THE MARCONIGRAPH

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THE MARCONIGRAPH

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Contents.

A Word of Thanks.

We wish to express our thanks to both the public and the Press for the cordial reception accorded the first number of *The Marconigraph.*

Many letters of congratulation have been received from readers, which unfortunately owing to limitation of space we are unable to reproduce in this number, but as some indication of their general trend we quote the following paragraph which appeared in *Syren and Shipping*:—

"With the constant extension of Wireless "Telegraphy it was of course inevitable "that a Journal devoted to matters con- "nected with that method of communica- "tion should come into existence. Such "an organ has now made its appearance, "and appropriately enough it is to Mar- "coni's Wireless Telegraph Company, "Limited, that its inception is due."

A Note on the Month's News.

In the present issue we have given an article on the Wireless Installations on the Upper Amazon. The notes were supplied by the Engineer in charge of the operations, and the article illustrates some of the many difficulties that have to be overcome before these installations in remote parts of the world are carried out.

We also publish an account of a Sealing Expedition as related by one of the Marconi Officers, who made the voyage on the SS. "Florizel," which demonstrates one of the many uses to which Wireless Telegraphy has been applied.

The other short articles and notes of recent happenings in the Wireless World will no doubt prove of interest to all.

On the technical side, we have reproduced, with the kind permission of the Physical Society of London, Dr. Fleming's paper on "The Measurement of the High-Frequency Resistance of Wires," which, it is believed, will prove both interesting and instructive.

Increase to 24 Pages.

Since the appearance of the initial number of *The Marconigraph*, it was found necessary to increase the number of pages in the present issue to twenty-four, and it is anticipated that this enlargement will be permanently maintained.

Arrangements have been made for the publication month by month of a series of articles, illustrated by photographs, relating to the erection of the wireless stations in various parts of the world.

It is also intended to include in *The Marconigraph* from time to time notes by Dr. Fleming and other eminent scientists.

COLONEL ALBERT THYS.

Adolf Eckstein's Verlag, Berlin, W. Mohren str 8.

THE MARCONIGRAPH

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by

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

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NOTES.

Colonel Albert Thys, whose photograph we reproduce this month, is chairman of the Belgian Wireless Telegraph Company (La Compagnie de Télégraphie sans Fil) and a director of the recently formed German Wireless Telegraph Company (Deutsche Betriebs Gesellschaft für drahtlose Telegraphie m.b.H.).

Col. Thys is a reserve officer of the General Headquarter Staff of the Belgian Army and first made his name some twenty-five years ago when he was instrumental in having built the railway that runs from the coast of the Belgian Congo up to Léopoldville, from which town the whole of the interior was opened out by river communication. He was also the founder of the Banque d'Outremer and has been closely connected with a very large number of colonial and industrial concerns, amongst which we need only mention the Compagnie du Katanga, the Chinese Engineering and Mining Company, and the Shanghai Construction Company, these three companies being specially well known in England.

Col. Thys has been intimately associated with wireless telegraphy ever since its inception as a commercial possibility, and his great influence and untiring efforts have contributed very largely to establishing its use in European countries.

* * * *

The Marconi Companies have just concluded an important agreement with the French Government, whereby, *inter alia* French ships may, irrespective of the wireless system installed on their boats, communicate with Italian coastal stations and all Marconi coastal and ship stations. The effect of this agreement will no doubt prove of great advantage to both parties and strengthen the good relations already established between the French authorities and the Marconi Companies.

* * * *

The annual meeting of Marconi's Wireless Telegraph Company of America was held on April 27th, and it is interesting to note that Mr. Godfrey C. Isaacs, Managing Director of the Marconi Company in London, was added to the board of Directors; Mr. Charles A. Terry of New York and Major S. Flood Page of London were re-elected directors to serve for a term of five years.

* * * *

At a meeting of the Board of the Marconi International Marine Communication Company, held on May 2nd, Mr. Guglielmo Marconi resigned his position as Managing Director, and Mr. Godfrey C. Isaacs was appointed in his stead.

* * * *

The Imperial Conference and Wireless Telegraphy.

An important item to be discussed at the Imperial Conference which opens on May 22nd is the proposal of New Zealand for an Imperial Wireless Telegraph system.

We hope to give a report of the proceedings in our June issue.

WIRELESS TELEGRAPHY ON THE UPPER AMAZON.

Stanford's Geog! Estab!, London.

IT is one of the chief features of the wireless telegraphy system, and one which goes far towards contributing to its great success, that owing to its simplicity, it can be installed in regions which present the greatest difficulties to the overhead and underground telegraphic cable systems, difficulties which have very often proved to be insuperable, with the result that not a few remote parts of the world have been compelled to forego the use of telegraphy—to do without that greatest aid to modern life. But wireless telegraphy is altering all this. Day by day new districts are being brought within its scope; before very long there will be few large stretches of territory in the world that will not be linked up by means of wireless telegraphy; few stretches, at any rate, where the application of the system is warranted by commerce and population, or the potentialities for such.

It will come as a surprise to many people, perhaps, to learn that wireless telegraphy has penetrated to the upper Amazon, that river of rivers, and that at the present time it is playing a great part in opening up a vast region to the outer world which, until almost recently, was scarcely known by name to Europe. From the time when, nearly 400 years ago, the courageous Orellana descended the Andes on the eastern side, struck the head waters of one of the main tributaries of the Amazon, and sailed therefrom to the coast, until September, 1850, when the Emperor, Dom Pedro II., of Brazil, sanctioned a law authorising steam navigation on the Amazon, later opening the greater portion of it to all flags, the river was *aqua incognita*; now it is a busy scene of international traffic, ocean-going steamers from all parts of the world, and flying all flags, crowd its waters, and on its banks are ports equal to many a well-known port in Europe.

Of these, Para, near the entrance, and Manaos, almost halfway up the main river, and situated in the heart of the country, are the best-known, and Manaos has come to be the great depôt for the collection of the produce of the upper Amazon. Thence it is shipped down the river to Para, or direct to European and American ports, and the importance of Manaos may be realized, when one learns that in 1907 the total arrivals at the port were 1,589, of which 133 were ocean-going steamers from Europe and the United States, and 75 from south Brazilian ports. Manaos is connected by cable with Europe; but here cable communication ends, and the regions above it, on the various large tributaries of the Amazon, are cut off from rapid communication. One of the principal of these extends from Porto Velho, on the Madeira, downwards to Manaos. The Madeira begins at the confluence of the Guaporé with the Mamoré, and it is a river of great potentialities, in that it taps the rich and luxuriant region which lies at the foot of the Andes on the eastern side, along the lower portion of Peru, and the borders of Bolivia. In fact, it may be said to be the great natural highway for the conveyance of the products of a third of the State of Bolivia, to the port of Para. But for a distance of 210 miles, from Guajara Mirim to Porto Velho, the river is beset with rapids, which make navigation extremely hazardous. To overcome this difficulty, however, a railway Company, known as the Madeira-Mamoré Railway Company, has constructed a line 210 miles in length, along the "rapid" portion of the river, and by this means (a portion of the line is already constructed and working), goods will be conveyed to Porto Velho, and forwarded thence by river to Para.

This railway company, being exceedingly enterprising, hit upon the idea of connecting Porto Velho and Manaos by means of wireless telegraphy, thus bringing Port Velho within the bounds of the most advanced civilization, and accordingly the Marconi Wireless Telegraph Company were instructed to fit up two wireless stations, one at Manaos, the other at Porto Velho. The work has been completed, long since, and at the present time the upper Amazon, from Porto Velho to Manaos, is within the wireless circuit. It may be found of interest to learn how the work of installation was accomplished, and the nature of the plant erected, and for this purpose we publish the notes of one

Brazilians clearing space for the Site selected for the Manaos Station.

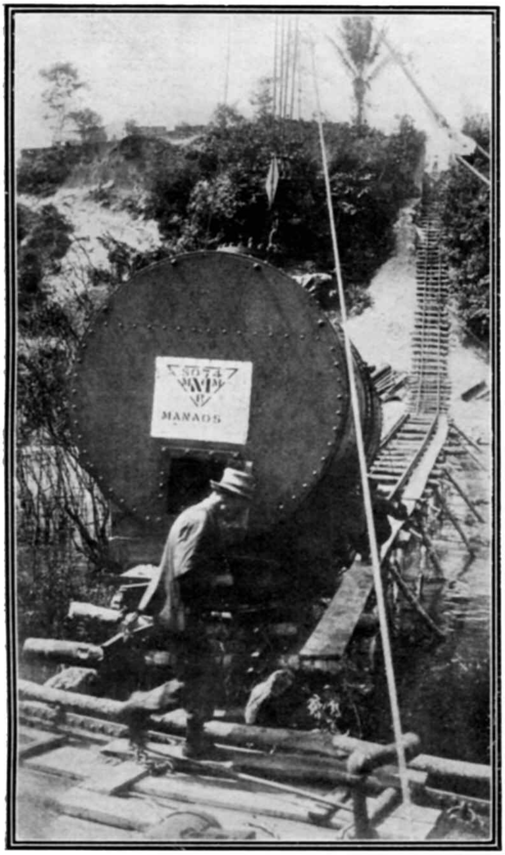
of the engineers who was engaged upon the work, and who proceeded from England to Para, and up river to Manaos and Porto Velho.

He says: "After a long tiring journey across the ocean, owing to the intense heat, the prospect of the journey up the Amazon grew very attractive; interesting it could not fail to be, seeing that we were about to ascend the river which has the greatest volume of water of any river in the world, and one which was for many years, and is now, to a certain extent, the home of mystery, for that which is unknown is ever mysterious, or deemed so. And yet, despite all this, the journey was monotonous; at times uninteresting. After all, all rivers are very much alike, and all have their interesting and their uninteresting portions. Exclude all ideas as to latitude and longitude, shut out the vision of mediæval junks, with shining brass cannon, and yellow, oval mongol faces peering at you from the decks thereof, and at one or two places you have, on the Woosung River, going up to Shanghai, a glimpse of Father Thames.

"From Para, which is growing to be a very great port, and which has enormous possibilities, for with Brazil lies the future, the steamer passes to the main stream of the river, through a section termed 'The Narrows.' Here the river-craft thread their way between picturesque islands, and in places the waterway is such that the sides of one's vessel are almost scraped by the boughs of trees, which o'erhang the river in luxuriant masses of various and delicate shades of green. Occasionally the channel widens, but at the widest part one could throw a stone to the shore. On many of the islands we pass, fine tall trees are to be seen, several with a uniform height of 80 feet or so. To me, the timber seemed to be poor, on the whole, but here and there a good specimen showed itself, its fineness rendering it conspicuous among the poorer of its kind. The river was in flood, and we saw it, therefore, at its busiest. Quite a number of craft, of various kinds, we passed, and here and there on the river banks, houses of primitive description stood; and in places, small settlements. The houses, if one can term them such, were of the usual wood and leaf construction, the floor being carried some feet above the level of the ground, to avoid flooding. In these small homesteads live the people of the country, generally of Indian or mixed blood, making a living by collecting wild rubber from the trees growing near, cultivating the indispensable manioc, and fishing in the waters everywhere at hand. Later we pass farms under water, with cattle thereon wading and swimming in search of food.

"Once through 'The Narrows,' and we steam out into the wide expanse of the main stream, and from this point on to Manaos the journey becomes less interesting. The country is very flat and it is thickly clad with trees; soon the lack of variety begins to tell on one. The 'sameness' of the Amazon, if one may call it so, is like the 'sameness' of many another tropical river—the very wealth of vegetation grows monotonous, bare banks and an inland view are longed for, and one begins to abominate the never-ending prospect of trees, trees, trees. Except when one is passing at the flowering season of most of the trees, there is little variation as regards their colouring. At the flowering season of the year, however, a brilliant scene may be witnessed, for so many of the trees flower like plants, and you have blossom in all notes of colour, from the rich red of the flamboyant acacia, to the yellows and whites of other arboreal orders. Our sense of pleasure was not increased by the presence of mosquitoes. True there were not many, not so many as we had been led to expect, and we took the precaution, a wise one, of sleeping in mosquito-proof bunks, but we were told that the mosquitoes which were present were of a particularly dangerous variety, hence a good deal of the discomfort they caused was of the anticipatory nature. As for the heat, it was very trying. During the day it was most severe, though the sun's rays on this part of the Amazon are not so deadly as they are in many other parts of the globe, owing to the humidity which prevails, but at nightfall relief came, for which one was truly thankful. The nights were often cold, and one enjoyed a warm blanket.

"The site which had been selected for the Manaos station was one about three miles west of the town, and about a mile east of the pumping station. The ground lies



Hoisting Boiler up the Incline Plane, Manaos.

about a quarter of a mile back from the river bank and fronts the river. The bank here rises to a height of 60 feet above high-water mark, and it was necessary, therefore, to cut an inclined plane down the face of the cliff and lay a track up from the water's edge to the site of the Power House. All materials had to be brought by lighter from the town, unloaded at the foot of the track, hoisted up the inclined plane, and sent down to the Power House. The great difficulty to contend with was the variation in the height of the river, the fluctuation from high to low water amounting to from 30 to 35 feet. Our track was constructed approximately at high water, and according as the river became lower, it had to be extended. As the water dropped, the bank did not keep to its almost vertical slope, but commenced to slide rapidly, so that before all the material could be unloaded, the track had to be extended on trestles.

"The station we erected at Manaos is equipped with two 70 K.W. 2,000 volt A.C. generating sets, driven by belting from steam engines. The transmitting aerial is suspended by four steel masts, each 217 feet high, the receiving wire being carried over them to a short mast 65 feet high at the receiving house. This station is built to connect with a similar one at Porto Velho, on the Rio Madeira, with a 5,000 word per day capacity, and after its installation had been completed, we journeyed on to Porto Velho by steamer, to undertake the installation there. The journey from Manaos to Porto Velho occupies from eight to thirty days, according to the state of the river, since at low water boats can proceed by day only, and even then must make their way very carefully, to avoid the many sand-banks and shallows. Occasionally a boat grounds and is compelled to wait, ignominiously, where she has struck, until another craft comes along and hauls her off, the mosquitoes having descended upon her and her living freight meanwhile, to the disgust and discomfort of the latter, whose only recreation consists in attempting to bag some of the many alligators which are basking, like themselves, on the mud-banks.

"At Porto Velho, the site chosen for the wireless station was on what used to be known as Cascalha Hill and was the railway camp: now its name has been changed to Wireless Hill: thus does the Marconi System make geography! Our material was unloaded and brought to the foot of this hill by the Madeira-Mamoré Railway Company, for which company we were erecting the two stations, and we had to haul it up, and on to the site. All difficulties were overcome speedily, and the station, one similar in all respects to that we had erected at Manaos, was soon completed. Singularly, one of its first performances was to announce the opening of the first section of the Madeira-Mamoré Railway to Manaos, and since then it has proved of immense benefit to the railway company in their arduous undertaking of opening up trade communication between Eastern Bolivia and the outer world. When the river Madeira is full, ocean-going steamers occasionally steam up to Porto Velho, and captains of such vessels have found the wireless system of great aid to them in communicating with their agents or owners. Wireless should play no small part in increasing the importance of Porto Velho, and in aiding to make it the great trade head-quarters for the territory fed by the Madeira and its tributaries.

"The following details as to the Power House, etc., at the two stations (each is the same as the other) may prove of interest: The Power House is a steel frame galvanised iron building, extending over an area of 100 ft. by 30 ft. It has two 100 H.P. boilers, of the economic return tube marine type, situated so that the doors are, approximately, on the centre line of the building, giving the fireman ample room in front of the furnace for stoking and cleaning; the bunkers run along the end of the building, and alongside the boilers. Two Mumford steam pumps are provided, fitted so that either or both may be used for the supply of water to either or both boilers. At Manaos, these pumps take their water from a 60,000 gallon reservoir, which was built beside the Power House and is kept full by an electric motor-driven pump, lifting water from a well sunk about a hundred yards from the main building. Water was found in the dry season a few feet below the ground at this point, but it was not considered sufficiently reliable as a permanent source, so the well was sunk some twenty feet deeper, when a second layer of water-containing gravel was struck, immediately above a strata of white clay. The well was sunk as far as this, and it has resulted in a good supply of water, which is always available. Besides this source of supply, the gutterings of the building are all constructed so that they drain into the reservoir, and the amount of water collected in this manner is more than sufficient to compensate for that used by the boiler during the rainy season. At Porto Velho, the railway people have provided a main from their camp water supply, obviating the necessity of constructing a reservoir, well and pump.

"The boilers are connected with a single steam main, which feeds both engines and pumps. The engines are in the second, or main division of the Power House. Besides the engines, this room contains the alternators and switchboard, and a work bench. The engines are compound, by Davey

General View of Manaos Station.

Paxman and Company (horizontal slow speed compound Colchester type), each capable of delivering 100 B.H.P., at 120 revolutions per minute. Each has a seven-foot fly wheel, on which is laid the belting which transmits the power to the alternator. The alternators, built by the E.C.C., are two in number, and each is capable of delivering 70 K.W., at 2,000 volts, 50 cycles, when run at 600 R.P.M. The alternator sets are right and left hand, corresponding to the engines, and are mounted on separate beds, with the adjacent faces machined up so that if necessary the two beds and the two alternators, which are provided with shaft extension and half couplings, may be bolted together, and the whole plant run as one unit.

"The switchboards are divided into two groups, one for the D.C. and one for the A.C. machines. Each alternator feeds three transformers, each capable of going 25 K.W., at 20,000 volts, when supplied with single-phase alternating currents at 2,000 volts. Thus it will be seen that the generating plant is duplicated throughout, the station working on one set and having the other as a stand-by. As a matter of fact, owing to the damage done to the Porto Velho transformer in transit, only one transformer was able to be worked when the plant was operated first, and communication was maintained for more than a month in this manner.

"The transformers are in the third and last section of the Power House. In this room the high tension electro-magnetic relay switches, the various tuning inductances, the motor-driven disc discharger, condenser, jigger and aerial tuning inductances, are situated. The high tension relay switches are worked from the Receiving Room by the operator on duty there. The condenser stands are built to accommodate the Poldhu type condensers, and are divided into two groups, with the disc discharger between them. This discharger is a 24-inch eight stud standard type disc, directly connected, through an insulating coupling, to a 10 B.P., 220 volt D.C. motor, built to run at 3,000 R.P.M. The side electrodes of this disc are cup pattern, and are revolved by insulated gearing, driven through a worm gear on the end of the disc shaft. The jigger is a modified high-power one. The connection to the aerial is made through a leading in insulator, set on to the end of the building. The transmitting aerial is suspended by insulated wires from steel masts. The outer pair of masts is 220, and the inner pair 200 feet high.

"The earth system is made of a number of metal plates buried in proximity to the Power House, and a system of radial wires laid on the surface of the ground under the aerial, extending from a stream beyond the free end of the aerial, back to the Power House, and from the Power House to the river. The two receiving wires are suspended over the transmitting wires and run from each outer mast, past the main pair of masts and the Power House, to a short sixty-foot mast, which is erected beside the Receiving House. The Receiving House is a small galvanised iron building, covering an area of 20 by 10 feet, and it is divided into two rooms; the Instrument Room contains the magnetic detector and the valve receiver. From this house the whole of the wireless work is transacted, since the manipulating key in this building controls the relay switch in the wireless room at the Power House and regulates the discharge of the transmitting condenser, in accordance with the reorganised groupings of the Morse code."

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The Governor of Colombo, at a recent meeting of the Council, said that Ceylon's Wireless Station, which is to be placed at Colombo, is calculated to make considerable changes in the working and potentiality of the port.

* * * *

It was announced by Mr. Thomas, the Postmaster-General of Australia, that the Federal Government has decided to appoint a British officer to organise and develop a wireless telegraphy system in the Commonwealth.

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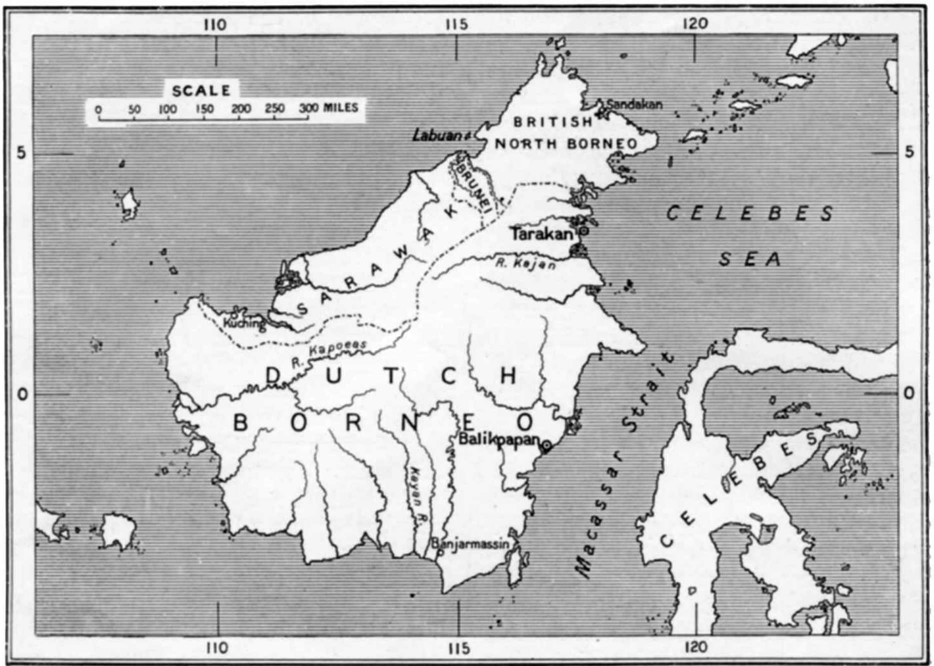
WIRELESS TELEGRAPHY IN BORNEO.



Stanford's Geog¹ Estab¹, London.

TARAKAN, the port in Borneo from which the products of the Bataafsche Petroleum Company's oil fields are shipped, is about to be placed in wireless telegraph communication with Balik-papan, already served by the German-Dutch cable system. The Balikpapan station will be the larger and more powerful of the two, for the reason that, in addition to the communication required with Tarakan, 300 miles distant, it has also to work with stations to be erected at Sitoe-Bondo on the Island of Java, 430 miles away, and at Koepang on the Island of Timor, a distance of 660 miles.

A multiple T type aerial, supported by five tubular steel masts, will be employed, and it is interesting to note that the central mast will be 250 feet high, which will constitute a record height for this style of mast.

Power is being provided by the Petroleum Company in the form of two-phase alternating current at 2,000 volts and 50 cycles, and will be transformed into single-phase current with similar characteristics, by a direct-coupled motor-generator set.

In other respects the station will be of the Marconi Company's 30 K.W. standard type, embodying the disc transmitter for the production of a musical note in transmission; the magnetic detector and tuner for reception.

The Tarakan station will be furnished with a semi-directional aerial of the multiple L type, supported by a mainmast of the same size and type as that at Balikpapan and two extension masts, each 150 feet high.

A 20 H.P. slow speed, horizontal, electric light type Gardner oil engine will drive by belt a 13 K.W., 200 cycle, E.C.C. generator and the usual Marconi disc.

It may appear that generously proportioned stations have been provided. Tarakan is not, however, ideally situated from the wireless point of view; high mountains occur between it and Balikpapan, and the equator just about equally divides the distance between them. Atmospheric disturbances, therefore, are not likely to be conspicuous by their absence.

The plants for both stations have been

arranged for operation on a wave-length of between 8,000 and 9,000 feet for ordinary communication between them. Provision has also been made for the use of wave-lengths of 1,000 and 2,000 feet, in order that the stations may conform to the Service Regulations of the International Radio-telegraphic Convention governing wireless telegraphic communication with ships, and it is hoped that no little business will be done in this direction.

Mr. S. Kos is to be relieved of his work at Slangkop, Capetown, and will assume charge of the erection of the Borneo station. His assistant, Mr. Jones; the mast expert, Mr. Post, and Messrs. Magnee and Meyer, Dutch telegraphists, are already on their way out, and some six months hence should see the Balik-papan and Tarakan stations in working order.

The Turkish Contract.

The Marconi Company have been favoured with a contract from the Turkish Government, for the equipment of eleven ship stations and one shore station.

The Company's 3 K.W. sets will be installed on the following four vessels: "Messoudieh," "Abdul Hamadieh," "Medjich," and "Tiri Migglian," while the "Perki Scheekit," "Barki Satvet," "Bassora," together with four torpedo boat destroyers, will be fitted with standard 1½ K.W. ship sets. The former vessels will have a range of 600 K.M., and the latter 250 K.M.

The land station is to be erected at Constantinople, and will be of 20 K.W. with a range of 1,000 K.M., and to transmit five wave lengths ranging from 600 to 2,000 meters.

A Coltano type mast 250 feet high, with six extension masts, each 110 feet high, will be used to suspend the aerial. The generating plant consists of a 55 B.H.P. Gardner vertical high-speed oil engine, coupled to an E.C.C. dynamo. The station will have a Tudor Accumulator Battery, which has a capacity of 900 ampere hours, and power will be supplied by a direct coupled alternator disc set, having an output of 20 K.W. at 1,000 volts and 300 cycles when driven on 1,500 R.P.M. The station will have both valve and magnetic detection receivers.

The erection of the station has already commenced, and the work is being carried out under the supervision of Mr. Cole of the Engineers' Department.

During the erection of the Admiralty station at Wick, which is now almost completed, secrecy has been maintained throughout the progress of the work. The installation is part of the equipment for the proper direction of the manœuvres of the different fleets to be concentrated at the Scapa Flow, and Cromarty Firth naval bases.

* * * *

It is said by the *Edinburgh Evening News* that the Admiralty have been prospecting on various commanding sites along the Haddingtonshire Coast on which to erect a signalling station, equipped with wireless telegraphy, etc., and it is understood that the Naval authorities have settled on ground located on the high altitude between Seacliffe and North Berwick. Ground will be leased there, and very possibly operations will proceed at once. Rosyth Naval Base has made this station necessary.

* * * *

The Marconi Wireless Telegraph Company of Canada, Limited, have received instructions from the Newfoundland Government to proceed with the erection in the summer of two small power stations on the Labrador, at Makovick and Cape Harrison.

* * * *

A new Wireless Station is being erected under the control of the Military Authorities of the Italian Army, at Bologna. The apparatus consists of the Marconi 5 K.W. standard type installation, which will have an effective working range overland of about 180 miles. The station is to be employed solely for military purposes.

* * * *

The Italian Government Wireless Station at Becco di Vela has been closed and a new station at Taranto with a range of 500 kilometres is to be opened to public service on the 15th May. On and after that date the Government Wireless Stations at Capo Mele and Capo Sperone will be opened day and night for public service.

A NOTE ON THE EXPERIMENTAL MEASUREMENT OF THE HIGH-FREQUENCY RESISTANCE OF WIRES.

By J. A. FLEMING, M.A., D.Sc., F.R.S.,
Professor of Electrical Engineering in University College, London.

Reproduced from the "Proceedings" of the Physical Society of London, Feb. 15th, 1911.

In a paper read to the Institution of Electrical Engineers in December, 1909, the author described an apparatus for the measurement of the high-frequency resistance of wires with which many additional experiments have been made lately in the Pender Electrical Laboratory, introducing one or two little improvements which have conduced to greater accuracy.* The apparatus as originally described consisted of a pair of glass tubes $T_1 T_2$ having bends at the bottom full of mercury and closed by air-tight stoppers at the top and bottom (see Fig. 1). These tubes are connected by a lateral inverted syphon made of barometer tube having in it some paraffin oil with an air bubble (*b*) in the centre. The arrangement therefore forms a differential air thermometer and the air bubble serves to show whether the air pressure in both the large tubes is the same. The vertical tubes are about 30 in. in length and 1·5 in. in diameter. In each tube is placed one of two exactly equal wires (W) to be tested. The wire is supported from a copper rod passing air tight through a rubber stopper and the bottom end attached to another copper rod hangs in the mercury in the lower bend by means of which an electric current can be passed through the wires.

Means are provided by a condenser, inductance and discharger for generating electric oscillations of any desired frequency. Also means for passing a continuous current of any strength through either wire. By means of throw-over switches ($P_1 P'$) the high frequency or the continuous current can be passed through either wire in the tubes and measured by means of suitable high-frequency hot-wire ammeters, $A_1 A'$, as described in the Author's previous Paper (*loc. cit.*). Neglecting for the moment some necessary corrections, the experiment made consists in passing a continuous current through one wire and a high-frequency current through the other similar wire and adjusting them until the rate of production of heat in both cases is the same, when a steady condition is reached, as shown by the indicating bubble remaining stationary. If R is the steady resistance of the wire and R′ is its high frequency resistance, and if A and A′ are the equi-heating values of the continuous and high-frequency currents respectively, then for thermal equilibrium we have $A^2R = A'^2R'$, and therefore $R'/R = A^2/A'^2$.

One essential condition of success is that the high-frequency current must be measured

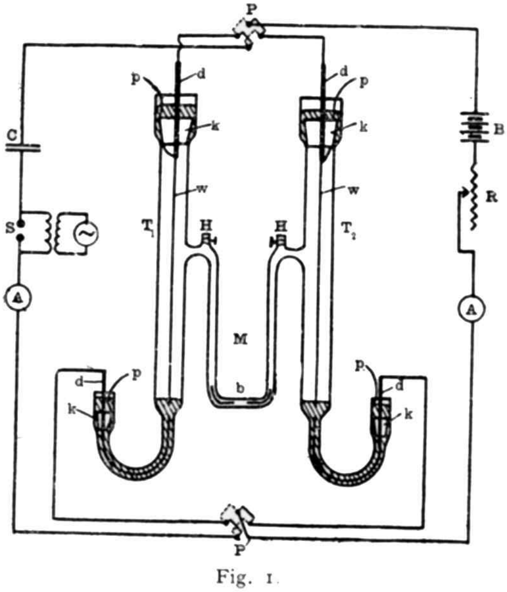


Fig. 1.

* *See* J. A. Fleming. "Some Quantitative Measurements in Connection with Radio-telegraphy." "Proceedings of the Institution of Electrical Engineers," London. Vol. XLIV., p. 349, 1910.

by an ammeter capable of giving the true root-mean-square value. Such an ammeter has been described by the author in detail in the Paper referred to as read before the Institution of Electrical Engineers.*

There are, however, a number of precautions to be taken in using the apparatus. In the first place, although the wires tested and the tubes in which they are placed are as nearly alike as possible, the conditions of loss of heat are not absolutely the same. There may be a small difference in the emissivity of the wires due to difference in polish, also a difference in superficial area. Again the glass tubes may not absorb or radiate heat quite equally; and therefore the rate of loss of heat from the wires is not quite the same.

Supposing then that currents are passed through the two wires such that the bubble remains at rest it shows that the air-pressure in the two tubes is equal, and therefore that the air in the two tubes has the same mean temperature. If the experiment is continued until a steady state is reached the rate at which heat is being removed from each wire is proportional to some constant depending on the nature of its surface and some function of the mean temperature of air in the tube. Hence, if we pass a continuous current, A_1, through one wire and a high-frequency current, A', through the other, and if t_1, is this mean temperature in both tubes when the bubble is at rest we shall have

$$A_1{}^2R=e_1f(t_1), \qquad (1)$$
$$A'^2R'=e_2f(t_1),$$

where e_1 and e_2 are constants appertaining to each wire and $f(t_1)$ is some function of the mean temperature of the surrounding air.

Again, if we cause the high-frequency and the continuous current to change wires and vary the value of the continuous current until we again reach a steady state, at which the mean temperature of the air in the tubes is t_2, and if A_2 is the continuous current required to thermally equilibrate the same high-frequency current A', we have

$$A_2{}^2R=e_2f(t_2), \qquad (2)$$
$$A'^2R'=e_1f(t_1).$$

From (1) we have

$$\frac{R'}{R}=\frac{e_2}{e_1}\left(\frac{A_1}{A'}\right)^2. \qquad (3)$$

and from (2) we have

$$\frac{R'}{R}=\frac{e_1}{e_2}\left(\frac{A_2}{A'}\right)^2. \qquad (4)$$

Hence from (3) and (4) we have

$$\frac{R'}{R}=\left(\frac{\sqrt{A_1A_2}}{A'}\right)^2 \qquad (5)$$

In other words, if we equilibrate the same high-frequency currents by continuous currents A_1 and A_2, changing wires in the two measurements, then the ratio of the high frequency to the steady resistance is equal to the ratio of the product of the two direct currents to the mean square value of the high-frequency current. In the former experiments we assumed that the arithmetic mean of the two continuous currents should be used, but it is clearly more correct to take the geometric mean. Against the former experiments on this subject the criticism was made that the calculated value of the high-frequency resistance with which the observed value should be compared should be the high-frequency resistance to damped oscillations which, as Dr. E. H. Barton has shown, is somewhat larger than the high-frequency resistance to persistent oscillations or undamped high-frequency currents.* This correction is a small one, though not absolutely negligible. Hence, in the above formula R' must be understood to mean the resistance to such oscillations as are employed in the experiment. Also, it was asserted that the heating effect due to the high-frequency current was partly due to the charging current of the condenser used.

This last is, however, a quite negligible source of error. The condenser used was a battery of Leyden jars, which, when charged and discharged, gave trains of oscillations, each having about 30 to 50 oscillations or so, as proved by the decrement in that circuit. Hence the actual charging current of the condenser is not more than 3 per cent. or so of the oscillatory current at the most, and its mean-square value is not more than

* This hot-wire thermo-electric high-frequency ammeter is now being manufactured by Mr. Robert Paul, of Newton Avenue Works, New Southgate, London, N.

* *See* Dr. E. H. Barton "On the Equivalent Resistance and Inductance of a Wire to an Oscillatory Discharge." "Proc. Phys. Soc., London," 1899, Vol. XVI., p. 409, or "Phil. Mag.," 1899, Vol. XLVII., p. 433.

about 0·1 per cent. Moreover, the resistance on which the low-frequency charging current operates is the ordinary or steady resistance of the wire, whilst the resistance to the oscillatory current is the much greater high-frequency resistance. Hence, any correction under this heading is negligible in comparison with other sources of error.

The greatest practical difficulty is to secure a sufficiently steady high-frequency current. This was generated by employing a motor-driven alternator to give current to a large high-tension transformer raising the potential of an alternating current having a frequency of 50 to a potential of 10,000 or 20,000 volts. This voltage was used to charge one or more Leyden jars, which were discharged across a spark-gap, an air-blast on the gap being used to steady the discharge. The frequency of the oscillations so created was measured in each case by a cymometer, and the mean-square value of the current by one of the Author's hot-wire thermo-electric ammeters.

The voltage of the alternator could be regulated by a resistance in its field so as to alter the number of spark discharges per second. The wires inserted in the tubes for test had in all cases potential wires attached to their ends brought out separately through the stoppers. The purpose of these was to enable a measurement of the resistivity of the wires to be made *in situ* and at the temperature actually used. The experiments were conducted as follows: The two wires of identical materials were selected and cut the right length, and, having been cleaned, the diameters and lengths were carefully measured. They were then attached by solder and screw clips to the holders and inserted in the tubes. After the apparatus was rendered air-tight, continuous currents were passed through the wires and the current and volt drop down these wires measured with the potentiometer, the currents employed being of about the same value as those actually used in the thermal balance. These measurements gave the resistivity (ρ) of the wire. Thus, if A is the continuous current through the wire in amperes and v the volt drop down the wire of length l and section s, the resistivity is given by $\rho = sv/lA$. Generally speaking, a number of such measurements were made and a curve set out so as to be able to determine the proper value of the resistivity corresponding to any steady current used.

This having been done, the high-frequency current A′ was passed through one wire, say, in the left-hand tube, and a continuous current, A_1, passed through the right-hand wire and adjusted until the bubble in the inverted syphon remained at zero, after sufficient time had elapsed to allow the thermal state to become steady. The currents were then reversed, and the alternating passed through the right-hand wire and a continuous current, A_2, through the left-hand wire. The ratio of the product of A_1 and A_2 to A'^2 was then calculated, and this gives the ratio of the high frequency (R′) to the steady resistance (R) of the wire.

The wires tested in these experiments were circular sectioned straight wires of copper (No. 30, No. 16, No. 14 S.W.G.), tin, eureka and steel, and two spirals of No. 16 bare copper wire.

For each straight wire the value of the quantity $\sqrt{h} = \pi d \sqrt{\frac{n}{\rho}}$ was calculated, where d is the diameter in centimetres, ρ the resistivity in C.G.S. units corresponding to the mean value of the continuous current A used, and the frequency n of the oscillatory current A′. It has been shown* that if $\sqrt{h}$ has a numerical value in the above units exceeding, say, 10, then for such wires the ratio R′/R is given by a formula due to Dr. A. Russell,† which is nearly equivalent to

$$\frac{R'}{R} = \frac{\sqrt{h}}{2} + \frac{1}{4} + \frac{3}{32\sqrt{h}} - \frac{1}{16h\sqrt{h}}$$

For values of $\sqrt{h}$ in the neighbourhood of 10 and upwards the two first terms suffice.

On the other hand, if $\sqrt{h}$ is less than 10 or so, then the ratio R′/R must be obtained by the aid of a formula called the Ber and Bei formula, first given by Lord Kelvin and re-obtained and discussed by Dr. A. Russell.

In these calculations we have used Lord Kelvin's formula, because it has been reduced

* *See* J. A. Fleming, "The Principles of Electric Wave Telegraphy and Telephony," 2nd edition, p. 112, 1910, for references to the literature of this subject.

† *See* Dr. A. Russell, "Proc. Phys. Soc., London," Vol. XXI., 1909; also "Phil. Mag." Vol. XVII., p. 524, 1909, "On the Effective Resistance and Inductance of a Concentric Main."

to numerical form for certain values of $\sqrt{h}$ or its equivalent by Dr. Magnus Maclean.* The values of R′/R for the non-magnetic wires for the values of the frequency and current employed have been accordingly calculated in Table given below.

The correction to be applied for the higher resistance of the wires to damped rather than undamped resistance has not been made in the calculated value of R′/R because the decrement of the oscillations was not observed in every case, but this correction can at most increase the calculated value by about 1 per cent. or less. Dr. Barton has shown that the correction to be applied to Lord Rayleigh's formula for the ratio of R′/R, which is the same as the first term of Dr. Russell's formula is multiplication by a factor $s\sqrt{s+k}$, where $s=\sqrt{1+k^2}$, and $k=\delta/\pi$, where δ is the semi-period decrement of the oscillations. Experiments made on similar circuits to those used in the case of these measurements showed that δ might be taken to have some value of the order of 0·04, and therefore $k=\delta/\pi$ of the order of $\frac{1}{80}$. Hence, for such a case, $s\sqrt{s+k}=1\cdot007$, or the correction is under 1 per cent. Since the value of R′/R obtained by experiment cannot be repeated with differences much less than 1 per cent. it has not been considered necessary to apply the correction to the calculated values of R′/R, but it can be seen that, as far as the present experiments go, it would, if applied, make the agreement with the observed ratio in some cases rather better and in others rather worse than it is without it. In any case, the conclusion to be drawn is that this experimental method furnishes a value for the ratio which is in very fair agreement with that predetermined by theory in those cases in which the latter can give us a value.

This being so, we can have confidence in it in other instances, such as those of the magnetic metals in which an unknown quantity, viz., the permeability, enters into the value of $\sqrt{h}$. In this case $\sqrt{h}=\pi d\sqrt{\frac{\mu n}{\rho}}$.

Accordingly, for straight wires of the

Table I.—*The Measurement of the High-Frequency Resistance of Certain Wires.*

Conductor tested.	Value of $\sqrt{h}=\pi d\sqrt{\frac{n}{\rho}}$	Frequency n.	R.M.S. value of the H.F. current in amps. $=A'$.	Value of the direct current in amperes which balances A′ thermally. Right hand tube $=A_1$.	Left hand tube $=A_2$.	Value of $A=\sqrt{A_1A_2}$.	Ratio of currents $\frac{A}{A'}$	Ratio of resistances $R'/R=(A/A')^2$. Measured.	Calculated.	Remarks.
Bare straight copper wire, No. 30 S.W.G. dia. = 0·03149 cm.	2·415	1,080,000	1·75	1·79	2·48	2·11	1·21	1·45	1·45	Calculated from Lord Kelvin's formula $\rho=1,800$ (measured).
Bare straight copper wire, No. 16 S.W.G. dia. = 0·1626 cm.	12·77	1,080,000	5·80	13·1	17·0	14·92	2·57	6·62	6·64	Calculated from Dr. A. Russell's formula $\rho=1,730$ (measured).
Bare straight copper wire, No. 14 S.W.G. dia. = 0·198 cm.	15·4	1,060,000	6·70	18·5	19·7	19·1	2·86	8·10	7·95	Calculated from Dr. A. Russell's formula $\rho=1,760$ (measured).
Bare straight tin wire, pure tin, dia. = 0·0265 inch	2·79	1,060,000	1·85	1·93	2·04	1·98	1·07	1·15	1·13	Calculated from Lord Kelvin's formula $\rho=17,000$ (measured).
Bare straight Eureka wire, No. 26 S.W.G. dia. = 0·019 inch	0·623	1,060,000	1·045	1·00	1·08	1·04	0·995	0·99	1·00	Calculated from Lord Kelvin's formula $\rho=23,500$ (measured).
Steel wire, 1·0% C. .. dia. = 0·017 inch	$0·906\sqrt{u}$	1,060,000	0·530	1·36	1·37	1·363	2·575	6·63	—	$u=196$ (calculated). $\rho=23,500$ (measured).
Steel wire, 0·8 % C. .. dia. = 0·0156 inch	$0·906\sqrt{u}$	1,060,000	0·530	1·35	1·38	1·363	2·575	6·63	—	$u=196$ (calculated). $\rho=19,800$ (measured).
Spiral of No. 16 bare copper wire, 135 turns turns per cm. = 2·65	—	545,000	3·90	10·8	11·05	10·91	2·800	R″/R = 7·82	R″/R′ = 1·63	value of R′/R calculated for $n=545,000$ by Russell formula = 4.80.
Spiral of No. 16 bare copper wire, 135 turns turns per cm. = 2·65	—	750,000	3·90	9·8	10·15	10·0	2·517	R″/R = 6·54	R″/R′ = 1·2	value of R′/R calculated for $n=750,000$ by Russell formula = 5.54.

* *See* Lord Kelvin, Presidential Address, "Journal," Inst. Elec. Eng., 1889, Vol. XVIII., p. 35, and Appendix. Dr. Russell has shown that this Table requires recalculating, and some revised Tables have been published by Mr. H. G. Savidge, *see* "Proc. Phys. Soc., London," Vol. XXII., p. 105, 1910.

magnetic metals, we have approximately the equation

$$\frac{R'}{R}=\tfrac{1}{2}\pi d\sqrt{\frac{\mu n}{\rho}}+\tfrac{1}{4},$$

and this equation can be used to find the value of μ when n, d and ρ are known and R'/R is experimentally determined. Observations were accordingly made with two steel wires of different carbon content about 1 per cent. and 0·8 per cent., using the same methods. It was found that the experimental value of R'/R, corresponding to a frequency of $1{\cdot}06 \times 10^6$, came out in both cases the same, viz., 6·63. The diameters of these wires were respectively 0·017 in. and 0·0156 in., and the experimentally determined resistivities 23,500 and 19,800 C.G.S. units, hence $d\sqrt{\frac{n}{\rho}}=0.906$ in each case, and we have the value of the permeability μ from the equation

$$6{\cdot}63=\tfrac{1}{2}\times 0{\cdot}906\sqrt{\mu}+\tfrac{1}{4}$$

or $\mu=196$ for both wires.

Since the radius of the cross-section of each wire is nearly 0·02 cm., and since the root-mean-square value of the current is about 1·3 amperes or 0·13 absolute units, it is clear that the root-mean-square value of the magnetic force H at the surface of the wire is about 13 C.G.S. units. The value of the permeability above found, viz., 196, is a kind of mean value corresponding to an intermittent oscillating magnetic force, and not to any steady value of the magnetic force.

If a magnetic force of 13 C.G.S. units was steadily applied the permeability corresponding to it would be about 900 or 1,000 for such a steel as is here used. Hence we cannot infer from the static magnetisation curve the permeability corresponding to a high frequency intermittent magnetising force any given R.M.S. value, since the actual permeability for such a magnetising force so applied appears to be always much less than for the equal steady force.

In the last place two experiments were made on the high-frequency resistance of spirals of copper wire. It is well known that a close spiral of wire of good conducting material has a larger high frequency resistance than the same wire stretched out straight. Hence, for such a spiral we have three resistances to consider, viz., its steady resistance R, its high frequency resistance R' and its spiral resistance R''. The ratio of R''/R can be determined in the above-described apparatus as easily as that of a straight wire.

A spiral of copper wire, No. 16 S.W.G., was made having 135 turns and 2·65 turns per centimetre of length. This was tested at two frequencies, viz., $n=545{,}000$ and $n=750{,}000$. In the former case R''/R was found to be 7·82 and in the latter 6.54. From the known value of R'/R for this wire at these frequencies it was found that R''/R' was for the lower frequency equal to 1·63 and for the higher 1·2. These values show that the ratio R''/R' appears to diminish with increase of frequency.

The subject of the high-frequency resistance of spirals has already engaged the attention of several mathematicians and experimentalists. The formulæ given so far for predicting it for high frequency currents do not seem to be in good agreement with experimental results.

The latest investigation is that of Dr. J. W. Nicholson (*see* "Proc. Phys. Soc., London," Vol. XXII., p. 114, 1910, "On the Effective Resistance and Inductance of a Helical Coil"). He considers mathematically such a case as is here dealt with experimentally, namely, a circular-sectioned wire wound into a spiral of fairly close turns in one layer and traversed by a high frequency current.

If a is the radius of the cylinder on which the spiral is wound and r is the radius of the section of the wire, and n is the number of turns in a length, z, of the spiral, then the angle a of the spiral is defined by $\tan a=z/2\pi na=\beta\pi D$, where β is the distance from turn to turn and D is the diameter of the spiral. When a is greater than $12r$, and the frequency greater than $4{,}900/r^2$, Dr. Nicholson arrives at an expression for the effective resistance of the spiral per unit length of the wire which he gives in the form (*see* his equation (46), p. 128, *loc. cit.*)

$$R=\left(\frac{\mu p\sigma}{2\pi r^2}\right)^{\frac{1}{2}}\left\{1+\left(\frac{\sigma}{8\pi\mu p r^2}\right)^{\frac{1}{2}}+\frac{3}{4}\frac{\sigma}{8\pi\mu p r^2}\right\}$$

$$-\frac{\sigma}{32\pi a^2}\cos^2 a(1-5\sin^2 a)$$

$$\left\{1+\left(\frac{\sigma}{8\pi\mu p r^2}\right)^{\frac{1}{2}}-\frac{9}{4}\left(\frac{\sigma}{8\pi\mu p r^2}\right)^{\frac{3}{2}}\right\}$$

where σ is the resistivity of the wire, μ the the permeability, r the radius of section, and $p=2\pi n$, where n is the frequency. This expression can be simplified as follows: In place of his R put R″ since he uses R to denote the effective resistance per unit of length of the spiral wire, and I have here employed R to signify the steady resistance per unit of length. In place, therefore, of $\sigma/\pi r^2$, write R, since this is the steady or ohmic resistance per unit of length of the wire. Also take $\mu=1$, as we are dealing with non-magnetic wires, and in place of $\sigma/8\pi p r^2$ write $1/4h$, which makes $\sqrt{h}=2\pi r\sqrt{\frac{n}{\sigma}}=\pi d\sqrt{\frac{n}{\rho}}$, as above; also write d for $2r$ and D for $2a$.

With these changes, Dr. Nicholson's formula becomes

$$\frac{R''}{R}=\left\{\frac{1}{2}\sqrt{h}+\frac{1}{4}+\frac{3}{32}\frac{1}{\sqrt{h}}\right\}$$

$$-\frac{1}{32}\frac{d^2}{D^2}\cos^2 a(1-5\sin^2 a)\left\{1+\frac{1}{2\sqrt{h}}-\frac{9}{32}\frac{1}{h\sqrt{h}}\right\}.$$

It will be seen that the first three terms in large brackets are the approximate expression, according to Dr. A. Russell's formula, for the ratio of the resistance per unit length of the wire for high-frequency currents to its steady resistance per unit of length, the wire being straight. This ratio is what we have called R′/R. Hence Nicholson's formula becomes

$$\frac{R''}{R}=\frac{R'}{R}-\frac{1}{32}\left(\frac{d}{D}\right)^2\cos^2 a(1-5\sin^2 a)\left\{1+\frac{1}{2\sqrt{h}}-\frac{9}{32h}\frac{1}{\sqrt{h}}\right\}$$

when d is the diameter of the wire and D of the spiral. If the angle a is small the term $\cos^2 a(1-5\sin^2 a)$ is nearly unity, and positive in sign, and if h is large the three last terms in large brackets are also not far from unity and positive.

Hence the formula clearly shows that for a value of a less than 26° 35′ R″/R should be *less* than R′/R by a small quantity. Now, this is contradicted by experiment. R″/R is always *greater* than R′/R, and the ratio of R″/R is as shown above, a quantity which is 1·63 or 1·2 for the spiral in question for the two frequencies 545,000 and 750,000.

Also the formula shows that when $a=\sin' 1/\sqrt{5}=26°\ 35'$ R″/R=R′/R; and that when a is greater than 26° 35′, R″/R is greater than R′/R. The formula is, therefore, qualitatively wrong in certain cases and not in agreement with the results of experiment. The only case in which it agrees with observation as regards ratio of R″ to R′ is when the angle of the spiral is greater than 26° 35′, but this case has little or no practical importance, as the inductance coils of importance are mostly spirals of small angle.

Similar experimental measurements of the ratio R″/R′ made for copper spirals of the same kind by T. P. Black* in 1906 gave results of the same order as those obtained by me, viz., values between 1·2 to 1·89 for frequencies of 10^6 or that order and spirals made of wire 0·15 and 0·3 cm. in diameter.

It can be proved by elementary reasoning, as given by the author in the Paper read to the Institution of Electrical Engineers, that the spiralisation of a wire must increase its high-frequency resistance, and this is experimentally confirmed by the measurement here given and by all those of Black. There is no doubt that a fairly close spiral of many turns made of No. 16 copper wire has a resistance to high-frequency currents with frequency $\frac{1}{2}10_6$ to 10^6, which is from 1·5 to 2 times that of the same wire stretched out straight to the same currents. Hence any formula which makes it less or only greater by a very small percentage must be wrong.

A formula given by Sommerfield gives, as Black has shown, too large a value for R″/R, and another formula given by Cohen has only been tested with rather low-frequency currents.

There seems, therefore, still room for mathematical investigation to obtain for us a formula for the resistance of spiral wires to high-frequency currents, which shall be as much in accord with the results of observations, as are the formulæ given by Lord Kelvin and Dr. Russell for straight conductors. The experimental work for this Paper has been very carefully carried out by Mr. A. D. Peacock, superintended by Mr. G. B. Dyke and by me; and to them I am indebted for the experimental results here given.

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* *See* T. P. Black, "Widerstand von Spulen für Schnelle Elekt Swingungen," "Annalen der Physik," Vol. XIX., p. 157, 1906.

SEAL HUNTING IN THE ARCTIC ICEFIELDS.

An account of the 1910 Expedition.

BY

ERNEST T. FISK,

Marconi Officer on the SS. "Florizel."

The "Florizel" was the largest of the ships that made the voyage. She was the first to be fitted with Wireless Apparatus, and the only vessel fitted with an equipment in 1909. In the following year the SS. "Eagle" was also fitted. Wireless Signalling proved to be of such valuable service during the voyage, that, previous to setting out on this year's expedition, several more of the vessels of the fleet were equipped with similar sets of Marconi Apparatus.

THE morning of March 12th was fine, clear and calm. At Harvey's coastal wharf lay the three "ventures"—the "Adventure," "Bonaventure" and "Bellaventure" side by side; further up the harbour was the "Florizel," while a short distance astern of her was the "Beothic."

Shortly before the hour of sailing, every available harbour tug was steaming round us with sightseers. The Governor was among them on board a launch belonging to H.M.S. "Calypso."

At four in the afternoon, the five ships cast off and steamed out through "The Narrows" in single file, led by the "Florizel," while the wooden ships which completed the fleet had sailed from Pool's Harbour, 100 miles north of St. John's, at eight o'clock that morning.

A "Whitecoat," Bawling.

At 10.30 p.m. Captain Kean of the "Florizel" received a wireless message from the "Eagle," giving the position of the wooden fleet. They were already in the icefields and found conditions very hard for progress.

That was the first wireless message to be exchanged between two ships of the Newfoundland Sealing Fleet.

At 11.0 p.m. we ran into heavy broken ice which became more closely packed as we proceeded. By two o'clock next morning we were well into the icefields, ploughing our way slowly. In clear water the ship steamed thirteen knots an hour, but here, with the same pressure, she made no more than five knots.

We were then in the vicinity of the Funk Islands, but had lost sight of land.

At noon this day, March 13th, the ship's position was 22 miles north by east from the Funk Islands. During the afternoon we passed numerous "bobbing holes" where seals had been to the surface for breathing which were good indications of whitecoats being in the vicinity.

Two different types of seal are hunted: they are the Harp Seal and Hood Seal. The young Harps are always referred to as "Whitecoats" because of their white

The "Florizel" Jammed.

furry coats, and are the most sought after.

Towards evening a strong breeze came up from the W.S.W. with driving snow, and the ice became heavier. The ship was stopped at 7 p.m. for fear of passing a patch of seals and missing them in the night. The "Bellaventure" stopped also about half a mile to the eastward.

A wireless message came from Captain "Joe" of the "Eagle," who was making a western cut, reporting the ice very heavy there and progress very slow. They had seen a few old seals.

We started again the next morning, March 14th, at 4.30 a.m. The ice was very heavy and a great deal of butting was necessary. Many times the ship came to a dead stop with engines working at full speed ahead. At 6.30 p.m. the ship jammed in heavy ice and could move neither ahead nor astern with all her 2,300 horse-power, and was only freed after continuous working for four hours at "Prizing" and "Blasting," which necessitated seven kegs of powder, each keg thirty pounds, being used.

The next day, Tuesday, came in splendidly. The sun shone brightly over a frozen ocean and the sky was a clear blue. The icefields appeared to be absolutely solid, not a break or a lane could be seen anywhere, and there seemed little hope of making headway through it. The "Bellaventure" was alongside, and the two ships commenced working together, ahead and astern all day.

The ice was not so heavy the next day, and we made better progress. We were steaming N.N.E. in line, and continued north until the latitude of Belle Isle was reached, and finding no seals there, turned south-east. At three o'clock in the afternoon, a wireless message came from the "Eagle" saying their men had just returned from a long walk to the westward, where they had seen thousands of old seals cleaning themselves. That was a good sign of young seals being in the vicinity. The news was passed to the "Bellaventure" by megaphone, and both ships steamed in that direction. The "Beothic" and "Bonaventure," which had been following us all day, went away in a different direction. At noon we were 90 miles from the "Eagle," in latitude 51·58 N. and longitude 53·14 W. During the afternoon we passed several scattered families of Hood Seals. The next morning was very foggy, and at eight o'clock, after steaming all night, we were not more than sixteen miles from the "Eagle's" position. Seeing no sign of seals in the vicinity, and that further progress in that direction was useless, our courses were changed to E.S.E.

The fog continued with drizzling rain, making it an impossibility to see more than a few yards from the ship.

At 11 o'clock the "Bellaventure" stopped and a man was seen to jump out on to the ice and capture a fine large whitecoat. This caused some excitement, as whitecoats are seldom found away from the patch. Twenty minutes later they were thick around us. They might have been seen hours ago but for the fog, and we might have missed them had we not steamed right into their midst. They laid around us in thousands and their cries could be heard in all directions.

Before the ship was stopped the Captain shouted, "All hands out!" and immediately 160 men were clambering down the sides and on to the ice. Two or three watches (each watch consisting of 30 or 40 men under the control of a master) commenced killing close by. Other watches went further away to work and were lost to sight a few yards from the ship in the fog.

A westerly gale sprung up in the afternoon and cleared the fog. At 7 p.m. the ship was stopped for the night. Whitecoats could be heard bawling on the ice all night, and by moonlight the old seals could be seen roaming around looking for their young.

A message had been sent to the "Eagle," giving the position of the patch, and she steamed toward us all day, though her progress was slow through heavy ice. She stopped about twenty miles from us at 8 p.m. and reported seals around her.

Next day, Friday, March 18th, our men left the ship at daybreak; they had a three-mile walk over the ice to another patch where they made a big kill. The ship was jammed all day, and remained in the same position overnight.

At daylight the men left the ship again and went away in single file over the ice.

The next day was Sunday and no seals were killed.

Another wireless message came from the "Eagle," which indicated that seals were very plentiful in her vicinity

Killing commenced again at daylight on Monday. Whitecoats were about in thousands.

During the afternoon we steamed through several miles of rugged and rafted ice which made a beautiful sight.

The next morning there were over 600 men in sight killing seals. They constituted the crews of four ships, the "Bonaventure," "Bellaventure," "Beothic" and "Florizel."

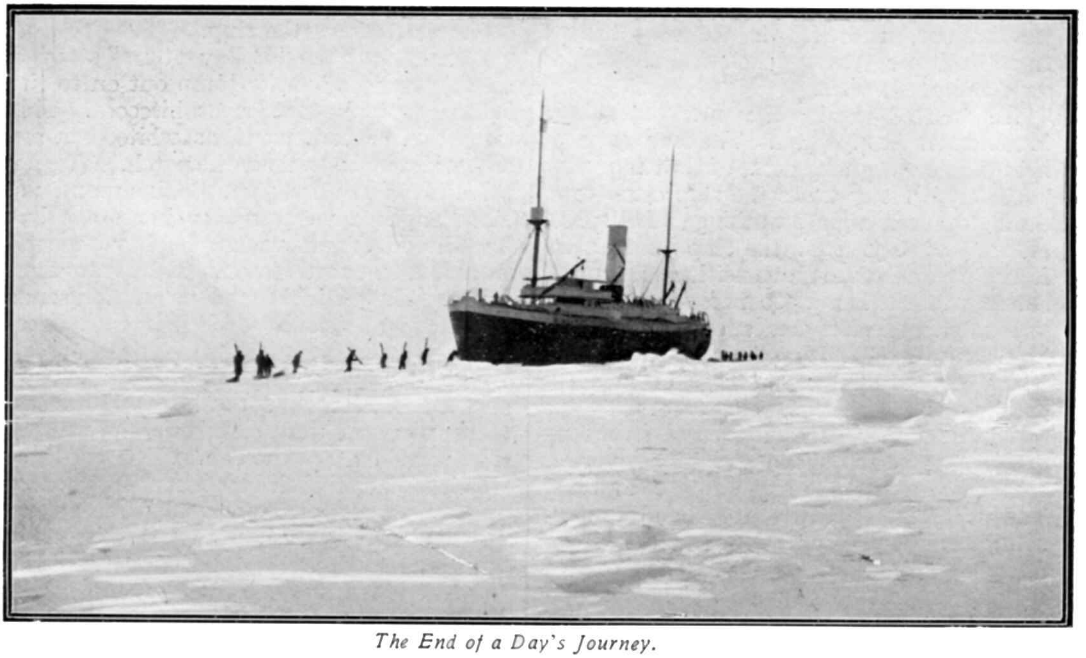
From the barrel aloft could be seen smoke from the "Adventure" to the eastward, and just above the sou'west horizon appeared the wireless spars of the "Eagle."

A wireless message came from the "Eagle" reporting that her rudder had been unshipped by rafting ice, but was reshipped after three hours' hard work.

On March 29th (Monday) several of the wooden ships were around us with their men at work on the ice. Lines of men tramping and groups of men killing could be seen in all directions.

Great rejoicings were held on board after the day's work was finished on Tuesday, March 30th. We had on board the pelts of 43,000 seals; all previous records for one ship were thus beaten.

The remainder of our pelts were picked up on Wednesday morning, and the total amounted to 49,000. By 3 o'clock that



The End of a Day's Journey.

afternoon our work with the seals was practically finished.

When all were safely aboard, with flags flying and men cheering, we headed for St. John's, on April 1st, and made very good headway through the ice homeward bound.

We left the icefields on Friday morning, and forty-nine blasts of the whistle were given as we passed Cape Bonavista to tell them we had 49,000 seals.

Just before 4 o'clock in the afternoon we rounded the North Head and entered St. John's Harbour.

It was a case of "See the Conquering Hero Comes." The news had preceded us, and the shores and wharves were lined with hundreds of people.

The whole fleet had returned by the first week in May, and the total catch amounted to over 300,000.

NEW PATENTS.

A patent, numbered 4910, of 1910, for an improved method of overcoming the effect of atmospherics or X's on receivers has recently been granted to Marconi's Wireless Telegraph Co., Ltd., and Mr. C. S. Franklin.

The opposition method of eliminating objectionable signals is now well known and consists of two receiving circuits, one tuned to the wave length of the signals which it is desired to receive, and the other to a slightly different wave length, the detectors in these two circuits being connected in opposition to the telephones. With this arrangement signals of the right wave length produce a much more powerful effect on one detector than on the other and can therefore be heard in the telephones, while signals of all other wave lengths produce almost equal effects on the two detectors and therefore no sound in the telephones.

In the present invention two tuned detectors are placed in the same circuit and the receiving system is given two natural wave lengths by inductive association with a closed oscillation circuit, thus producing the same effects as if the detectors were in two differently tuned circuits. The advantage of this arrangement is that powerful X's, whatever their wave length, set the receiving circuit oscillating at its natural frequencies and therefore produce little or no effect upon the telephones, while signals which effect one detector more than the other are heard with only a slight diminution of strength.

The Post Office Electrical Engineers' Journal, commenting on the recent action brought by Mr. Marconi and his Company against the British Radio-Telegraph and Telephone Company, says: "As is usual in litigation proceedings on patents, the defence attacked the validity of the principal patent at issue, but the fight mainly turned on questions of oscillation transformers and their equivalents, together with questions of strong and weak couplings. Mr. Marconi was given what is practically an unqualified verdict. A decision, so definite in its terms, and conveying so broad an interpretation of the Marconi tuning patent of 1900, necessarily affects the position of the smaller fry of wireless telegraph concerns very seriously, perhaps the more so as they are now between the devil and the deep sea, being bound on the one hand by the judgment given, and on the other by the restrictions as to character of transmitting appliances imposed by the Postmaster-General in conformity with the regulations of the International Radio-Telegraph Convention. The first demands that the broadly interpreted Marconi patent be not infringed, whilst the latter practically insists on a method of syntonic transmission, embracing modern practice in syntonisation of the circuits being used. The whole case was closely argued out, and the written judgment forms an interesting and instructive document which should serve to throw light on the legal view of the wireless telegraph position generally, and form a useful guide for future reference."

The Egyptian State Telegraph Department have placed an order with the Company for the installation of Marconi apparatus on board the yacht "Mahroussa," belonging to H.H. the "Khedive." The plant will be a standard 5 K.W. ship set, which will give the yacht a working range, under normal conditions, of about 350 miles over sea. The installation will be completed in about six weeks time.

MARITIME WIRELESS TELEGRAPHY.

THE Marconi International Marine Communication Company continues to make good progress in the Mercantile Marine, and additions are being made daily to the number of boats which already send and receive wireless messages at sea. The month of April saw the fitting of the Booth Line's Royal Mail Steamers "Denis" and "Hildebrand," which run between Liverpool and Brazil. The "Hildebrand" is the latest addition to the fleet, and lett Liverpool, April 19th, on her maiden voyage to North Brazil, calling at intermediate ports in France, Portugal, and Madeira. The Booth Steamship Company, Limited, has long been identified with the rapid progress of the Amazon ports of Para and Manaos.

Of Messrs. Elder, Dempsters Company's express boats, running between Liverpool and West Africa, the SS. "Karina" is the latest to be fitted with the Marconi Company's Standard Plant. This vessel is the second on the African service to be fitted with wireless apparatus, but it is the intention of the owners to have all their express steamers on this route similarly equipped.

The Compania Peruana de Vapores y Dique del Callao Company's SS. "Pachitea," trading on the West Coast of South America, was also fitted.

There are now quite a number of vessels trading to and from the Clyde, which have wireless installations on board, and we may now add the "Tritonia" and the sealing vessel "Seal," which were both equipped during the month of April. The "Tritonia," which belongs to the Donaldson Line, runs between Glasgow and Canada; while the "Seal" is a new vessel built for the sealing trade, and is owned by Messrs. J. A. Farquhar and Co.

The SS. "Athenic" of the Shaw, Saville and Albion Line, with a service between London and New Zealand, *via* the Cape; and the SS. "Andorinha," owned by Messrs. Yeoward Bros., running from Liverpool to Lisbon and the Canary Islands, were similarly equipped during that month, together wlth the SS. "Volturno" and "Campanello" of the Uranium Steamship Company, having a service between Rotterdam and New York, *via* Halifax.

The SS. "Leicestershire," of the Bibby Line, made her first voyage since being fitted with wireless apparatus on May 4th. She sailed from Liverpool for Egypt, Colombo, Southern India (*via* Tuticorin), and Rangoon. Four other boats in this service, belonging to Messrs. Bibby Brothers, will be fitted on their arrival back in port; while the SS. "Oxfordshire," which is now being built, will also be equipped.

Orders have been received for the equipment of five of the New Zealand Shipping Company's vessels, viz., the "Ruahina," "Ruhapehu," "Rotorua," "Turakina," and the "Remuera."

The SS. "Cæsarea" and "Sarnia," of the London and South Western Railway Company's cross channel boats, are expected to be fitted at the end of the present month. The same Company have also given instructions for the equipment of two more of their Channel boats, now building.

* * * *

La Compagnie Generale Transatlantique of Paris have entered into contracts with La Compagnie Française Maritime et Coloniale de Telegraphie sans Fil, for the installation of Marconi Apparatus on 14 additional vessels of its fleet, which are as follows:—

MEDITERRANEAN BOATS.

"Maréchal Bugeaud," "Eugene Pereire," "Duc de Bragance," and "Ville d'Alger."

ATLANTIC BOATS.

"St. Laurent," "Hudson," "Californie," "Louisiane," "Quebec," "Montreal," "Abdel-Kader," "Virginie," "Mexico," and "Caravelle."

The French Company has also concluded the arrangement for the equipment of the SS. "Medgerda" and "La Marsa," for La Compagnie de Navigation Mixte.

* * * *

The Marconi Wireless Telegraph Company of America recently completed the installation of a wireless set on the S.Y. "Noma," which is owned by Col. Astor.

Mr. Robert W. Todd is having a three-masted schooner yacht built named the "Karina," which will be similarly equipped.

A 2 K.W. 480 Cycle Ship Set has just been supplied to the Canadian Government for the C.G.S. "Kestrel."

The Marconi Wireless Telegraph Company of Canada, Limited, is extending its business on the great lakes. A station has already been erected at Port Arthur, Ontario (the head of the lakes), and it is hoped before the end of the summer to have a complete chain of inter-communicating stations between Montreal and Port Arthur.

The Company has completed contracts with the Canadian Towing and Wreckage Company, Limited, of Port Arthur, for the equipment of three of their vessels, namely the "Imperial," "Luddington," and "Empire"; and with the Northern Navigation Company for the equipment of their steamers "Hamonic" and "Huronic," the two latter being among the largest and finest boats on the great lakes.

The stations at Heath Point, Anticosti, and Fame Point, Quebec, were reopened on May 1st, the Government Icebreaker "Montcalm" taking men and supplies to the stations from North Sydney. All the stations from Cape Race to Montreal are now in operation.

* * * * *

The Reid Newfoundland steamer "Invermore" was recently equipped with the Marconi Apparatus by the Marconi Wireless Telegraph Company of Canada, Limited This vessel takes the place of the SS. "Bruce," recently wrecked near Louisburg, Cape Breton, on the Canadian Newfoundland service plying between North Sydney, Nova Scotia, and Port aux Basques, Newfoundland.

* * * * *

Arrangements have been made with the Italian Ministry of Posts and Telegraphs, whereby ships of the Deutsche Betriebs-Gesellschaft für drahtlose Telegraphie, equipped with Marconi Apparatus, may continue as they have done in the past—to correspond with Italian coast stations at the old tariff; while those ships of the D.E.B.E.G., not fitted with Marconi Apparatus, will be allowed to communicate with Italian coast stations on and after the 1st June, 1911, when a new Convention will come into force.

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A 2 K.W. set has been installed on board the Norwegian Cruiser "Troll." With the mast facilities on board, a normal working range of about 150 miles will be obtained.

Compulsory Wireless Telegraphy on Board Ship.

In our last issue we referred to the passing of an Act by the Senate and House of Representatives of the United States making the installation of wireless apparatus on ocean-going vessels compulsory. The following is an extract from a notice subsequently issued by the Department of Commerce and Labour :—

The Berlin Convention has been ratified by the following nations and provinces :

The United Kingdom and British South Africa, Germany and all German Protectorates, France, Norway, Japan, the Netherlands, and Dutch Indies, Russia, Sweden, Austria-Hungary, Spain, Denmark, Belgium, Brazil, Turkey, Portugal, Roumania, Mexico, Bulgaria, Persia, and Tunis.

Wireless operators, holding valid certificates, issued by the governments named above, will be recognised as persons "skilled in the use of such apparatus" within the meaning of the Act cited, unless in the case of a specific individual there may be good reason to doubt the operator's skill and reliability. Such certificates should be ready at hand for the inspection of Customs or other officers before the ship departs from the United States.

Methods of assuring the skill of other operators will be the subject of another regulation. Generally speaking, an operator to be "skilled" within the meaning of the Act should be able—

(*a*) To send on an Ordinary Morse Key for five consecutive minutes at not less than twenty words per minute, five letters being counted as one word. The accuracy of signalling, the correct formation of the letters, and the correctness of spacing will be taken into account.

(*b*) To receive and write legibly at the prescribed speed from a double head gear telephone receiver as ordinarily used for radio-telegraphic reception.

(*c*) To understand simple diagrams of the electrical connections of the apparatus.

(*d*) To be able to connect up the apparatus.

(*e*) To name the principal parts of the apparatus and indicate their use.

(*f*) To mention the most common faults, and the means usually taken to remedy them.

(*g*) To explain the steps taken to change from one wave-length to another, in sending and receiving.

(Signed) CHARLES NAGEL,
Secretary.

Panic Averted by Wireless.

Great excitement was recently caused on the American shore when, in a dense fog, the steamer "Prinzess Irene," with 1,724 passengers on board, struck on a sand bank opposite Lone Heel Life-Saving Station, near Fire Island, about 40 miles east of New York.

Immediate aid was rendered in response to the C.Q.D. call sent out by the Marconi operator on board; but, notwithstanding the continued efforts to relieve her, the "Irene" remained in the same position for two days, during which time wireless messages were freqeuntly exchanged between the passengers and their friends on shore.

Over 10,000 words passed through the Marconi Station at Sagaponack.

* * * *

At the forty-sixth annual meeting of the Liverpool Training Ship "Indefatigable," it was stated that quite a number of boys are becoming efficient in wireless signalling, and several have already gone to sea as assistant operators, and have given every satisfaction.

MARCONI FIELD STATION APPARATUS.

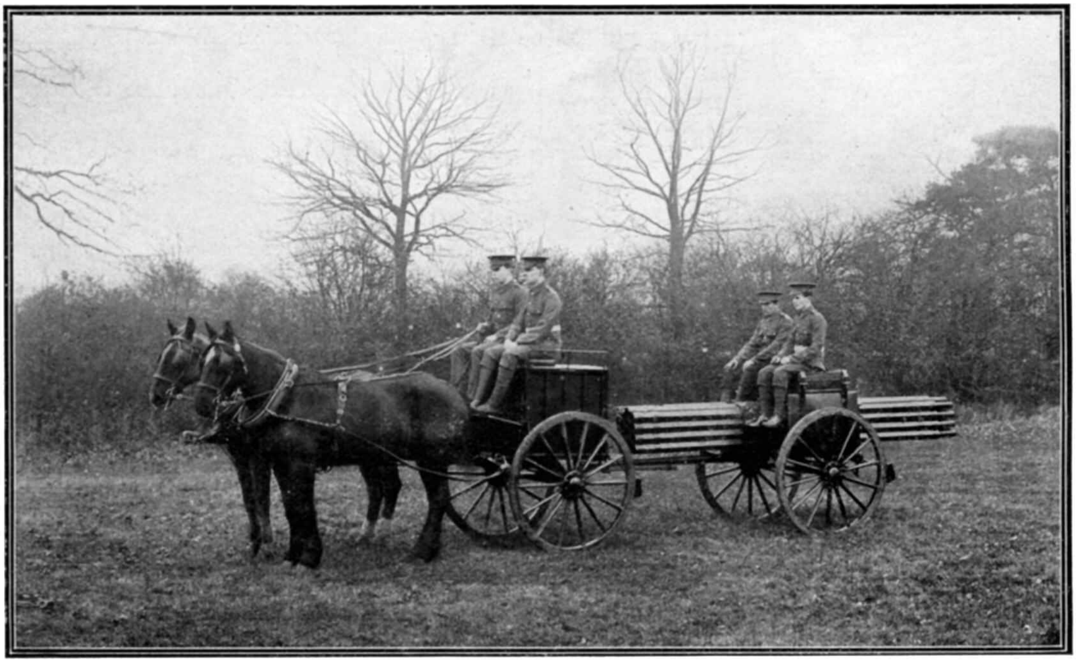
Since the publication of our last issue, in which we referred to the tests of the new 1½ K.W. portable military stations, a further series of trials have taken place between Broomfield (Chelmsford) and Grantham, a distance of 95 miles. The results proved to be eminently satisfactory, and the proceedings were watched by certain members of the War Office. A station was next erected at Selby, Yorks., and communication continued with Broomfield, a distance of about 136 miles.

The test over this increased distance proved to be equally satisfactory.

Finally the Selby station was moved to Northallerton (Yorks.), where thoroughly reliable communication was immediately established with Broomfield, a distance of about 200 miles.

Cavalry Sets for India.

The Indian Government recently placed orders for two of the Marconi new type of cavalry set. They are intended to be used by the sappers and miners for field telegraph work.



Marconi Operators with Apparatus on the road.

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