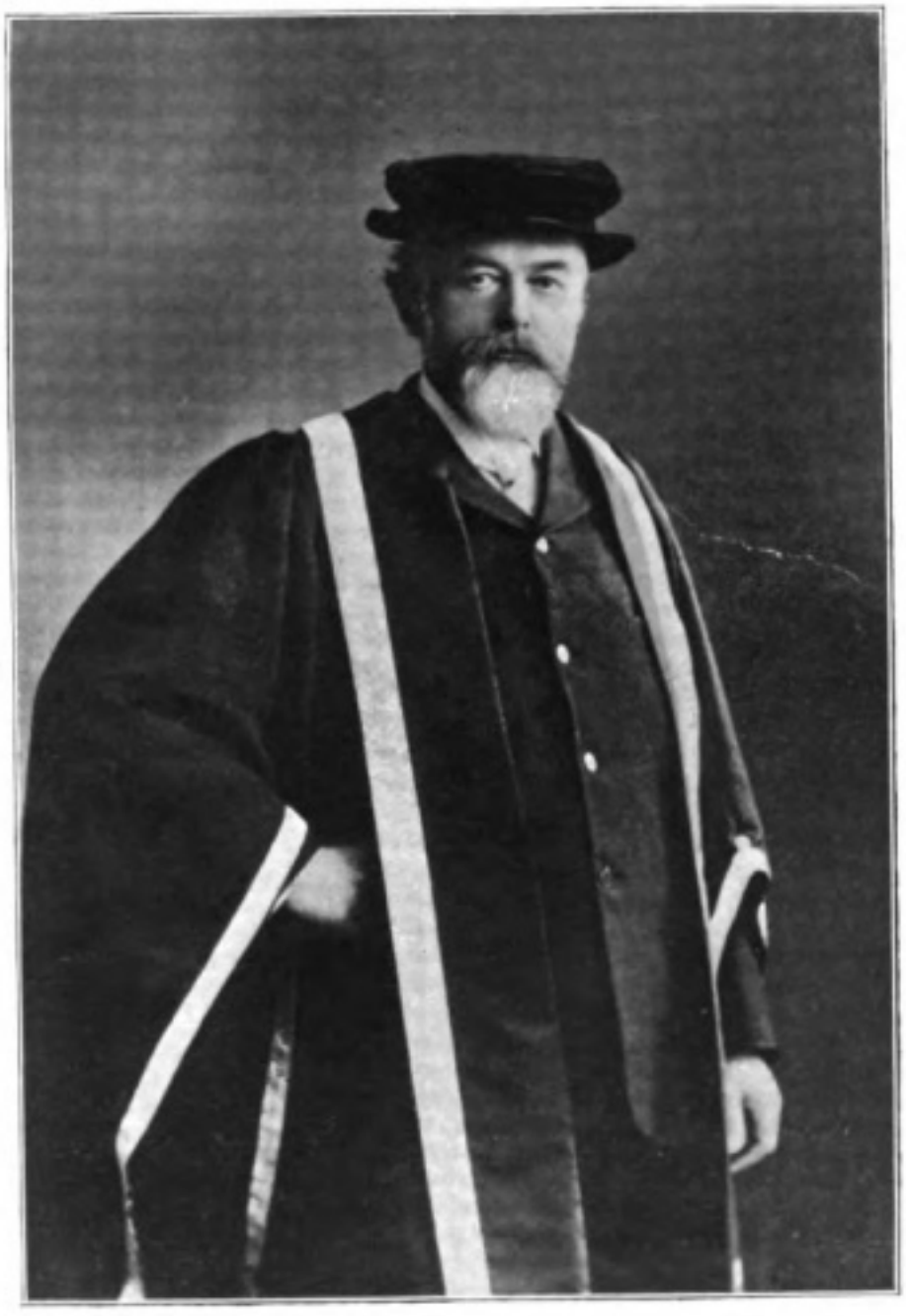


SIR OLIVER JOSEPH LODGE.

Personalities in the Wireless World

SIR OLIVER JOSEPH LODGE

Principal of Birmingham University and President of the British Association for the Advancement of Science

. . . " He was a scholar, and a ripe and good one,
Exceeding wise, fair-spoken and persuading. . . ."

THE adaptation of this quotation to the subject of this month's biography needs no apology. The words in which Shakespeare speaks of Cardinal Wolsey could aptly be applied to Sir Oliver Lodge, and, if it be allowed to alter a quotation to fit an altered subject, we might add :

" Witness for him
That place of learning which he raised in you,
Birmingham, . . . though unfinished, yet so famous,
So excellent in art, and still so rising,
That Englishmen shall ever speak his virtue."

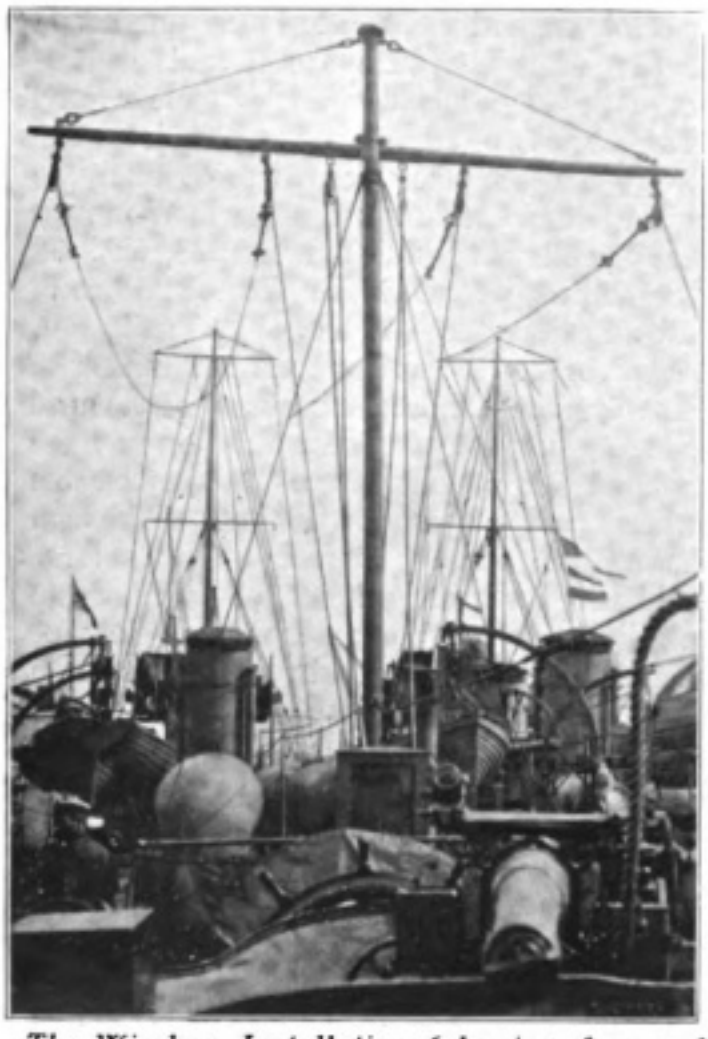
Sir Oliver Lodge has been Principal of the new University of Birmingham since its inauguration in 1900, and it is largely due to his zeal and influence that it has achieved already so important a position in the educational world.

Sir Oliver was born at Penkhall, Staffordshire, on June 12th, 1851. He was educated at Newport (and Salop) Grammar School, and was intended for a business career. But science held too great an attraction for the young student, and, instead of following the course prescribed for him, he entered University College, London, in 1872, and five years later gained his doctorate of science. Later, he was for many years Reader in Natural Philosophy at the Bedford College for Women, until he was appointed Professor of Physics in University College, Liverpool, which post he only vacated to take up work at Birmingham. In 1891 he presided over the Mathematical and Physical Section of the British Association, and this year he is President of the same Association for the Session which opens this month at Birmingham University. In 1902 he was knighted, and if there was anyone connected with science who deserved recognition, it was Dr. Lodge. He had already made a name for himself by reason of his scientific research, which included investigations on lightning, the seat of the electro-motive force in the voltaic cell, phenomena of electrolysis, and the speed of ion, the motion of the ether near the earth, and electro-magnetic waves and wireless telegraphy. His treatises on these various subjects are many, but the one perhaps most likely to interest readers of THE WIRELESS WORLD is that which was published in 1908, entitled " Signalling Across Space Without Wires," and another, " The Ether of Space." But Sir Oliver Lodge has not confined himself to this or even kindred branches of natural science. Metaphysics and philosophy have engaged his attention to a considerable extent, and his works dealing with such matters are widely appreciated by a large and ever-increasing public. His authorship in this direction is too extensive to allow for them to be treated individually, but mention must be made of " Life and Matter," a book which has gone into several editions since it was published in 1900, and which is a masterly exposition of the philosophy that he holds so dearly. Besides this, he has written short articles on, or introductions to, books of quite a different nature, notably Ruskin's " Unto This Last," and " Sesame and Lilies," which have recently appeared in the " Everyman's Library." But most interesting of all, perhaps, is his " Biography of John Priestley," another of Birmingham's famous men, for this great forerunner of modern thought bears a striking resemblance to his biographer, both in his outlook on life and his qualities as scientist and philosopher. Therefore, in conclusion, let us transpose a passage which Sir Oliver Lodge uses in connection with Priestley, and apply it to the subject of our sketch : " His services to experimental science are astonishing, but his constant dignified pleading for civil and religious liberty are of even more value."

Ships at War

Incidents in and Observations on the Recent Naval Manœuvres.

ONE of the great events in the naval year has been brought to a close by the completion of the manœuvres on the East Anglian coast. What exactly has taken place will not be known until Sir William May issues his report, but the main events have been sufficiently prominent to



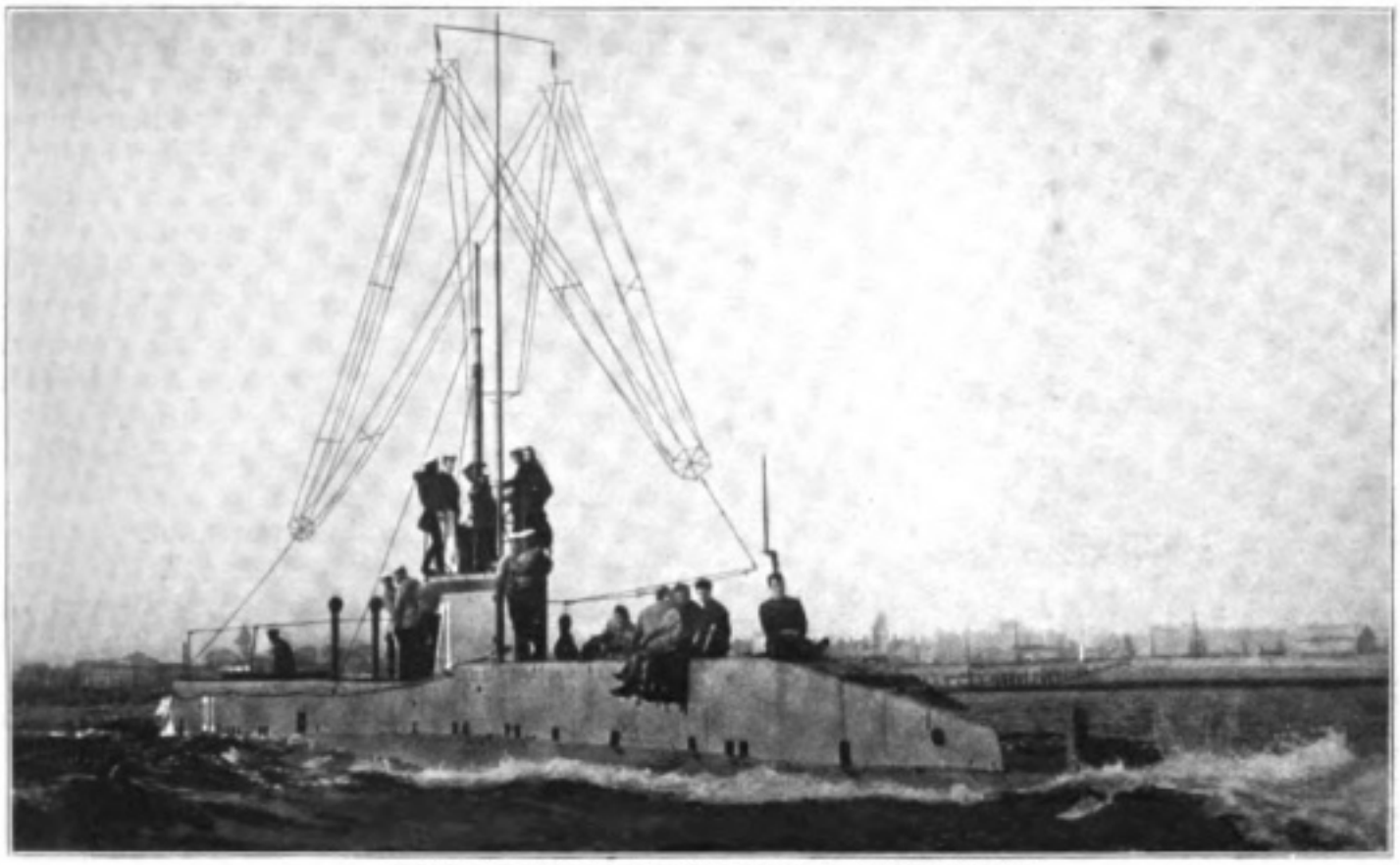
The Wireless Installation (showing fore and aft masts) on one of Great Britain's latest Dreadnoughts.

engage the attention of the public. The vessels engaged in the manœuvres numbered some 350, and they were divided into the "Red" and "Blue" fleets. The "Red" were the invading force, the "Blue" the defending. Perhaps the most exciting episode of all was the landing of 4,000 troops by the "Red" fleet at Grimsby, when the Humber was captured, together with two important positions, Grimsby and Hull, with the adjoining wireless stations at Cleethorpes and Humberstone. These were looked upon as great prizes by the victors, for as soon as they came into possession of them they started communicating with the fleet outside and availed themselves to the full of their good fortune.

That was on the Thursday, July 24th. Later, another invasion was made by the "Red" fleet, on Sunderland and Blyth. The tactics employed were much the same as in the case of the earlier victories. On Saturday morning a strong "Red" force appeared off the Tyne. About 4.30 a.m. a division of the "Red" fleet, consisting of about twenty vessels, approached. They were challenged by the "Blue" cruisers and a number of torpedo boats which had left the harbour immediately after the "Red" vessels had been sighted, and after heavy firing the attacking vessels were forced to retire. This, however, appears only to have been a feint on the part of the "Red" fleet in order to prevent assistance being sent to other ports, for early the same morning the "Red" fleet landed a force at the important Northumberland coaling port of Blyth, and captured the town. Two sighters, seven destroyers, and two transports rapidly approached the harbour. The coastguard on the look-out immediately gave the alarm, and telephonic communication was effected with the Northern Cyclists Battalion, who were encamped a little to the south of the town. A party with two maxims immediately hastened to their defence, but they were too late for the "Red" transports. The *Rohilla* and the *Rewa* had anchored, and had already landed a force under the cruisers' fire. The cyclist corps could offer but a feeble opposition to the attackers, who were brought ashore in steam pinnaces, each drawing a string of six boats, and the defenders were ultimately driven back and their machine guns captured. Meanwhile, a destroyer and submarine, which had been cruising along the coast, fell into the enemy's hands, but not before the submarine had put one of the "Red" trans-

ports out of action. This, however, availed little in defending the city, for the port was now completely at the mercy of the invading army. The General Post Office, the railway station, and other places were "destroyed." The bridge over the South road was blown up to prevent the arrival of a relieving force from Tynemouth, the telephone and telegraph wires were cut, and the lighthouse was occupied and frequent signals exchanged with the ships outside. Much the same happened at Sunderland. The town was captured and its principal buildings destroyed, but here disaster followed swiftly on the heels of success. While the "Red" troops were landing four torpedo boats of the defending force arrived. The "Red" destroyers drew out to meet them, and the "Blue" ships thereupon withdrew—all but one submarine, which had meanwhile drawn near. Hiding behind a small merchant steamer, it approached the cruiser unperceived, and fired a torpedo, effectively disabling the "Red" cruiser. While this was in progress, the invading troops had reembarked in the transports, and the "Red" fleet prepared to leave the harbour But here a surprise awaited them: fourteen vessels of the "Blue" fleet had arrived off the port, and formed a ring round the entrance. There was no fighting. The "Reds" could only accept capture at the hands of the enemy.

Such are the outward and visible signs of "manœuvres" as far as the general public is concerned. What they mean to the actual participants is an entirely different thing. Manœuvre days are days of extreme stress and hard work, with very little compensation in the way of excitement. No man, except the admirals or their staff officers, knows what is happening. The rest of the officers and men have a general idea that one side is to attempt to land troops, and that the other side is to prevent them doing so, but apart from that there is little except extra labour to distinguish manœuvre practice from any other day's work. Sea routine goes on as usual: scrub decks, breakfast, divisions, prayers, the work of the ship, stand easy, more work, till working hours are over. The captain divides his time between his cabin and the bridge; the commander is intensely occupied from early morning till late at night



OUR NAVY'S LARGEST SUBMARINE

and one of the first to be fitted with Wireless, an asset which has been found of enormous value in the recent manœuvres.

FULL STEAM AHEAD!
A Leviathan ploughing its way through the waters.

with the ordering and supervision of the whole work of the ship; the first lieutenant, usually gunnery lieutenant as well, is responsible for the condition of the decks—acres of decks down below. The torpedo lieutenant is in charge of the torpedoes and all connected therewith, and all electrical appliances generally. The watch-keeping lieutenants relieve one another upon the bridge and the upper deck. Upon the navigating officer falls the responsibility of keeping the ship upon her course. He is not supposed to require any sleep. He can sleep if he likes, but his responsibility continues. So long as the ship is at sea so long is he on duty. He becomes red-eyed and very silent.

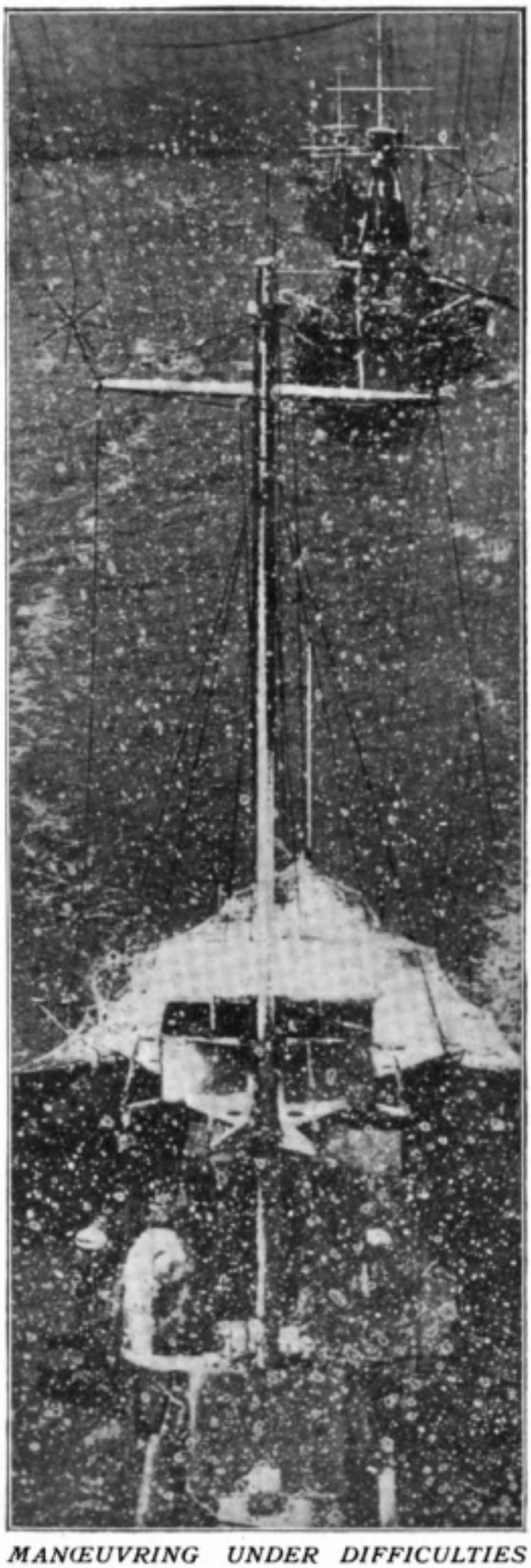
In the good old days things were different. Then naval manœuvres were conducted in a placid happy spirit. The attacking admiral used to spy for a hole in the rules and sail through them, as the phrase went. They sailed to pleasant places and made delightful landfalls. There was no hurry, and people went ashore and saw life, and so on. It used to be a fine thing to finish up a long cruise with a big fleet action, two long lines of battle, the slow ships in the rearguard huddled together in a vain effort to keep station, and the guns firing, and the smoke turning into a blue and yellow fog, and the commander pressing buttons in a frenzy of excitement in the conning tower, trying to fire a torpedo, while the admirals on either side exchanged signals, which gradually indicated a rising temperature. Then they would stop, the two fleets would join up amicably, and steam in a most tremendous and imposing majesty into Arosa Bay, or Lagos, or somewhere, and all would be peace. But that is all over now. Things have become extremely scientific and there is no slacking and no practice. All is in deadly earnest, and life on a destroyer at such times is a hard one. The captain hardly ever leaves the bridge by day or night. He may snatch a few minutes on a hard couch in the chart house if he is lucky, but three or four nights in the dirty weather and fog in the great North Sea is usually his portion. Then for the men. The work must be done somehow, and under the worst conditions. No service clothes on for such times as this. A sweater, an old pair of breeches, sea boots and oilskins are good enough to be yanked out in such rough work. As for meals, it is

often impossible to sit down. Sardines and whisky are consumed standing.

Life on a submarine is not much easier. "The submarine goes grinding along with a noise like a mill, her long fish-body awash, the helmsman and the captain aloft, on the circular turret amidships, peering over the canvas screen. Down below the artificers squat in the steel tube among the furious petrol engines, in the midst of a stupefying racket enough to drive them insane. If the boat is to sink, there is a sudden silence as the engines stop and the electric motors are switched on. The figures vanish from the conning-tower, and presently there is nothing to be seen but the slender pole of the periscope, cutting the waves like the wing of a bird. The captain, below, grasps the steel handles, shoulder high, which swing the mirror, and staring into it beholds a tiny picture of the great field of sea and the scattered ships, like little toys. If he sink deeper, submerging the periscope, the mirror reflects a cliff of green water. In the captain's brain is an accurate record of exactly how much weight is in each part of the vessel, and a precise estimate of the orders he must give minute by minute. Upon the absolute integrity of the response of his mind depends the existence of all on board."

Meanwhile, on the surface, the battleships follow in the wake of one another, the ship ahead lifting and falling with the rhythm of the waves. At night the speed lights shine from the yards, unless the Admiral orders all lights to be extinguished, as he usually does in manœuvres. Then the officer of the watch, keeping station, is oppressed with care. If a fog descends he can see nothing but the fog-buoy trailing astern from the ship ahead, and dimly squaltering through the hissing water like a duck.

Again, there is the danger of a torpedo attack. The destroyers prefer a moonless night with a little sea-way and a dash of rain. Hour by hour the guns' crews in battleship and cruiser stand by their guns, staring into the gloom. A red cinder flying from her funnel may betray the destroyer, and the quick-firing guns open instantly. But the target is travelling at thirty miles an hour. Day and night, in the wireless room, a blue-jacket dwells in an atmosphere like the heart of a thunderstorm, blue flames playing about him and a crackling noise of sparks.



MANŒUVRING UNDER DIFFICULTIES
It is not always fair weather sailing. This photograph was taken from the Captain's bridge during a snowstorm.

The admiral or captain receives the messages written out on signal forms, and acts upon them as he may. Ten years ago there was no wireless; a ship desiring to convey information to another must come within sight of her and signal with flags.

During the present manœuvres wireless has been used more extensively than on any previous occasion. At times so many code messages have been passing simultaneously that a certain amount of interference might have seemed almost inevitable and the smart and rapid working, and freedom, in the main, from interruption, has been a noteworthy feature. The fact is, naval wireless operating has reached a very high state of excellence. All important work is being done by cypher automatically changed with every message sent, and this, combined with the great increase in power and range of ships and stations, makes it almost impossible for outsiders to identify the sources of messages or those to whom they are sent.

And this mention of wireless calls for particular remark. Its importance in time of war cannot be overrated, and this not only in connection with battleships, but with vessels of the merchant service, all of which, be it remembered, would be likely to be affected in the event of a naval war. Perhaps the best means of illustrating this point is to quote from a report issued not very long ago by the Board of Admiralty on the subject of Naval Warfare, and the possible invasion of England:—

"The really serious danger that this country has to guard against in war is not invasion, but interruption of our trade and destruction of our merchant shipping. The main object aimed at by our fleet, whether for the defence of commerce or for any other purpose, is to prevent any ship of the enemy from getting to sea far enough to do any mischief before she is brought to action . . . if a fleet of transports is sighted anywhere by a single cruiser, or even by a merchant ship if she is fitted with wireless, every ship which happened to be in a position to intercept the transports would at once get the order to concentrate as necessary for the purpose, whether she was at sea or in harbour . . even supposing that by some extraordinary lucky chance the transports were able to reach our coasts . . . long before half the troops could be landed, the transports would be attacked and sunk by submarines . . . besides the submarines there would always be a large force of destroyers . . . a superior force would be brought to attack him before the landing could be completed . . . an invasion on even the moderate scale of 70,000 men is practically impossible."

"PARASITIC WAVES"

M. FRANK DUROQUIER is a French Meteorologist of repute, and his observations are always deserving of attention. His most recent investigations have resulted in his establishing the fact that the telephone receiver is remarkably sensitive to climatic conditions, so much so that an intelligent wireless operator can foretell the weather from the character of the noises in his receiver.

The noises to be heard in a receiver he attributes to the "parasitic waves" of the atmosphere which are set in motion by each change in the weather. Hitherto it has been believed that the wireless system could only foretell storms, by means of a very clever, if complicated, arrangement which causes the greater disturbances to register themselves automatically through the medium of a pendulum. But the use of the telephone makes it possible to obtain the same results in a much less roundabout way.

"By these means," says the professor, "we have studied the parasitic waves of the atmosphere for a whole year, and we were not only surprised at the great variety of these parasites, but at the accuracy with which they register the character of atmospheric disturbances." Connect a telephone receiver with a wireless system and you can tell from the character of the noises whether a gale, or a thunderstorm, or cold, or rain is coming.

A strong crackling signals the approach of a thunderstorm. A fall of hail causes a slight whistling in the receiver. Asthmatic, irregular noises betoken a coming fall in temperature and frost. If the wave-lengths of the parasites shorten and give the impression that the noises are grouping together, you may safely predict a change in the wind. Great barometric depressions and very violent storms are heralded by very frequent cracklings, which now and again almost develop into a sound as of an explosion.

The Transmission of Photographs and Drawings by Wireless Telegraphy

By PROFESSOR KORN

Professor Arthur Korn, of Charlottenburg, is the inventor of the process which he explains in the following article.

THE telegraphic transmission of photographs and drawings by means of conductors is no longer a dream; thousands of photographs have been exchanged telegraphically between Paris and

Fig. 1.—A Telegraph Transmission of a Drawing by means of an Artificial Conductor.
The portrait is that of Senator Villa, President of the International Exhibition, Turin, 1911.

London, Berlin and Paris, Monte Carlo and other photo-telegraph stations; and as the publication of pictures in large illustrated papers has thus become possible, with a considerable advantage over the ordinary transmission by post, it may be said that photo-telegraphy has fought its way into practice. The illustrations in Figs. 1 to 3 will enable one to form an opinion of the transmissions that have hitherto taken place.

Apart from the problem of the tele-vision, which, being based upon the same principle as photo-telegraphy, is possible in itself, but can only be carried out by means of enormous sums of money, we are also attracted to the task of transmitting photos and drawings by "wireless."

Would it not be most interesting on board an ocean liner if, besides the Marconigrams which maintain communication with the other parts of the globe by means of words, we were to find also in the "ocean journals" pictures of the most recent events? But not only for the sake of amusement, but for a great number of important applications, the wireless transmission of photographs and drawings will meet with great interest; we mention here as an example only the possibility of transmitting signatures absolutely reliably from ocean liners to home; the possibility of transmitting the portraits of criminals, who are trying to escape on an ocean liner, by "wireless" to the big steamers at sea, and thus of identifying the malefactors with more certainty than is possible through the mere description in words.

There has never been a lack of proposals and primitive tests in this respect, and I refer those readers who are interested in the completest possible specification of these

Fig. 2.—A Telegraphic Transmission of a Photograph by means of an Artificial Conductor.

Colonel Mangin, who was chief of the French Troops fighting in Morocco.

tests and proposals to the summary in Korn-Glatzel's "Handbuch der Photo-telegraphie and Telautographie" (published by Nemnich, Leipzig, 1911), pp. 159-163 and 410-413.

I would like to explain here briefly the principles of the method, which is based upon my picture telegraph methods (with the use of conductors), and the possibility of application of which I have already proved through the tests I carried out in conjunction with Professor Glatzel.

Just as with picture-telegraphy with conductors, we can distinguish between a black and white method (telautography) and a half-tone method. Whilst, with the methods of the second kind, the qualities of selenium are made use of with advantage in the sending station, because its electric resistance alters under the influence of light, one uses for the black-and-white method an arrangement in the sending station whereby the black-and-white picture (handwriting, drawing, autotype) to be transmitted is engraved by means of a non-conducting material on a metal foil, which is wound round a rotary cylinder 4 (Fig. 4). A metal point is sliding on the foil and moves just like the stylo of a phonograph with every revolution of the cylinder a little sideways, thus engraving the picture in fine spiral lines. Each time, when the metal point comes across a conducting spot of the foil, a part 5 of the inductance 3 is short-circuited, which regulates the period of the electric oscillations of a wireless "sending" station in connection with the inductance 1 (which is coupled with the inductance 3) and the capacity 2. The station is supposed to transmit with non-damped or feebly damped oscillations, which are, according to what has been said before, tuned to a certain period, so long as the part 5 of the inductance 3 is not short-circuited; but if this part is short-circuited, *i.e.*, if the metal point of the telautographic sender comes across a conducting spot of the picture foil, the oscillation is put out of tune.

The receiver is provided with an aperiodic circuit II, which consists of a capacity 8, an inductance 7, and a detector 9 (a thermo-detector is best); the inductance 7 is coupled with the inductance 6, which is inserted between antenna and earth. A large inductance 10 and a string galvanometer 11, which we shall consider presently, are connected in parallel with the condenser 8. The inductance 10 serves the purpose of keeping the arriving currents, which alter their direction, off the galvanometer 11, and of letting only currents of one certain direction pass through same, so that it can deflect only to one side. If the receiver is

properly tuned to the incoming waves of the sender the string galvanometer will each time deflect when the metal point of the transmitter is on a non-conducting spot of the picture foil, whilst no deflection will be observed when the metal point in the sender is on a conducting spot of the foil.

The deflections of the string galvanometer are then used in the same manner as with ordinary picture telegraph receivers (with conductors), to reproduce in the receiver the picture in question. The string galvanometer consists of a fine metal thread (14, Fig. 6), which is stretched between the poles of a strong electro-magnet, and through which the currents are led to cause the deflection of the galvanometer. The thread is deflected when an electric current passes through it, as a consequence of the effects of the electro-magnet, in the plane vertically to the magnetic lines of force, and in one or the other direction, according to the direction of the current that passes through. We want to reproduce the picture in the receiver on a sensitive film, wound round the receiving cylinder 16. This receiving cylinder rotates in a box, into which no light can penetrate, synchronously with the transmitting cylinder (on which the foil with the original picture is laid), a thread on the axis ensuring that the cylinder is moved with every revolution a little sideways in the direction of its axis, exactly as the metal point in the sending apparatus is moved with every revolution. We concentrate the light of a Nernst lamp 15, by means of a lens, on the thread 14, and project, by means of a second lens, an image of the thread on the slit of a tube leading to the receiver-box. The optical device is so arranged that the shadow of the thread just covers the slit when the thread is not deflected ; in this case, no light enters the receiver-box ; when, however, the galvanometer is traversed by a current, *i.e.*, when the thread is deflected, the shadow of this moves away from the slit, and light penetrates into the box ; the light rays are collected by a lens in the tube and projected on to a small element of the receiving film, so that every non-conducting spot of the picture foil in the sending station corresponds to a photographic impression on the

Fig. 3.—M. Brindejonc de Moulinais.

This photograph was transmitted from Berlin to Paris by Wireless Telegraphy. The distance covered was about 750 miles.

receiving film; however, each time the metal point of the transmitter rests on a conducting spot of the foil no photographic impression will be obtained on the receiving film. If the movements in the sending and receiving station are synchronous the picture will be registered photographically, line by line, on the receiving film. The synchronisation of the movements in the transmitter and receiver will not cause great difficulties, as with wireless transmission the speed of the two rotating cylinders must be considerably lower than with the transmission over conductors.

receiver is actuated for every corresponding shade, and in accordance with the relay, which is actuated in the receiver, the galvanometer (of the form shown in Fig. 5) indicates a greater or smaller deflection. Such a string galvanometer as I am using for the half-tone transmissions with selenium in the receiver consists of two metal threads stretched between the poles of a strong electro-magnet; a tiny leaf of aluminium is fixed in the centre of the two threads. The light of the Nernst lamp 15 is concentrated, by means of a lens, on the leaf, and an enlarged image of the latter is then projected,

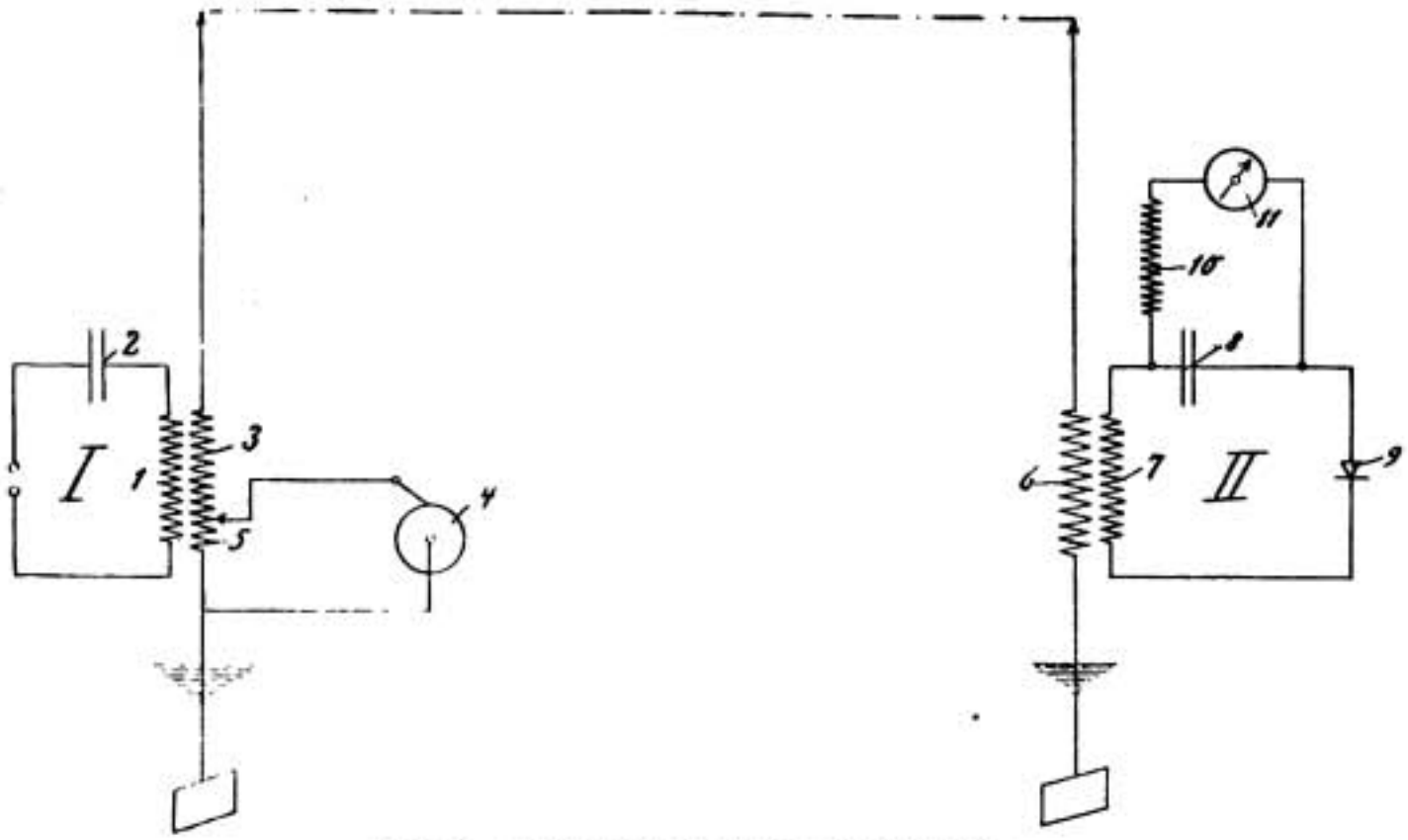


Fig. 4.—A diagram of the apparatus used.

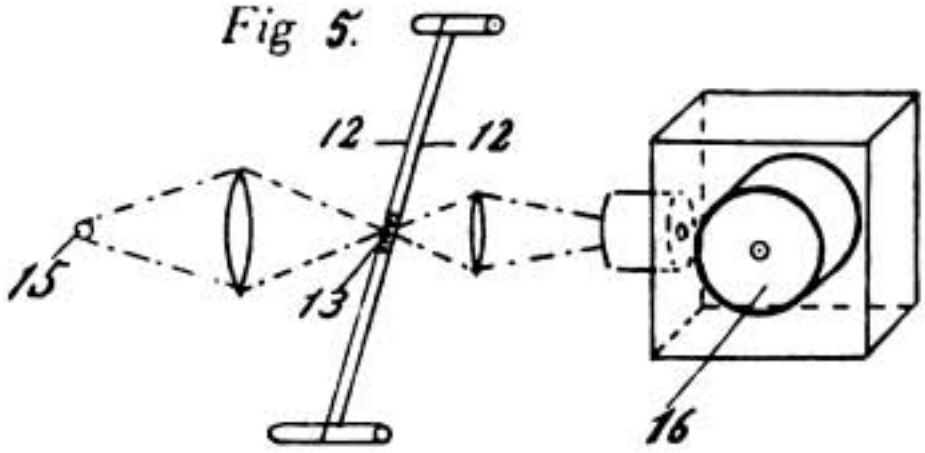
This method is probably the only one which is really suitable for the wireless transmission of black-and-white pictures (handwriting, drawings, autotypes); if real half-tone pictures are to be transmitted it is best to make use in the transmitter of the sensitiveness to light of selenium; it is then possible to distinguish a *definite* number of shades (perhaps 10–20) in the original photograph, by measuring the degree of every part of the original photograph by means of a selenium cell, and by emitting from the sender a wave of a certain period for every shade. A certain relay in the

by means of a second lens, on an opening of the tube leading to the receiver-box. When there is no current passing through the galvanometer the shadow of the leaf just covers the opening; when, however, a stronger or weaker current is sent through the galvanometer, the shadow of the leaf moves more or less away from the opening, so that more or less light is thrown on the receiving film, according to the quantity of the currents that passes through the galvanometer, *i.e.*, according to the shade of the part that is just being transmitted of the original photograph. Thus, assuming syn-

chronous movements of the sending and receiving cylinder, the picture will be reproduced on the receiving film like a proper half-tone photograph.

The half-tone method presents no special difficulties; the essential problem is to keep the times for the transmission as short as possible to enable a practical utilisation of the method.

Fig 5.



WIRELESS AND LIGHTSHIPS

THE project of establishing a wireless telegraph installation on board the Kish Lightship in Dublin Bay was discussed at a recent meeting of the Dublin Port and Docks Board. Although it is not the first time that the Board have considered the question, the latest meeting does not appear to have brought it appreciably nearer a solution.

The need for the establishment of a wireless telegraph installation on board the lightship arises primarily from the necessity of obtaining advice regarding the arrival of vessels in the harbour. At present there is no means of ascertaining the arrival of a vessel at the quays until she is seen coming up the river. If a vessel is late no one can tell how long overdue she is likely to be, and the owner's representative must waste considerable time in waiting her arrival. The disadvantage of the lack of communication with the Kish Lightship is particularly noticeable in the case of foreign vessels requiring tugs. If such a vessel wants a tug she must lie-to in the bay until she "catches the eye" of some chance coast-guard, who rushes to the nearest public call office and communicates the news. Another method adopted is for the pilot boat, which may be anywhere in the bay, to steam slowly into Kingstown and send a man ashore to telephone the authorities in Dublin.

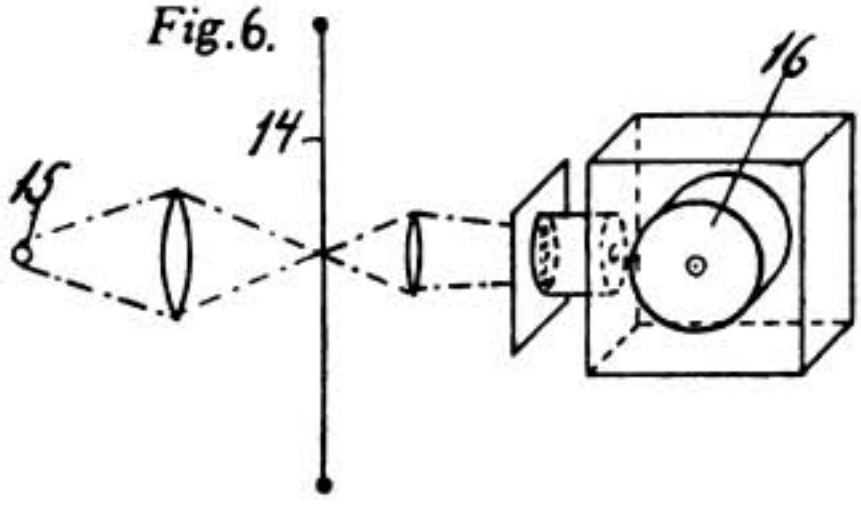
These methods do not commend themselves to the commercial people of Dublin, and it is not surprising, therefore, that a representative body such as the Port and Docks Board should be intent upon securing the effective and more economical means of communication which a wireless installation on board the Kish Lightship would afford.

The Port and Docks Board brought their suggestion some time ago before the Irish Lights Commissioners, who have sole control of the lightship.

It is understood that the Port and Docks Board are anxious to have this project carried out for the benefit of the commercial people and the shipping companies of Dublin, who feel the need for some means of communication with a ship placed as the Kish Lightship is, which could give notification of ships coming from Liverpool and cross-Channel ports, and which, perhaps, would be of still greater service to foreign vessels which, naturally, cannot always be up to time.

The lightship is in an admirable position for the purpose for which the Board want to put it. It is in the fairway of ships coming into Dublin and Kingstown, covering the Kish Bank, which is said to be one of the most dangerous in the United Kingdom.

Fig.6.



Suitable Wire Dimensions for High Frequency Resistance*

By L. W. AUSTIN

WITH high frequency experiments it is often necessary to introduce some resistance into the oscillatory circuits. For the sake of convenience in calculating it is desirable to measure the wires for the resistance, so that the so-called skin effect may be neglected; thus, in this way, the resistances can be measured after the continuous current methods with the certainty that the high frequency resistance will practically be of the same value. If the experimenter does not take the trouble to calculate the ratio between the high frequency and alternating current resistance, he will often use wires of too small dimensions.

I have, therefore, calculated graphically in accordance with Prof. Zenneck's observations † the diameters of the wires which can be used for various wave-lengths, without the above-mentioned difference of resistance exceeding one per cent. By doubling the diameter as stated in the table this difference amounts to about 10 per cent., whilst a decrease to one-half reduces the difference to about one-tenth per cent. (Zenneck).

"Maximum Current" in the third column means a current which can be conducted by the various strengths of the Constantan wires without producing too much heat; the current capacity of Manganin is almost the same. Carbon and various electrolytes can of course be used instead of the metals with even smaller corrections, but their resistance temperature co-efficients are so great that these substances are not so suitable as resistances as are Constantan or Manganin.

If a greater current capacity is desired, the wires can be used in parallel connection, soldered between parallel metal bands, as long as the intermediate space is not too small.

TABLE OF WIRES, FOR WHICH THE HIGH FREQUENCY RESISTANCE IS GREATER THAN THE CONTINUOUS CURRENT RESISTANCE BY LESS THAN 1 PER CENT.

Wave-length m. (ft.)	Constantan or "Advance Wire."		Manganin Diameter m/m (in.)	Platinum Diameter m/m (in.)	Copper Diameter m/m (in.)
	Diameter m/m (in.)	Maximum Current Amp.			
100 (328)	0·30 (0·0118)	3·5	0·29 (0·0114)	0·13 (0·005125)	0·006 (0·000236)
200 (658)	0·46 (0·0181)	4·5	0·40 (0·01575)	0·20 (0·00788)	0·045 (0·00177)
300 (986)	0·57 (0·0224)	5·5	0·50 (0·0197)	0·27 (0·0106)	0·09 (0·00354)
400 (1314)	0·66 (0·0259)	7·0	0·60 (0·0236)	0·30 (0·0118)	0·10 (0·00394)
600 (1972)	0·83 (0·0327)	8·0	0·75 (0·0295)	0·37 (0·0145)	0·15 (0·00592)
800 (2630)	0·98 (0·0386)	10·0	0·88 (0·0346)	0·42 (0·0165)	0·20 (0·00788)
1,000 (3288)	1·10 (0·0433)	11·5	0·99 (0·0389)	0·50 (0·0197)	0·21 (0·00827)
1,200 (2946)	1·20 (0·0472)	12·5	1·10 (0·0433)	0·57 (0·0224)	0·22 (0·00866)
1,500 (4932)	1·30 (0·0512)	14·0	1·21 (0·0477)	0·63 (0·0248)	0·26 (0·01022)
2,000 (6576)	1·52 (0·0599)	17·0	1·38 (0·0544)	0·73 (0·0287)	0·30 (0·0118)
3,000 (9864)	1·80 (0·0709)	24·0	1·62 (0·0639)	0·80 (0·0315)	0·33 (0·013)

German silver ranks approximately with Manganin.

* (From the *Jahrbuch der Drahtlosen Telegraphie und Telephonie*). † *Leitfaden der drahtlosen Telegraphie*, p. 352.

THE IMPERIAL WIRELESS SCHEME

THE MARCONI AGREEMENT WITH THE BRITISH GOVERNMENT FOR THE ERECTION OF A CHAIN OF WIRELESS TELEGRAPH STATIONS WAS RATIFIED BY PARLIAMENT ON AUGUST 8TH.

THE new Marconi contract was debated in the House of Commons on Friday, August 8th. The Government motion for the ratification of the agreement, which stood in the name of Mr. C. F. G. Masterman, the Financial Secretary to the Treasury, read as follows:

> "That the agreement between Marconi's Wireless Telegraph Co., Ltd., Commendatore Guglielmo Marconi, and the Postmaster-General, with regard to the establishment of a chain of Imperial wireless stations (Parliamentary paper No. 217 of session 1913) be approved."

In his explanatory statement, Mr. Masterman remarked that in the original contract which came before himself and the Treasury a year ago last March, they were convinced by the representations made to them that there was only one company in a position to guarantee long-distance wireless work. After the lapse of a year and a half they were not convinced that any other company was qualified. The Treasury, he said, had a clear and satisfied mind as to the value of the contract.

Mr. Masterman was followed by Sir Henry Norman, who declared at the outset that his own attitude was simply that of an advocate for State ownership of the wireless stations. He disclaimed any prejudice against the Marconi Company, and said that he had never in speech or in writing spoken of Mr. Marconi's work without high appreciation and of himself otherwise than with perfect courtesy and respect. "I know perfectly well," he said, "that in the commercial organisations of wireless telegraphy to-day the Marconi Company is ahead of all its rivals." Sir Henry Norman suggested that the Government should adopt and work their own scheme of wireless telegraphy. In this attitude he was supported by Sir Croydon Marks, whose speech in opposition to the ratification of the contract followed upon similar lines to that of the previous speaker.

Lord Robert Cecil then moved an amendment representing that, in the absence of a report by an independent body on the desirability of an agreement with contractors for the erection of a wireless chain, or on the terms of the proposed contract with the Marconi Company, the House ought to refuse its approval. After a speech by Mr. H. Terrell in support of the amendment, Mr. Herbert Samuel, the Postmaster-General, replied at length. After quoting the opinion of Lord Parker's Committee, Mr. Samuel read out the opinion of the Army Council, who declared it to be a factor of the highest importance in Imperial Defence that the wireless stations should be at once equipped. The Board of Admiralty held the same opinion—that it was essential that action should not be delayed. The Government, said Mr. Samuel, could not ignore these repeated representations of the authorities and departments responsible for the defence of the Empire. He pointed out that England was not alone among the countries of the world in employing a contracting company for the erection of long-range commercial stations, and he referred to what was being done in Germany, Norway and Italy. France recently had laid before her Parliament an elaborate scheme by the French Postal Administration for the erection of a large number of stations throughout the French dominions. That scheme was referred to the Budget Com-

mittee of the French Chamber, who approved of the general idea, and recommended the French parliament to vote over £600,000 for the erection of a certain number of stations. In Canada it was not the case that any stations were being erected by the Poulsen Company, as had been represented in the House of Commons erroneously. What had happened was simply that the Canadian Government had given a licence to the Poulsen Company to erect a station at their own cost and at their own risk to carry on their own business, worked by their own staff. There was nothing in the nature of a Government station, and the Canadian Government were not paying a single sixpence to the Poulsen Company for this station.

The South African Government desired to erect a long-range wireless station, and were a party to the very contract under consideration by the House. The South African Government made independent inquiries into the Poulsen and other systems, and they came to the conclusion that their own proposals were right, and they asked to be allowed to be parties to this contract. Mr. Samuel laid stress upon the importance of securing the services of Mr. Marconi, and said that if Mr. Marconi were hampered in the conduct of his enterprise in this country the consequence would be that he would transfer it elsewhere. "I think," he added, "that would be a great disadvantage to the United Kingdom. He employs here hundreds of workpeople, he has equipped ships with wireless telegraphy, he has built the stations all round our coasts, his inventive power has resulted in the saving of lives of hundreds of people. I think it right to tell the House that Mr. Marconi has felt most deeply the way in which his honoured name has been made into a by-word, a political catch word, almost a term of abuse, so much so that he was most reluctant to enter into any personal obligation in the new contract, and it was only at my repeated personal requests that he consented again to sign the contract and to enter into a personal engagement on his own behalf. We get the advantage under this contract of his help and inventive powers. I wish to inform the House that he is now experimenting on a new machine, to which he attaches the greatest importance, and which will mean a very considerable economy in work. This machine cannot be substituted for the present machine, but it can be used for electrical disturbances." Mr. Samuel laid before the House the proposal of the Government for the future organisation of the wireless service. The stations when built, and others that had to be built in other parts of the Empire, would be under the control of the State. There was to be a small committee consisting of Post Office engineers and one or two from the Admiralty who would watch the erection of the stations, and consider technical problems from week to week. The Parker Committee would be maintained as a standing Committee, and Lord Parker had promised his continued co-operation. Further, there was to be an organisation for scientific research into problems of wireless telegraphy, and those connected with it would keep in touch with foreign discoveries.

Mr. Bonar Law then addressed the House, and he was followed by Mr. Asquith, the Prime Minister, who, speaking in support of ratification, explained that he was influenced by the important strategical considerations which were constantly brought before him. Two years had elapsed since the Committee of Imperial Defence came to the conclusion that it was a matter of the utmost urgency that this chain of wireless stations should be erected and brought into use; that nothing had been done was most disquieting. Speaking with a full sense of responsibility, he affirmed that the work ought not to be delayed even for another month, and as the Government could not undertake it the only course was to enter into a contract with the Marconi Company, and he commended the acceptance of this contract to the judgment of the House.

The divisions were then taken: in the first division Lord Robert Cecil's amendment was rejected by 221 votes to 140. The main question was then put, and was carried by 210 votes against 138. The agreement was accordingly ratified.

A White Paper (No. 217, July 31st, 1913) was issued prior to the debate containing particulars of the arrangement which were debated on and ratified in Parliament on August 8th.

The B.A. at Birmingham

THE meeting of the British Association for the Advancement of Science, which will open in Birmingham on the 10th of this month, will be the fifth meeting which has been held in the metropolis of the Midlands. It is appropriate that Sir Oliver Lodge should assume the presidential chair, for he has done a great work for science and, as Principal of the University, a great work for Birmingham. His inaugural address is awaited with a great deal of interest, and it is believed he will make a wide and philosophical survey of the position of science in general, incidentally dealing with the discussions and controversies relating to the existence and the functions of the ether of space and the physical continuity of which it is the chief element.

The city is making active preparations to accommodate the British Parliament of Science; all the twelve sections composing the Association will be afforded ample accommodation for their meetings. Seven of the sections will be grouped in one of the University buildings, Mason College, and excellent quarters have been found for the other sections in Queen's College, the Midland Institute, the Technical School, and the Temperance Hotel. The Town Hall is to be used as a general reception room, and on September 11th the Lord Mayor will hold the reception of the delegates in the New Art Gallery of the Council House. As usual, there will be various garden parties and other social functions.

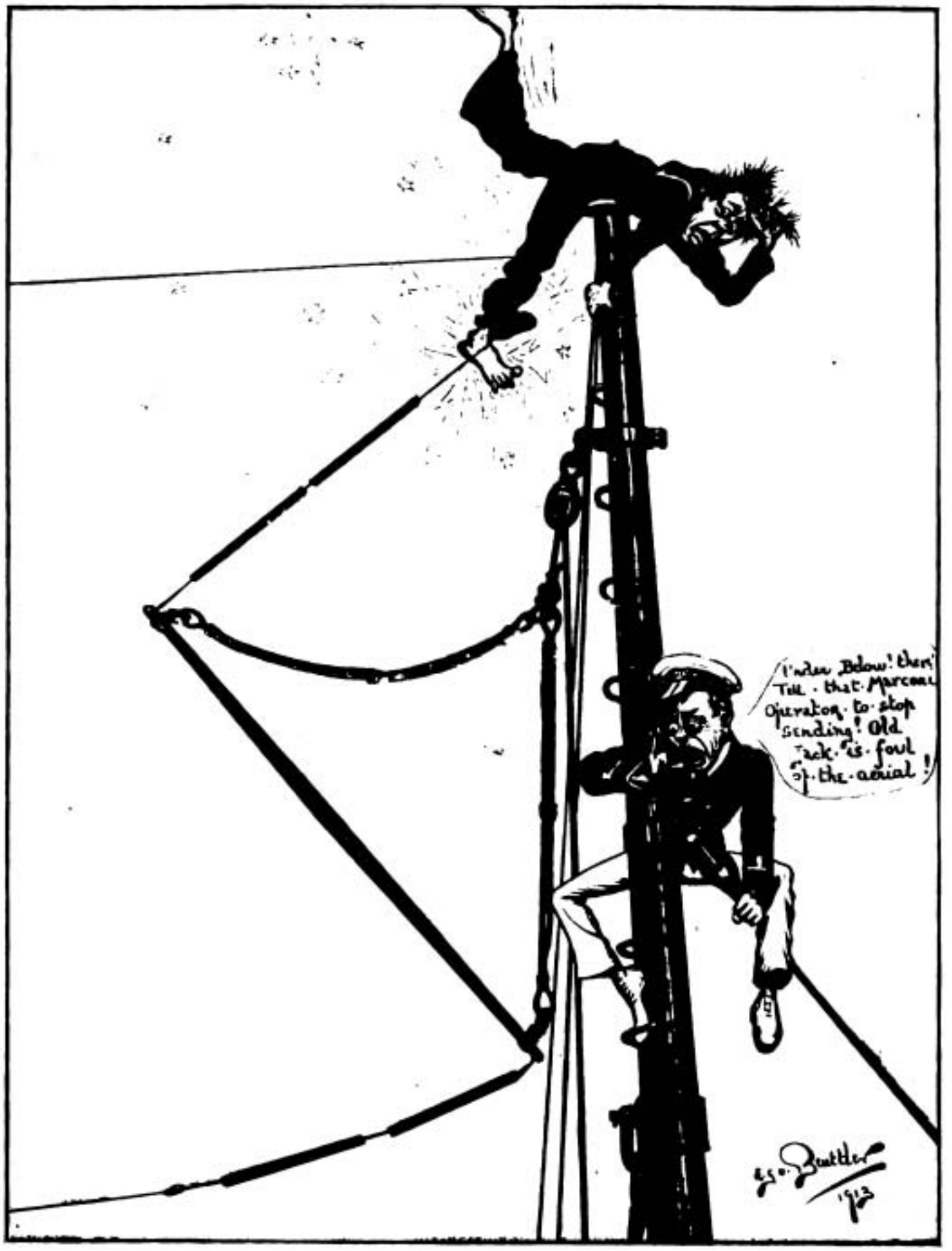
The subject list of lecturers and papers to be read at the meeting is not yet complete, but already there are several which should prove particularly interesting to THE WIRELESS WORLD. One is by Prof. Marchant on "Some Effects of Atmospheric Conditions on Wireless Signals," while Prof. Howe will discuss "The Nature of the Electro-Magnetic Waves employed in Radio-Telegraphy and the Mode of their Propagation." In the mathematical section there is to be a discussion by Prof. A. E. H. Love, Prof. E. Rutherford, and Prof. Pringsheim on "Radiation," while Mr. W. H. F. Murdock will read a paper on "A Direct Method of Measuring Magnetic Perceptibility and the Instruments for this Purpose."

BIRMINGHAM UNIVERSITY

C

CARTOON OF THE MONTH

Wireless Terms Illustrated



VI. A High Resistance

A Lonely Land

A short account of St. Kilda and of the Wireless Station which has recently been erected there, and by means of which the inhabitants are at last able to communicate with the outside world.

THE weather is not pleasant, the air has not much warmth, half the year is deluged with rain. From the autumn to the vernal equinox a dry day is hardly known, except when the shadows are suspended by a tempest. Under such skies can be expected no great exuberance of vegetation. Their winter overtakes their summer . . . the autumn struggles hard to produce some of our early fruits ; I gathered gooseberries in September, but they were small and their skins were tough.

In some parts there is only a thin layer of earth spread upon a rock which bears nothing but short brown heather, and is not generally capable of any better product. The only fuel of the island is peat. Herds of goats and sheep are kept, and the goats' milk is made into cheese by the inhabitants of St. Kilda.

To the southern inhabitants of Scotland the state of the mountaineers and the islands is equally unknown with that of Borneo or Summatra ; of both they have only heard a little and guessed the rest. They are strangers . . . to the advantages and wants of the people . . . whose evils they would remedy.

Such were the impressions gathered by the great Dr. Johnson in his voyage to these lonely parts, which at that time was an expedition worthy of record, and which he memoralised in his *Journal of a Voyage to the Hebrides*. Curiously enough, the observations which he made at that time, and which are marked with that acumen which was the great writer's chief characteristic, afforded until a few weeks back a fairly accurate description of the loneliness of these lands.

St. Kilda is the largest of a small group of sixteen islands on the Southern Hebrides. Its greatest length, which lies from east to west, is three miles, its greatest breadth two. The cliffs of this rocky island rise sheer out of deep water, except at the landing stage, where nestles the little township which holds the entire community of this deserted island. In all probability St. Kilda was the core of a tertiary volcano, and to-day its highest point, "Conagher," reaches some 1,200 feet above sea level, but the island also contains Sandstone Hills, and the boldness of its scenery is softened in many parts by considerable richness of grass land. Its inhabitants in 1901 numbered 77, but this census shows a decrease in population, for once upon a time it boasted as many as 150 souls.

Potatoes, oats, and barley are cultivated, and about one thousand sheep and a few cattle are also kept. It is an odd fact that fishing, which one would have imagined to be the chief pursuit of the people, is practically neglected, though the same cannot be said of wild-fowl shooting. This affords both the pastime and business of many, and the bag is very varied, for it includes puffins, guillemots, petrels, razor-bills, and solan geese—which are used both for food and oil. Manufacture on the small scale is also indulged in, for coarse tweeds and blankets are made from the sheep's wool, which, by the way, is not shorn after the usual fashion, but is plucked from the sheep.

The whole land belongs to the famous

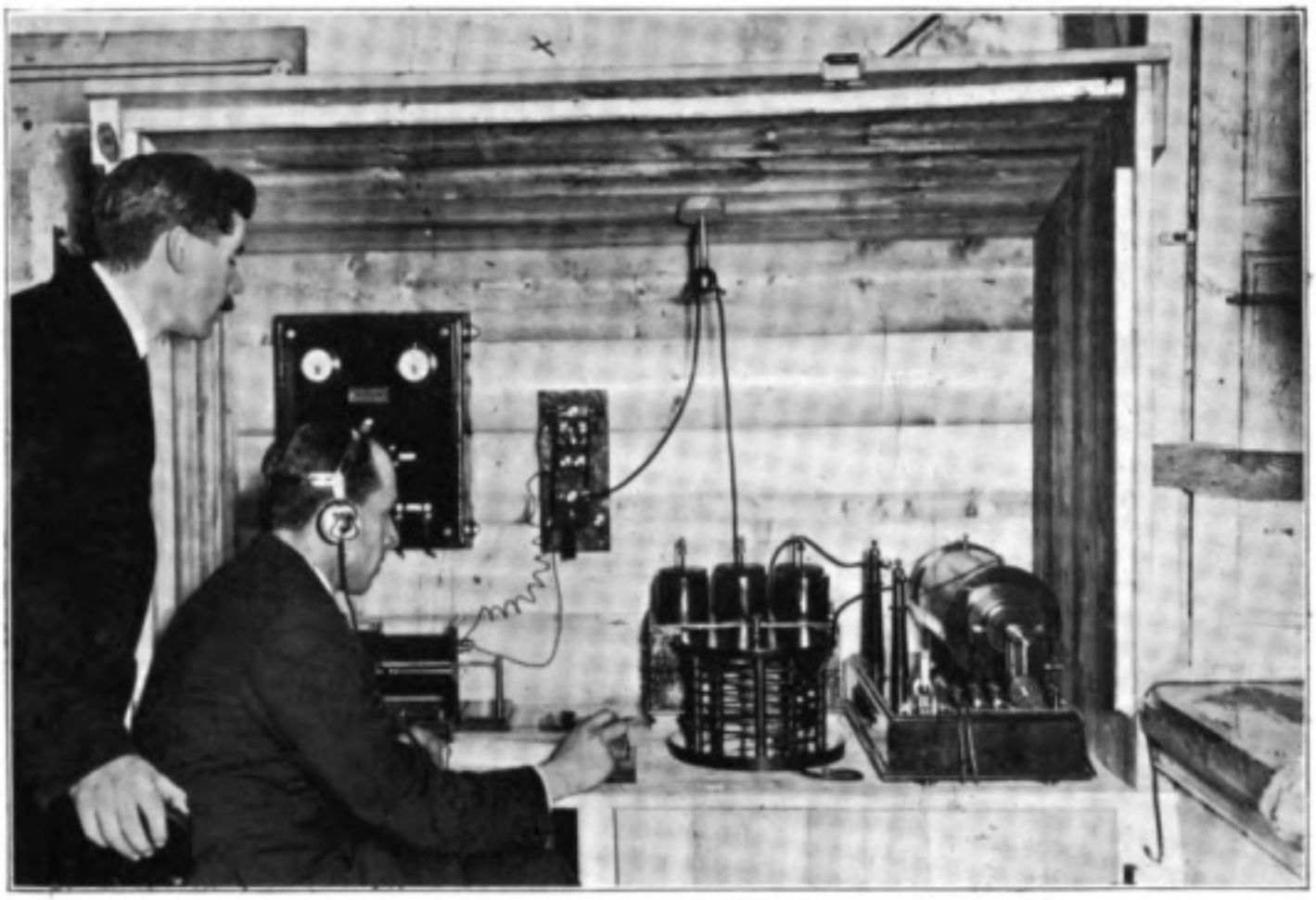
clan of the Macleods, of Skye, who purchased it in 1871 for £3,000, as since 1779 their ownership had lapsed, owing to the then laird selling his inheritance for a trifling sum. The island is inaccessible for eight months in the year, and the only means of communication was, until recently, by means of "sea messages." These were placed in strong wooden boxes which were despatched in the waves when a west wind was blowing, for then they drifted to the main land or the western islands of Scotland, and were due to arrive there within a week.

But through the generosity of the *Daily Mirror* all this has been changed. For the past year the severe straits to which the inhabitants were reduced, even to the extent of famine, has been the subject of a vigorous press campaign, and it has resulted at last in the erection of a Marconi station at St. Kilda, through the agency of the *Daily Mirror* and the generous aid of Mr. Gordon Selfridge, who contributed £100 towards the expenses. This was not before the necessity for some intervention had become urgent. Early last year the St. Kildans were cut off from the world and desperately short of provisions, so desperate that the *Daily Mirror* organised a relief expedition, and sent them provisions in a specially chartered tug. This year the islanders were stricken with influenza, and in danger of death owing to lack of medical attention. On this occasion the Admiralty was communicated with, and a cruiser was sent to the assistance of the islanders. Then it was that the erection of a station was decided upon, and Mr. Dudley Ward Miller, of the British Telegraph Instruments, Ltd., was appointed engineer in charge of the expedition.

The steamer carrying the requisite materials for the station steamed into St. Kilda on Thursday morning, July 10th, and

A GENERAL VIEW OF ST. KILDA

Its appearance to-day strikingly supports Dr. Johnson's description of the Island in his "Journal of a Voyage to the Hebrides." The newly-erected Wireless Masts are plainly visible.



LEARNING TO MANIPULATE THE APPARATUS.

The "Postmaster-General" of the Island being initiated into his new work.

immediately a site for the station was selected. The gear and necessary provisions being landed, work was commenced in dead earnest; the huge 70 feet masts, which carry the aerial, and which had been cast in the harbour from the steamer, were hauled up. This was no light task, for they had to be hoisted up steep rocky cliffs, and in spite of the difficult nature of the operation and the weight of the masts—each was a ton and a half—the whole work was finished within 24 hours, and the station complete on July 22nd. Then the instruments had to be installed, and this could not be done hurriedly. Nevertheless, everything was in working trim by the 31st. On that day the correspondent of the *Daily Mirror* left the station for Lochboisdale, where there is a post-office wireless station, which has been commissioned to receive all wireless messages from or to St. Kilda, but we will leave him to tell his own story:

"When I bade farewell to St. Kilda, Mr. Ward Miller said to me:—

"'I shall speak to you in a day or two. We shall not be a lonely island any longer.

"We had already heard with remarkable distinctness messages sent from Poldhu, in Cornwall; the Eiffel Tower, in Paris; Nauen, in Germany; and other places, and but for the non-arrival of sulphuric acid for charging the batteries, we should have begun the transmitting tests.

"The acid, however, did not arrive until Tuesday, and it was late that evening before the work on the transmitting apparatus could be begun.

"I arrived at Lochboisdale, some sixty miles from St. Kilda, on Thursday night, and on the following morning Mr. W. N. Morgan, a post-office wireless operator, reopened the wireless station here, which had been closed since last April.

"So that at both stations there was a considerable amount of anxious work to be done before communication could be established.

"Mr. Morgan cast aside the limitations of the ordinary post-office hours and worked assiduously from eight o'clock in the morning until one o'clock the next morning.

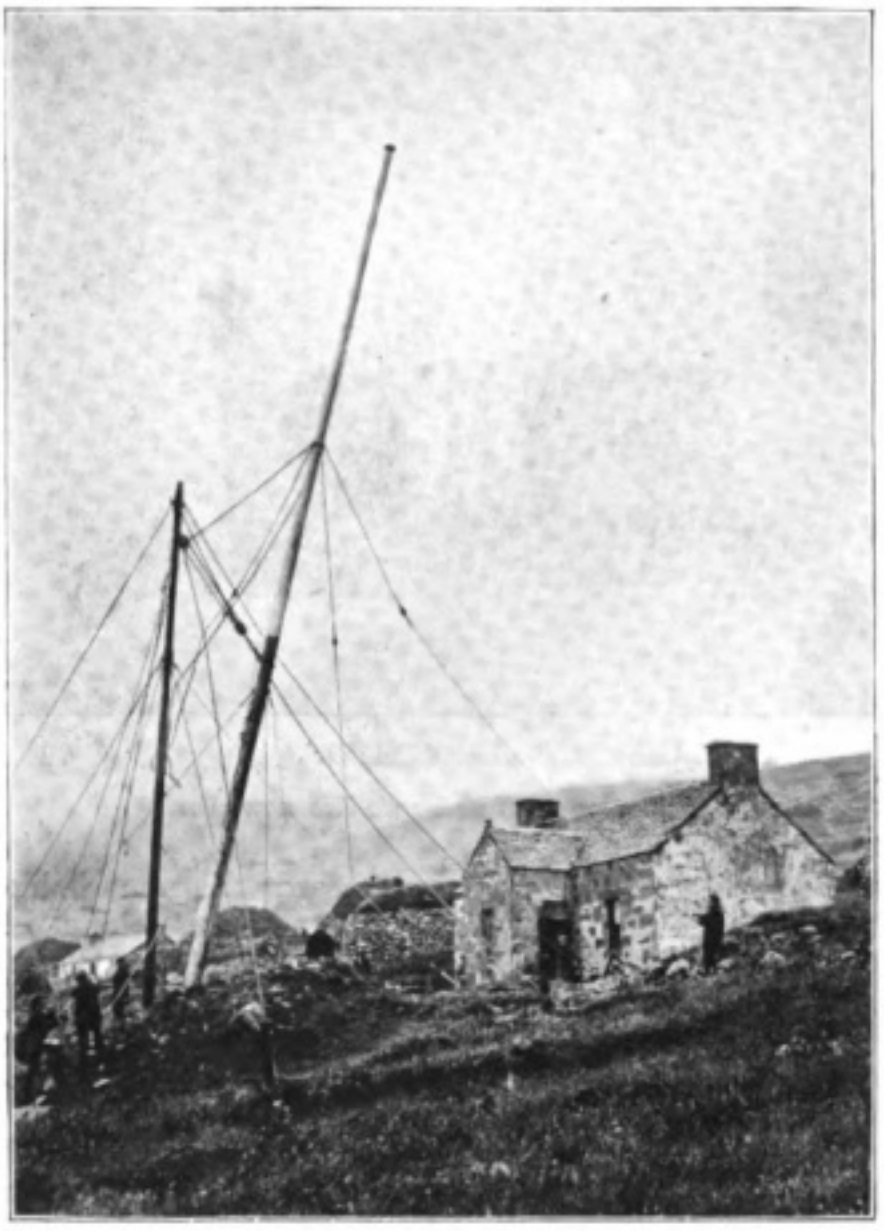
"Occasionally he obtained faint traces

that on the other side Mr. Ward Miller was working just as energetically.

"But Mr. Ward Miller was having some trouble in getting through his signals. A series of V's—the letter always used when wireless tests are made—could scarcely be heard.

"But both sides persevered, and the reward came at nine o'clock last night—three working days after the tests had started.

"Before leaving St. Kilda I arranged that the code letters to be used for calling up the station should be 'T.D.M.'—the initial letters of the title of *The Daily Mirror*



ERECTING A MAST

This was the most difficult part of installing the station, for each mast weighs a ton and a half and the island is very rocky.

"At nine o'clock last night Mr. Morgan called 'T.D.M.' promptly, and with joyous repetition came the reply, 'O.K. O.K. here. St. Kilda. Who are you?'

"The dots and dashes were quite clear. We at once replied:

"'Here. Lochboisdale. I am getting you O.K. Send V's for fifteen minutes.'

"St. Kilda responded: 'Here — St. Kilda—St. Kilda — St. Kilda—St. Kilda—I have a message for his Majesty the King when you are ready.'

"And then, with the telephone receivers to his ears, Mr. Morgan, in that dim light of an oil lamp, took down the message which the inhabitants of St. Kilda wished to be sent to the King on the opening of the station.

"Quickly and distinctly the words came through the air. It was the first telegraphed message of any kind that had ever been sent from the island in the Atlantic.'

"This loyal salutation called for the following reply:

"'*The King desires you to convey to the inhabitants of St Kilda his sincere thanks for the loyal message which you have addressed to his Majesty on their behalf.*

"'*His Majesty trusts that your improved communication may be the means of improving the welfare and happiness of his subjects in St. Kilda.—Equerry.*'

"With the installation of the wireless station, St. Kildans for the first time in their history are able to know the correct time. Hitherto it has been roughly guessed by the sun's position.

"I shall long remember the islanders' amazement at the wonders of wireless — their astonishment when they were told the exact Greenwich time and various items of the world's news picked up by the operator."

Steam Trawlers and their Work

The Fisheries of the North Sea. The Ousting of the Fishing Smack by the Steam Trawler. Life under the New Régime, its "Pros" and its "Cons." The Efforts made to Ameliorate these Conditions. The Introduction of Wireless on Steam Trawlers.

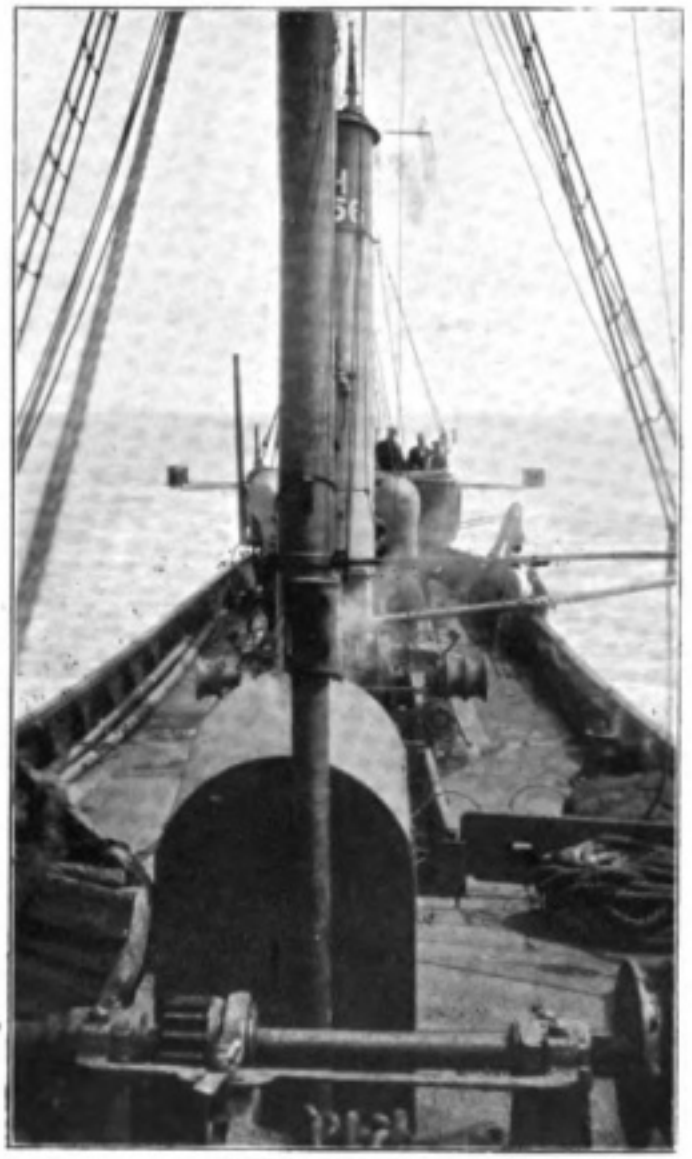
WHAT is the cost of our fish markets, and what is the price paid for our breakfast delicacy or our evening's *sole au gratin*? It cannot be reckoned in mere dollars' worth, for our supply of fish is only bought by hardship and peril and even life itself.

This harvest of the sea which daily fills the markets of Billingsgate and Grimsby is not gathered without great toil, and always, even under the most favourable conditions, with a certain amount of risk; but the general public know little or nothing of the life and work on a steam trawler, so a few facts may be of interest to the reader before the subject of the wireless equipment of a steam trawler is touched upon.

The great fisheries of England are in the North Sea. The Dogger Bank has been called the Charing Cross of the North Sea, for it is there that all known fishermen meet. The fleets are constantly on or near the Dogger. The steam carriers surge up London river from the Dogger, and it is back to or near the Dogger that they mostly go when they are clear of Billingsgate, or Gravesend. The steam trawler is now practically the only class of vessel employed in fishing, though at first it nearly succumbed to the opposition of the fishermen, who are perhaps the most conservative race of beings in existence, and who for a long time urged that the steam trawl made the fish unfit for market, as their insides were broken and the galls burst, and further that in areas where the trawler was in use the fish diminished in quantity and deteriorated in size. Of course, these notions were forced to give way before actual experience. There are three kinds of these vessels: the fleeters, the single boaters, and the Icelanders. The fleeters are the smallest, and carry enough coal and provisions

A Hull Fishing Steamer fitted with special masts and Marconi apparatus.

to last them about six weeks, during which time they stay on the fishing ground and deliver their catch of fish every morning to the carriers. The single boaters leave port for some particular ground on which fish is likely to be found. This may be fifty miles or more from the coast, and if a trial trawl on a likely spot is productive of good results, a buoy called a "Dan" is placed in the sea to indicate the location of the fish, and the neighbourhood is worked either until the fish leave it or the catch justifies a return to the port. As the fish is caught it is gutted, boxed, and iced, and put in the steamboats' fish-room. The third class is composed of the



THE "OTHELLO,"
A trawler which has just been equipped with a wireless installation.

larger vessels, which during the season go to Iceland and the White Sea, spending three to four weeks on the trip, and bringing home large cargoes of fish which realise sometimes as much as £1,000, the result, however, depending very largely on the state of the market. From stem to stern the "Icelander" is crowded with appliances. There is the cabin, the engine-room, boiler-room, coal bunker, reserve bunker, fish and ice-room, store-room, and the forecastle, which contains accommodation for about eight men. These vessels have proved so successful in working long voyages that to-day energetic measures are being taken to organise fleets of trawlers for Australian and Japanese waters.

All the fish that are trawled from North Sea waters are divided into two great classes, prime and offal. The prime is composed of the upper kinds of fish, and the fish of the lower orders constitute the offal. Soles come an easy first. Nothing pleases the fisherman more than a good haul of this aristocrat of the deep, for however erratic the market may be, there is always a sure profit on the catch. Turbot comes next, then brill. The offal comprises many sorts of fish, especially haddocks, halibut, gurnet, whiting, and skate. All those mentioned find a constant market at Billingsgate, but there are others which are not considered worth offering as regular lines, though here again there is often a local market. A good instance of the varied taste in this respect is afforded by the skate. On the German side of the North Sea, this fish almost ranks as prime, while in England it is still despised as scarcely worth the eating—not so much now as it used to be, for it is becoming extensively used at restaurants where good cooking can transform it into a dish fit for the menu of the unsuspecting.

The condition of the market that is most dreaded by the North Sea fishermen is when there is a glut, for the fish which may have taken him many days' care to procure must then be sold at a price that compensates him for not a tithe of the labour and expense of fishing. A Yarmouth resident once stated that many a time he had seen fresh herrings sold for a hundred a penny at the fishwharf, and even thrown away as worthless. This condition of things, however, is not as bad as it used to be. Steam has accelerated and equalised speed, so that good fishing localities can be followed up with greater regularity. Another thing that the introduction of steam has done is to minimise delay in transport. This has had a most beneficial effect on the market, for nowadays foreign buyers make a point of visiting the English markets and often large deals are transacted with the salesmen, so that in many instances a "catch" may never be unshipped but bought *en bloc* and the carrier ordered to take it straight away to the foreign port named by the buyer. This is a very different condition of things to what prevailed in the days of the old fishing smack, for then it was no uncommon occurrence, especially in summer time, for a whole fleet of vessels to be becalmed, when the fish stored in the hold of each boat would soon become unfit for food and require to be thrown away.

Again, steam has enabled fishing operations to be carried out on a more organised plan. Nowadays a fleet will make a campaign on

some likely spot, and trawling will be done by everybody in unison. Such, for instance, is "Sellier's Fleet," which consists of seven carriers and fifty-five fleeters.

Although there is nothing approaching the rigid discipline of the Royal Navy, still these fishing fleets are very carefully controlled by an experienced fisherman, who is officially known as the "Admiral," but familiarly as the Boss. This admirable Admiral is responsible for the fishing operations of the fleet. Nothing is left to chance, for both night and day there are certain signals given, to which the skippers shoot or haul their gear. In the daytime signals are made by means of flags. The regular night signals are, one green rocket when the gear is to be shot, and the trawl is to be on the starboard tack, and corresponding one and two red rockets to port. Two white rockets is the signal for the trawl to be hauled. With each fleet, there is what is known as a mark boat, which is to indicate the rendezvous of the trawlers when they assemble for the purpose of sending off their fish to the carrier. Operations are usually conducted within a radius of ten miles off the mark boat. There is nothing more impressive than this hauling of a North Sea trawl, especially at midnight. All around is a vast solemnity of water, spangled with the bobbing lights of the floating town, which has a population of some 500 men. The steam winches are wheezing and clanging, and the wheels of miscellaneous mechanism are rattling with sudden stoppages and spasmodic starts. Suddenly the conflict ceases. There is a sizzling of water, a quick lashing of what seems to be a complicated knot, and then the slithering mass of fish. There is at once a greater splashing and clashing, for the gear is overboard again, and the trawl which had scarcely rested, is scooping up and collecting more fish.

You have heard the curt command "Right over!" and the next you know is that men are knee deep in pounds of slithering fish, and that cutting knives are being fiercely plied.

But the life of a North Sea fisherman is not all *couleur de rose*. "I reckon," a whaleman was once heard to say, "'at no man but a fool who wasn't forced would go fishin'. It's sixteen weeks since I left my wife—and I'm pinin' to see her again. She'll be goin' to church by this time, and there's so much work to do and so little for it when it's done."

A GROUP ON THE "CÆSAR."

The success which attended these experiments with wireless seems to be mirrored in the faces of the experimental party, for they look "jolly good company every one!"

PACKED AND STORED IN THE CARRIER.
Fish in the hold of a Carrier ready to convey it to Grimsby.

But there are many humanising agents at work now. Steam is one of them, for it minimises the precariousness of the life, and shortens the periods of absence from home. Another is the splendid work done by the Royal National Mission to Deep Sea Fishermen, who do wonders with their hospital and mission ships, for by this means doctors travel with the fleet, and the sick and injured can be cared for, bringing besides the little luxuries of life, such as warm clothing and good literature, to the toilers. The latest addition to the fishermen's welfare is wireless telegraphy. Only recently an interesting experiment was carried out by the Marconi Company with a view to determining the extent to which wireless telegraphy could effectively and economically be applied to steam and fishing vessels. The result of the experiments was to show that it would be an invaluable asset, and the idea is to instruct skippers and fishermen in the use of it, for it can be employed not only in fishing operations, but in giving notice of approaching storms. Furthermore, for a long time it has been recognised that the conditions of modern steam trawling demand that some means of communication with the shore should be effected, and there is none that is capable of fulfilling such a purpose except wireless telegraphy.

By courtesy of Messrs. Hellyers' Steam Fishing Company, Limited, of Hull, the Marconi Company had at their entire disposal for several days the trawler *Othello* and the carrier *Cæsar*, and as the result of tests carried out some highly useful data were obtained. Having regard to the size of the trawler, its mast facilities, and the kind of work carried on by a vessel of this description, it was decided at the outset that the most suitable form of wireless equipment would be a type approaching as nearly as possible the Marconi standard $\frac{1}{2}$ kw. set. Two installations of this power, but of somewhat different design, were therefore placed aboard the trawler, and light topmasts were added to carry the aerials. An average range of ninety miles was aimed at. With regard to the carrier, the duties of which would be likely to call for a considerably increased range, it was decided that liberal provision — within reasonable limits, of course—should be made, not only as regards the power of the equipment, but also as regards the height of the masts. The existing masts of the *Cæsar* were taken out of her, and two new wooden masts, providing a height of a trifle over 100 ft. from the water-line, were put in their place. Two types of Marconi 3 kw. stations —one of the pattern generally used in the mercantile marine, and the other of a portable military description—were installed. Neither the trawler nor the carrier possessed any electric light equipment, so it was necessary in each case to provide sufficient electric power to work the wireless installations. In the *Othello* the two types of installation, being of small power and very compact, were accommodated in a small mess-room aft, whilst the steam engine for supplying current was placed in the ship's engine-room, and an oil engine which, for the purposes of drawing comparisons, was also employed, was put in the fore 'tween decks. On the *Cæsar* recourse was had to the main hold. By the courtesy of the British, German, Norwegian, and Dutch authorities controlling wireless stations in the North Sea, the experiments were greatly facilitated. The vessels left Hull on June

11th, and proceeded across the Dogger Bank towards the coast of Denmark. At a distance of 270 miles from Cullercoats, the *Cæsar* sent and received messages without difficulty; thus the estimated range of between 180–200 miles was considerably exceeded, and the strength of signals in both directions was such as to indicate that the range of 270 miles could have been increased still further. With the *Cæsar's* aerial lowered to 65 ft. above the water level she communicated with Scheveningen at 195 miles. There were good strong signals both ways, and messages were freely exchanged. The *Othello* with her plant was able to communicate with Cullercoats, 180 miles away, messages being freely exchanged at that distance, and also with the *Cæsar*, a distance of 100 miles, with the latter ship's aerial at 65 ft. above the water. Of course, it must be understood that the operators were working under considerable difficulties, the peculiar movement of these small vessels making them very sea-sick and constantly throwing them about. In consequence of the very satisfactory results of the tests, Messrs. Hellyers immediately placed an order with the Marconi Company for one installation of the type fitted on the carrier *Cæsar*, and three installations of the class fitted on board the trawler *Othello*.

A bronze tablet, designed by Henry Bacon, the eminent New York architect, to mark the site of the first public telegraph office in the United States, has been placed on the wall of the old Post Office Department building, on Seventh Street, N.W., between E and F, in Washington, D.C., and was dedicated on July 4th.

The inscription on the tablet reads :—

"Samuel F. B. Morse, artist and inventor, opened and operated on this site, under the direction of the Post Office Department, the first public telegraph office in the United States, April 1st, 1845. 'What hath God wrought.'"

TRAWLERS AT HULL.

One of the largest fish markets in the world.

Administrative Notes

The following Austrian coast stations were officially opened for general public correspondence on July 1st :

Austrian Coast Stations.

Trieste (O.H.T.).
Castelnuovo (O.H.C.).
Sebenico O.H.B.

All these stations will maintain permanent watch. The station charge will be 20 cms. per word, with a minimum of fr. 2 per radiotelegram. The coast station at Pola is now no longer open for public service.

* * *

Revised British Regulations.

In view of the revised regulations relating to radio-telegrams, which came into force on July 1st, the British Post Office issued a new set of instructions. The principal alterations affecting the treatment of radiotelegrams are as follows :

(1) Radiotelegrams can be *forwarded* at the risk of the sender to a ship *through intervening ships* (not more than two in number). An additional charge of 4d. a word with a minimum of 3s. 4d. must be collected if one retransmission only is desired ; or 8d. a word with a minimum of 6s. 8d. if a radiotelegram is to be retransmitted through two ships. The instruction "——retransmission télégraphe" or "——retransmission lettre" (the blank space to be filled up with the number of retransmissions required) must precede the address and be charged for as three words. In the former case the telegraph charge for a reply of 5 words from the coast station must be prepaid, and in the latter a charge of 2½d. is collected for a letter from the coast station. The coast station will inform the office of origin by wire or letter, as the case may be, if one or both the retransmissions asked for by the sender were necessary to reach the ship to which the radiotelegram was addressed. If the message can be sent direct to the ship to which it is addressed from the coast station the whole of the sum deposited for retransmission will be refunded. If two retransmissions are paid for, but only one was found to be necessary, the balance of the charges due will be refunded.

(2) Radiotelegrams can be sent to a ship to be *posted* as letters *at a port of call*. A fee of 2½d. in addition to the ordinary radiotelegraphic charges is payable in such cases. The radiotelegrams should be addressed in the following form :—

——Poste Buenosaires——Smith 14 Calle Prat Valparaiso Avon Lizard.

(3) The *name of the ship* in the address with the call signal which must be added where it is given on pages 889–898 of the Post Office Guide is *now counted as one word* irrespective of its length. Similarly the name of the coast station in the address is counted and charged for as one word.

(4) The sender of a radiotelegram may *prepay a reply* of any value. The instruction—R.P.—followed by mention of the amount prepaid, must be entered in the service instructions and telegraphed, as well as before the address. The amount prepaid should be expressed in sterling currency—*e.g.*, "RP 15/6." the whole expression counting as one word.

(5) The sender may request the coast station to *notify* him of the *date and the hour* when the *radiotelegram was transmitted* to the ship to which it was addressed. The information can be transmitted at the sender's option by telegraph or letter, and sufficient must be prepaid in the former case to cover a telegram of 5 words from the coast station, or, in the case of a letter, 2½d. will be collected. The instruction "PC" or "PCP," as the case may be, must precede the address of the radiotelegram and be included in the chargeable number of words.

Radiotelegrams to be *repeated or collated* may be accepted in accordance with Rule 42 of the Instruction regarding Foreign and Colonial Telegrams.

Australian Stations.

THE opening of the Port Moresby (Papua) and Thursday Island stations for the transaction of public and official business has been officially notified. Each of these stations gives a continuous service, and the charges have been fixed as follows :

ORDINARY MESSAGES.

For Ship-shore Communication.—Sixpence per word radiotelegraphic charge, without minimum, plus Commonwealth land-line charges.

For messages sent from the Commonwealth to Papua.—One penny per word per radiotelegraph station, plus Commonwealth land-line charges—*i.e.*, in addition to the land-line charges one penny per word will be charged for handing the traffic at Thursday Island wireless station, and one penny per word for Port Moresby station.

For the present delivery charges, if any, will be collected from the addressee.

PRESS MESSAGES SENT BY WIRELESS TO AND FROM PAPUA.

The present press land-line charges within the Commonwealth, viz. :—

	Within the State in which the Wireless Station is situated.	Other States.
	s. d.	s. d.
Not exceeding 25 words ...	0 6	1 0
Exceeding 25 words but not exceeding 50 words ...	0 9	1 6
Exceeding 50 words but not exceeding 100 words ...	1 6	3 0
Every additional 50 words or portion of 50 words ...	0 6	1 0
Plus a wireless charge as follows :—		
Not exceeding 25 words		2 6
Exceeding 25 but not exceeding 50 words		5 0
Exceeding 50 but not exceeding 100 words		10 0
Every additional 50 words, or portion of 50 words		5 0

* * *

Stations in the United States.

The functions of the United States Bureau of Steam Engineering are set out in an official communication recently issued. This department is charged with the manufacture, installation, maintenance, inspection, alteration, repairs of and requisitions for all radio installations ashore and afloat as far as radio material and other equipment of radio stations are concerned; with tests and experiments of all radio apparatus; and with the preparation of technical instructions concerning the operation of such apparatus. The department maintains close relations with the Superintendent of radio stations to ensure co-ordination of all radio work, and prepares the estimates for all radio expenditures. Each coast radio station is under the direct control of the commandant of the naval station within which it is situated, unless specific orders have been issued to the contrary. In this case a duplicate of all inspection reports pertaining to the station is sent to the commandant of the naval station. Any coast radio station not lying within the limits of a naval station is under the control of such officer as the department may direct. The maintenance and inspection of material of coast radio stations is performed by such navy yards as are appointed for the purpose by the Bureau of Steam Engineering.

* * *

Safety at Sea.

IN reply to a request from Senator Fletcher, of Florida, asking for a review of what has been accomplished by the Department of Commerce in way of providing for the safety of life at sea, Secretary Redfield submitted an interesting report, in which he referred as follows to the subject of wireless telegraphy :

> You helped to frame the acts of Congress concerning radio-telegraphy and aided in the ratification of the Berlin and London radio-telegraphic conventions, so I need not tell you that on this subject the legislation of the United States, in principle and in most of its provisions, already has been accepted as the basis for the international prescription and regulation of this far-reaching agency for the promotion of safety at sea. The principle of a constant wireless watch on ocean passenger steamers (two operators) as a measure of Government regulation, to which there is now no dissent, was first proposed by my colleague, the Secretary of State, Hon. William J. Bryan, in November, 1911. Our own act of June 24, 1910, has been amended in accordance with this suggestion, and at the international conference last June in London, 31 countries approved the principle of a constant wireless watch, at least in the case of large passenger steamers, as a measure of international regulation. The same convention also provided for auxiliary apparatus for use in event of the failure of the ship's main power plant, as does our act of July 23, 1912. So far as radio-telegraphy is concerned, the work, from our point of view, before an international conference, will be mainly the adjustment of minor differences between our regulations and those which may be suggested by other powers, so as to secure uniformity. To prepare for this work I have requested the wireless companies furnishing operators and apparatus for ship and coast stations and the shipowners concerned to propose the names of suitable experts who may confer with the Commissioner of Navigation and representatives of the Naval Radio Service and the Bureau of Standards.

Photographic Recording Apparatus

Addition to Liverpool University Wireless Equipment

PROFESSOR E. W. MARCHANT, the David Jardine Professor of Electrical Engineering at Liverpool University, has done, and is doing, much to produce accurate data in connection with wireless telegraphy. The university possesses, thanks to the generosity of Sir William Hartley, a wireless telegraphy installation which is capable of receiving messages from all parts of the world, though the licence granted to the university is, of course, only for scientific purposes. Sir William Hartley has quite recently made another gift to this branch of the university's work in the form of a new photographic recording apparatus for wireless signals. This apparatus takes photographs of the strength of the electric waves, and daily records are being collected from Paris and other places. These show the barometric pressure, the direction and the force of the wind, and the state of the sky and the sea.

The new apparatus at the university is intended to enable exact measurements to be made of the strength of the signals received from day to day. The current through the detector is passed through a specially-sensitive Einthoven galvanometer. The latter consists of a powerful magnet between the poles of which is placed a thin silvered quartz fibre about 1–10,000th of an inch in diameter, through which the current from the detector passes. A shadow of the fibre is thrown on to a plate, and as the plate moves the vibration of the fibre is recorded. By this arrangement it is possible to show the effect of every spark that is made at the Eiffel Tower station in Paris. On one or two occasions it has been possible to detect slight irregularities in the sparks at Paris. Observations are being carried out with this apparatus as to the effect of different atmospheric conditions on the strength of the signals received. Recently, by arrangement with Commandant Ferrié of the Eiffel Tower station, a series of signals was transmitted between the hours of 7 and 10 p.m., and an interesting set of photographs was obtained which showed the sudden increase in the strength of the signals just after sunset. Within half an hour the strength of the signals increased by nearly 70 per cent. It is intended to make a continuous series of observations with this apparatus so as to obtain a record of signal strength which will throw some light on the variations which are known to occur in wireless.

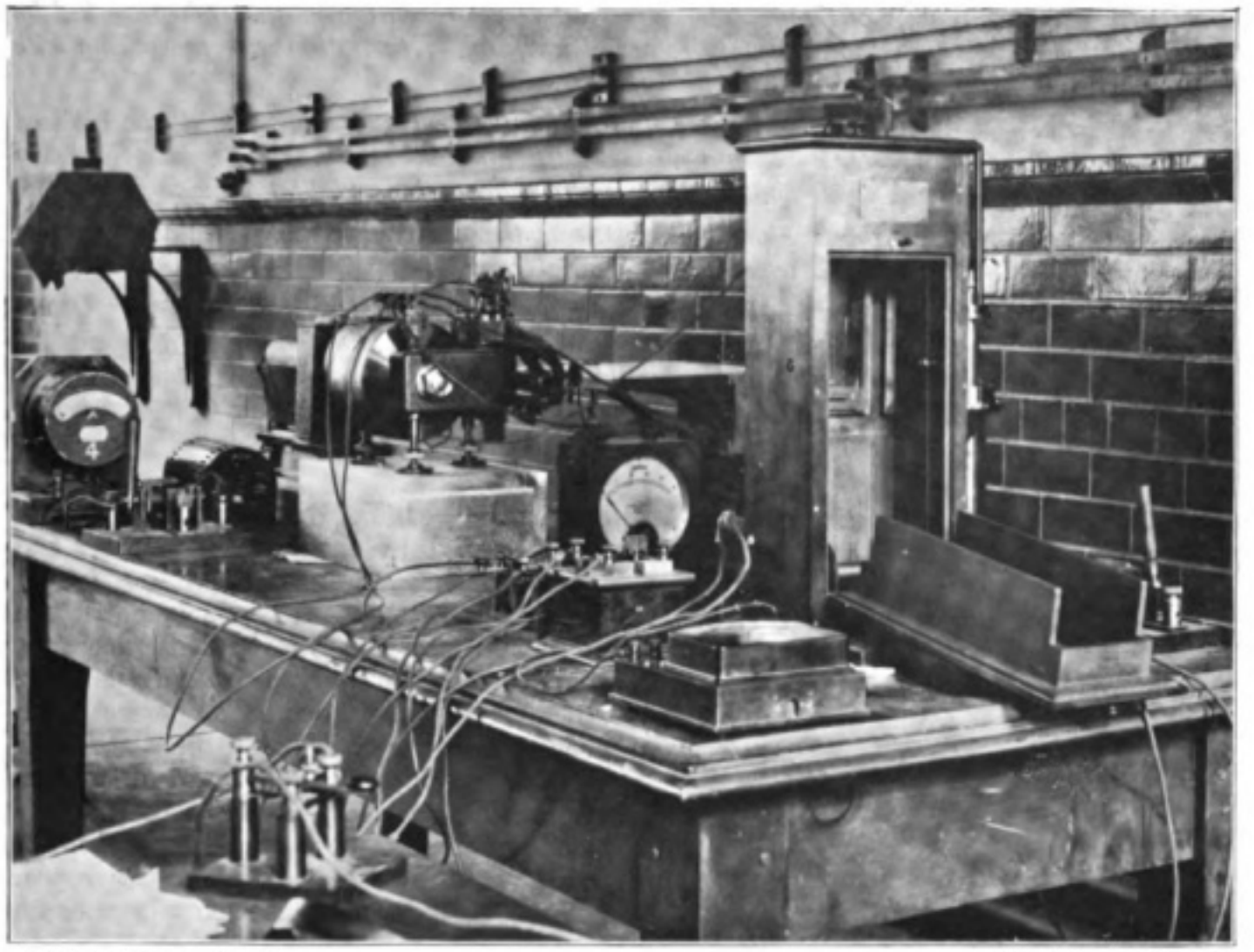
As is well known, the strength of the electric waves in wireless telegraphy varies; for instance, during the daytime it is found necessary to use a stronger current than that needed during the night. Again, there is a sudden intensification of wireless signals from America just after sunset. How and why this occurs has not yet been definitely discovered. But it is hoped that, by means of research work which will be possible with the recently-installed instrument at Liverpool University, some light may ultimately be thrown upon this unsolved problem of wireless telegraphy.

At fixed hours each day the time signal is recorded and the weather report compared with that published by the Meteorological Office.

The apparatus can be used also for the reception of rapid signals. The method by which this can be done is as follows: After the photographic plate has registered the vibrations of the quartz fibre, it is taken out of the camera and developed, when the message it holds can be read as easily as the dots and dashes of the Morse code on a tape machine. The daily observations which are now being made should prove of interest and importance in giving accurate data of the variation in strength of wireless signals under different atmospheric conditions.

MIMIC WARFARE AT EARL'S COURT

THE readers of THE WIRELESS WORLD should go to the Imperial Service Exhibition which is now in progress at Earl's Court. There they will find many things of great national, and more than national importance. Perhaps one of the most striking sections of the exhibition is that devoted to naval affairs. As one enters the grounds from Warwick Road, one comes on the scene of a naval harbour, made particularly realistic by the reproduction, actual size, of the stern of H.M.S. *Lion*. Those who do not know what the interior of a man-o'-war is like will be able to spend an interesting half hour here. But perhaps the mimic war is the most fascinating of all the exhibits. Upon a large sheet of water, with a broad and deceptive background of scenery which might be the coast of Dalmatia, four model battleships, two battle cruisers, and two destroyers will go through various review formations, and will then bombard the town on the coast. After a plucky resistance, it is compelled to surrender, upon which a landing party goes ashore and hoists the Union Jack. But the battle is not confined entirely to sea tactics; aeroplanes and an airship play their part, and, what is most interesting, they are propelled by "wireless." Their manœuvres are marvellous; explosives are dropped from the dirigibles on to the battleships, and the sensation caused by the unexpected onslaught of these "bolts from the blue" can scarcely be described; to see vindictive bombs dropping unceremoniously from nowhere on to the unfortunate vessels which are quite incapable of retaliation on their aerial foes awakens the imagination to an unwonted pitch of excitement. But, actual as it is, to the lay mind it seems all so unreal. As someone aptly described it, it was like a chapter of H. G. Wells turned into action, or Tennyson's "Peep in the Future," translated from Locksley Hall to Earl's Court to make all the world wonder.



By kind permission of] [*The Liverpool Courier*

Photographic Recording Apparatus installed at the Liverpool University

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. (*continued*).

THE old questions of naval and aerial supremacy were once again very much to the fore. The daily journals were spending great columns of type on the trend of events. Huge staring letters spread the war scare on the evening placards.

ANOTHER HOSTILE SPEECH FROM THE CHANCELLOR.

GERMANS INSULT ENGLISH TOURISTS.

PROPOSED INCREASE IN GERMAN BATTLEMENTS.

THREATENED INVASION OF ENGLAND BY AIR.

ENGLAND'S UNPREPAREDNESS, etc.

All such topics filled the Press till the whole country seethed with indignation. Exactly why, it would have been difficult to state. Nevertheless such indications were sufficient to show that however long the evil day might be put off, there would at last come a time when the two nations would be at death grips to decide which should hold the supremacy of Europe. If Beulner as a German had been affected by all this turmoil it would not have been surprising, but what was extraordinary was the fact that while he remained comparatively calm on the subject, Dupont became more and more excited in exact proportion as the newspaper headlines became more flaring, or the statements in Parliament became more violent. Then, too, the telegrams, which had at first come to him in single spies, now came in battalions. They were all in code, which he could only translate with Beulner's help, and all were of foreign origin. Nearly every one of them necessitated a reply, and some of them would make him swear in the very finest *lingua franca*. Often after the receipt of such telegrams he would order the grey motor car, and go down to Sotheby for a week-end. Usually he stopped at the Granby Hotel, though sometimes, in order to avoid remark, he would put up at Chittingham. He soon came to know the country by heart, for in his car he toured every road, every side track even. He made his way to the lower ridges of the town, and always appeared to be on the look out. There was no doubt that on many occasions he was anxious to find out if Doss and Suk were in the neighbourhood, and sometimes his efforts were successful. He never passed them without speaking. Sometimes he would offer money. That was when he heard something which

pleased him; but usually his efforts to obtain news were unsuccessful, and he would come away frowning at his ill-luck. Nevertheless, in this way he learnt all about the repairing course which the Summers airship was undergoing, and as matters progressed, so he became more and more cheerful, more *debonnaire*, more suave—more *à la* Dupont. Occasionally he would lay himself out to meet Miss Summers and make inquiries, but not too often, lest she should be suspicious; and never did he put himself in the way of Summers if he could help it. What he liked best to do was to hear from Suk that these interesting people were going to town, and would be doing this or that. Then he would manage, by hook or by crook, to come across them, and perhaps just pass the time of day. No occasion was he known to slip which might be turned to profitable advantage. Certainly Dupont was a very clever and determined man.

All this while Gwen was making great strides with her wireless. There was some reason to be gratified at the disaster, for it's an ill wind that blows nobody any good, and it served a good turn by giving her an opportunity of becoming more particularly useful to Charles. By this means she obtained a much more accurate and practical knowledge of the ship construction than she would have done by any number of theoretical lessons. She became quite an adept even in construction, and Summers soon learnt to call her in for little jobs which her more delicate fingers enabled her to finish off in neater fashion than he could ever have done. Then when the time came for little trial trips she learned how to get a far from perfect instrument under control. Perhaps something in the model would not balance rightly, so that the airship steered all lopsidedly, and the fault had to be rectified on the keyboard. Now, if Gwen had worked with a complete model she would never have been required to know such things. As it was, she became as proficient in the art of steering as Charles himself, and the latter soon had reason to be proud of the partnership of Summers and Thrale.

But however smoothly things went, many months necessarily elapsed before the mischief to the airship was rectified; for not only did the machine require extensive repairs, but, in Gwen's particular phrase, there were "other fish to fry." She had to be taught wireless telegraphy, and that took up many an evening which would otherwise have been devoted to airship construction; for although her struggles at the Morse code were heroic, even with the best will in the world one cannot learn a new language quickly. Besides, she had to learn something about the apparatus, so that her education occupied a good deal of Summers's time. After this another idea was brought forward, which also proved a good deal of hindrance to Charles in his work. It was suggested and finally decided that a wireless station should be erected at Thrale Hall, with the view of establishing communication between these two centres of attraction. Of course Charles made most of the machinery, and Gwen helped in a small way, but it took some time to get such apparatus into working order, and the spring of the following year was at hand before communication with Thrale Hall and the Vicarage was opened up. Gwen's set was pigmy compared with that of her professor, but it served its purpose very well. Many were the confidential messages transmitted between the stations, and often "x's were strong." Carried away by his enthusiasm, Charles did not realise how much his own work was being delayed. When he did he buckled to with a will, but it was another month or two before the airship was as sensitive an instrument as it was before the accident. As soon as it was completed to his satisfaction Summers approached the War Office in the hope that the Government might purchase his invention, or at least allow him opportunities to build a full-sized model for the purposes of demonstration. The procedure followed the usual course, and more months were taken up in negotiations, so that it was something over a year before things were sufficiently advanced for Charles to announce that matters were practically settled, and he would be allowed to demonstrate his invention before the Aeronautical Authorities with a view of its acquirement by the War Office. Great was the excitement of the two when so much was successfully concluded. Gwen felt that she had a right to feel proud of her *fiancé's* success, for had she not broken the machine for him and helped

to put it to rights? Besides, now that she knew all about wireless telegraphy, she could appreciate points which were outside the ken of the layman.

But Dupont had not been idle all this time. He had watched proceedings closely but cautiously, and he made innumerable opportunities of getting into closer touch with Miss Thrale. Presently he found his task becoming more and more difficult, and he waited in vain for a renewal of the invitation to watch the manœuvres. Finally he decided he could wait no longer, so he adopted bolder tactics, which were ultimately crowned with success. One day he motored down to Sotheby and put himself in the way of meeting Gwen and Charles. From conversation with the yokels, who by now were accustomed to him and the grey car, he informed himself of the time and place where it was most likely he would meet the two together. Armed with a sketch book, palette, paints, and the camp stool of an artist, he journeyed to a likely spot, and made active preparations for a sketch. Presently the two passed, and it goes without saying, there was a most delightful *rencontre*. Both parties expressed their surprise at the meeting, and Dupont, with the usual disclaimer of any pretensions to skill, showed them his effort. He was really a clever water-colour artist, and even the half-finished sketch testified to his ability. Compliments were paid him and modestly received. The Frenchman, of course, took the opportunity to make inquiries of Summers and his engineering work, and managed to introduce the subject of wireless. He did not forget to ask whether the unfortunate airship was repaired, and when Charles assured him that everything was O.K. he enthusiastically congratulated the young engineer, adding: "How much I should like to see that beautiful ship sailing again across the sky! I am very anxious to observe it, you know, for it combines in itself—is it not so?—the two greatest marvels of this century—the triumph over air and the triumph over space. I know nothing at all about engineering, but I understand enough of the romance of science to wish very much more than I can say to see your great invention, Mr. Summers. When do you sail it again? —for you know we were promised to see it, and so great is my desire to observe it that I am bold enough to ask you of your generousness to give us the chance that fate did not allow us last year."

Put so pointedly, the request was hard to refuse, and Charles, who was good-natured to a fault, readily replied: "Well, I shall be having it out on Saturday next, Mr. Dupont; why don't you and your friend come along? I don't suppose I shall be doing much, but if you care to take the chances, why then perhaps we might be able to amuse you for a short time."

"Oh, thank you, thank you, Mr. Summers," Dupont replied with alacrity. "For myself I can say, without hesitation, I shall be most pleased. As for Beulner, I am not so quite certain, but if my poor word will induce him, why, then he will come *bien volontiers*."

So the meeting was settled on; but Charles, when he had time to consider it from a remote standpoint, was annoyed with himself for being so easily coaxed into making the suggestion. It was against his own definite self-authorised rules to ask anyone to the manœuvres. Why, then, should he have been so silly as to invite two such bounders as a Frenchman and a German?—for, with insular prejudice, he always looked upon foreigners as people to be more particularly distrusted and avoided as emissaries of the devil. Well, there was no help for it now; he couldn't put them off a second time. Nevertheless, he was determined they should see as little as it was possible to show them.

CHAPTER VII.

EN RAPPORT.

The Saturday of the appointment arrived. Quite early in the afternoon the grey car glided up the drive of Sotheby Vicarage and discharged its occupants. The two men had spared no pains to make themselves acceptable, at least in the eyes of their hosts. Well favoured and in the smartest rig that Bond Street could turn out, there was little in their outward appearance to indicate that they were foreigners; in fact, Beulner might well have passed for an Englishman who had acquired a Continental tone, though Dupont was unmistakably French as soon as you caught

sight of the long oval-shaped skull and low forehead. They had not long to wait in the drawing-room before Gwen came in from the garden, followed by Mr. and Miss Summers. Introductions were exchanged, and the party in the good old English way immediately wandered over the shady grounds. Small talk passed the time away until tea was announced. Even now Charles did not appear till Miss Summers was urged to make a remark on his dilatory behaviour. Gwen explained that he had a hard problem on hand, and said he could not be interrupted.

"*Mathematique?*" inquired Dupont with airy nonchalance. "If that is so, then he does receive my most sincere condolences. I do hate the *mathematique*. When I was at the University of Paris I used to have to study algebra, euclid, trigonometry, until all my head was one pudding of A, B, C, D, and their sines and cosines. Oh, it was awful. At last I give it up and take to *poèsie* and *la drame*, but perhaps Mr. Summers knows himself in *mathematique*, and do them for the pleasure. Then, if that is so, I quite understand callers are *génants*—in the way—tiresome."

"Oh, no," interposed Miss Summers, "it is not mathematics this time, he could have left those easily enough, but he says he's got to draw up a report for the Government; I don't know exactly what it's about, but I think it's in connection with his wireless station. Anyway, a lot of people have been calling on him lately, and he's been working his little toy airship to death."

"Yes," said Gwen, "I saw some of them in the distance on Thursday. They were driving a splendid new Wolseley car. One of them was stout, and grey-haired, with short grey moustaches."

"Yes, that was a Colonel something or somebody, and such a dear old man. He quite took father's heart. He said he always read the lessons at his parish church, except when it came to the first chapter of Chronicles, which he left, on principle, to the curate!"

"And what's more," chimed in Mr. Summers, "he gave a guinea for the school treat; but that wasn't all profit, for he smoked three of my best cigars."

"Well, he didn't seem to know much about Charles's demonstration. All he said during the gyrations of the airship was, 'Very pretty, very pretty.' At least, that's all I heard him say."

"But I think he had a long conversation with Charles in the conjuring den," Gwen interpolated, "for he stayed there a terrible time. I was sitting on the churchyard wall waiting for him to go, so I know."

At that moment Charles appeared.

"What an age you've been," the three of them shouted in chorus, while Beulner and Dupont rose to shake hands.

"Sorry," remarked the offender, "but I did not think it was so late. I must apologise."

"Yes," chimed in Gwen, "you'll have to be awful nice to make amends. As it is you must be made to suffer for your bad behaviour. There's only one brioche left, and that I buttered for you a long while ago, and there's just half a macaroon which I managed to save. You ought to be very grateful to me, for you don't deserve even that."

Charles was not to be disturbed by this banter. He leisurely seated himself in a deck chair, and munched at the brioche. Meanwhile tea-table talk prevailed.

It centred to a large extent on the strained relations which still existed between Germany and England. Things during the past few months had been going from bad to worse. There was no doubt about it. Germany was trying to get a wider sea coast. She would have liked a port in the Mediterranean, but, finding that impossible, her hopes were set on improving her position in the Baltic. Just a little slice off the coastline of Finland would be of great service to her, and there was no doubt that she had been striving to get possession of the estuaries of the Danube for many years. Now, however, the matter was becoming more urgent. The congestion of German trade made relief not only a necessity, but one of paramount importance. Then, when affairs had assumed the nature of a crisis, a weak Government allowed its foreign policy to be discerned, and the foreign yellow Press was quick to work the matter up into a serious business. It could no longer be overlooked. Questions had been asked in the English Parliament which the Foreign Secretary had found difficult to answer. The lower class Opposition papers

had not been slow to make the most of this, and soon large columns were devoted to the discussion of England's naval policy, of her equipment in armaments and fleets, and all the branches of modern warfare. The reserve of the Government only made matters worse, and it looked as though a general election was imminent, for it would not be possible much longer to fly in the face of public opinion. Nevertheless, the Government, in spite of their apparent nonchalance, were making eager preparations against any unforeseen circumstance. Their unconcern was more apparent than real. The course they had adopted of trying to throw dust in the eyes of the public, or rather to treat them like children, and pretend that relations between the two countries were entirely amicable, in the hopes that their declaration of faith would be implicitly believed, was only the subterfuge of a weak party. Official circles were fully aware that, without open war, things could not be in a much worse state. Acting on such intimate knowledge, naval authorities were working night and day, in order to be prepared for possible emergencies. The complement of battleships was made up to the last unit. The commissariat was overhauled, and coal was being bought in enormous quantities, so that the supply should be equal to any demand that might be put upon it. Even arrangements were made for calling up the reserve. Similar exertions were being made in the army, and the aerial fleet was no exception to the general rule; but in this instance a somewhat lax War Minister had allowed the newer and less recognised branch of defence to be neglected, or rather, without active negligence, had grudged fostering influence, which alone could enable it to keep pace with the rapid developments of the new science. Now, when things were looked into, it was found that foreign aerial fleets were far in advance of the English, and immediately strenuous efforts were made to rectify the deficiency. The Government workshops were kept busy building new vessels, contracts were placed everywhere for the supply of material necessary, and it was hoped that the official peace would last long enough to allow the vessels to be built. At this opportune moment Summers approached the War Office with regard to his own invention, and the authorities, who at any other time would have been inclined to consider the matter over fantastic, were only too willing to clutch at anything which might save them in an awkward situation. Charles's proposals, therefore, received a readier welcome than would otherwise have been possible, and negotiations had proceeded so well that it looked as though a purchase by the Government would possibly be effected. This Dupont knew, and it was to prevent such a purchase that he had sought this evening's invitation. Armed with such knowledge, he carefully steered clear of any statement or suggestion which might be inclined to rouse Summers's suspicions. He treated the topic in hand as one for amusing comment and scintillating wit, until he had made an opportunity to draw Beulner into the conversation. He compared English soldiery with German, and commented upon the likely methods of either nation in warfare. This led him to the subject of wireless and the object of his visit. He tried to get Charles to talk, but true to his instincts the young Englishman was very reticent. Dupont therefore led Beulner to talk of his experiences with another system, and thus attained his desired result, for Charles quickly became interested, and in some measure threw off his cloak of reserve. Dupont was quick to recognise the change, and when he thought the time was ripe, put one or two leading questions which caused Summers to expostulate and propound his own theories on the subject. In order to corroborate his statements, Charles had resource to his airship, and he was obliged to show his airship to his visitors and explain its superficial mechanism; but when Gwen urged him to give a practical demonstration of his toy, he refused on the ground that it was not in complete working order, and would be damaged, and that it would be risky to attempt such a thing. Later, however, he did give way sufficiently to invite Beulner and Dupont into his den and to explain the Marconi system of wireless to the former, and demonstrate the sending of messages by the ship set. He got into communication with Crookhaven, and allowed the German to use his telephones. What was more, he offered to supervise the fitting up of his station at Hampstead, even

arranging for inter-communication between them. While the two were so engaged, Dupont attached himself to Gwen, and was shown about the place. Nothing escaped his eye. He saw the mysterious chest with its patent lock, the diagrams scattered here, there and everywhere. Without appearing to glance at the table where Charles had been working, he got an idea of the young man's recent occupation by careful scrutiny of the scribbled papers, carelessly tossed on one side.

He saw, too, the little stationery cabinet standing open on the table, and his fingers itched to help himself to its contents, but he knew such procedure would ruin his chances, and he could find no way of getting what he wanted without showing his hand. Instead, therefore, he kept himself well under control, and talked pleasant nothings to Miss Thrale, until he gathered that Beulner and Summers had completed their discussion. Then he took out his watch, remarking he was sure that they had exceeded the limits of the Vicarage hospitality, and the two of them, after exchanging courtesies with Mr. and Miss Summers, took their leave.

But they did not return to London that night; instead they put up at the Granby Hotel, and told the gratified landlady that they had come down for a quiet week-end.

It was clear that Dupont had much on his mind. All that evening he was buried in tobacco smoke, nor did he go to bed until the frequent attentions of the landlady intimated that she was anxious to shut up for the night. He had a little plan of campaign to work out, but he couldn't quite see his way clear. When he did tumble into bed it was not to sleep, but to lie gazing at the moon as it slowly travelled from one to the other of his bedroom windows. The outcome of his cogitations was a remark to Beulner next morning that he must see the old pedlar woman they had met previously. Beulner made no demur. He accepted the remarks from his chief with a well-trained disinterestedness characteristic of a German officer who has had to submit to years of puppet-like obedience. So it was arranged that they should spend the morning motoring about the country passing and repassing as much as possible, but not too frequently to attract remark, up and down the High Street, round Sotheby Church, and through the lanes where the pedlars had first been seen. Their efforts were rewarded, for about mid-day they came across the old couple sitting in the hedgerow where they had first met them. When the motor-car stopped, and Dupont got out, Suk never attempted to get up, but, with the superciliousness of her sex and class, waited with the passive resistance of a rebel against Society for Dupont to come to her. As Dupont approached her, Suk was the first to speak. "I know'd as how ye were comin' this way, zur. I saw the motor-car outside of the Granby yest' night, and when I heerd yon horn this morning I said to old Doss, they be looking for I, and roight enuf ye may be, for I can tell ye a thing or two. Maister Summers he be doing grert things, an' secret things. There be lots of fine folk nosing round that little shanty, an' there be those that talk in the village an' say as how they be King's men coming to buy the creetur that went sailing over the woods t'other eve. I be sure of this, for I bin making it my business to find oot. More'n that, I been got some rare news that be worth fur more than ten shillin', and I don't see why, if I tell ye, ye shouldna' cross my hand wi' ged geld."

Dupont laughed. The old shrew was a bit of a business woman. He held a sovereign between his thumb and finger. "There, madam, will that do to put in your pocket? But for this I expect fine news, great news. Tell it me."

Suk craned forward and lowered her voice.

"'Tother night, an' it were Friday, aboot five o'clock, when I ha' filled me basket with cresses, and were taking train for Chittingham, a motor driven by Maister Summers and other gentry coom along. They got oot to catch the train for Lunnon, and I crept after them, pretending I wanted th' same train. They were talking aboot the ship thing, for I heerd one of the folk say wireless, and another say, low like, 'I don't see whay the Gove'ment shouldna' buy th' idea as it is.' I dunno' what be th' idea they talked of, but I never let slip a word I could help. Then the govern'r spoke, an' told Summers how that the thing wer urgent, and as how he must git on wid' eet."

(To be continued.)

Colonial Notes

A REPORT presented to the Commonwealth Parliament by Commander Brewis, R.N., on the lighting of the western coast of Australia, reveals the interesting fact that it is more economical to provide these places with wireless telegraph stations than with telephones. Commander Brewis recommends that wherever possible isolated coastal lighthouses that are within reasonable distance of the wireless telegraph stations to be constructed round the Australian coast, or can be connected with one another, should be provided with low-power wireless equipment. In support of his contention that the first cost of the wireless equipment and the cost of upkeep are less than telephones worked by land lines and submarine cables, he mentions that the estimated cost of connecting three lighthouses—Cape Leveque, Cloat's Point, and North-West Cape, all in Western Australia—by telephone with the land lines exceeded £20,000; on the other hand, the cost of providing wireless equipment at twenty of the existing and proposed lighthouses of Australia, where such method of communication is considered desirable, should not exceed a total of £16,000. Commander Brewis, therefore, recommends that wireless telegraphy be installed at the following places :—

Lighthouse.	Nearest Wireless Station.	Distance.
Eclipse Island ..	Albany . .	15 miles
D'Entrecasteux Point	Albany . .	110 ..
Cape Inscription ..	Carnarvon . .	60 ..
Cloat's Point	Carnarvon	140 .
*North-West Cape ..	Cloat's Point Light	70 .
Cape Leveque ..	Broome	120 .
Lacrosse Island ..	Wyndham	60 ..

* * *

The example of Australia in this matter might be followed with advantage elsewhere. In Australia it is proposed to entrust the operation of the stations to the lighthouse keepers, nearly all of whom, we understand, are proficient in Morse, and should be able therefore to carry out their wireless duties after a few weeks' training. Great as is the economic advantage that alone is not urged by Commander Brewis in favour of the wireless scheme. There is the valuable aid to safety of navigation in southern waters, where many of the ships possess a wireless installation, as well as to the Commonwealth Meteorologist in compiling and communicating weather reports.

* * *

That the Canadian Government are convinced of the utility of wireless telegraphy on board vessels engaged in the fishery protection service is evidenced by the equipment of the C.G.S. *Canada* and *Dollard*, which the Marconi Company of Canada have just completed. One of these vessels, the *Canada*, has had an interesting career. She was originally a torpedo-boat destroyer, but was purchased nine years ago by the Dominion Government for fishery protection service in Canadian waters, being stationed at Halifax, N.S. In 1905, the *Canada* was fitted with a coil set of wireless apparatus, but with the advent in 1910 of the *Niobe* and *Rainbow*, which were intended to form the nucleus of a Canadian navy, she was utilised as a training vessel, for which purpose all the available accommodation was required, and it was found necessary to dismantle the apparatus. The vessel has again been commissioned on fishery protection service, this time on the Great Lakes, and bearing in mind the excellent results of the first wireless installation, the Government decided to equip her again. The new apparatus consists of a 1·7 kw. synchronous disc discharger, transmitter and valve receiver, with a coil transmitter and magnetic receiver as emergency gear. Call letters V.D.C. have been allotted to the *Canada*, which is owned and controlled by the Department of the Naval Service. The C.G.S. *Dollard* has just been delivered to the Department of the Naval Service by the Kingston Shipbuilding Company, of Kingston, Ont., where her wireless installation was fitted. Her call letters are V.D.O.

* North-West Cape can be connected by day with a lightship station equipped with low-power wireless telegraphy, but by night will be within easy range of Carnarvon (210 miles) and Roebourne (210 miles).

Educational Notes

THE large number of educational announcements which appear in the advertisement pages of this issue should make a strong appeal to those of our readers who contemplate taking up wireless telegraphy as a career, either as engineers or operators. Within the past two years the number of colleges where the necessary tuition is given has increased considerably.

The school at Marconi House calls for the attention of those resident in London. Here day and evening classes are held; the day class is for students who have generally had some previous land-line or cable telegraphic experience, and serve about two months as learners, in order to acquire a working knowledge of the Marconi system of wireless telegraphy.

Of the institutions which we desire to bring to the notice of our readers, these may be divided into two categories. One of these exists mainly for *teaching*—that is to say, imparting the ordinary routine of instruction in the solid, non-speculative truths underlying the whole fabric of wireless telegraphy. The other class adds to these functions special facilities for the research student. Among the latter, University College (University of London) and the East London College (University of London) hold prominent places. At the famous Gower Street College the Department of Electrical Engineering is under the direction of Professor J. A. Fleming, and it forms part of the faculty of Engineering. The research laboratory is specially equipped with apparatus for the study of high-frequency currents and of wireless telegraphy. At East London College facilities exist for the carrying out of research during the evening as well as in the daytime by duly qualified persons.

The Northampton Polytechnic Institute is well known in London. The full day course in mechanical and electrical engineering subjects will commence on September 29th, and students taking the complete course can specialise in their third and fourth years in wireless telegraphy. At the Working Men's College classes are held in natural and applied sciences specially for beginners,

The prospective operator cannot complain of lack of training colleges. In London the British School of Telegraphy and the London Telegraph Training College are each equipped with standard Marconi apparatus, and prepare students for the examination for the Postmaster-General's certificate. The East London College, which is located in Forest Gate, gives both practical and theoretical instruction. Provincial students are also well catered for. Thus, at the Royal Technical College, Glasgow, a full course of instruction has been arranged, under the direction of Professor Magnus Maclean, for persons desirous of qualifying for the Postmaster-General's certificate in telegraphy as a preliminary to their employment as wireless operators. The two establishments of the Manchester and Liverpool Wireless Telegraph Training Colleges are fitted with Marconi apparatus, and examinations are held frequently at these colleges. The Northern Wireless Schools have also a centre in Manchester, as well as one in Dublin, both of which are equipped with modern apparatus. Leeds, West Hartlepool, and Newcastle-on-Tyne are the headquarters of the Northern Schools of Wireless Telegraphy, and day and evening classes are held at each of these centres.

There are also a number of correspondence colleges with their headquarters in London. The University Engineering College have a course dealing with wireless telegraphy and telephony, and special facilities are offered to those who desire to study for the Postmaster-General's certificate for wireless operators.

The courses of the Empire Correspondence College are adapted to the requirements of operators and engineers and to the examinations of the Postmaster-General.

It is almost superfluous to advise students to learn foreign languages. Hugo's Correspondence Course should be a boon to those who are constantly travelling, or who have not the facilities for obtaining oral lessons.

Maritime Wireless Telegraphy

ON July 31st an action was brought, before Mr. Justice Bargrave Deane and two of the Elder Brethren of Trinity House, by the owners, master, and crew of the steamship *Devonian*, one of the Leyland liners, to recover salvage remuneration for services rendered to the steamship *Mexico*, her cargo and freight in the North Atlantic, in January and February last.

On January 25th last the *Mexico*, a steamship of 4,885 tons gross, belonging to the Compagnie Générale Transatlantique, left New York on a voyage to Dunkirk with a general cargo. On the 27th a bad south-westerly gale and a very heavy sea was encountered and some of the cargo in the 'tween decks became unstowed and shifted, doing considerable damage, and on the following day the tail-end shaft broke in the stern tube. The *Mexico* at once sent a Marconigram to the agents in New York reporting the accident, and they replied that the *Floride* and *Caroline*, which belong to the defendants' line and are fitted with wireless apparatus, had been sent to her assistance. On January 30th the *Mexico* became unmanageable in an easterly gale and very high sea, in which she rolled heavily. Alarming noises were heard in the holds and showed that the cargo had shifted badly, and at 8 a.m. the operator sent a Marconigram to Sable Island saying "Situation becoming more critical." About the same time the *Devonian*, bound from Boston to Liverpool with passengers and a general cargo and manned by a crew of 87 hands, received the following call from the *Mexico*: "Adrift with propeller lost, position 39.50 N., 59.33 W.; we expect help from steamers *Caroline* and *Floride*, both coming; please let them know our position." Further messages were exchanged, and when it was ascertained that the *Devonian* could reach the *Mexico* inside of eight hours she was requested to approach for fear of worse weather. The *Devonian* accordingly altered her course, and eventually the *Mexico* was sighted about 10.30 p.m. and the *Devonian* was requested to stand by till daylight. On the following morning the master of the *Devonian* sent a message that he could not wait indefinitely, and as no message had been received from the *Floride* or *Caroline* the master of the *Mexico* accepted the offer of the *Devonian* to tow her to Halifax. By means of a line brought by the lifeboat of the *Devonian* two of her wire hawsers were hauled on board the *Mexico* and made fast. The weather had then moderated. About 10 a.m. on January 31st the towage began. The vessels were then about 390 miles from Halifax. Shortly afterwards the vessels received a message from the *Floride* that she was 140 miles distant, but as the *Devonian* was doing the towage, the *Floride* resumed her voyage under instructions from New York. On February 1st and 2nd the weather was very bad again, and the *Devonian* hove to and just kept her engines working sufficiently to keep the hawser taut. During the afternoon of the 3rd the weather moderated and the towage towards Halifax was resumed, and was continued without particular incident till the afternoon of the 4th, when the *Mexico* was safely brought to an anchorage in Halifax.

The value of the *Devonian*, her cargo and freight was £252,177. The *Mexico* and her cargo were valued at £77,755, and there was no freight at risk.

The Court awarded £7,326 17s.

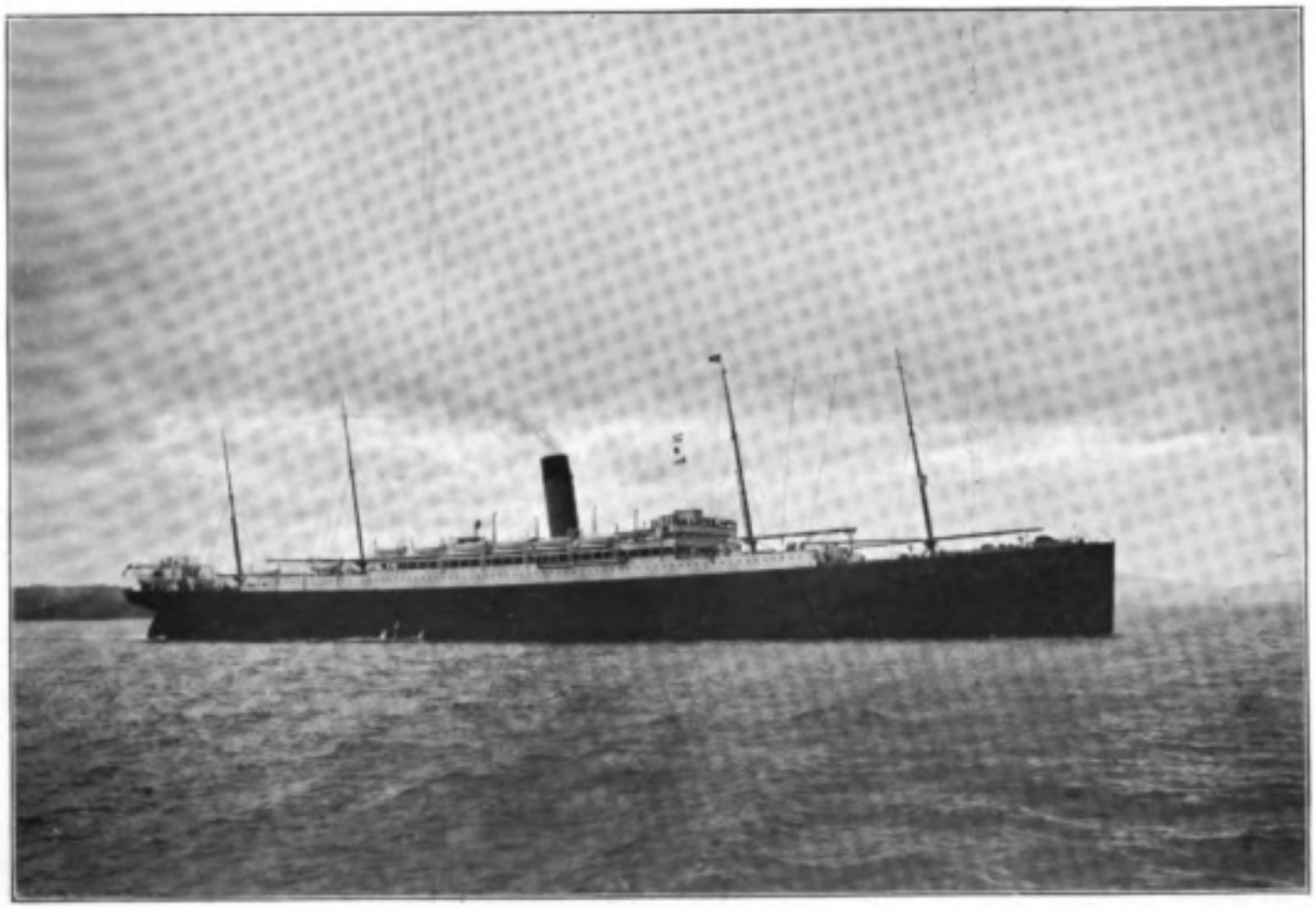
Mr. Justice Deane, in his judgment, said that the weather was not very bad the day the towage began, but in the night the weather altered, and the sea got up and the conditions were entirely changed. The *Mexico* rolled very violently and made very bad weather of it, her steering got worse, and she had a considerable list—12 or 15 degrees—to starboard, and that made her rolling worse, as the ship kept coming to port in spite of helm fully starboard. About 9.30 a.m. on February 1st, when the weather had got worse, the *Mexico* sent this message: "Rolling becomes dangerous. Please bring to sea a little more." The captain of the *Devonian* replied: "I notice your terrible rolling, but do not dare to go any faster to keep more head to sea fearing I part hawser." Later, the master of the *Mexico* called the

Devonian asking what weather to expect, as he was "fearing for the night." On the night of February 1st the weather became still worse, and in the morning the *Mexico* sent this message: "How has the night been, here very bad with incredible rolling, we don't lose confidence for we trust in your hawser, hope better weather for the day." There could be no doubt that the towage was then extremely dangerous. The cargo in the *Mexico* was loose, and that increased the list, and his Lordship was advised by the Elder Brethren that if this vessel had not been in tow she would probably have got into the trough of the sea and capsized, and not only the ship but valuable lives would have been lost. On February 3rd the same conditions prevailed, and the *Mexico* steered very wildly. Subsequently the weather got better, but the vessels were troubled with snow flurries, and, added to these troubles, the master of the *Mexico* was not sure that his reckonings were right. However, the vessels arrived safely at Halifax on the afternoon of February 4th. There was no doubt that it was a very valuable service extremely well performed, and that there was considerable danger not only to the salved ship but also to the salvors; to save property worth £77,700, property valued at £252,000 was put in jeopardy, so that a great responsibility rested on the master of the *Devonian*. The towage lasted 4½ days, and the *Devonian* lost 7½ days in consequence of the services. It was difficult to conceive a better service, and the award his Lordship would make was the sum of £7,000—£4,600 to the owners, £500 to the master, and £1,900 to the crew. In addition, he allowed £326 17s. for expenses at Halifax and loss of ropes and gear.

This case is a striking instance of the value of wireless telegraphy to ships at sea.

* * *

The new Cunard Canadian liner *Andania*, which has recently returned from her maiden voyage, is the latest example of the one-class cabin—called second cabin—type of steamer. The *Andania* is a twin-screw vessel of 13,400 tons, her length being 540 ft. and her breadth 64 ft. The ship is fitted with the Marconi wireless apparatus, and the system of submarine signalling is also incorporated in the design. The *Andania* has accommodation for 2,140 passengers—520 cabin and 1,620 third class.



The R.M.S. "Ceramic."

Contract News

The Marconi Wireless Telegraph Company of America notify that the following vessels have been equipped with Marconi Apparatus during the past month.

Ship.	Owners.	Call Letters.	Apparatus.	Remarks.
S.Y. *Cyprus*	D. C. Jackling	KYD	5 kw. and emergency	Private yacht.
Comet	Standard Oil Co.	KJT	2 kw. and emergency	Engaged in oil transport.
Senator Bailey	Steele Towing and Wrecking Co.	KGS	,,	—
S.Y. *Emeline*	Robt. Graves	KYN	,,	Private yacht.
Illinois	Texas Steamship Co.	KTH	,,	Transport vessels carrying limited number of passengers.
Lyra	Luckenbach Steamship Co.	WNG	,,	
S.Y. *Wana*	G. C. Sherman	KYX	1½ kw. and emergency	Private yacht.
S.Y. *Wakiva*	Edw. L. Doheny	KYI	,,	Private yacht.
Merced	McCormick Co.	WSZ	,,	—
Chicago	U.S. Government	NDI	,,	These vessels belong to the United States Naval Militia. The contract for their equipment provides for service *via* the coast station of the Marconi Wireless Company of America.
Gloucester	,,	NGI	,,	
Marblehead	,,	NJO	,,	
Dorothea	,,	NES	,,	
Don Juan de Austria	,,	NER	,,	
Gopher	,,	NGK	,,	
Machias	,,	NJI	,,	
Vixen	,,	NVS	,,	
Wolverine	,,	NWN	,,	
Essex	,,	NFJ	,,	
Dubuque	,,	NEU	,,	
Yantic	,,	NXC	,,	
Maine	,,	BQK	,,	Hospital ship in the service of the Government.
Petroleum	,,	BQM	,,	Petroleum carrier in the service of the Government.
Radiant	Standard Oil Co.	KTR	1 kw. and emergency	Engaged in oil transport.
Brilliant	,,	KTI	,,	
Forward	Yankee Salvage Co.	KPF	,,	—
Vessel not yet named	Chicago Duluth and Georgian Bay Trans.	WEN	,,	Engaged in world-wide Service.
State of Ohio	Cleveland and Buffalo Trans. Co.	WFR	,,	
See and Bee	,,	WFS	,,	
Lakeland	Port Huron and Duluth Steamship Co.	WDL	,,	—
S.Y. *Lydonia*	W. A. Lydon	WDY	,,	Private yacht.

The following vessels have been equipped by the Debeg Company.

Ship.	Owners.	Call Letters.	Remarks.
Gelria	Koninklijke Hollandsche Lloyd	—	
Tubantia	,,	—	—
Insulande	Rotterdamsche Lloyd	—	—
Guardian	Central and South American Telegraph Co. of New York	WGZ	Cable ship.
Imperator	Hamburg Amerikanische Packetfahrt A.G.	DIT	Passenger vessels.
Antonia	,,	DAN	
Armenia	,,	DEM	
Belgia	,,	DBY	
Bosnia	,,	DBZ	

Orders have been received during the past month by the Marconi International Marine Communication Co. to equip or to refit the following Vessels :—

Ship.	Owner.	Apparatus.	Remarks
Canning	Lamport and Holt	1½ kw. and emergency	Sailing between Liverpool and South America.
Berbice	Royal Mail Steam Packet Co.	,,	—
Bealantia	,, ,, ,,	,,	—
Mediator	The Admiralty	,,	—
Ingoma	F. and T. Harrison, Ltd	,,	Liverpool to the Cape.
—	Hellyers Steam Fishing Co. ..	½ kw. and emergency	Three units of important fishing fleet.
—	,, ,, ,, ..	3 kw. and emergency	The Carrier attached to the Fleet.

Vessels which have been or are being equipped with Marconi apparatus since our last issue.

Ship.	Owners.	Apparatus.
Caribbean	Royal Mail Steam Packet Co.	1½ kw. and emergency.
Kaipara	New Zealand Shipping Co.	,, ,,
Morinda	Burns, Philp & Co.	,, ,,
Baroda	British India Steam Navigation Co.	,, ,,
Vedamore	Johnson Line	,, ,,
Toronto	Wilson Line	,, ,,
Malaspina	Canadian Government	,, ,,
Soudan	P. & O. Line, Chartered as Troopship	,, ,,
Conqueror	His Grace the Duke of Manchester	½ kw. and emergency.
Iroquois	Anglo-American Oil Co., Ltd.	,, ,,
Navahoe	Anglo-American Oil Co., Ltd	,, ,,
City of Delhi	Hall & City Lines	,, ,,
City of Chester		,, ,,
City of Colombo		,, ,,
Kazembe	Bucknall Steamship Lines, Ltd.	,, ,,
St. George	Canadian Pacific Railway	,, ,,

The Spanish and General Wireless Trust

MR. GODFREY C. ISAACS, presiding at the meeting of the Spanish and General Wireless Trust, on August 1st, said that their assets were almost entirely composed of shares in the Compañia Nacional de Telegrafia Sin Hilos, the progress of which had not been sufficiently rapid to produce any revenue to this company in the shape of a dividend. Under the terms of the concession from the Spanish Government, a number of stations had been constructed, the first of which were at Aranjuez, near Madrid, Barcelona, Soller, in the Balcaric Islands, Cadiz, Vigo, and Las Palmas and Teneriffe, in the Canary Islands. The business had so far been mainly that of communication with ships at sea, the receipts of which had not come up to expectations. However, there had already been a marked improvement in the stations' receipts, and the number of messages was increasing month by month, and likewise the installations on board ships. The Portuguese Parliament had recently passed a law rendering wireless telegraphy obligatory on board all vessels of a certain denomination, and, no doubt, similar legislation would follow at an early date in Spain, which should add considerably to the business of the coast stations. During the year a new station had been opened at Santander, and others were approaching completion. Considerable difficulty seemed to have been encountered with the telegraph authorities in Madrid, which had given the directors of the Compañia Nacional a great deal of trouble in connection with the international telegraph service. Under the terms of the concession the company was clearly entitled to conduct that service, but this was questioned by the authorities. The board were advised, however, that the matter had now been practically settled, and negotiations had been opened by the Spanish Minister of Posts and Telegraphs with foreign postal administrations with a view to making the necessary arrangements for a wireless service. It was hoped that before long such a service would be in operation between Spain and this country, a station on each side being ready to start such a service from the moment the necessary authority on this side could be obtained. Other telegraphic developments had been retarded owing to the wars in Tripoli and Morocco.

The report was adopted without discussion.

The annual report of the Directors of Marconi's Wireless Telegraph Co. appears on page 388.

The Share Market

LONDON: *August 18th*, 1913.

The appearance of the Industrial Share market is more favourable than for some time past, the chief feature being the marked advance in prices in the shares of the various Marconi issues following the publication of the report.

A decided revival of public interest has taken place in the shares, the earnings now shown being in accordance with the highest anticipations.

The prices as we go to press are: Ordinary, 4¼; Preference, 3¾; Canadas, 14/-; Spanish, 13/-; American, 1 7/16.

Marconi's Wireless Telegraph
Co., Limited

REPORT OF THE DIRECTORS AND STATEMENT OF ACCOUNTS
For the year ending December 31st, 1912

Presented at the Annual Ordinary General Meeting of the Company, held at the Whitehall Rooms, Hotel Metropole, Whitehall Place, London, S.W., on Friday, August 22nd, 1913

CAPITAL - - - - - - £1,000,000

Divided into 250,000 Seven per Cent. Cumulative Participating Preference Shares of £1 each and 750,000 Ordinary Shares of £1 each

DIRECTORS.

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

AUDITORS.
COOPER BROTHERS AND COMPANY.

SOLICITORS.
COWARD AND HAWKSLEY, SONS AND CHANCE.

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

Report of Directors.

The Directors herewith submit the Balance Sheet together with Profit and Loss Account for the year ending December 31st, 1912.

As it was not found possible to complete the audit until comparatively recently, your Directors thought it desirable and felt warranted in deferring a little the submission of their report, they having entered into a new contract with His Majesty's Postmaster-General and considered it desirable to await its ratification by Parliament.

In the report for the year 1911 it was stated that the Share Premium Account would be increased in the next Balance Sheet to the sum of £256,630 5s. 2d. It will be observed from the Balance Sheet now presented that this figure stands at £255,707 3s. 1d. The difference is accounted for by the expenses in connection with the issue, amounting to £923 2s. 1d., having been debited to this account.

During the year 1912 the business of the Company continued to make satisfactory progress, the gross profit having amounted to £537,243 4s. 11d., as compared with a sum of £214,407 1s. 4d. for the preceding year, and a net profit is carried to the Balance Sheet of £413,294 11s., as compared with £141,717 7s. 1d. for the year 1911. A part of the above profit having been derived from the realisation of shares, your Directors deem it prudent to take this opportunity of creating a reserve account, and have appropriated £100,000 for this purpose.

The Directors recommend the payment of a final dividend for the year 1912 of 10 per cent. on both classes of shares.

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

Preference Shares: Dividend of 17 per cent. for year ended December 31st, 1912, of which 7 per cent. was paid on August 1st, 1912	£42,500	0	0
Ordinary Shares: Dividend of 20 per cent. for year ended December 31st, 1912, of which 10 per cent. was paid on August 1st, 1912, on the amounts paid up on July 8th, 1912	149,920	17	9
General Reserve Account	100,000	0	0
Balance carried forward to next account...	146,726	5	11
	£439,147	3	8

Your Directors propose to declare at the General Meeting a dividend at the rate of 7 per cent. for the year 1913 on the Preference Shares.

In the Balance Sheet, Patents and Shares in Associated Companies are again taken into account at their cost price, with the exception of the Spanish Shares and a portion of the American Shares, which figure at their par value. The Directors desire to draw the attention of shareholders to these words, for, notwithstanding that the same statement was made in the Directors' Report for the year 1911, misunderstanding arose in the minds of some, in consequence of its having been stated by some that the profits appearing in the Balance Sheet had been arrived at by means of writing up the shares held in Associated Companies. In order that there shall not be any misunderstanding of this nature in the future your Directors desire to make it clear that, whenever shares are acquired by the Company they figure in the margin of the Balance Sheet at their par value, and, no matter what that total may represent, they are taken into account in the Balance Sheet only at their actual cost price to the Company. To this figure is added the cost of patent renewals, patent applications, and any sum which may be paid in acquiring or protecting patents. Thus, in the Balance Sheet now submitted the £856,119 8s. 4d. represents the cost to the Company of the whole of its Patents and Shares in Associated Companies, the latter being represented in the margin at their par value of a total of £1,594,583 12s. 3d. Whenever the Company sells any portion of its share holding the Share and Patent Account is credited with the average or actual cost price of the shares, including a proportion of the cost of patents as stated above.

The total cost of shares and patents shows an increase over the figures of the preceding year of £347,596 0s. 4d. This is accounted for largely by the addition of shares in the American Company, which were acquired at par.

The total par value of shares shows a decrease as compared with the preceding year of £480,139 19s. 6d. This arises principally in consequence of the readjustment of the capital of the Argentine Company. The Argentine Directors considered that the capital of the Company, which was formed in the year 1906, with a capital of $6,750,000, of which $6,000,000 was in "A" Shares of $5 each and $750,000 in "B" Shares of $5 each, was excessive, and this Company has consented to the cancellation of 200,000 "A" Shares, of which our proportion was 155,898, and that one new "AA" Share should be exchanged for four shares of the original capital. It has also been agreed that the "B" Shares, of which this Company holds 78,250 of a total of 150,000, and which rank preferentially as regards capital, shall receive a preferential dividend of 5 per cent. and an increased proportion of any remaining profits.

By these arrangements this Company's holding in the Argentine Company shows a nominal decrease in the par value of its "AA" Shares of £676,780 15s. and an increase in the value of its "BB" Shares of £5,325, paid in respect of calls on these shares. This Company's interest in the Argentine Company is, therefore, practically unchanged; the alteration affects the number of shares and their nominal value only.

With the development of the wireless industry throughout the world the business of the Associated Companies in which this Company is interested is extending considerably.

BELGIAN COMPANY (Compagnie de Télégraphie sans Fil).—The business of this Company has continued to increase and show very satisfactory profits. It has recently been reorganised and its capital increased to £90,000, of which this Company holds one-third.

FRENCH COMPANY (Compagnie Française Maritime et Coloniale de Télégraphie sans Fil).—This Company has declared a dividend for the year 1912 of 10 per cent. on the Ordinary Shares and 31·25 francs per share on the Founders' Shares.

THE MARCONI INTERNATIONAL MARINE COMMUNICATION COMPANY, LIMITED.—The business of this Company during the year 1912 showed an increase of over 60 per cent. in its receipts, and a dividend of 10 per cent. was declared, an increase of 3 per cent. over that of the preceding year. This Company's business continues to develop in a very satisfactory manner.

GERMAN COMPANY (Deutsche Betriebsgesellschaft für Drahtlose Telegraphie m.b.H.) (Debeg).—This Company has paid a dividend of 8 per cent. for the year ending September 30th, 1912.

RUSSIAN COMPANY (Société Russe de Télégraphes et Téléphones sans Fil).—This Company has declared a dividend for the past year at the rate of 6 per cent. Its business continues to show very satisfactory development, and the business in hand this year represents a very substantial increase over that of the preceding year.

THE MARCONI WIRELESS TELEGRAPH COMPANY OF CANADA, LIMITED.—Under their contract with the Canadian Government for the operation of wireless telegraph stations on the Great Lakes, four stations have been established and placed in operation during the past year. One station is at present being enlarged and three other stations are to be built during the current year.

The negotiations with the Newfoundland Government were brought to a satisfactory termination in December by the completion of a contract which will continue the Company's exclusive rights in Newfoundland until the year 1926.

Under agreements with the Canadian and Newfoundland Governments the Company operates 32 stations in Eastern Canada and Newfoundland and five stations on the Great Lakes.

The Company also carries on a public telegraph service on forty-four steamers.

The Canadian Government has passed a law making wireless equipment of passenger vessels compulsory, which will necessarily result in further business for the Company.

The Company has now in hand for the Department of Railways the construction of two high-power stations at Hudson Bay and Le Pas, Manitoba, in connection with the construction of the new Hudson Bay Railroad by the Canadian Government.

Under their agreements with the Canadian and Newfoundland Governments the Canadian Company's subsidies from these Governments now exceed $100,000 per annum.

SPANISH COMPANY (Compañia Nacional de Telegrafia sin Hilos).—Seven of the first group of stations in Spain and the Canary Islands are in operation. The construction of the stations of the second group has been commenced, the first of which has been completed and opened to service.

During the breakdown of the cable between the Canary Islands and Spain the telegraph service was satisfactorily conducted by the Marconi stations. Arrangements are being made for this service to be opened permanently in the course of the next few weeks. Negotiations are pending for wireless telegraph services to be opened with this country and with Italy. The Company has obtained orders from the Spanish Government for military stations, and also secured the whole of the orders placed by the Minister of Marine during the last year for the equipment of ships of the Spanish Navy.

ARGENTINE COMPANY (Cia Marconi de Telegrafia sin Hilos del Rio de la Plata).—Besides the change in the capital of the Company, to which reference has already been made, there has been an alteration in the Directorate and Management. Upon the occasion of the visit of the Company's Representative to Buenos Ayres last year it was found that the Government Concession for the erection of a high-power station for external telegraph service was not in a satisfactory form. Subsequent negotiations, however, resulted in a new arrangement being entered into with the Government and the construction of a high-power station has now been commenced. A similar station will be erected in this country, and when completed a direct wireless telegraph service between the Argentine and Europe will be opened.

MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA.—This Company has declared a dividend of 2 per cent. for the year ending January 31st, 1913, a satisfactory result, having regard to the fact that the contract with the United Wireless Telegraph Company did not come into force until the month of July of last year, and called for considerable negotiation with shipowners and others to bring about more satisfactory terms upon which the work was in future to be conducted. The full benefit of these improved working conditions was therefore only enjoyed for a comparatively short period of the year. It will also be borne in mind that the increase of capital to the extent of £1,400,000 was for the purpose of providing a network of long-distance telegraph stations and the creation of telegraph services. Time is necessarily required to construct these stations, but this work has proceeded with all possible expedition. It is contemplated that before the end of this year a rapid and reliable telegraph service will be opened between this country and New York. Arrangements will be made to open collecting stations in the City of London and in each of the principal towns in England and Scotland. Similar arrangements have been made in the United States. It is expected that a substantial revenue will accrue from this source.

Stations are in course of construction at San Francisco and the Hawaiian Islands, which are approaching completion. It is hoped that before the end of the year we shall see a wireless telegraph service in operation between the United States and Japan, which will then be extended to the Philippine Islands and China.

The contract with the Norwegian Government having been ratified by the Norwegian Storthing, a further Transatlantic Station will be erected immediately to conduct a telegraph service direct with the North of Europe. Under the terms of the agreement the Norwegian Government will send all telegrams handed in at the telegraph offices for the United States by wireless unless specially routed otherwise by the sender. The Company and the Norwegian Government will pool the receipts of their respective stations, which should add a substantial source of revenue to the American Company.

Important negotiations are in progress with South American States, which should result in the construction of additional stations in the United States in the early future, and open up direct wireless telegraph service between North and South America.

At all of the stations under construction the new duplex system is being installed, which will provide for a service to be conducted in both directions at the same time. Automatic sending and receiving apparatus is also being supplied, which will enable messages to be transmitted at a speed up to about 100 words per minute in each direction, and this rate of working is likely to be exceeded.

FIELD STATION DEPARTMENT.—During the past year very considerable progress has been made both in the design and sale of portable wireless telegraph stations for military purposes.

Important improvements have been made in the Company's apparatus, and to meet the demands of the armies of the world the Company has added the following to its standard types of stations:

1. A 3-kilowatt station for transport by cart or motor-car.
2. A 1½-kilowatt station for transport by horses or camels.
3. A ½-kilowatt cabinet station for use as a permanent station where space is limited.

Highly satisfactory demonstrations of our field stations were carried out during the past year in several countries, from which a large business is expected to result.

Important orders have been received for field station apparatus from the British War Office and the Italian, Turkish, Roumanian, Greek and Servian Governments, and the total sales of this class of apparatus have nearly quadrupled in the past year, and continue to show substantial increase. The Company have made such arrangements as will enable it to give immediate deliveries of all classes of field stations, for which a big demand arises unexpectedly, and prompt deliveries are of all importance.

GENERAL BUSINESS.—During the past year this Company and its subsidiaries have received contracts and executed work for the Governments of the following countries: Great Britain, Canada, Newfoundland, India, South Africa, Ceylon, Falkland Islands, Trinidad, Italy, Russia, Turkey, Spain, Portugal, Norway, Roumania, Servia, Greece, Montenegro, United States of America, Brazil, Chile, Bolivia, Colombia, Japan and China.

Shareholders have been advised that, owing to the delay in submitting to Parliament for ratification the contract entered into with His Majesty's Postmaster-General for the construction of the Imperial Stations, and the substantial rise in the cost of materials, your Directors gave notice that they no longer considered that contract binding upon them. A new contract has been entered into in which provision is made for any extra cost which may be incurred by reason of the delay in the construction of the stations, and certain alterations and additions have been agreed to. Your Directors do not believe that the altered conditions will prove of any disadvantage to the Company, and, having regard to the position which the Company holds in the wireless industry, and which position your Directors are confident the Company will continue to hold, they contemplate that they will construct all the stations required for the Imperial Chain.

For a long-distance wireless telegraph service a number of the Company's recent patents play an essential part, and during the last twelve months your Scientific Adviser, Mr. Guglielmo Marconi, has applied for patents for a number of important inventions and improvements for apparatus used in both transmitting and receiving stations.

Notwithstanding all that has been stated and published in recent times respecting the continuous wave system of wireless telegraphy, experience has not yet proved that that system will be capable of conducting a long-distance wireless telegraph service as efficiently as the slightly damped spark system at present in use. Mr. Marconi has invented what your Directors believe to be the simplest and most economical method of generating, transmitting, and receiving continuous waves, and he alone has been able to transmit messages across the Atlantic by a continuous wave system, of which a satisfactory demonstration, and the only one, was given to the Advisory Committee appointed by the Government. Further tests are being conducted, but considerable work and time are required before it will be possible to say with any degree of assurance that any advantage in practical working is to be obtained, either by the continuous wave system alone, or used in conjunction with the spark system.

With the ability of the large staff of engineers employed by this Company, together with their valuable experience, directed and assisted by Mr. Marconi, your Directors are confident that the development of the wireless industry will continue to be pioneered by this Company.

The high-power station which is being constructed in Carnarvon, and which will be worked by the Company to conduct a direct service with New York, it is anticipated, will be completed and opened for service during the present year. It is being supplied with both the spark and continuous wave systems, which alone will prove from actual experience the comparative merits of the slightly damped wave and the continuous wave in all weathers, under all conditions, every day, week, and month of the year.

Important negotiations are being conducted with several foreign Governments for the erection of long-distance stations, which it is hoped will be brought to a successful issue at an early date.

The successful arrangements made in April, 1912, for placing share capital of the American Company have recently been made the subject of legal proceedings by Mr. O. Locker-Lampson, M.P., and Mr. P. E. Wright against the Company, your Directors and other persons. Within the last few months and shortly before the issue of the Writ these gentlemen acquired two and one shares respectively of this Company. Mr. Locker-Lampson has since increased his holding by 20 shares. No relief is claimed against the Company, which is merely joined as a nominal defendant. The apparent object of the proceedings is to impeach the action of the Directors and other persons in connection with the above arrangements.

The Writ was issued so long ago as May 23rd last, but at present Mr. Locker-Lampson and Mr. Wright have not delivered their claim.

Beyond this passing reference your Directors are advised that it would not be proper for them at this stage to make further comment or explanation.

The action for the infringement of patents against the National Electric Signalling Company was heard in New York during the month of June last, in connection with which Mr. Guglielmo Marconi gave lengthy evidence. The Court has not yet delivered its judgment.

The Directors retiring by rotation are Commendatore G. Marconi, LL.D., D.Sc., Mr. Alfonso Marconi, and Capt. H. Riall Sankey, who, being eligible, offer themselves for re-election.

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

By Order of the Board,

HENRY W. ALLEN, *Secretary.*

Marconi House, Strand, London, W.C.
August 11*th*, 1913.

Dr. BALANCE SHEET,

		£	s.	d.	£	s. d
To Capital—						
Authorised—Issued and fully paid.						
750,000 Ordinary Shares of £1 each...		750,000	0	0		
250,000 7 per Cent. Cumulative Participating Preference Shares of £1 each		250,000	0	0		
					1,000,000	0 0
,, Share Premium Account					255,707	3 1
,, Bills Payable					15,286	3 3
,, Sundry Creditors					236,843	13 3
,, Reserve for Expenses Unpaid and Payments in Advance					19,572	14 5
,, Profit and Loss Account—						
Balance as per last account, December 31st, 1911		160,756	6	3		
Deduct Preference Dividends and Ordinary Dividends for 1911 ...		134,903	13	7		
		25,852	12	8		
Profit for the year as per Account		413,294	11	0		
		439,147	3	8		
Deduct—						
7 per cent. Dividend on Preference Shares paid August 1st, 1912 ... ... £17,500 0 0						
10 per cent. Interim Dividend on Ordinary Shares paid August 1st, 1912 ... ... 74,920 17 9						
		92,420	17	9		
					346,726	5 11
To Contingent Liability on Shares in Associated Companies £51,062 10 0						
					£1,874,135	19 11

Dr. PROFIT AND LOSS ACCOUNT for

	£	s.	d.
To Rents, Rates, Taxes, Travelling and General Expenses and Income Tax	24,944	4	11
,, Salaries and Directors' Remuneration	58,603	10	6
,, Law Charges and Patent Expenses	5,588	8	3
,, Depreciation of Plant, Machinery, Buildings and Furniture	14,697	11	3
,, Foreign Agencies Expenses	3,268	7	11
,, Station Expenses and Experimental Work	19,621	14	1
,, Balance being Profit for the year carried to Balance Sheet	413,294	11	0
	£540,018	7	11

Report of the Auditors

We have audited the above Balance Sheet. The item, Patents and Shares in Associated Companies, in Montreal, New York, Buenos Ayres, Madrid and St. Petersburg, and shares for which certificates have Company. We have obtained all the information and explanations we have required. In our opinion affairs according to the best of our information and the explanations given to us, and as shown by the

LONDON, *August 11th*, 1913.

December 31st, 1912. Cr.

	£ s. d.	£ s. d.
By Cash at Bankers, in Hand and on Loan at Short Notice		278,320 19 7
„ Sundry Debtors and Debit Balances		381,418 18 10
„ Stock at Cost or Under as certified by Officers of the Company ...		81,206 14 8
„ Freehold Works at Dalston	39,160 15 4	
Deduct Mortgage	15,611 12 4	
		23,549 3 0
„ Freehold Property at Chelmsford and Plant, Machinery and Buildings at Chelmsford and Genoa Works		95,354 16 7
„ Long Distance Freehold Stations at Clifden, Ireland, Poldhu, Cornwall, and Carnarvon, Wales, and Movable Plant at other places ...		143,504 5 10
„ Office Furniture and Fittings at Head Office, Chelmsford, and Foreign Agencies		14,661 13 1
„ Patents and Shares in Associated Companies—		
198,790 fully-paid shares of £1 each of the Marconi International Marine Communication Co., Ltd.	198,790 0 0	
157,740 fully-paid shares of $5 each Series "AA" of Compañia Marconi de Telegrafia sin hilos del Rio de la Plata (Argentine Company)	157,740 5 0	
78,250 shares of $5 each (35 per cent. paid) Series "BB" of Compañia Marconi de Telegrafia sin hilos del Rio de la Plata (Argentine Company)	27,387 10 0	
566,826 fully-paid shares of $5 each of the Marconi Wireless Telegraph Company of America	566,826 0 0	
414,855 fully-paid shares of $5 each of the Marconi Wireless Telegraph Company of Canada, Ltd.	414,855 0 0	
250 shares of £1 each (20 per cent. paid) of the Marconi Press Agency, Ltd.	50 0 0	
240 fully-paid Preference Shares of Pesetas 500 each of Compañia Nacional de Telegrafia sin hilos (Spanish Company)	4,444 8 10	856,119 8 4
100,750 fully-paid shares of £1 each of the Spanish and General Wireless Trust, Ltd.	100,750 0 0	
11,500 fully-paid shares of Roubles 100 each of Société Russe de Télégraphes et Téléphones sans Fil	122,340 8 5	
175 fully-paid Ordinary Shares of Francs 100 each of Compagnie Française Maritime et Coloniale de Telegraphie sans Fil	700 0 0	
90 Parts Bénéficiaires (Shares) of no capital denomination of Compagnie Française Maritime et Coloniale de Télégraphie sans Fil	700 0 0	
100 Founders' Shares of no capital denomination of Compagnie de Télégraphie sans Fil (Belgian Company) ...	700 0 0	
Sundry shares	700 0 0	
Total Par Value	...£1,594,583 12 3	
		£1,874,135 19 11

the Year ending December 31st, 1912. Cr.

	£ s. d.
By Balance of Contracts, Sales and Trading Account	537,243 4 11
„ Transfer and Share Warrant Fees	2,775 3 0
	£540,018 7 11

to the Shareholders.

G. MARCONI, *Director.*
H. RIALL SANKEY, *Director.*

as to which see Directors' Report, includes shares of the par value of £951,699 5s. 11d., which are deposited not been issued. We have seen letters stating that the shares deposited abroad are held on behalf of this such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Company's books of the Company.

COOPER BROTHERS & Co. *Auditors.*
Chartered Accountants.

E

INSTRUCTION IN WIRELESS TELEGRAPHY

The Wireless Transmitter

(Fifth 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 appeared in the August number, page 337.]

ERRATA.—*Before proceeding further, we have to refer to some errors in the reference letters and numbers relating to the diagrams in our July and August articles, due to the fact that two sets of diagrams had been prepared. We specify the various errata below.*

July number.—*Fig.* 5, *referred to in the second column of p.* 262, *does not appear at all, its place being taken by Fig.* 7, *which shows the aerial connected directly to earth, the spark-gap mentioned in the text being omitted. In the first column of p.* 263 *the words "such as those shown in Figs.* 6 *and* 7 *" should read "such as those shown in Figs.* 5 *and* 6."

August number.—*In the description of Fig.* 9, *top of second column, p.* 336, *for A write J, for B write C, for C write D, for D write S.*

In the description of Fig. 10, *middle of same column, for A write J, for B write A, for C write E, for D write S.*

In the description of Fig. 11, *page* 337, *for B write E, for C write S, for D write J, for E write P, for H write B.*

In the heading of paragraph 32, *page* 335, *write "circuit" for "current." The heading will then read: Application of a High Voltage to an Oscillating Circuit.*

33. WE saw in our August article how a closed circuit could be set oscillating, by charging up a condenser to a high voltage by means of an induction coil and allowing it to discharge through an air-gap. Referring to Fig. 9 of that article, we see that the right-hand part of the diagram is drawn in thick lines. This is a convenient way of denoting the *oscillating* portion of the circuit, and as—especially in complicated diagrams—it is of great importance to distinguish between the oscillating circuits and the "low-frequency" circuits such as the induction-coil windings and leads, the reader is advised to follow this plan throughout. Looking at this Fig. 9, it may be asked, how can the thick lines be said to form a "circuit" at all since there is a distinct gap—S? A little thought will shows us that the gap is only a break in the circuit while the condenser is being charged up by the coil, during which time there are no oscillations and the circuit is not oscillatory; but when the voltage of the condenser has reached the value necessary to break down the insulation of the air between the spark-balls a spark takes place, and, as we said on p. 336, the gap then becomes a conductor, and the circuit is truly a closed one; it is during this time that the oscillations take place, so that the circuit is completed and forms a "closed oscillatory circuit." Similarly, in the next diagram, Fig. 10, when the spark takes place the circuit is completed and forms an "open oscillatory circuit."

34. **Factors limiting the power of Oscillating Circuits.**—We have also seen that the power which can be stored up in such a circuit depends on the capacity of the condenser, on the voltage to which this is charged, and on the number of times per second that it is charged and discharged. The last of these factors is limited by the following considerations. The note produced in the telephones of the receiving station has the same frequency as the frequency of the spark at the transmitting station, and the human ear cannot hear a note whose frequency exceeds a certain value, between 10,000 and 20,000

per second. Before this limit is reached, however, another practical difficulty arises, when the spark is produced by an induction coil, inasmuch as the construction and adjustment of a contact breaker to work at even a tenth of such a frequency becomes practically impossible.

If, therefore, we have an unlimited supply of power at our disposal, the only way in which we can use it is by increasing either the capacity or the voltage, or both. Now when, as on page 332, we substitute for our closed oscillatory circuit the open oscillatory circuit represented by the aerial of Figs. 1 and 5, we meet with the difficulty that unless we make this aerial very unwieldy and costly we can only give it a very small capacity; so that in order to store up in it the power that we require, our only resource is to charge that capacity up to a very high voltage. That means that the air-gap must be so long that it will only break down at a very high voltage; so that to use much power we must have a very long spark-gap between aerial and earth. Although as we have said that the air, when a spark is passing, becomes momentarily a conductor, yet like all conductors it has a certain resistance, and, as a matter of fact, this resistance is a good deal higher than that of the rest of the circuit; moreover, this resistance increases with the length of the gap. But we have seen on p. 262 that in an oscillatory circuit the introduction of resistance is a bad thing, causing a waste of energy, and a rapid dying-away of the oscillations; so that the introduction of a spark-gap between aerial and earth cannot be considered a good thing unless the gap be very small. Thus if, in order to utilise the power we require, we have to make this spark-gap of a considerable length, then the arrangement becomes much less efficient. This is not the only argument against the use of "plain aerial" with long spark-gaps; the mere fact that we have to charge our aerial to a very high potential is in itself bad, for at a certain voltage the wires begin to "brush" and discharge their electricity to the surrounding air, causing a considerable loss of energy; further, the difficulty of maintaining a sufficiently good insulation of the aerial to withstand such a high voltage becomes very serious in wet weather.

It is clear, therefore, that with a given aerial we cannot successfully increase the power we can put into it beyond a certain limit if we adhere to the "plain aerial" or "direct excitation" method.

35. **Indirect Excitation of the Aerial.**—Returning to the other kind of oscillatory circuit, the "closed" circuit, shown in Fig. 9, p. 336, we see that we can increase its capacity far more easily than we can increase the capacity of the aerial, so it is easy to make such a circuit capable of utilising a large amount of energy without using a long spark-gap. It is true that the size of this capacity is limited by the length of the wave we wish to send out, for, as we

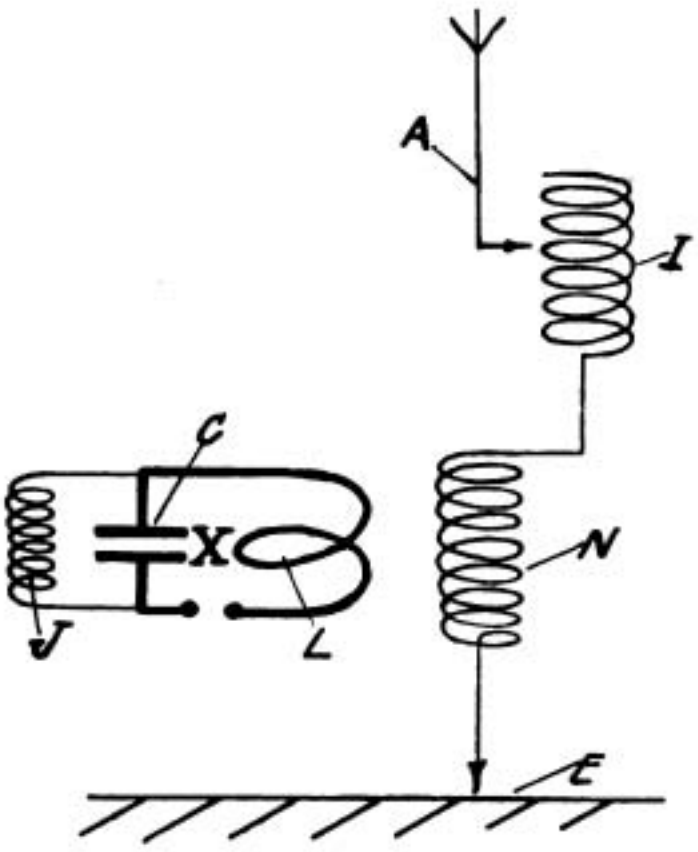


Fig. 1.

know, the wave-length depends on the product of the capacity and inductance, and however short we may make the leads from the condenser to the spark-gap, we cannot reduce their inductance below a certain amount. But this inductance can naturally be made far smaller than the inductance of the long aerial-wires, and therefore the capacity of the closed circuit can be made many times larger than that of the aerial, and the circuit will still give the same wave-length as the aerial. Such a closed circuit—as we saw on p. 263—is, however, not a good "radiator"; that is to say, it does not readily send out waves into the

æther, and is therefore not a good substitute for the open circuit provided by the aerial, which is an excellent radiator. If, however, we combine the good energy-storing property of the closed circuit with the good energy-radiating property of the aerial, we shall satisfy all requirements.

This is the plan on which is based the "coupled-circuit" transmitter now in general use, a diagram of which is shown in Fig. 1.

The closed oscillatory circuit, X, is set oscillating by charging up the condenser, C, until a voltage is reached at which the spark-gap breaks down. The oscillating currents thus set up pass to and fro round the circuit, which includes, besides the usual leads from the condenser to the spark-gap, a coil, L, consisting of one or more turns of

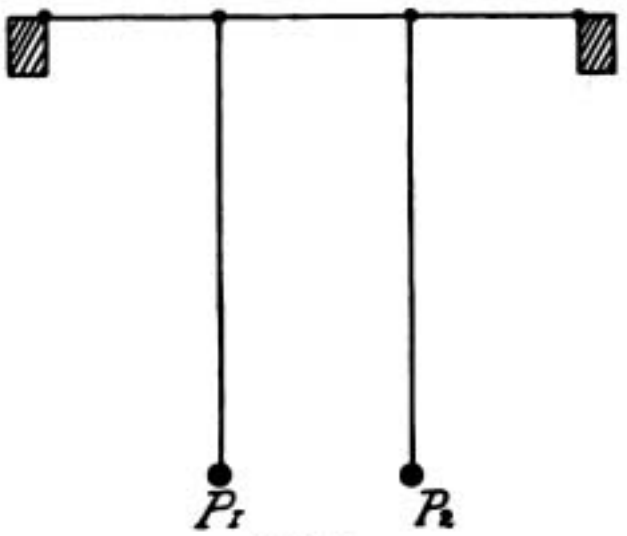


Fig. 2.

wire. This coil is so placed with respect to another coil, N (usually of six or more turns), that the two coils exercise magnetic induction (see p. 114) on each other. One end of this second coil is connected through a variable inductance, I, to the aerial, A, and the other end to earth, E. The oscillating currents flowing through L create, through the mutual inductance of the two coils, oscillating currents in the aerial, thus setting the latter oscillating. If, however, the values of capacity and inductance of the aerial circuit are arranged so that the aerial has a frequency different to that of the closed circuit, the aerial will try to oscillate at its own frequency in opposition to the oscillations put into it by the closed circuit, with the result that one set of oscillations will interfere with the other, and very little energy will be transferred from the closed to the open circuit. Under these conditions the two circuits are said to be **"out of tune,"** and we may take it that the first oscillation in the closed circuit induces a wave in the aerial coil; this wave travels up the aerial, reaches the free, insulated end, turns back and tries to return to earth; but on its way there it meets another wave coming up the aerial, induced by the second oscillation in the closed circuit which is not "keeping time" properly with the aerial, and these two waves partly destroy one another.

But if the aerial circuit is so arranged as to have the same frequency as the closed circuit, the first wave, instead of meeting a contrary wave, will travel down to earth unhindered, and as it swings back again it will find the second wave, induced from the closed circuit, ready to join it in its progress up the aerial and down again to earth; and this will go on, one wave adding on to the others already in the aerial, until the condenser, C, is discharged; that is to say, until the energy originally stored up in the closed oscillating circuit is transferred to the aerial. Under these conditions the two circuits are said to be **"in tune."**

36. A simple experiment can be made with pendulums, which illustrates this point.

A piece of string is stretched between two fixed points, Fig. 2, and two pendulums, P_1 and P_2, are hung from it a short distance apart. Now if these pendulums have the same time of swing, and therefore the same frequency, they may be said to be **in tune,** and it will be found that if P_1 (which may be taken to represent the closed oscillatory circuit) be started swinging, it will, owing to its being coupled to P_2 by the string A, gradually start a similar swing in P_2.

The swing in P_2 will get greater and greater until the energy that was originally put into P_1 is transferred to P_2, and P_1 will have come to rest.

If, however, P_2 be made shorter or longer than P_1, so as to have a different frequency, the two pendulums may be said to be **out of tune,** and it will be found that, although a certain amount of swing will be induced in P_2, the two pendulums will interfere with one another, and *both* will come to rest after erratically jerking about.

Clearly, therefore, it is most important that the two circuits shall be "tuned" to

the same wave-length ; and, if this is done, the aerial is kept supplied by the closed oscillatory circuit with energy to radiate.

Since the capacity of the condenser, C, is many times that of the aerial, it can be made to store a large amount of energy even though the voltage is kept comparatively small ; so that instead of having a long spark-gap introducing a good deal of wasteful resistance in the aerial circuit, we can have quite a short one, with a small resistance, in the closed circuit, and none at all in the aerial circuit.

This closed circuit is spoken of as the **"primary" circuit;** the two coils, L and N, form together an **"oscillation transformer"** or **"jigger,"** the coil L being the **"jigger primary,"** and the coil N the **"jigger secondary."** The variable inductance, I, which is, of course, used to alter the wave-length of the aerial circuit so as to agree with that of the primary, is called the **"aerial-tuning inductance."**

In order to be able to adjust the primary circuit to the exact wave-length required, some part of its inductance is generally made variable. Sometimes this is done by making the coil of several turns, one, two, or more of which may be included in the circuit for tuning purposes.

37. **The Auto-Jigger.** — In the above method of indirect excitation we had two entirely separate circuits, the primary circuit and the aerial circuit, connected by *no conductor*, but only by the mutual induction of jigger-primary and jigger-secondary ; and we saw that, provided each of these two circuits was tuned to the same wave-length, the arrangement offered us an excellent combination—a good storer of energy combined with a good radiator of energy.

There is another form of indirect excitation, using what is called an auto-jigger, which at one time was fairly extensively used, and is still popular among amateurs owing to its simplicity.

In this auto-jigger arrangement we still have the two circuits—the primary circuit with its condenser and jigger-primary, and the aerial circuit with its aerial, its tuning inductance, its jigger-secondary and its earth, and these must be tuned to the same wave-length just as in the case of the ordinary jigger (though this fact is often neglected by amateurs) ; but in the case of the auto-jigger the primary circuit is in actual metallic connection with the aerial circuit ; in fact, the jigger-primary is formed of a certain number of turns of the jigger-secondary itself.

Thus in Fig. 4, which illustrates the auto-jigger, the aerial circuit consists of the aerial, A, the aerial tuning inductance, B, the jigger-secondary, CD, and the earth connection, E ; while the primary circuit consists of the condenser, F, the spark-gap, G, and the jigger-primary, D, which is merely a certain number of turns of the jigger-secondary, CD.

With such an arrangement we have the same advantage as with the ordinary jigger—namely, a good storer of energy (the

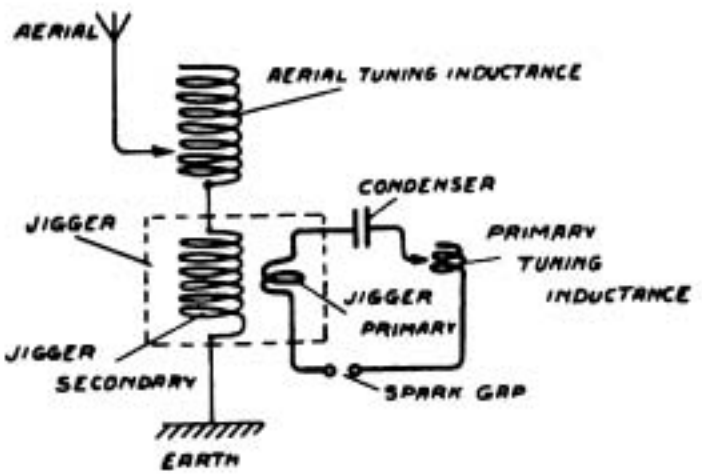


Fig. 3.

closed oscillatory circuit containing the large condenser, F) transferring its energy, through the action of the coil, D, to the good radiator (the open oscillatory circuit, ABCDE).

The auto-jigger, however, has certain disadvantages, which we shall see presently.

38. **Reaction of Secondary on Primary.**— The behaviour of a coupled--circuit transmitter, whether an ordinary jigger or an auto-jigger, is less simple than would appear at first sight.

It might seem natural to suppose that since the primary circuit has the same wave-length as the secondary or aerial circuit, it would simply transfer its energy (put into it by the induction-coil) to the aerial in the form of oscillations of the same frequency ; and that the aerial would radiate out this energy in the form of æther waves of the length corresponding to that frequency.

But we must remember that just as the

currents flowing to and fro in the jigger-primary induce currents in the otherwise passive secondary, so do the currents (thus made to flow in the secondary) act on the primary and induce currents in it; so that when the primary circuit has given up its energy to the secondary, the latter starts giving back some of its energy to the primary, which returns it to the secondary, and so on. This goes on till so much energy has been removed from the circuits—by losses in resistance and by radiation from the aerial—that the current in the primary has no longer power to cross the spark-gap, when the process stops until it is started again by the induction coil charging up the condenser once more.

39. This will be more easily understood by referring again to the pendulum experiment described in par. 36 (p. 397). In this paragraph we only followed the action of the

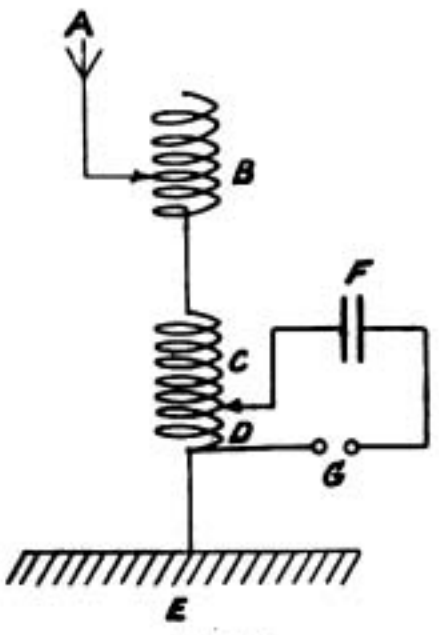


Fig. 4.

pendulums up to the moment when the driving pendulum, P, had transferred its energy to P_2, but, if we watch their action still further, we see that P_2 now becomes the driving pendulum, and its energy will gradually be transferred back to P_1, and this transfer of energy goes on backwards and forwards until so much energy has been lost in friction in the air and string that both pendulums come to rest.

Now this rather complicated give-and-take process has a peculiar effect on the wave set up in the aerial.

The result of coupling a closed oscillatory circuit to an open oscillatory circuit, each of which is tuned to the same wave length, is the production of two wave lengths, one longer and the other shorter than the wave length to which both circuits have been tuned. These two wave lengths are known as the **Resultant Wave Lengths.**

40. It is not an easy subject to understand, but it is a very important one, and our readers are recommended to take pains to understand it.

Resultant Wave Lengths of Coupled Circuits.—The jigger-primary has a certain amount of inductance (which has already been defined) due entirely to itself—its number of turns, its diameter, the spacing of its turns, etc.; this is called the **self-inductance of the primary**.

Similarly the jigger-secondary has a certain self-inductance, due to its number of turns, diameter, spacing of turns.

But besides these two self-inductances, which would remain unaltered if the primary were taken to the Equator, and the secondary kept at home, there is a third inductance which affects both primary and secondary, and which is due to the proximity of the one coil to the other. This is called the **mutual inductance;** thus the primary has, in addition to its self-inductance, the mutual inductance due to the effect of the secondary, and the secondary has, in addition to its self-inductance, the mutual inductance due to the presence of the primary. This mutual inductance depends on the position of the primary with regard to the secondary, on their distance apart, and on the number of turns acting on each other.

The mutual inductance of two such coils, though it is an abstract kind of thing which cannot be seen, is nevertheless a definite quantity, and is very important, as it is through the agency of the mutual inductance that the primary circuit is able to transfer its energy to the aerial circuit.

41. Let us suppose for the sake of simplicity that the self-inductance of the primary circuit is equal to that of the secondary circuit; we know that the wave-lengths of the two circuits are the same, but as a rule the inductance of the primary is much less than that of the secondary, so as to enable the primary condenser to be of much larger capacity than that of the aerial; there is no reason, however, why we should

not for the sake of argument make the two capacities equal, and therefore the two inductances also equal. Let each of these inductances be L, and let the mutual inductance between primary and secondary be M.

Now the give-and-take process which we described above has this result: it makes the mutual inductance M *add* itself to the self-inductance L at one moment, and then, a fraction of a second later, it makes M *subtract* itself from L. The result is that at the first moment each circuit behaves as if its total inductance were L+M, and at the next moment as if it were L—M. But these moments are so close together—separated only by such an infinitely small fraction of a second—that what happens is that the circuits appear to possess these two values of inductance *at the same time*; so that they behave as if, instead of each having an inductance, L, they each had two different inductances, L+M and L—M.

But if a circuit has two inductances and one fixed capacity, it is clear that it will give two wave-lengths; and, as a matter of fact, the result of the give-and-take action between primary and secondary is that the aerial sends out two waves, one longer and one shorter than the wave to which both the primary and aerial circuits were tuned.

It is clear that the production of these two waves is governed by the size of M compared with L; if we make M very small compared with L by increasing the distance between the primary and secondary of the jigger, L+M will only be very slightly larger than L—M, so that the two waves will be so nearly equal as to be indistinguishable.

So if we move the jigger-primary farther and farther away from the jigger-secondary, we can reduce M and make the two waves approach nearer and nearer to one another, till finally they merge into one wave length which will be of the same value as that of the circuits taken by themselves.

We assumed, for the sake of simplicity, at the beginning of paragraph 41, that the inductance of the primary was equal to that of the secondary. If, as is usual, these inductances are different, the same thing holds good, except that the simple formula of L+M and L—M becomes somewhat more complicated and elaborate.

AMATEUR NOTES.

A MEETING of the Liverpool and District Amateur Wireless Association was held recently, when it was announced that Professor E. W. Marchant, D.Sc., and Mr. L. S. Cohen, had consented to act as vice-presidents. The subject of "extreme" protection against lightning risks was again referred to, when it was suggested that a double pole two-way switch could be used for the purpose of earthing both aerial and also metal guy ropes, if thought necessary. On Saturday afternoon, August 9th, the Association paid a visit to the Formby Power Station of the Lancashire and Yorkshire Railway.

* * *

A meeting of the Birmingham Wireless Association was held recently at the club room. The chair was occupied by Mr. P. S. Beaufort, and a paper was read by the vice-president, Mr. W. F. B. Bartram, on "Atmospherics and Interferences in Radio-telegraphy." The paper was devoted chiefly to commercial stations. Mr. Bartram gave the connections of and described the Marconi multiple tuner. From this subject he went on to that of lightning, and some extremely interesting facts were forthcoming. A warning was given to all those who are in the habit of earthing their aerial to gas-brackets, and is one which cannot be too strongly emphasised. This was followed by a short and interesting description of one of the members' transmitting apparatus. This station is the work of Mr. H. Littley, and is situated in West Bromwich. The aerial is supported in three places by steel towers 78 ft., 65 ft., and doubling back underneath to 45 ft. It is composed of 26 wires 95 ft. long, making a total, with leads-in, of 2,700 ft. The aerial is in two parts, and can be used separately or together. The town supply of 230 volts D.C. is used, being generated into 110 volts A.C.; a 6 in. coil, with spark-gap of zinc electrodes ½ in. in diameter. The wave-length is about 300 metres, and Mr. Littley has been heard in London. Mr. Littley has promised another and fuller description of his station at a future meeting. The secretary is very anxious that those members—a great number—who have not yet filled in the particulars of their stations on the forms provided should do so at once.

Our Bookshelf

"WIRELESS TELEGRAPHY," by Professor C. L. Fortescue. (Camb. Univ. Press. 1s.)

Professor Fortescue sets out to help the reader who, "possessing a general scientific knowledge, is anxious to know something, not only of the accomplishments of wireless, but also of the means by which they are obtained." This he accomplishes admirably in a little book of some 140 pages, every one of which is eminently readable and instructive. The first four chapters, explaining the electrical phenomena which are involved in the processes of wireless, should—with the help of their mechanical analogies—give the reader a sound and clear basis on which to erect the facts which may be accumulated from the later chapters; and without such a basis—which we have found to be none too common—the amateur's notions on the subject of wireless are inclined to develop into a confused mass of uncorrelated facts which impede rather than assist progress.

The later chapters, which include references to the various "systems," are written from a thoroughly unprejudiced standpoint and, on the whole, give a very fair representation of the state of affairs at the present day. We think, however, that Professor Fortescue is inclined to optimism when he speaks of the continuous wave processes; he does not mention, for instance, the serious difficulty which is presented by the tendency of continuous-wave generators (such as the high-frequency alternator) to vary the length of the wave emitted, and thus to vitiate all their advantages of sharp tuning; and he pays particular attention to the assertion that a much smaller aerial can be employed with continuous waves than with non-continuous waves. This is certainly a point which remains to be proved by practical experience; and when we read of the "antenna of enormous spread" used at the Goldschmidt station at Slough, and see the great tower which it has been thought necessary to erect at the Goldschmidt Hanover station, we cannot feel that the assertion is sufficiently well founded to deserve an unquestioned place in Professor Fortescue's book.

We also notice that on p. 64 the waves sent out by the Poulsen generator are described as "absolutely undamped," and productive of the "maximum of selectivity." That we are not inclined to agree with this statement can be seen by reference to the article on the Poulsen System which appeared in the July number of THE WIRELESS WORLD.

Professor Fortescue distinctly over-estimates the power which it is proposed to use at the great stations of the "Imperial Scheme," when he states (on p. 114) that in a three-way station, when transmission is taking place simultaneously in all three directions, three sets, each of 2,500 horse-power, will be in use at the same time, thus making a total of 7,500 horse-power. He has evidently misread the draft specification, which shows that the "total power" at certain of these stations will be 2,500 horse-power. We like Professor Fortescue's irony on the subject of the wireless telephone, which will be appreciated by readers of popular journals. After describing some of the successful results in telephony, he goes on: "Latterly it appears that rather less interest has been taken in the problem; at any rate, fewer 'Inventors of the Wireless Telephone' have appeared."

No reader of THE WIRELESS WORLD should fail to get this excellent little book.

* * *

We have just received the illustrated report of the International Congress of Practical Telegraphy, which was held in Turin in 1911. This Congress, it will be remembered, was arranged to celebrate the jubilee of the formation of modern Italy. This official report of the events which took place is worthy of the occasion which it commemorates. It is handsomely produced, is full of most interesting matter, and is beautifully illustrated; more especially are we struck with the excellence of the designs which ornament its pages. It is also interesting to note that the work of Mr. Marconi receives due acknowledgment, and, further, that a Marconi wireless station has been used in the decorative scheme for one of the clever certificates presented with the prize by the Minister of Posts and Telegraphs for a national competition in telegraphic efficiency.

HINTS FOR AMATEURS

Some Experiments with Aerials for "Receiving"

By W. HARRIS SHADDICK

WIRELESS experimenters are constantly erecting quite efficient aerials, yet, much to their disappointment, they frequently "receive" nothing. Shall we take an example? An intelligent enthusiast recently fitted up his aerial according to up-to-date principles. This aerial was some 200 feet long, and over 50 feet from the ground. The situation was quite suitable, and the "earth" was excellent. He had spent freely on his instruments, and had in this case obtained proper workmanship for his money.

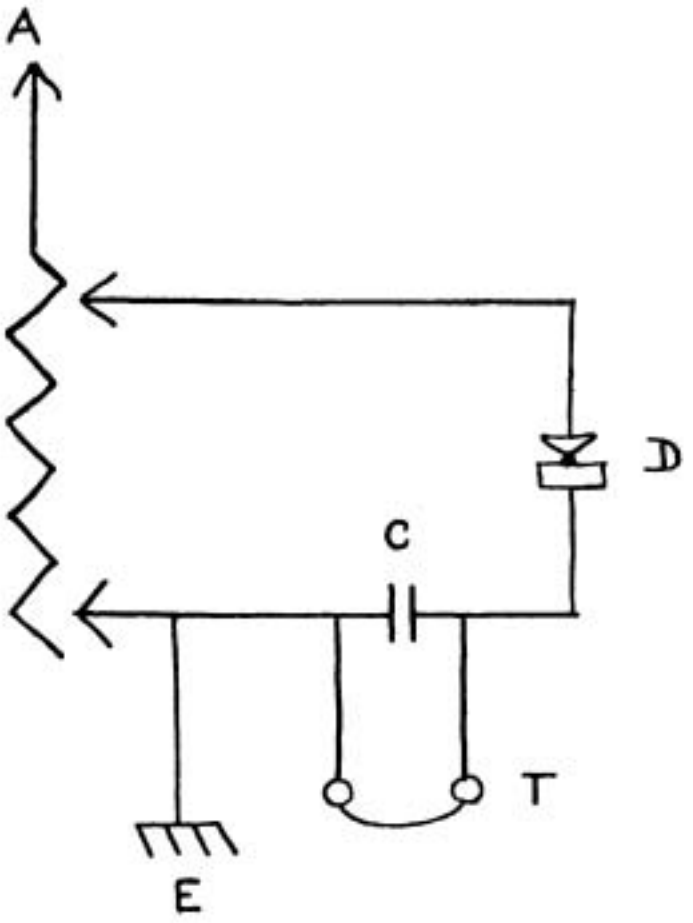


Fig. 1.

His inductance was 10 inches long and 6 inches in diameter, wired with No. 20 enamelled copper wire.

The telephones were of the correct high-resistance type.

As to the detector, its efficiency was equal to its attractive appearance.

Remembering all, there should be nothing wrong. But weeks went by, and our wireless man received no message. He *was* disappointed.

Presently he began to reason and then to make inquiry, with the very common result that he was told to blame his aerial.

The advice was wrong. The trouble was minute, and it was not in the "heavens."

This man is typical of numerous experimenters.

Recently I carried out a number of experiments in the hope of demonstrating that aerials of very imperfect construction and of short length can really yield excellent "receiving" results. These experiments will further prove the futility of casting the common blame upon the said aerials. All these trials have been undertaken round about and in the house. There has purposely been no special endeavour to fit up the perfect antenna. Rather, insulation has been mainly neglected, and the erection has generally taken minutes instead of hours and days. And what has been the invariable sequence of these operations? The answer is: one readily gets from these impromptu aerials all, or nearly all, the average wireless man desires.

So the following experiments will first show that the non-receipt of signals does not necessarily depend upon the antenna. Secondly, the inquiries will prove the utility of these particular aerials in confined places such as oftentimes belong to Boy Scouts. They will also indicate very clearly that for receiving messages by wireless a big outdoor aerial is not an absolute necessity.

I will begin with the instruments used in these experiments.

First, a word about the inductance. This I made for special and outdoor work. It consists of a little less than 1 lb. of enamelled copper wire, No. 24 gauge, wound on a cardboard cylinder 11 inches long and 4½ inches wide. The wiring was bared for about ½-inch in two places for brass ball-sliding contacts.

As to the detector. This was quite a home-made affair, bringing very simply a zincite point on to a morsel of copper

pyrites. The telephones were double and of 4,000 ohms together. I used as an extra aid a condenser consisting of 18 pieces of tinfoil, each 3 inches by 1 inch, alternating with paraffin paper. This was used for "shunting" the telephones, and was placed between the detector and the "earth."

For aerial I bought two separate ½-lb. reels of gauge 19 bare copper wire to be used in parallel, two light wooden rods some 3 feet long to act as "spreaders," and two porcelain reel insulators.

Fig. 2 shows the complete apparatus.

A few words about the situation of the house. It faces nearly east and west. The front is a part of the Epping Forest, free of

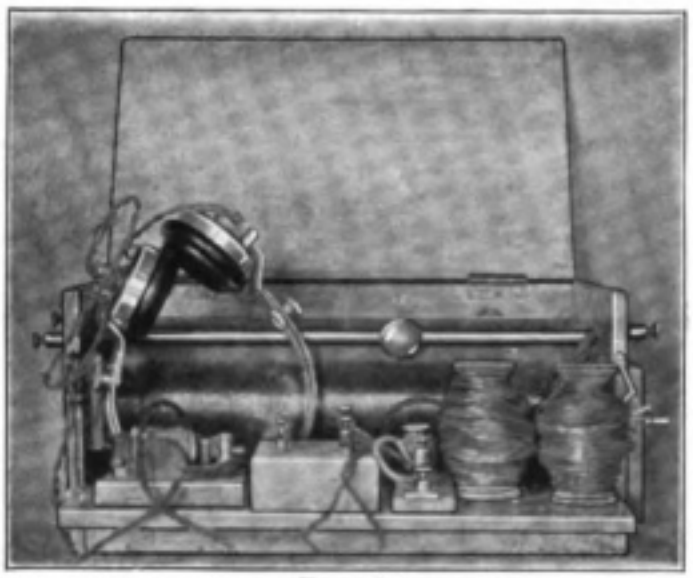


Fig. 2.

trees, but for two 50 feet poplars abutting on to my residence.

The back of the house is roughly enclosed by buildings on three sides, but it is saved by its garden, which is 80 feet long and 60 feet wide. This garden has its share of trees of different kinds, varying from two poplars nearly 50 feet high down to others 20 feet in height.

From a wireless point of view the situation is not ideal. My "earths" were at the front and the back, two separate ones. At the front I buried 4 feet deep 1s. worth of galvanised iron wire netting; at the back, at the same depth, a tangle of waste wire representing not more than a 20 feet length.

Now for the experiments:

EXPERIMENT 1.

Laboratory Aerial.

My laboratory is a room situated at the back of the house, and is 24 feet long. It is comfortably filled with all the usual chemical and electrical apparatus. The aerial was suspended 3 feet from the ceiling, its mean height being 18 feet from the ground level.

The total length of the wiring from the extreme ends of the room was 24 feet plus 6 feet to the instruments upon a table.

The insulation was very simple, consisting only of two small reel insulators, one for each end of the aerial at the extremities of the laboratory. These insulators were merely strung upon two French nails driven into the walls.

Result.—The practice signals from certain London schools, together with those from a well-known suburban experimenter, were very readable. Norddeich lacked volume, and was just audible. Paris time and weather reports came in on the loud side.

Considering the amount of inductance necessarily used, and the meagreness of the aerial, the results were really excellent.

Norddeich was certainly disappointing. But I do not attach much importance to this item, for such is oftentimes the case on bigger aerials than this 30 feet one.

EXPERIMENT 2.

Roof Aerial.

In this experiment the commencement of the two wires was attached to the insulators strung on wooden posts driven into the ground. These posts were 10 feet in an oblique line from the laboratory window. The wires advisedly were just 6 inches from the ground. They were from this point drawn directly up to the roof and allowed to rest upon the tiles, passing over and touching the guttering. At this position they were separated by a "spreader," and dropped to the ground level at the front of the house. Holes were drilled in the window frame, allowing the ends of the wiring to pass directly to the instruments in the dining room.

Results.—With upwards of 70 feet of aerial thus improvised Paris signals were fairly loud—Cleethorpes was more than readable. Some 300 to 600 metre wavelength signals were excellent.

I was able to test this aerial during rain—as might be expected, the results were impoverished, but by no means to the extent of destroying them. "Earth" sounds were too apparent for comfort. But, taking things all round, the signals

were good, and approximately about three-quarters as loud as those received over my big and well-constructed aerial.

EXPERIMENT 3.

Portable Garden Aerial.

For the purpose of this trial a table was placed at the laboratory window. Upon this table was stood the inductance, to which one end of the aerial was suitably attached. From here the wiring was continued to the bottom of the garden.

No attention whatever was paid to the trees and shrubbery *en route*. In fact, two trees at the opposite sides of the garden were utilised for securing the ends of the two wires.

Here are the dimensions of this portable aerial :

	Feet.
Length from laboratory window to bottom of garden ...	80
Wires spaced at bottom of garden	50
Average spacing of wires ...	40
Average height above ground	12

Results.—Cleethorpes was clear, and easy to read. Certain distant stations, French and German, were very busy during this experiment. The " calls " were really excellent. This aerial was, for some reason, better suited for its work than my principal one, much higher, and properly insulated. The reason may be apparent, but I will not discuss it here—suffice it to say I was highly pleased with the results of this trial, especially as all correct insulation was barred.

EXPERIMENT 4.

Loft Aerial.

The two reels of wire were unwound in my loft in opposite directions, commencing at the door. They were separately placed on the beams, and their ends drawn through the ceiling to the inductance in my laboratory below. In this way each reel furnished some 30 feet of wire, which represents the length of this aerial. The wires at their utmost divergence were separated by some 25 feet. There was no insulation beyond what the woodwork furnished.

Results.—The usual stations were also very busy during this experiment. " Paris news " in the neighbourhood of 9 p.m. was somewhat inferior to what is furnished over my principal aerial. But there was no mistake about the clearness of the signals given. Cleethorpes was more than passable, for the notes so often blurred were in this case distinct and clear.

Foreign stations were also in evidence, together with certain ubiquitous amateurs, so much noted in these parts for their never-dying " V's." I found there was a distinct advantage gained by lengthening the " lead." This is quite reasonable. With proper precautions and facilities to extend the wires one could almost be tempted to speak glowingly of loft aerials. It is no small thing to remember that the aerial is here hidden from sight.

EXPERIMENT 5.

Dining Room and Hall Aerial.

The aerial for this trial was just 26 feet long, and was suspended from insulators similarly to the laboratory aerial. Its height was 8 feet from the floor, being about 3 feet below the ceiling of the dining room and hall.

Results.—Paris messages were just readable. Two 300 metre wireless signals came through loudly. But, on the whole, this experiment did not furnish data nearly so good as was the case one floor above.

Summary of Results.—These five experiments do not represent the whole of those undertaken. They are offered as a fair sample only.

The principal thought driven home is, that the experimenter must not be so ready to blame the aerial. In nearly every case the failure to " receive " should be looked for elsewhere. Upon this point one could write a great deal as a result of several years' experimenting.

A second lesson may be learnt.

There is really no necessity to go to the great expense and trouble oftentimes borne so patiently and perseveringly by our wireless friends. They must really learn that these electro-magnetic waves, representing messages from the wide world o'er, attach themselves in unlooked-for places.

I will grant that generally a moderately high aerial will be more satisfactory than a low one. Certainly, also, a fairly long aerial is to be preferred to a short one.

But if a high and long antenna is not available, then one on the lines described will furnish both pleasure and profit.

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.

W. P. (Lanark) shows from his question that he had better study the instructional articles now appearing in THE WIRELESS WORLD before attempting experimental wireless.

L. P.—For answer to your question, "How do you set about getting the consent of the Postmaster-General?" write to "The Secretary, General Post Office, London," who will send you an application form.

L. F. wants to know how to rig up a small wireless station. An old motor-cycle ignition coil will do for the transmitter, and a simple crystal receiver for the receiver. An aerial-wire (vertical) about 20 feet high is needed at each end.

J. F. W.—Size of helix, etc., has little to do with distance of transmission; height of aerial (which you do not even mention) has a great deal. Evidently you need to read the series of instructional articles very carefully before commencing work.

W. H.—Read our instructional articles and the answers to other people's queries. Apparatus by which you would be able to pick up messages from big stations, and so practise "receiving," would not be very complicated or costly, but you would have to spend a guinea on the licence.

D. C.—Read our instructional articles, answers to queries and amateur contributions. Your aerial is too low to be of any use for distance-working. You must raise the lower end so as to give it a better average height; this should be 40 feet or so. Use a tree or a chimney if you cannot have a mast.

D. N.—The low resistance of your telephone is quite enough to explain your not getting any results from distant stations. Also do not forget that your aerial-inductance-earth circuit and your condenser-inductance circuit must both be tuned to the wave you are receiving. To do this really requires a wavemeter.

J. H. H.—Connections not good. See other replies to queries. Your "load-coil" sounds as if it were wound in several layers; if so, this is fatal. Use thinner wire—say, No. 30—in a single layer. Read our instructional articles. What crystals are you using? Are you sure they do not require a battery and potentiometer?

G. CONTI.—We think the amended sketch you send us should be satisfactory. The variable condenser across the jigger-secondary must, of course, be very small. You may find tuning-up rather difficult; we shall be glad to hear how you get on. It would be interesting to hear how this compares for selectivity with the ordinary circuits.

S. S.—Is it possible to use a Morse inker for recording messages from Eiffel Tower?

Answer.—Certainly. The coherer and relay would be the simplest method, but a relay can be made which would work off a crystal or a Fleming valve and operate a Morse inker, especially with such strong signals as those you mention, received on a good aerial.

F. L. S.—I am making a rotary condenser, and find that the plates touch, although the distance between the moving and the fixed vanes is over one-sixteenth of an inch. What is the cheapest remedy? Must paper-ebonite be used, or will shellaced paper do?

Answer.—Dip your vanes in shellac varnish, allow them to dry, dip again, and so on, till a thick coating is obtained.

Q. O. X.—It is certainly possible to make a bell ring over the distance mentioned by you, but not, we fear, with the relay you have. The ordinary bell coils do not make a nearly sensitive enough relay for wireless at any distance. As for setting the bell so as to be rung by a particular station, this also can be done, but not with simple apparatus; for such would be liable to be set going by any stray atmospheric.

C. R.—We cannot reply to questions like your first and second. It is contrary to etiquette. No station has such flat tuning as to be receivable "anywhere between 600 and 3,000 metres." Loosen your coupling or lower your aerial, and tune properly; the station is so near that it is forcing its wave on your receiver. Take care that all your receiving circuit leads are as far as possible from, and at right angles to, your lighting leads.

R. R. H.—Using such thick wire, probably you have not nearly enough inductance to tune your aerial to the long waves you are looking for. Since you have no condenser, and therefore only one oscillating circuit, the tuning coil with tappings is entirely wasted in the position you give it. Put this one in series with the aerial in addition to the other. Even so, you will probably need more inductance. And you must certainly insulate your aerial at both ends.

J. B. W.—In the case of a flat spiral, *i.e.*, only of one wire thickness, the formula holds. Probably in an induction-coil secondary section the error will not be great. But there is the danger of the capacity-effect from turn to turn. No. 32 wire would not cause serious loss through its resistance. But the use of such coils is entirely experimental—they are not as efficient as the ordinary single-layer coils, where the proportion of the number of turns in primary and secondary can be arranged to best advantage.

J. W. T.—(1) Your diagram, though neat enough, is the most mysterious of all those we have received. No indication is given as to where the three terminals shown are connected with the tuning inductance or its sliders; no parts of the apparatus are labelled, and some of it is quite beyond our powers of guessing. Study the diagrams appearing in many places in THE WIRELESS WORLD, and learn how to represent what you want to represent. (2) Yes. (3) *a*, by a Wheatstone bridge; *b* and *c*, best for you to test these on actual received signals; *d*, test for short-circuit, and if possible insulation-resistance and capacity.

X. T.—*Answer.*—(1) Two chokes are necessary, one in each lead from transformer. Wire enamelled will do. About 200 feet each coil. (2) Losses in the loops are negligible—probably less than those which might be introduced by extra joints. (3) Immaterial for ordinary reception, provided resistance of whole circuit is not too