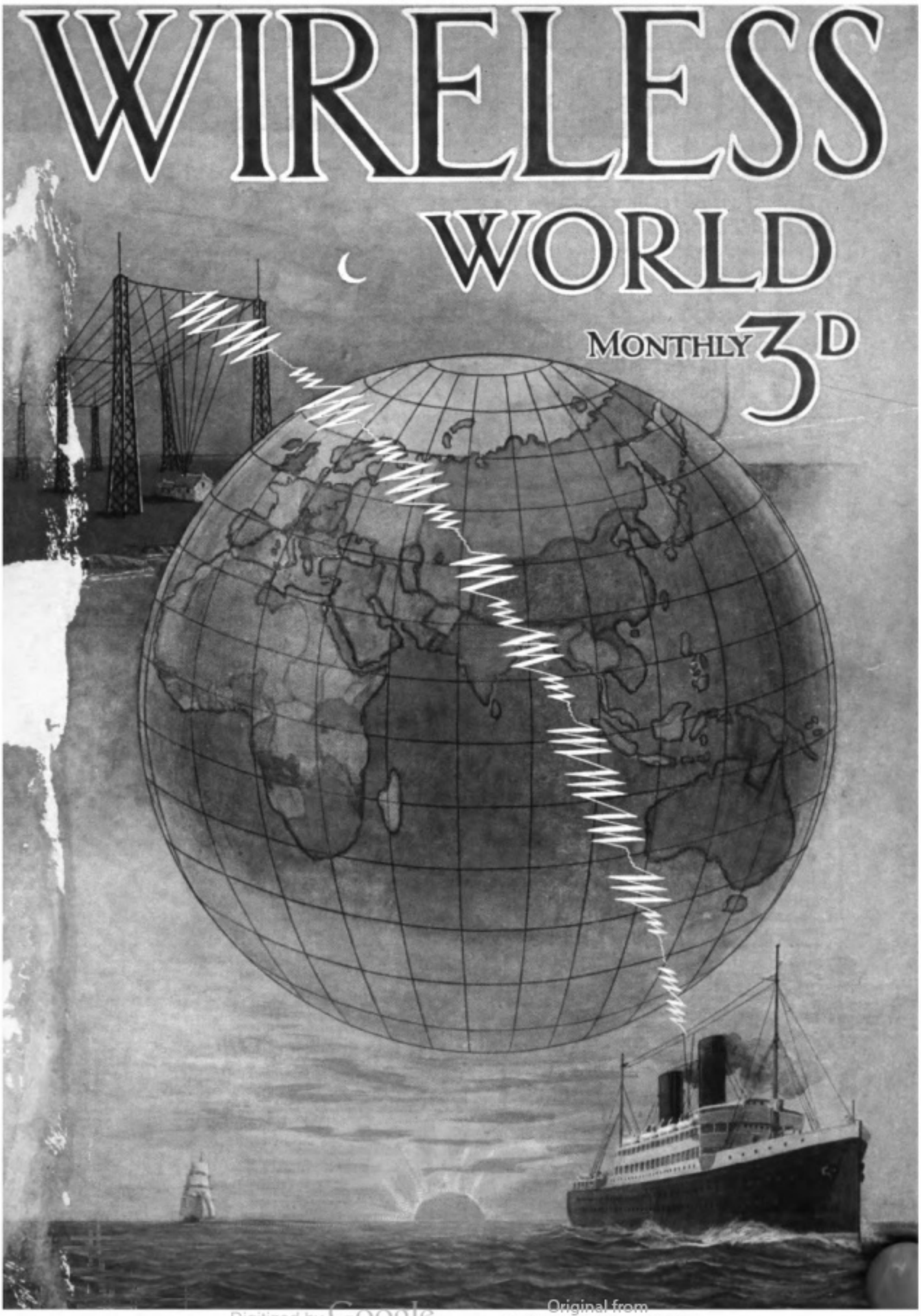

The Wireless World.

With which is incorporated "The Marconigraph."

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

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THE
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Wireless Telegraphy on Trains

THE experiments with wireless telegraphy on trains which have been conducted for some weeks on the Lackawanna Railroad received its first practical test on November 24th, and judging from the press accounts it is amply justifying itself already. The Lackawanna Limited, the only train in the world to carry wireless, was running at fifty miles an hour thirty miles east of Scranton, Pennsylvania, when a conductor of the train fell ill. In the ordinary way considerable delay would have been necessitated by a change of conductors, but in this case a wireless message was sent ahead to Scranton, and when the train arrived there an emergency man was waiting, and the disabled conductor was able to leave his post and consult a physician without delay. Wireless saved still another loss of time when word was sent ahead that the train was so crowded that another Pullman carriage was required. Mr. L. B. Foley, Superintendent of Telegraphs, who was on board the Limited, predicted that the day was not far distant when every train and railway system in the world would be equipped with wireless. "As a means of preventing accidents," said Mr. Foley, "I think wireless will prove of the greatest value. In the Underground at New York, for example, the train despatcher sits in his room, and by the flashing of lights knows exactly where every train is. If two trains get dangerously close together, he can send a signal that will almost instantly stop one or both of them. I believe that the same thing can be done on the railroads with wireless."

On the second day, November 25th, another distinct point was registered in the applications of wireless telegraphy when, for the first time on record, news bulletins taken by wireless were displayed on a moving train. The New York correspondent of the *Daily Telegraph* says that the results of the first day's practical test were so encouraging that officials made arrangements for a news service which is unique in history. Passengers on the train were astonished to see the latest foreign and home despatches spread before their eyes as they were being whirled along at sixty miles an hour. Messages from Scranton gave passengers the latest news of the Mexican situation, the stock market quotations, the White House wedding, etc. Several travellers sent messages to their friends telling the exact position of the train and the time of arrival at their destination. We have already published information relating to this interesting experiment which promises so much in regard to safety on railways, and in an early issue we hope to supplement this information with the results of the working of the system. The work was carried out by the American Marconi Company.

MR. E. J. NALLY.

Personalities in the Wireless World

MR. EDWARD J. NALLY

Vice-President and General Manager of the Marconi Wireless Telegraph Company of America.

THERE are few more interesting personalities in the wireless world than Edward J. Nally, the recently appointed Vice-President and General Manager of the Marconi Wireless Telegraph Company of America, for his life is an unbroken record of splendid achievement and remarkable ability. Most of us learn by failure the lessons that promote success, but Mr. Nally is not of this category. A beneficent fate endowed him with all the talents, and though he started life without worldly advantages, he has steadily climbed step by step up " young ambition's ladder," and now has attained the topmost " round." Yet it can never be said that at any time has he spurned " the base degrees by which he did ascend," and it is his sympathy with all those in the subordinate positions which once he himself occupied that makes him one of the most loved of America's great business men.

Born in 1859 of Irish parents, the young Nally spent most of his boyhood in St. Louis. His father, who had emigrated from Ireland when still a young man, had prospered exceedingly, and for many years was a man of influence and position in his adopted city ; but while Mr. Nally was still a little boy, a succession of business reverses set in, and the family was brought to the verge of destitution, so that the early years of young Nally's life were absorbed in a struggle to make ends meet. Here the grit of the boy made itself apparent. No chances of turning " an honest penny " were ever missed, or work, even of the most arduous description, shirked. But the crowning misfortune was the failure of his father's eyesight when Nally was still only eight years old, and the boy was obliged, in order to keep the home together, to work as a cash boy in a departmental store for the magnificent wage of thirteen dollars a month. When he was sixteen he entered the Western Union Telegraph Service as a messenger boy. In 1878 he was given a junior clerkship, and later he held several higher positions in the Western Union.

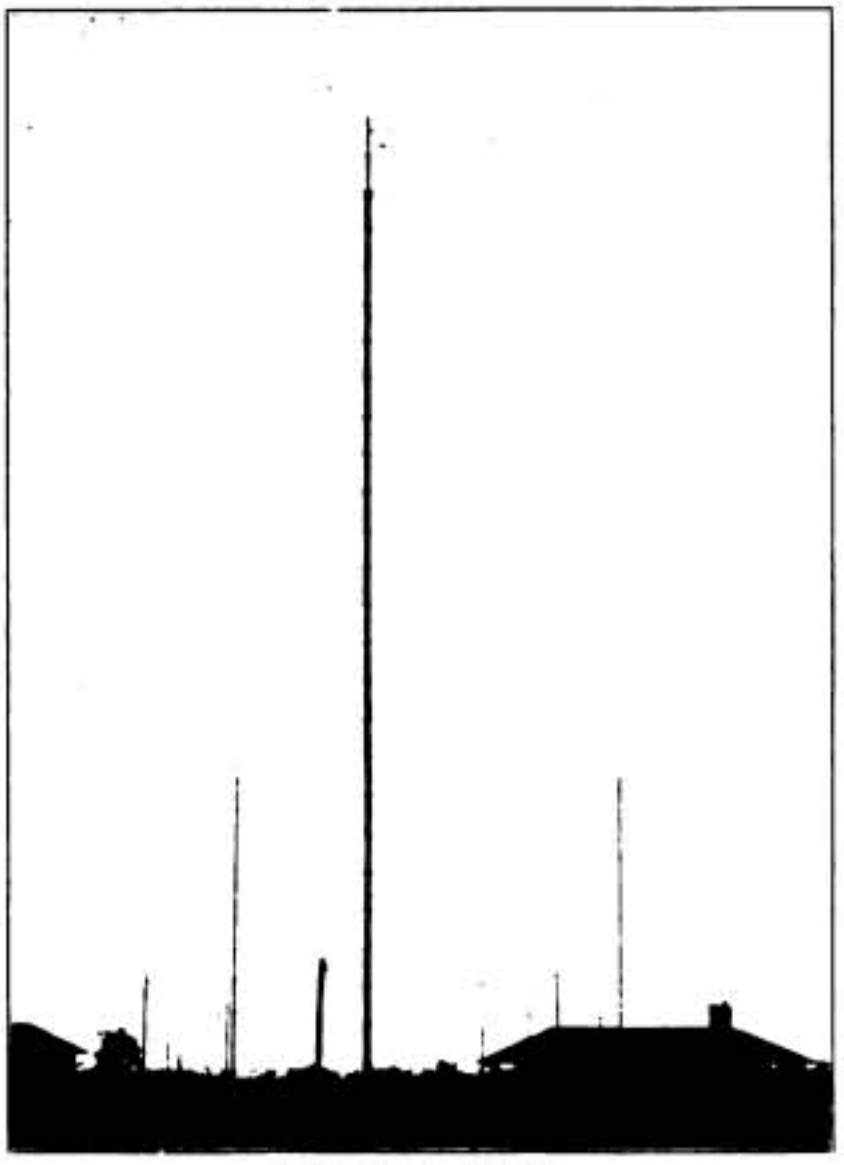
But the time of the flood-tide in his career was approaching. A few years later he was offered an appointment with the Great North Western Telegraph Company, and became their superintendent at Minneapolis. In 1890 he became assistant general superintendent at Chicago. Within a year he was made general superintendent ; five years later, vice-president, director and member of the executive committee with headquarters in New York ; finally, on April 11th, 1904, his forty-eighth birthday, he became Vice-President and General Manager, which position he continued to hold until his retirement a few months ago. In transferring his interest to the Marconi Company, his object was to identify himself with a movement which he knew would have a permanent influence on the world's progress.

But enthusiastic man of affairs as he is, Mr. Nally has yet found time for other interests. In 1897 he married Miss Lee Warren Redd, of Lexington, Ky., and is the devoted father of a son and daughter. He has a beautiful home at Ossining-on-the-Hudson, the house commanding the splendid sweep of the river at this point, His greatest hobby is his library and collection of rare prints and etchings, over which he has spent many of his pleasantest hours ; for he acquired a rare taste in mezzotints and engravings while he was yet a boy, when night after night at the close of business he he used to visit an old book and print shop in Ninth Avenue, St. Louis, where the proprietor allowed him to rummage to his heart's content, and gave him full value for his few odd cents saved each day by walking to and from work.

Wireless in Equatorial Borneo

By S. F. KOS.

BALIKPAPAN AND TARAKAN STATIONS. SUCCESSFUL EXAMPLE OF WORKING IN THE TROPICS. WHY THE STATIONS WERE REQUIRED. LIFE IN THE OILFIELDS.



Balikpapan Station.

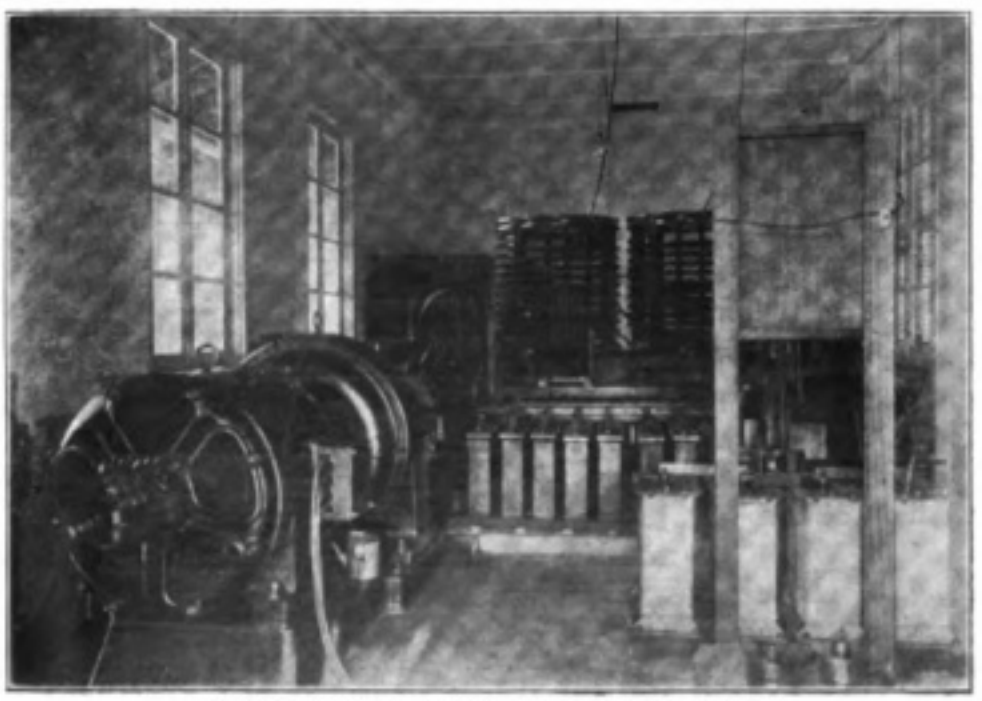
THIS article deals with two modern Marconi wireless telegraph stations, one a medium-power and the other a high-power station, which have been erected at Tarakan and Balikpapan, in Dutch East Borneo. The stations were built for the Bataafsche Petroleum Company. This company obtained a licence from the Postmaster-General for the Dutch East Indies, and placed a contract for two suitable stations with the Marconi Company. In granting the licence the Government made the stipulation that the station at Balikpapan must be made capable of working with other stations at Sitoebondo, on the Isle of Java, and Timor, on the Isle of Koepang.

The station at Balikpapan is situated 116° 52′ E, 1° 15′ S., and the station at Tarakan is on a little island off the mainland, 117° 38′ E., 3° 20′ N.; the distance between the stations as the crow flies is 278 nautical miles (516 kilometres), and the intervening country is of a most unfavourable nature from a wireless point of view. This was not by any means the first time, however, that the Marconi Company had to contend with tropical conditions. Past experience stood in good stead for the design of these two stations, which have given full satisfaction from the moment they were put into operation.

At Tarakan, where no sufficient supply of electrical power was available at the time the stations were being erected, a 29 h.p. oil engine was installed as prime mover. This engine drives by belt an alternating current generator, with an output of 13 kilowatts normal, at a pressure of 1,000 volts, and a frequency of 200 periods. Mounted on the same shaft as the alternator are a small continuous current dynamo (which supplies current for the excitation of the alternator, a small blower motor, and a "signalling switch") and the Marconi Rotary Disc Discharger. The current from the alternator is transformed up by a static transformer to a potential of 13,000 volts, and this high tension current is used to charge a condenser, consisting of 24

Standard Poldhu Units, in earthenware containers, connected 12 parallel and 2 series. The oscillatory discharge of this condenser takes place through the primary of the jigger, or oscillation transformer, and across a double spark gap at the rotary disc. The jigger is of the open type, providing air cooling and a maximum facility for varying the coupling between primary and secondary. The rotary discharger carries a number of studs which have a definite relation to the periodicity of the alternator, thus producing a spark frequency of 400 per second. A spark of this nature gives forth a good sounding musical note of just the right pitch for telephonic reception at the receiving station. "Higher" notes are sometimes employed, but it is doubtful whether they are as good for "continuous" work, as the human ear soon tires through listening to these notes for prolonged periods, often losing all sensitiveness for reception of weak signals. Another feature of this form of discharge is its quenching action: the spark takes place between two electrodes, which are fixed but for a rotary movement about their own axis (for cooling and equal wearing purposes) and the studs on the periphery of a rapidly rotating disc. The result is that the spark exists just long enough to give a powerful impulse to the primary oscillating circuit, and thus through the coupling of the jigger to the radiating aerial; but there is no time for the formation of an arc, the resistance of which would cause a big decrement in the amplitude of the waves and give rise to other harmful phenomena. The waves thus radiated are but feebly damped; they possess all the advantages of "continuous" waves produced, say, by an "arc" system of radiotelegraphy, without any of the disadvantages. For instance, their detection and reception does not necessitate the use of a "ticker" to split the waves up into groups of a frequency audible to the human ear. Signalling is effected by means of an ordinary operating key, such as is used in the Post Office; this makes and breaks a circuit which actuates a relay; this relay operates a lever carrying two contacts which make and break the 13,000-volt circuit. The arc which forms at these contacts on breaking is destroyed by means of a small electric blower. The aerial is of the semi-directional type and is suspended between three masts, one of 260 feet high and two of 150.

Balikpapan—the Station Building.



The Transmitting Room at Balikpapan.

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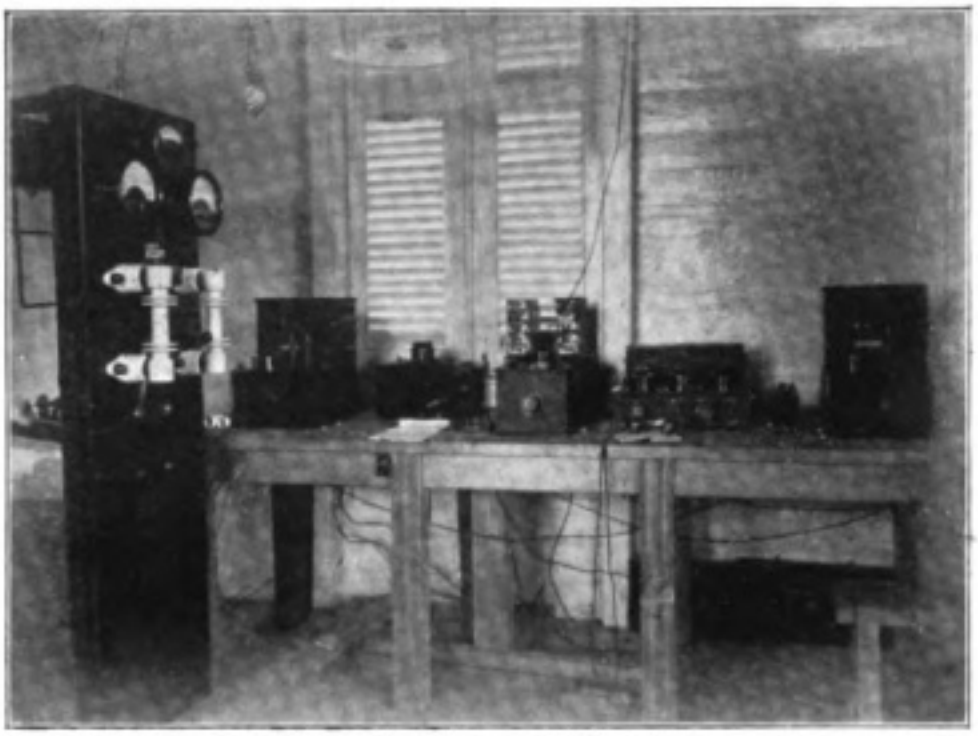


Receiving Room at Tarakan.

The plant at Balikpapan is substantially the same as that at Tarakan, except that every part of the installation is larger in proportion to suit the higher power that is being dealt with at this station. The alternator has an output of 30 kilowatts normal at a pressure of 2,000 volts and 200 frequency. Electric power being available at Balikpapan, the alternator-disc combination is driven by a direct coupled electric motor, which receives current from a two-phase supply at a pressure of 2,000 volts per phase. On full alternator output this motor takes 42 kilowatts. The condenser battery at Balikpapan consists of 60 Poldhu units, connected 20 in parallel and 3 in series. The power normally used for communication between the two stations is only about 10 kilowatts (alternator output).

The aerial system at Balikpapan is also different from that at Tarakan on account of the extra requirements with regard to communication with Sitoebondo and Timor Koepang. It is of the multiple wire twin-T type, supported between five masts, one 260 feet high, and four 220 feet. All the masts at Balikpapan and Tarakan are sectional steel structures, with wooden topmasts.

Having described the plant at these wireless stations, and before passing to a summary of the actual performances of the stations, a little may now be said with regard to the demand for communication by wireless telegraphy in such an out-of-the-way part of the world. The most important settlement on the east coast of Borneo is Samarinda, and as a sort of "anti-climax" we may next mention Berouw and Boelongan. Coal is found in considerable quantities at Berouw, and for the rest the industry at all these three centres consists chiefly in the export of tobacco, sugar-cane, fruit, copra (*i.e.*, flesh of the coconut), etc.

But there are several other settlements along the coast where the sole industry is the boring for oil and kindred undertakings, distillation of petrol, the gaining of paraffin wax, candle manufacturing being amongst the principal. The industries here are practically controlled by the Bataafsche Petroleum Company, and nearly all the inhabitants are in the employ of the company. The head offices for the Indies of that company are at Batavia, whence the various undertakings throughout the Indies are controlled. But for Borneo only, the headquarters are at Balikpapan. Here are all the "works" necessary for cleansing and separating the products which are gained from the wells in the various districts, also numerous large tanks for storage.

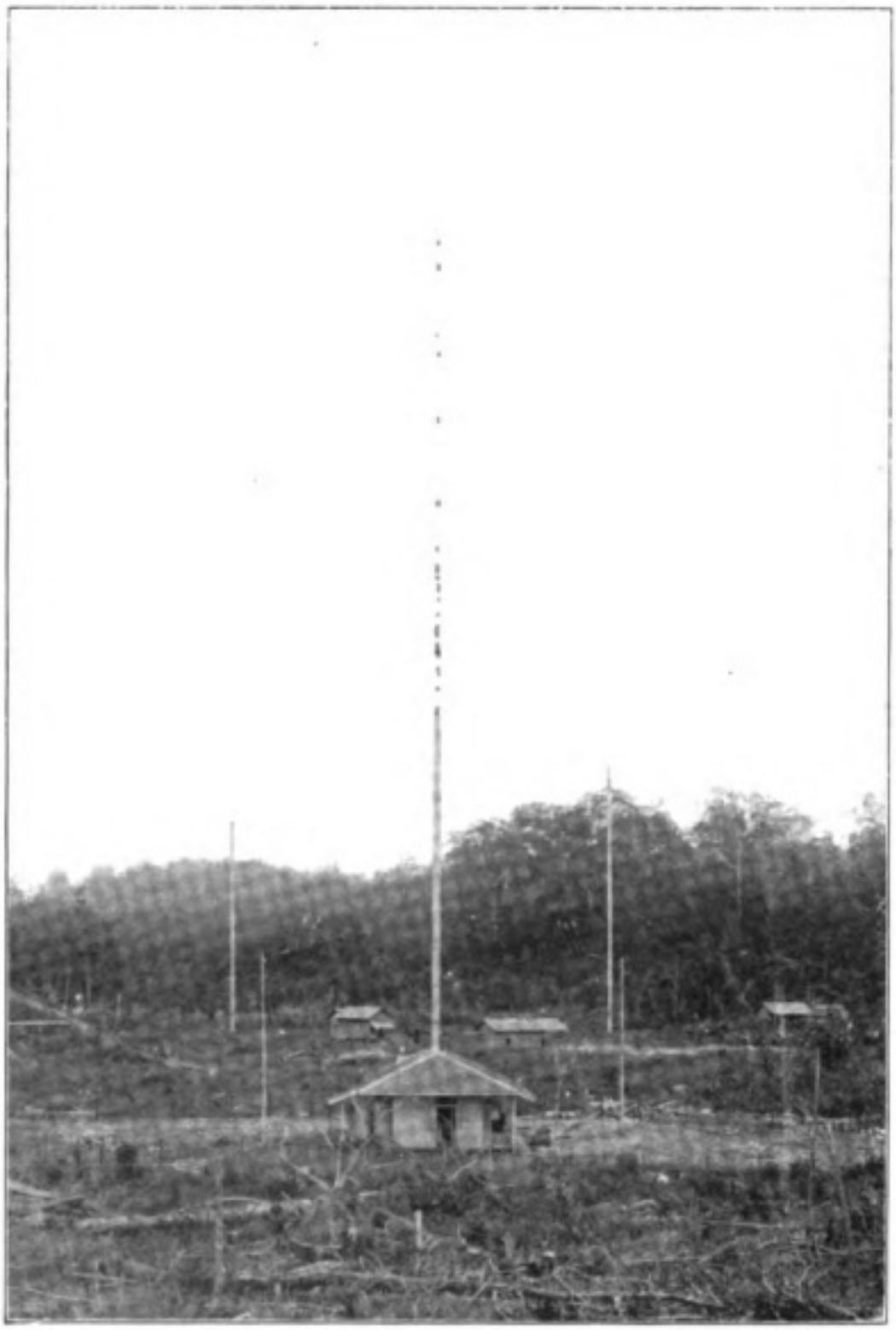
The "white" population does not number more than about three hundred; but the male portion of this small community controls some thousands of Chinese, Javanese, Malays and Lascars.

Balikpapan is connected with Samarinda by telegraph line and by cable with the other islands of the Archipelago and the Continents. The town enjoys a good service of steamers from the Paketvaart Company and other transport lines. The Bataafsche Petroleum Company also own a number of small cargo steamers and two steam yachts. These vessels call at most of the settlements of the Company, but some of these, nevertheless, are quite isolated. This certainly applies to Tarakan,

one of the most important centres of operation of the Company, where the Paketvaart Company's steamers call about once in three weeks.

Although Tarakan does not boast many "spouters," there are a great number of pumped wells, regularly producing an amazing quantity of crude oil, which is nowadays in so great demand for fuel for boiler furnaces and crude oil engines. This oil is mainly transported by tank steamers, which call first either at Balikpapan or at some other port in telegraphic communication with Balikpapan, so that the latter is always advised by telegraph of the prospective sailings and calls and requirements of these tank boats. The sailings and the amount of cargo required are never regular, so that formerly much time was wasted. But now that there is an efficient wireless communication between the two places, Tarakan is regularly advised of the callings of any steamers and the amount of cargo required by them. Balikpapan on the other hand, is kept informed as to the exact state of the production at any time, and can make arrangements accordingly. There are, of course, many other reasons why a prompt and rapid means of communication is here so very desirable, such as movements of the staff, provision of stores, machinery, workshop materials, etc.; but quite apart from any business considerations it must be a great relief for the handful of Europeans at Tarakan (there are only about twelve of them amongst hundreds of coolies) to know that they can communicate with Balikpapan to summon aid if there be need of it at any time.

But why was wireless chosen as the means of telegraphic communication? Principally on account of its reliability and facilities for upkeep, as well as for considerations of cost. If it were even possible, the laying of a cable from Tarakan to Samarinda would



View of Tarakan Station.

have entailed enormous expense, and the upkeep would have been another big item.

The erection of the stations was completed within six months after the delivery of the plant. Balikpapan commenced working on February 1st, 1912, and during the fortnight following, tests were carried out with the station at Sitoebondo, which was completed almost simultaneously. These tests were quite satisfactory. About a month after Tarakan was also working, and April saw the stations in regular communication. The first few weeks were occupied in making tests for tuning, etc., messages for the Bataafsche Petroleum Company being exchanged, though not yet officially. From May 3rd until June 3rd an official service was carried on between the two stations by the Marconi Company for the Bataafsche Petroleum Company, to demonstrate the efficient working of the stations previous to their being taken over. This service was very satisfactory, numerous messages being exchanged, amounting to as many as 5,000 and 6,000 words per day, the official hours being from 9 a.m. till noon, and 3 p.m. till 6 p.m. Among the messages exchanged was some of the most difficult matter for any telegraphic concern to handle.

The stations were then taken over by the Bataafsche Petroleum Company. Two operators from the Marconi Company entered the service of the Bataafsche, and these gentlemen have since been operating the stations successfully. They are assisted in their work by native attendants only. Both the stations are under the control of Mr. A. G. Hendrikse, of the Petroleum Company, and in a recent communication he states that "the service continues to give every satisfaction."

Communication between Balikpapan and the stations at Sitoebondo and Timor Koepang, distances of, respectively 460 nautical miles (853 kilometres) and 672 nautical miles (1,247 kilometres), was easily established and maintained. Signals from Balikpapan are reported to have been heard at Sabang, about 3,000 kilometres distant, and in the Philippines.

Certain steamers of the Paketvaart Company are now also equipped with the Marconi System, and the "BPP" and "TAR" stations (these are the official call letters) have only recently been thrown open for public service with these steamers. For these communications, which must be effected on the regulation 300 and 600 metre waves, a subsidiary plant was installed at each station. The subsidiary plant, however, is excited from the main plant by means of a "cascade connection." This saves all the extra generating machinery which would otherwise be required, and has the advantage of giving the same musical note on the short waves as on the long ones, although a "fixed" discharger is employed for the short wave bank; the explanation is that the supply current from the big plant already has a frequency of 400.

"LIFE" IN THE OILFIELDS.

The man who is devoted to the attractions and amusements of a city life had better stay away from Borneo. Life here is essentially "home life" after strenuous business hours in a temperature of about 100 degrees in the shade! And the home is more often than not greatly lacking in comfort. Many of the workpeople live in "native houses"; a structure of stout branches, walled and roofed in with "katjang," *i.e.*, a kind of palm leaf, cured in the sun. Nevertheless this style of house, if built with some care, is habitable for a year or two. It certainly has the advantage of being cool. All dwelling-houses are built on piles averaging about six feet in height. This is necessary to keep snakes, centipedes, and numerous insects out of the house. And even with this precaution many undesirable "aliens" still find their way in. For instance, one night I found a centipede on the inside of the mosquito net, many of these are 12 inches and even longer. When they run along the "katjang" walls they are readily detected, as they make a peculiar noise, due to the hard scales of their bodies rubbing against the dry palm leaves. To find one of these in bed is not altogether a happy experience, for a bite causes severe illness which often ends fatally. Snakes entered the station building on one or two occasions, and once, when kneeling on the floor drilling a slate panel, I heard a rustling behind me, and, on looking round, found it was caused, not by silk skirts, but by a snake, about five or six feet long. I believe

I howled, which was foolish, as I was quite alone in the building, the incident occurring in the "tiffin" hour; I certainly jumped, which was sensible. I played hide-and-seek with that snake for the next twenty minutes or so, but finally got him. On another occasion the Petroleum Company's engineer, Mr. Hendrikse, "collected" a couple of snakes from under the roof, where they were hidden in the wooden box built round the aerial leading-in insulator.

The Marconi stations, both at Balikpapan and Tarakan, are some distance away from the European settlement, at Balikpapan the distance being five kilometres. Some thousands of trees were cut down, both to clear the sites for the stations themselves and also to make a big open space "at the back" of them, to avoid, as far as possible, any screening effect. This sounds a fairly big job in itself; but the Malay coolies, though addicted to laziness, if given the chance, are nothing if not cunning. So they would tackle one of the most formidable looking forest giants with axe and saw and fire, and when the tall and heavy one finally succumbed to their combined efforts it would bring down several of the surrounding lighter trees in its fall. Thus the station is situated in a big, open space, bordered by thick jungle on the one side, and the sea of Celebes on the other. At Tarakan there is nothing but jungle all round. A pipe line for oil transport runs past the station into the forest and is laid through it along the crest of a hill; it ends at Lingkas, the "port" of Tarakan "Port" here means a few bungalows, numbers of large oiltanks, and a wooden jetty built some way into the sea. My colleague, Mr. Jones, will remember how he taxed my nerves severely on one occasion. On a Sunday afternoon we walked to Lingkas along the pipe line through the forest. At Lingkas we paid a visit to the only European who was there at the time, drank some clappa-ajer—*i.e.*, coconut milk, and talked until it was quite dark. We did not quite like the walk back through the forest, but my friend Jones informed me

Mr. F. Post, and his gang of Lascar labourers engaged in Mast Erection.

that there was a newly-made road which would lead us safely home. Fortunately we secured a little oil lamp, for the night was pitch dark. The first part of the journey was quite easy, except that we had to go up and down hill and scale fallen trees, which were 6 feet and more in diameter. This, by the light of an oil lamp, requires a certain amount of skill. But the exciting part came when we reached level ground. The road, indeed, *was* newly made! It seemed to run through a marsh, and every hundred yards or so it was cut across by ditches. Jones informed me that all these ran into the river, which flowed near by, and that the whole of the neighbourhood was alive with crocodiles. The ditches were bridged over by planks in some cases, and in a few by a single pole only, and rather "wobbly" at that. The prospect of falling off one of these, possibly into the jaws of a half starved crocodile lurking in the darkness below, did not make me feel very comfortable. The journey ended, however, without mishap. I thought at the time that Jones, my companion, was playing a practical joke on me with his story, but since then I have often seen crocodiles both there and elsewhere along the coast. Once in a while a native is swallowed by a crocodile. Notwithstanding this, however, the blacks go into the river to bathe without any apparent fear. At Samarinda I watched a number of native children plunge into the river together, shouting loudly "boewaja" (crocodile) all the time. At first I used to take my morning dip in the sea at Balikpapan, but the unwelcome appearance of a crocodile made my visits few and far between. I had not known of crocodiles entering the sea; but apparently they do so to fish. They stay in for hours at a time, and one Sunday morning we spent an exciting time in hunting one. On this occasion the crocodile was at the mouth of the river, which flows into the sea not far from the Marconi station; it had to wait till the tide was at its highest to be able to cross the bar. When we got to the spot it was just getting out, bellowing like a cow all the time. We fired one or two shots at it from a sporting rifle, but they took no effect, for the crocodile swam well out from the shore and then along it, travelling about three miles an hour. We hunted our elusive friend for two or three hours, firing at times, but without effect (the hard scale on the body resists a rifle bullet unless fired at very short distance); but finally it began to come closer in to the shore; we waded waist-high into the water and a well-directed shot probably hit the brute right in the eye. It threw up its head and apparently was flung right over backwards; then it sank and did not come up again. We waited about for an hour or more but did not see it again; nor was it washed up afterwards—at least, not to my knowledge.

On another occasion I was lucky enough to shoot one at very close quarters, and yet in a very safe manner to myself. This time the animal was coming back to the river after its trip out to sea. As usual, the natives warned me of its advent; I took up a position on a footbridge some two or three hundred yards from the mouth of the river. Underneath this spot the water was clear, and only some six or eight feet deep. Mr. Crocodile swam about outside the bar for some time, until the tide was at its highest. All the time he was loudly booed by scores of natives who had collected to watch the fun. Finally he slipped in through the gully and then ducked immediately. I waited for ever so long, and at last spotted him just in time, crawling over the sandy bottom of the river. His head was already underneath it, so I jumped round quickly to the other side of the bridge and then fired at him straight down. He made a great commotion and turned right round on his back. Mine was not a repeating rifle, so he managed to escape; but I followed him along the river, reloading speedily. A minute or so after he had to come up to breathe, and then I hit him in the head again, the distance being only some thirty or forty yards. But I did not get this victim either, as he sank on the off side in the river, which flows into a marshy part of the jungle.

Life in such countries is, of course, full of exciting and amusing incidents, but space does not allow me to relate many of them. I may, perhaps, mention one amusing anecdote. The Malays are passionate gamblers. On pay days it is the custom to give them their money before noon, and after that no more work is done for the

rest of the day. Immediately they have their money they all squat down in groups, a cloth marked in black and white squares and figures is spread on the ground, and the "banker" produces a "dado"—a spinning top with six sides, marked with figures corresponding to those on the cloth. The dado is spun and a basin placed over it; the players put their money on the various squares and the banker doubles each amount from his own pocket. After sufficient time has been allowed for the dado to come to rest, the basin covering it is lifted; the dado lies with one of its sides up, and the figure showing is the winning one.

In the Chinese "kampong" (village), there is quite a little Monte Carlo, called in Malay the "Roemah Majin"; this is run by Chinamen and patronised chiefly by Malays.

One Sunday I gave one of my coolies a Ryksdaalder—*i.e.*, a Dutch coin equivalent to about four shillings, and instructed him to go into the kampong and purchase a duck for my dinner. He left about midday and could have been back within an hour. But one o'clock came, and two, and then three and four, and through another couple of weary hours I impatiently watched for the return of my toekang ajer (water carrier); this was his special duty when not fetching ducks). I also sent another boy in quest of him. At six o'clock he returned, fell on his knees, buried his face in his hands, and touched the ground with his forehead, as a sign of entire submission. But I had no duck for dinner that day, and some Chinamen in the Roemah Majin were the richer by four and twopence at my expense. Toekang Ajer next day lost his easy job of carrying water for bathing and drinking purposes from the forest, and had to do some wholesome digging in the earth trenches instead for days after, to cure him of his gambling habits. But next pay day he lost his "gadji" (wages) to the dado god as lustily as ever.

A Native Village near Tarakan.

An Atlantic Sentinel.

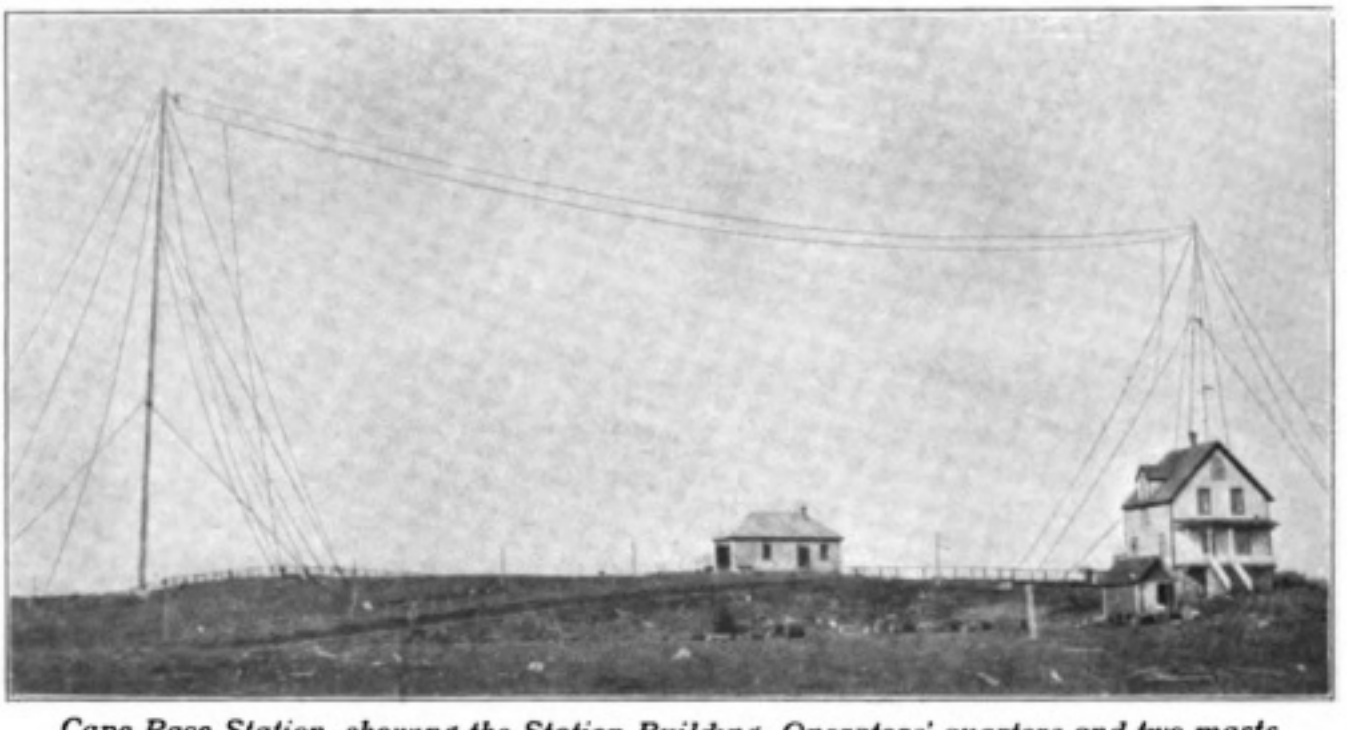
THE NEW STATION AT CAPE RACE.

WITH the completion of the new wireless station at Cape Race a fresh series of successes in wireless telegraphy has been recorded from the Canadian Atlantic system.

The first station was built in 1911, and had a range of 300 miles. It was destroyed by fire in May, 1913, but the Canadian Marconi Company lost no time in proceeding to equip the new station with the most modern apparatus, thus giving it greatly increased range. On October 11th, 1913, the new station was in operation.

Cape Race projects far into the Atlantic and is situated some 1,000 miles from Montreal and New York. As the new station possesses a normal range of 500 miles it is now possible to transmit Marconigrams from, say, Montreal or New York, *via* Cape Race, to vessels steaming in mid-Atlantic; not only to those on the Northern or Canadian route, but also to liners steaming on the Southern route and destined for the American ports. The sphere of operations of Cape Race station now covers a greater portion of the Trans-Atlantic steamship route than any other station on the American continent engaged in ship and shore business, and not only affords thereby new commercial advantages, but it will prove to be a special factor as an aid to vessels in danger which would otherwise have been beyond the range of land stations.

Notwithstanding the short period during which the new station has been in operation, remarkable figures have already been recorded. The Austro-American liner *Oceania* when on her westward voyage, early in November, was signalled at a distance of 750 miles east of Cape Race, the message constituting a record for a wireless signal from a vessel using the St. Lawrence route. That record, however, was speedily eclipsed, for on Monday, November 17th, a message was received from the C.P.R. liner *Empress of Britain* which was sent when the vessel was but half way across the Atlantic and while she was still nearly 1,700 miles east of Quebec, her exact position at the time being 834 miles east of Cape Race. These results were attained by night, but it can be expected with a fair degree of certainty that the station's guaranteed normal range of 500 miles by day will be considerably



Cape Race Station, showing the Station Building, Operators' quarters and two masts.

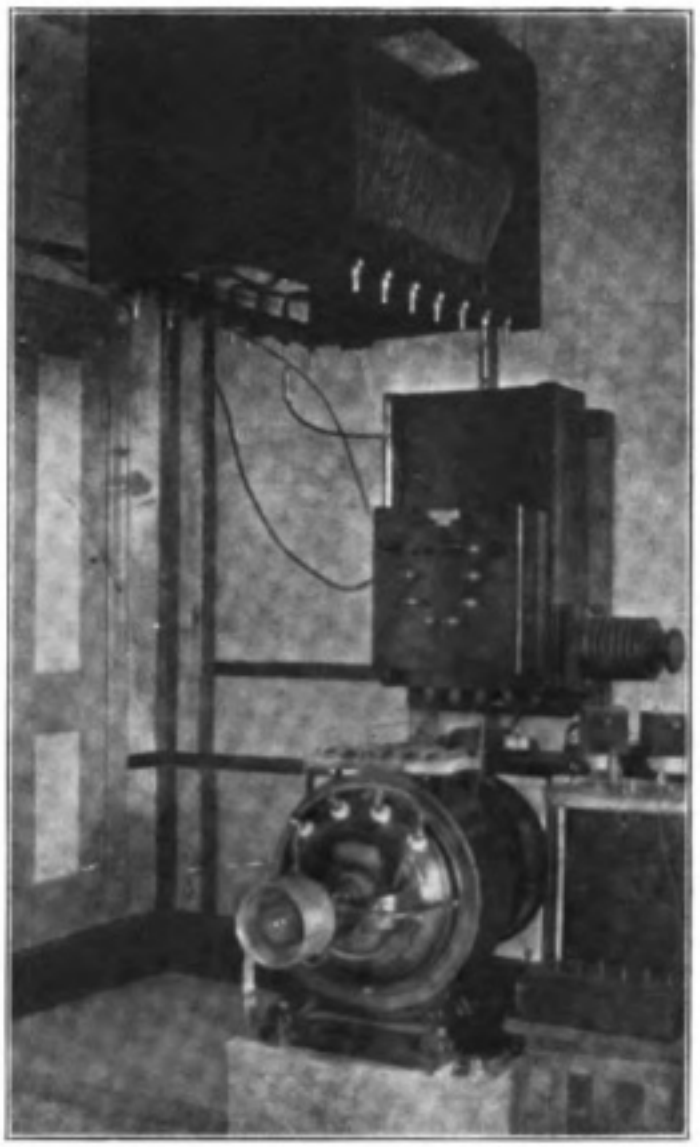
exceeded when the apparatus has been running a greater length of time.

The almost inestimable value of the Cape Race station as an aid to navigation in the Atlantic has been fully appreciated, and the station building and equipment has accordingly been designed to give the greatest possible security against interruption of service, the building being of concrete and the operating plant being duplicated throughout.

The apparatus comprises two complete transmitting sets, each consisting of 5½ kw. generator, belt driven by 10 h.p. horizontal gasoline engine. Alternating current at 240 cycles and 440 volts single phase is generated. The transmitter is of the synchronous disc discharger type, giving a pure musical note of the frequency of 480 per second.

The transmitters are designed for wave-lengths of 300–600 and 1,800 metres, and intermediate lengths can also be obtained. Up to the present only the normal 300–600 metre waves for coast station service have been used, but it is quite possible that in the near future arrangements may be made to utilise the 1,800 metre wave for a long distance service with steamers transmitting a news service and general public correspondence. Signals on this wave-length should be readable on the one side by stations within range of Crookhaven or the Azores and on the other side by United States stations on Long Island.

The power plant, with generators and transmitters, is situated in one large room separated from the office and receiving room by a concrete partition. The receivers are of the latest design and equipped with the most sensitive detectors. A magnetic detector is also installed as an emergency receiver.



Transmitting Apparatus.

Instrument Room showing Switchboard, etc.

There was recently inaugurated at Madrid, in the presence of leading officers of the Telegraph Corps, an important school for the training of wireless telegraph operators. The ceremony was attended by the Director-General of Posts and Telegraphs, Mr. Arminan, who also represented the Minister of the Interior, who was prevented from attending by indisposition. Speeches were delivered by Mr. Lopez Cruz and by Mr. Arminan. Afterwards the various classes were visited and demonstrations of wireless telegraphy were witnessed. The school is situated at 23, Calle Echegaray, in the old Moctezuma Palace.

Short Circuited Inductances.

By Dr. LOUIS COHEN.

IN a recent discussion at a meeting of the Institute of Radio Engineers a question arose regarding the effect of short-circuiting the overhanging turns of an inductance coil in an oscillating circuit, as indicated in the illustration below.

Some maintained that the short-circuiting of the overhanging turns produces large damping in the oscillating circuit, while others declared that their experience with such an arrangement had not shown any bad effects. It would appear that there exists some misunderstanding about the problem, and it will perhaps be of some interest to indicate briefly the mathematical solution of the problem, and to show that both views may be justifiable. It is all a question of the relative magnitudes of L_1 and L_2 and the mutual inductance between the coils L_1 and L_2.

Mathematically the problem is the same as that of the oscillation transformer. To simplify the discussion, assume a sine emf (undamped) acting on the oscillating circuit: we have then the well-known transformer differential equations for the two circuits, which are as follows:

$$\left.\begin{aligned} L_1\frac{dI_1}{dt}+R_1I_1+\frac{1}{C_1}\int I_1dt+M\frac{dI_2}{dt}&=E\epsilon^{i\omega t}\\ L_2\frac{dI_2}{dt}+R_2I_2+M\frac{dI_1}{dt}&=0 \end{aligned}\right\} \quad (1)$$

Solving these two equations, we get for the absolute values of the currents in the two circuits:

$$I_1=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\sqrt{\left((M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}+R_1R_2\right)^2+\omega^2\left(L_2R_1+L_1R_2-\frac{R_2}{C_1\omega^2}\right)^2}}$$

$$I_2=\frac{EM\omega}{\sqrt{\left((M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}+R_1R_2\right)^2+\omega^2\left(L_2R_1+L_1R_2-\frac{R_2}{C_1\omega^2}\right)^2}} \quad (2)$$

The circuit may be tuned in two ways: it can be tuned without any regard to the secondary circuit, or the system as a whole can be tuned including the secondary circuit.

In the first case $L_1\omega-\frac{1}{C_1\omega}=0$, and the expression for I_1 in equations (2) reduces to

$$I_1=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\sqrt{(R_1R_2+M^2\omega^2)^2+R_1^2L_2^2\omega^2}} \quad (3)$$

In the second case, tuning the system as a whole,

$$(M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}=0$$

or

$$\omega^2=\frac{1}{L_1C_1(1-K^2)},\quad \left(K^2=\frac{M^2}{L_1L_2}\right) \quad (4)$$

and the expression for I_1 in equation (2) (neglecting R_1R_2) becomes

$$I_1=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\left(L_2R_1+L_1R_2-\frac{R_2}{C_1\omega_2}\right)}=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\omega(R_1L_2+R_2L_1K^2)} \quad (5)$$

If the overhanging coil were entirely removed and the oscillating circuit tuned to its natural period, we would have

$$I_1'=\frac{E}{R_1} \quad (6)$$

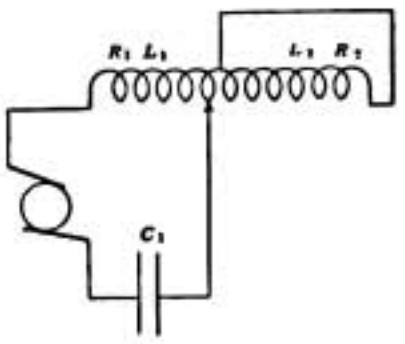
Comparing equations (3), (5) and (6), it is seen that by tuning the primary circuit alone, the presence of the short-circuited overhanging coil (or closed secondary) reduces the current in the primary circuit in the ratio,

$$y_1=\frac{I_1}{I_1'}=\sqrt{\frac{R_1}{R_1^2+\frac{2R_1R_2M^2\omega^2+M^4\omega^4}{L_2^2\omega^2+R_2^2}}} \quad (7)$$

Tuning the system as a whole, the effect of the closed secondary is to reduce the current in the primary in the ratio,

$$y_2=\frac{I_1}{\quad}=\frac{R_1\sqrt{L_2^2\omega^2+R_2^2}}{\omega(R_1L_2+R_2L_1K^2)} \quad (8)$$

An examination of equations (7) and (8) will show what effect the closed secondary may have under different conditions. If the overhanging coil consists of a large number of turns, so that L_2 is large compared with L_1 and M_1, the effect will be negligible and either by (7) or (8) $y = 1$ approximately.



Short-circuiting the overhanging turns of an inductance coil in an oscillating circuit.

The greater the value of L_2 the closer the approximation If, on the other hand, the overhanging coil consists of only a few turns, so that L_2 is small compared with L_1 or M_1, the effect may be very serious, and in some extreme cases the current in the oscillating circuit may be reduced to almost zero because of the closed secondary.

One or two illustrations will perhaps make it clearer.

Assume the case of a coil of 100 turns, length 10 cm., radius 5 cm., with ninety turns overhanging.

$L_1=0{\cdot}02$ mh., $L_2=0{\cdot}59$ mh., $M=0{\cdot}024$ mh. Assume $R_1=10$ ohms (including radiation resistance of antenna, if the coil is part of an antenna circuit).

$$R_2=3 \text{ ohms}, \quad \omega=10^6.$$

For these constants we have by (7),

$$y_1=\frac{10}{\sqrt{100+\frac{34,560+332,000}{348,000}}}=\frac{10}{\sqrt{101}}$$

$$=1 \text{ approximately}$$

By (8)

$$y_2=\frac{10\times 590}{10\times 590+3}=1 \text{ approximately.}$$

Short-circuiting the secondary has practically no effect on the current in the primary in this case. Suppose, however, that only thirty turns are overhanging. Then, $L_1=0{\cdot}42$ mh., $L_2=0{\cdot}12$ mh., $M=0{\cdot}056$ mh. Assume $R_1=10$ ohms, $R_2=1$ ohm, $\omega=10^6$. For these constants, by (7),

$$y_1=\frac{10}{\sqrt{100+\frac{11,090,000}{14,400}}}=\frac{10}{\sqrt{100+770}}=0{\cdot}34.$$

The current in the primary circuit is reduced to 34 per cent. of the value that it would have if the secondary circuit were entirely absent.

If the system is tuned as a whole, including the secondary, we have by (8)

$$y_2=\frac{10\times 120}{1,200+26{\cdot}4}=0{\cdot}98.$$

For this case, tuning the system as a whole, the current in the primary will not be affected materially by the presence of the secondary.

Consider now an extreme case, the overhanging coil consisting of a single turn.

$L_1=0{\cdot}68$ mh., $L_2=0{\cdot}0003$ mh., $M=0{\cdot}006$ mh. Assume $R_1=10$ ohms, $R_2=0{\cdot}05$ ohms, $\omega=10^6$.

By (7) $y_1=0{\cdot}09$.

By (8) $y_2=0{\cdot}33$.

For this case even by tuning the system as a whole the current in the oscillating circuit is reduced to one-third its normal value.

It is evident, therefore, that the effect produced by short-circuiting the overhanging coil depends altogether on the relative magnitudes of L_1, L_2 and M.

Experiments made some three years ago by the writer gave results which were in general in agreement with the above. It was suggested at that time that a single-turn secondary placed within the inductance coil so as to get the maximum mutual inductance and rotating it back and forth through 90 deg. would produce sufficient variation in current to serve as a means for sending signals in a wireless station in place of the key generally employed.

[The question whether efficient tuning can be carried out on an inductance by the method of short-circuiting a variable amount of it is one which, in one form or another, is continually presenting itself to amateurs. The mathematical view of the problem is treated by Dr. Louis Cohen with his usual distinction in the above paper reprinted from the "Electrical World" of New York. The investigation shows that under certain conditions the method may result in very serious loss.—*Editor.*]

Flinders Island has now been brought into touch with the Australian wireless system by the establishment of a station there.

The Characteristics of Insulation Resistance

IN a paper recently read before the Institution of Electrical Engineers, Mr. Evershed dealt with this subject which is of interest to every wireless engineer.

During recent years a great deal of valuable research work has been done to increase our knowledge of the properties of insulating materials, yet, notwithstanding the progress so made, the natural laws governing insulation resistance are but little understood. So little that if at the outset of this paper a plausible statement were made to the effect that the insulation resistance of an electrical system depended mainly upon the dielectric properties of the insulating materials, it might easily pass unchallenged. Possibly some objectors might be found among those who have to maintain the insulation of electrical plant; for no one who has had much experience of the behaviour of insulation in practice could fail to be struck by the disparity between insulating materials under test in the laboratory and the same materials under the ordinary conditions of use. It is, of course, easy to guess that the disparity is generally due to the presence of moisture; and, in fact, the only insulating materials whose behaviour in use corresponds with their predetermined dielectric properties are those which are non-absorbent. Of the remainder, and they form the majority of the materials in common use, we can only predict that the insulation resistance of any electrical system in which they are used will be governed almost entirely by the moisture they absorb. Everyone knows that insulation resistance decreases on a damp day and recovers during dry weather. It is, perhaps, not so generally known that in most cases insulation resistance decreases, in a perfectly definite way and almost instantaneously, as the electric pressure upon it is increased, and slowly recovers if the pressure is restored to the initial value or cut off altogether. The connection between these two facts is by no means obvious, yet they are so closely related that if we succeed in explaining one of them we shall certainly understand the other. The effect of moisture, the effect of voltage, the effect of polarity, these and other phenomena commonly met with in insulation have been forced upon the author's attention for many years past, and the pressing need to find answers to the questions that so frequently arise in connection with insulating materials induced him to undertake an experimental research with a view to the better understanding of their behaviour in everyday use.

What is the margin between the working voltage and breakdown? That is the fundamental question at the root of every inquiry into the properties of insulation. If a definite answer is ever forthcoming, it will not have been found in "blind" tests of breakdown voltage. To conduct tests without any means for ascertaining what is going on in the insulator as the breakdown voltage is approached, without either observing the current or, better still, the resistance, is to shut our eyes and deliberately avoid looking for the cause of failure. (The flash test as applied to some costly piece of electrical apparatus must have been inspired originally by something akin to the heroism of the savage.) The author has therefore sought, by investigating the nature or leakage conduction, to establish some definite relation between applied P.D. and insulation resistance. If the curve expressing this relation be traced from a few volts up to the breakdown point it will be found to consist in general of two parts of opposite curvature. The two parts of the curve will be joined together by an approximately straight line, the length of which varies greatly according to the nature and condition of the insulation. This connecting link is sometimes so short that the two parts of the curve appear to meet at a point of inflection, and they then form a sort of ogee curve. The research had not proceeded very far before it was realised that the shape of the first part of this characteristic curve is determined by the extent to which leakage is due to moisture, and, further, that leakage through the substance of the insulator—dielectric leakage—was negligibly

small compared with that caused by the merest trace of moisture. This leads to the point of view that for most practical purposes an insulator may be regarded as having no inherent conductivity, the conducting power which it appears to possess being usually caused by leakage over damp surfaces. If the insulator is porous, then the leakage surfaces are not only those outside the insulating body, but those surfaces which bound the maze of capillary channels inside the porous material.

After dealing with moisture-curves of cotton and paper, Mr. Evershed said: "The degree of moisture in an absorbent material like paper may be varied within wide limits without much affecting the law of the moisture curve, although the corresponding variations in the resistance will be enormous. But when the material contains a considerable excess of moisture, so that it is sensibly damp, the law begins to change. . . . When an absorbent insulator is sodden with water its resistance follows Ohm's law."

Summing up the results of his researches with absorbent insulators, he said: "The composition of the insulating substance seems to be of little importance. So long as the structure of the material is such as to provide capillary spaces to harbour moisture leakage will take place in the characteristic manner. Of course, the difficulty of maintaining adequate resistance in absorbent insulators is fully realised, and they are seldom used without an attempt being made to exclude moisture by means of some non-absorbent insulator applied as an oil or a varnish, and intended to close all the capillary channels."

Mr. Evershed then went on to deal with the effect of filling up the pores of absorbent materials, taking as examples oiled paper and varnished windings, and showed that these attempts to get over the difficulty are by no means completely successful. "The experiments on oiled paper lead irresistibly to the conclusion that the mode in which absorbed water forms conducting paths is substantially the same whether the insulator is saturated with oil or not. The water may be in the insulator before impregnation with oil or it may be very slowly absorbed afterwards, but once inside it will conduct electricity just as though the oil was not there." With regard to the varnishing method he said: "It need hardly be pointed out that when a porous body is saturated with a liquid varnish, and the solvent is then dried out, the solid body of the varnish remaining in the insulator is necessarily insufficient in quantity to fill the pores. They can only be entirely filled up by soaking the insulator in oil, or in a melted wax, or in some equivalent solid insulator which can be liquefied by heat. Hence a porous insulator, even when varnished, is likely to have many channels available for the reception of water. Whether water can find its way into them depends on how far the varnish has been able to stop up the pores on the outside of the insulator." If the windings are subjected to the temperature variations which occur in ordinary use, varnish appears to be powerless to stop absorption altogether.

An interesting point dealt with in the paper was the "valve" effect of certain insulators; of which porcelain is an example; this effect leading to the phenomenon that the insulation resistance may be found to be very much greater when the voltage is applied in one direction than when it is applied in the other. This result Mr. Evershed explains by the theory of electric endosmosis, which he puts forward as the broad principle of all film-conduction in absorbent insulators.

THE PHYSICAL SOCIETY.

The annual exhibition of the Physical Society was held in London on December 16th, about forty firms contributing instruments to the exhibition, and these in many cases were shown in operation. The advances being made in the field of wireless telegraphy are invariably reflected at this exhibition. In the crystal receiver shown by the Marconi Company, the detector consists of two carborundum crystals, which can be used either independently or put in opposition. The direction finder is intended to be employed with a directive aerial system, and it is designed either for directive receiving or for ascertaining the direction of a wireless station. An adjustable air condenser was also shown at the Marconi stand. This instrument has been designed to give the largest possible capacity in a given space, whilst leaving sufficient gap between the plates to allow a pressure of 500 volts to be safely used with it. The maximum capacity is 0.01 mfd.

Grounding System for High-Power Stations

ONE of the essential features of long-distance wireless stations is an effective grounding system.

In selecting the sites for the erection of the new Atlantic coast stations of the American Marconi Company, a number of elements had to be considered. The transmitting and receiving sites had to be more than twenty miles apart and correlated in such a manner that a line connecting them would be at right angles to the direction of desired transmission. The sites had to be chosen on low, marshy land on the coast, or near some waterway that would afford a direct electrical connection with the ocean. Where it was not possible to get the whole property in a marshy district it was necessary to have the land around the power-house at least damp and moist. Then, by burying a network of copper wires and zinc ground plates, a good electrical earth connection was possible.

With the middle of the oscillating circuit as a centre, wires radiate to a circle of zinc plates at a radius of 100 feet. This circle is continuous, all the plates being bolted together, and buried vertically in a trench, so that the radiating wires can be led down to the ground and soldered to the upper edge of the zinc ring. From the centre of the system about 224 copper cables, made up of stranded copper wire, are led from two sides of the building through insulators to the top of eight poles, set on a circle of eighty feet radius. From the insulators, on the top of these poles, the cables are separated and led down to the earth and soldered to points along the circle of zinc plates. The location of the eight poles and the separation of the cables is so arranged that the length of each cable from the centre of the system to the point it enters the ground is approximately the same.

Radiating from the ring of zinc plates there are about 112 copper cables soldered to the ring at equal distances. Each of these cables extends about 300 feet beyond the zinc ring and terminates in a zinc plate thirty inches by eighty-four inches, buried vertically. From these outer plates, on the side of the circle under the aerial wires, extends a further grounding system parallel to the aerial and extending under its full length and a little beyond. Local conditions however, usually make it necessary to slightly alter this general arrangement. Thus, the site of the power station at New Brunswick, N.J. (referred to in THE WIRELESS WORLD for November last), is situated in a swampy meadow and bounded by the Delaware and Raritan canal on the north-east side. Running beside the canal is a stream connected to the Raritan River by culverts under the canal. In view of this condition, it was deemed advantageous at this station to straighten out one side of the circle of zinc plates and bury a large number of plates in the bed of the stream, by this means assuring a good electrical connection through the Raritan River with the ocean.

At the receiving stations the circle of ground plates is made with a fifty-foot radius, with the receiving room of the operating house as the centre. The only wires extending beyond the circle of zinc plates are a number of cables radiating from the centre and extending in a marsh, or waterway, near which the operating house is situated. Each of these lines terminates in a zinc plate, as at the transmitting site.

A precaution, which is essential in the construction of the power-house and the running of power and lighting circuits, is to run all lines in iron conduit and thoroughly ground the conduit at frequent intervals; otherwise considerable difficulty might be caused by the current induced from the high-frequency oscillating circuits. Wherever possible, all circuits are carried underground, and the supply is run in conduit underground for about half a mile, approaching the power plant in a direction at right angles to the direction of the aerials.

Radio-Telegraphic Research.

WE announced last month the appointment by the Postmaster-General of a committee to consider how far and by what methods the State should make provision for research work in the science of wireless telegraphy, and whether any organisation which may be established should include problems connected with ordinary telegraphy and telephony. The British Association, readers will remember, have also appointed a committee for the purpose of furthering radio-telegraphic investigations and it is interesting to note that during the past month, the Council of the British Association has made a grant of £500 to that committee out of a gift of £10,000 made to the Association for scientific purposes by Sir J. K. Caird at the Dundee meeting in 1912. The work which lies before both committees is to some extent identical, and useful results should accrue from the investigation of such mysteries of wireless telegraphy as are met with by observers distributed over a wide area.

The Rt. Hon. C. E. H. Hobhouse, M.P.
Chairman of the Committee appointed by the Postmaster-General to consider the organisation of State Research in Wireless Telegraphy.

It should be clearly understood that the State Committee, which includes representatives not only of pure research work but of the Post Office, the Admiralty, the Army, and the administrative departments, is only an advisory body, and is intended to initiate, and not to carry out, research work. But a probable outcome of its work is the establishment of a special research department for wireless telegraph research at the National Physical Laboratory, and the presence of Dr. Glazebrook, the Director of the Laboratory, on the committee lends support to this view.

It is common knowledge that there are fundamental problems in wireless telegraphy which still await solution; neither the nature of the electro-magnetic waves employed in radio-telegraphy nor the mode of their propagation has yet been definitely determined. There is no dearth of hypotheses, but none of the theories yet advanced can be held to explain all the observed facts. Assuming that radiation consists of two parts, the surface waves, which follow the earth's surface, and the space waves, it remains to be determined what are the respective functions of each set of oscillations and their method of propagation.

Of great interest is the battle which is being waged over theories of wave transmission. At the moment there is a disposition to accept the hypothesis put forward by Dr. W. H. Eccles as yielding the best explanation of the observed phenomena. This hypothesis is based on the assumption that the sun's rays ionize the atmosphere in such a way that the concentration of ions increases gradually in the higher layers of the atmosphere. In that case a ray started horizontally would pursue a curved path with its concavity towards the earth, and it is held that if the ionization be great enough any electric ray might follow and overtake the curvature of the earth.

Then there are the definite day and night effects upon the strength of signals.

There is also need for an investigation into the means to be adopted for the elimination of general atmospheric disturbance without any diminution of the intensity of the signals. The disturbances are more commonly known as "atmospheres" or "X's."

The Marconi Tradition.

AT THE "VOLTURNO" INQUIRY. STORY OF THE DISASTER RE-TOLD. THE WORK OF THE WIRELESS. OPERATOR'S BRAVERY.

THE story of the burning of the *Volturno* in mid-Atlantic, and the summoning of ten rescuing vessels by means of wireless telegraphy, is now being re-told and carefully investigated in the calm atmosphere of the Wreck Commissioners' Court. It is the Board of Trade who ordered the investigation to take place, and the Court is presided over by the Rt. Hon. the Earl of Desart, who is assisted by the following assessors :—Commander F. W. Caborne, Vice-Admiral L. Wintz, Capt. J. Ruthven and Mr. E. C. Chaston.

On the opening day of the inquiry, November 26th, counsel appearing on behalf of the Board of Trade read a provisional list of the questions for the Court to decide, one of which is :

> What installation for receiving and transmitting wireless messages was on board the steamship *Volturno* ? Was there any emergency apparatus on board ? What was its capacity ? Was any part of the installation damaged or put out of action by the fire, and if so, when ? How were wireless messages sent and received during the time the ship was on fire, and up to what time ?

It would be improper to make any comment upon this question or upon the evidence given bearing thereon while the inquiry is in progress. But there can be no impropriety in pointing out that the line of investigation is well calculated to throw sufficient light on the points raised in this question to enable the Court to decide upon it without any difficulty.

Mr. R. B. D. Acland, K.C., who, with Mr. W. N. Raeburn, is appearing on behalf of the Board of Trade, made it clear in his opening address that the saving of the five hundred odd souls on board the ill-fated vessel was due to the aid summoned by wireless telegraphy. The trying ordeal through which those on board were passing has already been pictured to the world, but it is only bit by bit that we fully realise how painful was that ordeal. The captain, aided by his officers and men, was courageously battling with flames, when it was found that the foremast, which was right in the centre of the fire, had become insecure. If it went, all possibility of communicating with the outside world was gone, for it was to the foremast that the aerial of the Marconi apparatus was fixed. The second officer and others managed to secure the mast and keep it going until in the evening the aerial was broken by another explosion. The work of the Marconi operators under these conditions can well be imagined, and they well merited the generous tribute paid to them by Mr. Acland, who said :

> "All this time—and I think it is only fair to say so—and until the very end, the Marconi operator, following the traditions of the service, remained at his post without coming outside his house, and was the means of communicating to all the different ships which eventually came to the rescue."

When the ship's dynamo was put out of action and the power supply for the wireless apparatus failed in consequence, the operator changed over to his emergency gear, which worked well until an explosion occurred (due probably to the explosion of the rockets and cartridges), and this swept the operating cabin away. "At that time," said Mr. Acland,

> "there were ships in attendance, and the wireless had done its work, so that it was not so great a disaster as it might have been, although they had been communicating with the rescuing ships right up to the time when the aerial blew away."

When this occurred there was, according to the Marconi operator, ample power in the accumulators to have gone on longer if

necessary and if means had been available at the time.

The first witness called to give evidence was Capt. C. E. Harwood, the master of the ss. *Narragansett*. He said he received a wireless message, S.O.S., from the *Carmania* at 7.45 a.m. ship's time on October 9th, when he was 230 miles to the southward and westward of the *Volturno's* position. He sent the message to the *Carmania*, "Coming full speed." Suggested pumping lubricating oil round the *Volturno* so as to enable the boats to get alongside.

Evidence was then given regarding the construction of the vessel and the stowage of the cargo, after which the master of the *Volturno*, Capt. F. J. D. Inch, was called, and he gave the actual story of the disaster. He told of his instruction to the Marconi operator to send out the "S.O.S" signal and of the *Carmania's* response. When he heard from the operator that the *Seydlitz* and the *Grosser Kurfürst* were coming up close he asked the *Carmania* to go in search of his two boats that were missing. The *Kroonland*, a sister ship, next put in an appearance, and so close did she come that the passengers on the *Volturno* evidently thought she was going to lay alongside, for they started shouting out to her, "Come alongside! Come alongside!" But their hopes were soon dashed when they saw her steam round the weather side of the burning vessel. Her master informed Capt. Inch by wireless that he was going to send a boat with experienced boatmen in it, but after several attempts he had to give up the task as hopeless, the heavy seas making it impossible for any boat to be out then.

There had been a series of explosions on board; at about 10 o'clock at night the magazine exploded and the aerials came down. But the wireless had done its work and the operators had stuck manfully to their posts. What happened then may be explained in the Captain's own words:

> "I went back and told the Marconi officers they need not stop in there any longer, as they could do no more. From seven o'clock in the morning up to one o'clock they had stopped there the whole time—they never came out."

Later, we find in the Captain's evidence that the Marconi officers helped him to lower passengers into the boats that had come up alongside.

Here we cannot refrain from drawing attention to one point which emerges from a perusal of the evidence, not because of its relation to this inquiry, but because, in our opinion, it emphasises very strongly a moral which cannot be too deeply impressed. It would appear that the mere knowledge that relief was coming to the unfortunate emigrants huddled together on the burning *Volturno* exercised a wonderfully soothing influence upon those on board. In the course of his evidence the third officer of the *Volturno* was asked when he received any information that the *Carmania* had answered the *Volturno's* distress signals. He replied, "I went forward with another officer from the bridge deck and we connected that on the side of the funnel and standing on the fore deck the second Marconi operator came with the news that he had communication with the *Carmania*."

> "Did you let passengers know that?"
>
> "Yes, the captain sent me aft to the passengers to tell them that the *Carmania* was coming full speed."
>
> "And then you told them that in some language or another?"
>
> "Yes."
>
> "Did that have a good effect upon them?"
>
> "Yes they quietened down quite straight."

The chief engineer, Mr. Robert Dewar, explained in his evidence that the dynamos stopped working about eight o'clock, and after that the wireless set obtained its energy from accumulators which lasted until the explosions brought the aerials down about 10 p.m. Mr. Seddon, the chief Marconi officer, was on board during the whole night—right up to the end until the ship was abandoned—with the Captain, Mr. Dewar, and others, about eight all told.

The Marconi operators on board the *Volturno* gave evidence on December 5th. The senior operator, Mr. Walter Seddon, stated that he and Mr. Pennington, the junior operator, had made several previous voyages in the vessel and continuous watches were kept in the Marconi cabin night and day, each of the operators working six hour spells. He was asleep at the time when the fire broke out, and was awakened

by the assistant purser, who rushed to his room and cried: "Get up, the ship is on fire." The Marconi cabin was then in charge of Mr. Pennington, who had just got the *Seydlitz*, and was giving them the position of the burning ship. It would be about a quarter past seven when he had finished with the *Seydlitz*. Mr. Seddon was quite positive that it was the *Seydlitz* who was the first to answer, and he stated also that when he entered the Marconi cabin Mr. Pennington was sending out his own ship's position, which was marked on a piece of cardboard. A record was always kept of the times when distress signals were sent in the same way as a record of the time of ordinary messages was kept, and both he and Mr. Pennington were entering up communications with various steamers throughout the day.

When he took the instruments over from Mr. Pennington he sent out another "S.O.S." signal, and the first vessel he got immediately afterwards was the *Carmania*, to which he gave his position from the cardboard slip. The *Carmania* replied that her distance was about 59 miles, and that she was coming all speed to render assistance. Shortly afterwards he got the *Grosser Kurfurst*. As soon as he heard that the *Carmania* was coming he sent word to his captain by the second operator. He was able to learn the progress of the fire so as to be able to report to the *Carmania* from time to time through Mr. Pennington, who went between the captain and himself, and who brought messages from the captain which were sent to the *Carmania*. Mr. Seddon then gave particulars of some of the messages that passed between the *Volturno* and the *Carmania*. At 7.45 p.m. (ship's time) he changed over to the emergency gear, which worked very satisfactorily until the aerials were brought down by an explosion at 9.45 p.m. (ship's time). He stayed on board all night and assisted to put women and children into the boats, before leaving in the last boat with the captain, the chief engineer and some others.

At the conclusion of Mr. Seddon's evidence Mr. Dunlop, counsel for the owners of the *Volturno*, rose, and addressing the Commissioner, said:

"My lord, Mr. Seddon is not a servant of the owners, and they have asked me to take this opportunity of publicly thanking him for his services, and I gladly do so."

Mr. C. J. Pennington, the junior Marconi operator, was next called. He was in the operating room on the morning of October 9th, when he heard a cry of fire, and the captain came and told him to call for assistance. He immediately sent S.O.S., just after 7 a.m. The captain afterwards came and gave him the position of the ship—49° 12 north, and 34° 51 west—which he sent out. He got his first answer from the *Seydlitz*, about 7 minutes after calling. Mr. Seddon came into the operating room while witness was speaking to the *Seydlitz*, and took charge as soon as he had finished working with the *Seydlitz*. Mr. Seddon immediately received an answer from the *Carmania*, and told witness to report to the captain. Asked whether he reported the *Seydlitz* as well as the *Carmania*, Mr. Pennington replied: "If I remember right, the captain came to the Marconi house before he brought the position and asked me if I had received a reply, and I told him No—not then. When he brought the position, if I remember right, I told him I had the *Seydlitz*—just got him, and would then send the position to him as he had just brought it to me."

Before witness withdrew he was thanked by Mr. Dunlop on behalf of the owners for the services he had rendered to the *Volturno*.

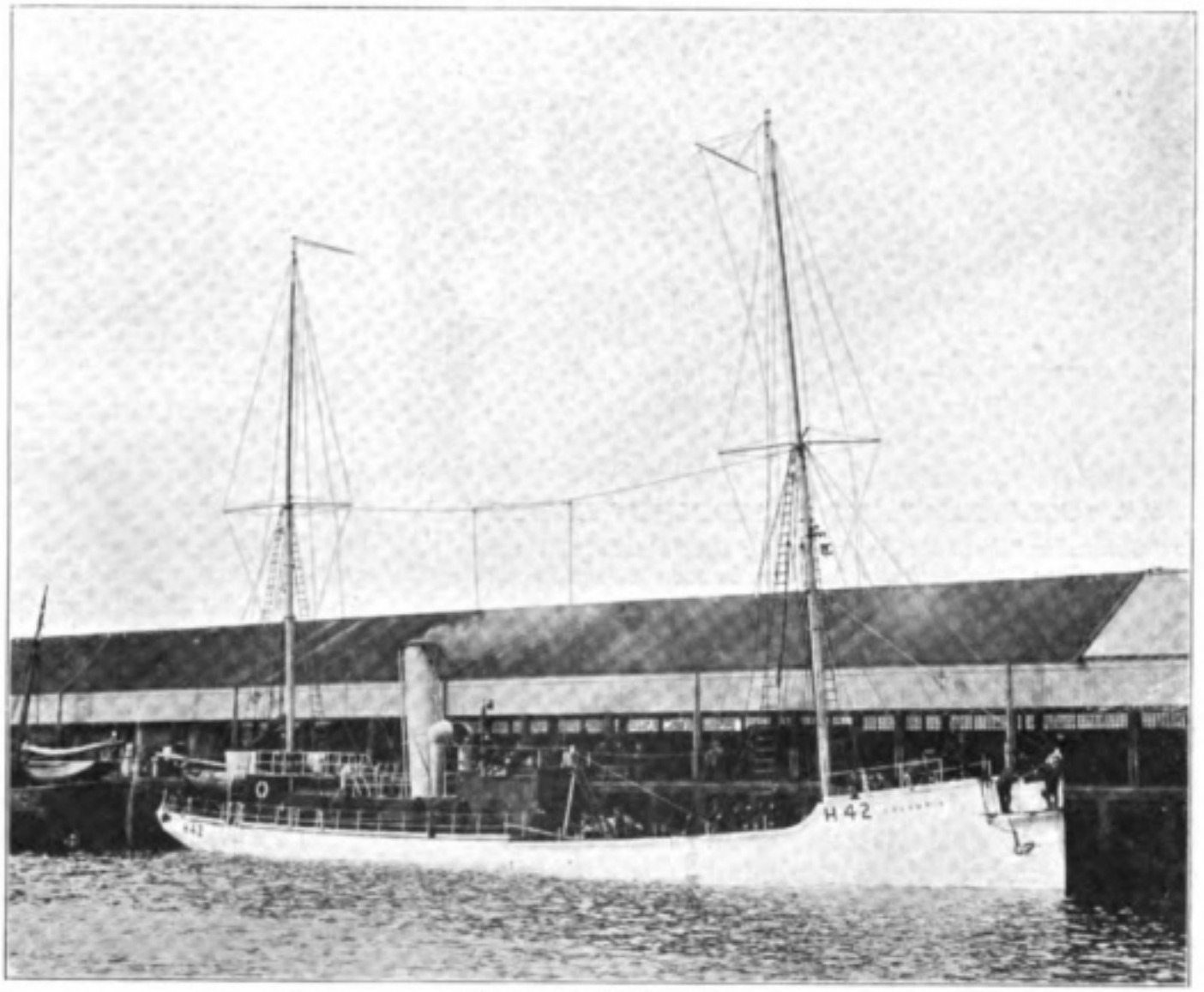
A wireless telegraph station has been added to the electrical equipment at Columbia University, New York. This installation has been made possible by a recent gift of $8,000. The station is intended for special students sent by the United States Naval Academy to take graduate work at Columbia.

* * *

At a special meeting of the Institution of Civil Engineers, Mr. Alexander Gracie, Managing Director of the Fairfield Shipbuilding and Engineering Co., described the progress in marine construction during the past twenty years. Referring to modern developments he said:—"Wireless telegraphy, probably the greatest boon ever given to those in peril on the sea, is now installed in over 1,800 vessels and at 270 shore stations."

The Wireless Equipment of a Fishing Fleet

IN an earlier number of THE WIRELESS WORLD appeared an article of some length on steam trawlers and their work, but if we may be allowed to criticise our own magazine it is now, from the standpoint of recent events, out of date. For then the possibilities of wireless telegraphy, as applied to trawling, were discussed, and the preparations for its inauguration on some of the Hellyer's Fishing Fleet were outlined. Now all this has become an accomplished fact. Marconi sets have been duly installed, and have already proved the value of wireless telegraphy to the fleet in question, though it will be some considerable time before the limits of its resources can be appraised: indeed, if it ever can be, for unusual circumstances and unforeseen emergencies are sure to arise when its aid will be required, and it is under such conditions that the value of wireless is most conspicuous. Nevertheless we can confidently predict that henceforth the fortunate trawlers possessing this equipment will wonder however it was they



S.S. "COLUMBIA"

The mark-boat of Messrs. Hellyer's Steam Fishing Fleet. She is the last word in scientific equipment, for she possesses a Marconi installation, a wireless compass, directional aerials, searchlight, and electric light.

S.S. "COLUMBIA" AND "BARDOLPH" IN DOCK.

The "Columbia" is in the foreground; the "Bardolph," one of the Fleet's trawlers fitted with wireless, can be seen lower down the dock.

managed to exist without this aid to navigation and business enterprise.

For the better understanding of these advantages, let us add a parenthetic note of the system on which North Sea trawlers work.

The sixty steam trawlers belonging to Messrs. Hellyer when at sea remain close together in charge of an "admiral," or, in his absence, a "vice-admiral." His is the duty of choosing the fishing ground.

When the fleet has made a full catch, each "fleeter" transfers her cargo to a swift steam "carrier," which then travels at full speed for Billingsgate, where she discharges her cargo.

On Saturday, November 24th, two of the three vessels fitted with Marconi apparatus for Messrs. Hellyer's Steam Fishing Company left St. Andrew's Dock, Hull, for the North Sea to take their part in the new scheme of the wireless control of the fleet. These vessels were the *Bardolph* and the *Columbia*, while a few days before the *Caliban* had left the same port for the same destination and to fulfil similar service. The *Bardolph* is the flag-ship of Messrs. Hellyer's fleet, and carries the commander, "Admiral" Lynn. The *Caliban* is under the command of "Vice-Admiral" Windas, while the *Columbia* is to be "mark-boat," an office of no little responsibility. She will take up a fixed position on the Dogger Bank. This place has been fixed by the owners. The other two vessels have gone to join the fleet in their fishing operations.

In the past it has been always a matter of difficulty, and not a little expense, in the way of consumption of coal, for outward bound vessels to come up with the fleet; for the fishing ground is frequently changed, and the carrier or "fleeter" on its return from the market is often at a loss to locate its whereabouts. But under the present scheme the *Columbia* takes up her position quite independent of the fleet, and vessels proceeding to the fishing grounds first make for the mark-boat.

At night her searchlight will be in use, or rockets will be fired, and the skipper searching for the fleet will be informed through a megaphone as to the exact location of the fleet, the *Columbia* being in constant communication with the fleet. In this way much valuable time will be saved.

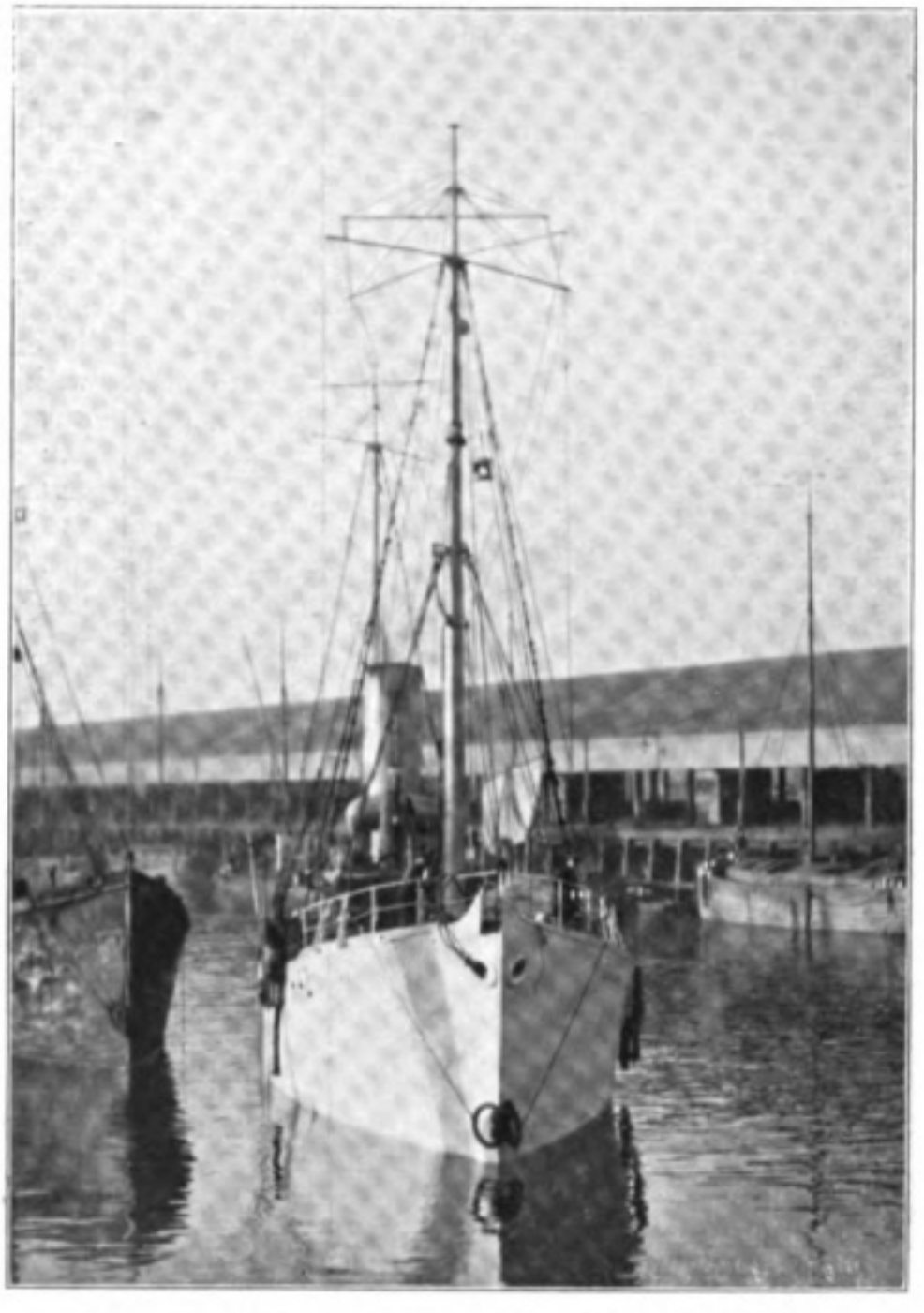
This will not be the only purpose served by the installation of the wireless. The fleet will be able, amongst other things, to ascertain, if necessary, or be informed of the state of the markets.

There was great need for improvement in this direction. The merchants have grumbled long and loud over the irregular supplies, which threaten to strangle the market at Hull. An instance in point occurred only the other day. There was not a single North Sea trawler at the Hull Billingsgate, the market being solely dependent upon four Icelandic catches. At another time it may be there is a terrible glut, and many thousands of pounds worth of good material has to be wasted. Given the general adoption of wireless, this could be avoided, and it would benefit not only the trawler-owner, but the market itself, as it is sure to have an effect on the price of fish, for owners will be able to keep themselves minutely informed of the extent of the "catches," and to order the boats home when the chance of a profitable "deal" occurs. Therefore the installation of wireless telegraphy is opening up a new era for the fishing industry, and the enterprise of such owners as Messrs. Hellyer's is likely to be amply repaid.

In due course it is anticipated that the other fishing companies will follow suit, and it is not improbable that wireless will be generally adopted by the fishing industry.

For defensive purposes the new installation will also be important. Should another Dogger Bank incident occur, as during the Russo-Japanese war, the Admiralty can be instantly informed of the circumstances.

The delight of the North Sea fishers when they found that they were to be in possession of a Marconi wireless installation knew no bounds. For a fortnight at a time or longer these hardy fellows are wont to go away, out of touch with the world and its happenings, and out of reach of such warnings as the meteorologists are able to give, even in advance of the experienced eye of the mariner, of the approach of storms. As soon as the *Bardolph* joined the fleet in the North Sea communication was established with the land, and the trawlers inaugurated their new

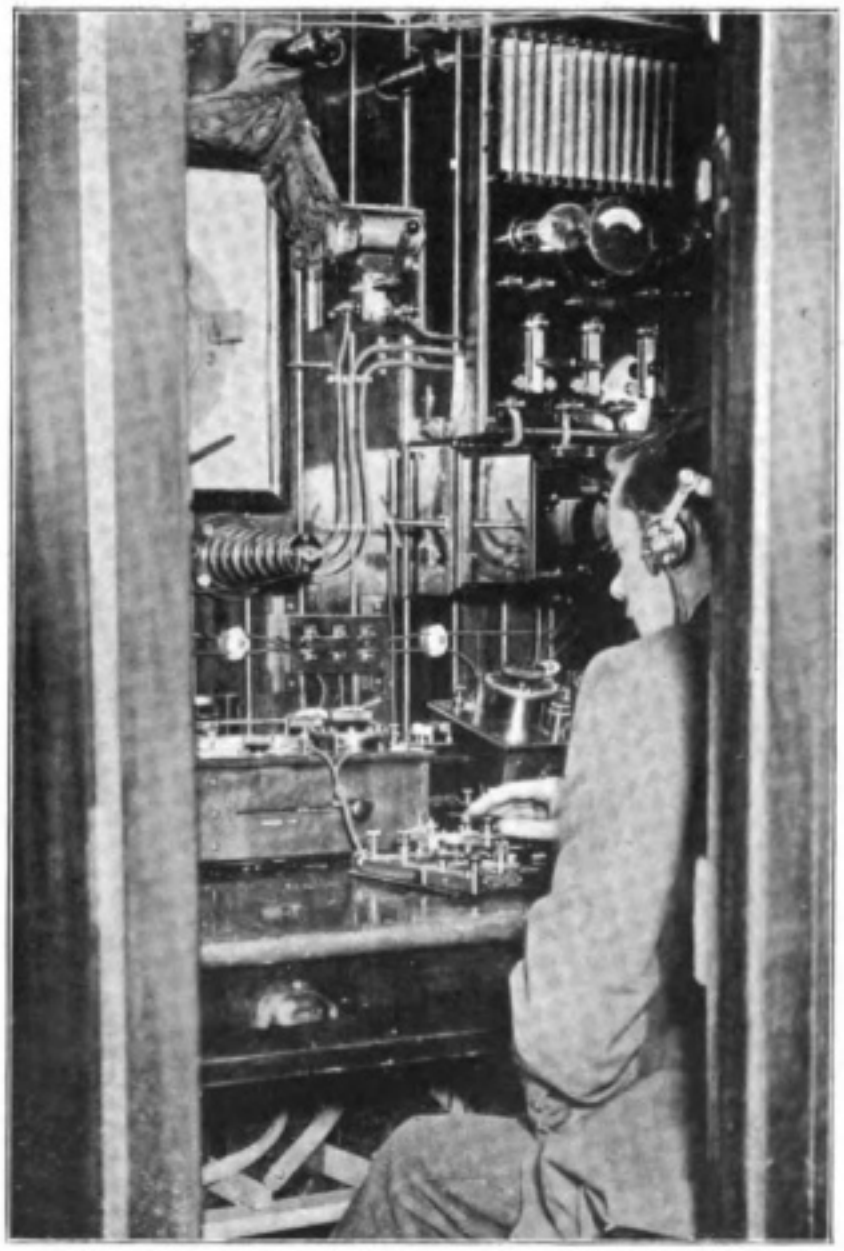


THE "COLUMBIA" LEAVING THE HARBOUR.

The telescopic masts, which have been invented especially to withstand bad weather, are here shown lowered. Compare them with their extended appearance in the foregoing photograph.

wireless installation by sending the following message to the President of the Board of Agriculture and Fisheries :—

" Greetings from Lynn Admiral Hellyer's steam trawling fleet—the first British steam trawling fleet fitted with Marconi wireless telegraph apparatus and wireless compass. Fleet now 210 miles E.N.E. from Spurn."



AN OPERATOR AT WORK ON THE " COLUMBIA."
The " Columbia " carries two operators, so that one may always be on duty.

Mr. Runciman, in reply, sent a radio-telegram to the fleet conveying his congratulations.

Other inaugural messages were also dispatched ; one was to Mr. Archer at the Trawler Insurance Company's office, St. Andrew's Dock. It read : " Radia Columbia, M.F.H. (signalling letters). To Archer, Trawler, Hull. Everything working well; 216 miles E.N.E. from Spurn.—Lynn, admiral."

This message was received by the Wireless Station at Cullercoats on the Northumberland coast, at 9.25 a.m., and it was received at Hull shortly afterwards.

Last of all was a message received at Marconi House, which ran : " Columbia 210 miles E.N.E. from Spurn, everything working well.—Admiral Lynn."

The *Bardolph* and the *Caliban* are trawlers; they have both been fitted with ½ k.w. and emergency sets ; but the *Columbia* is a " fleeter," and her rig-out is more extensive. She is equipped with a 3 k.w. and emergency set, so that she will be able to send messages over a distance of 300 miles—and more !—and besides carries a direction finder and a wireless compass. This is somewhat of a novelty among the smaller merchant vessels, though it is already in use on the more important liners and in the Navy. It enables the operator to locate with certainty the exact position of any ship calling him, and to correct her if her skipper has made any error in calculation. But these are not her only conveniencs ; her equipment is completed with an electric light installation and a searchlight. In fact, she is the last word in the application of science to everyday business. She will carry two wireless operators, so that one can always be on duty.

A meeting of the Institute of Radio Engineers was held at Columbia University on December 3rd, when Mr. E. F. W. Alexanderson, Consulting Engineer to the General Electric Company, read a paper on " Dielectric Hysteresis at Radio Frequencies."

The first meeting of the Washington Section has been postponed until January 7th, 1914.

* * *

The Admiralty have decided to establish a school for signalling and wireless telegraphy instruction at Harwich, in connection with the training establishments for boys at Shotley. The 11,000-ton cruiser *Spartiate*, at present stationed at Portsmouth as a training ship for stokers, is to be fitted for the duties of a signal and wireless telegraphy ship.

Communications with Cavalry

WIRELESS TELEGRAPH STATIONS IN THE INDIAN ARMY MANŒUVRES.—
THEIR INFLUENCE ON THE OPERATIONS OF THE DIVISIONAL TROOPS.

AN interesting example of the military uses of wireless telegraphy is furnished by the Inter - Divisional manœuvres between the 3rd and 7th Army Divisions which took place in India last year. Major D'A. Legard, of the 17th Lancers, has given in the *Journal* of the United Service Institution of India an interesting account of the means adopted for maintaining communication between the Divisions, and from this he draws important inferences as to what might have happened had there been sufficient portable wireless telegraph stations. In the manœuvres the Cavalry Division possessed two wireless stations, but these, it appears, were not sufficient to cope with the work required, and it has prompted Major Legard to consider how an adequate wireless service might have been employed. The example which he gives is important as showing how communications between the headquarters of an army and an independent cavalry can be obtained.

The general plan of the 7th Divisional Commander involved a movement to the River Jumna (the frontier) on the first day with his whole force and a subsequent crossing of that river, with a view of attacking an enemy's force which was believed to be concentrating near Sonepat. Headquarters, 7th Division, therefore, moved west from Dilaura to Bagpat, while the Cavalry Division received orders to march from Budhana to Kutana (a distance of 30 miles), almost parallel to, and about 25 miles distant from, the march of the 7th Division.

A signal company formed part of the 7th Division.

The Cavalry Division had an improvised signal squadron comprising: two wireless stations, eight cyclists, and sixteen despatch riders and signallers. Communication was established each night, but little was done during the day.

The following points seem to be necessary for the efficient carrying out of the signal service :—

(*a*) Co-ordination of the various means of communication by the O. C. Signal Squadron, who is in charge of the whole signal service of the Cavalry Division.

(*b*) Previous instruction at personal interview to be given by the G. S. O. Cavalry Division to the officer commanding Signal Squadron.

(*c*) When the Division halts, information to be given as to the probable length of halt.

(d) Arrangements to be made for supplementing the wireless with alternative methods of transmitting messages.

The accompanying diagram shows the arrangements for inter-communication which Major Legard suggests might have been made if the signal squadron had been provided with the following equipment, *viz.*: two wagon wireless stations, four pack wireless stations, eight cyclists, sixteen despatch riders and signallers.

The officer in charge of army signals, or G. S. O. II. (operations section) at headquarters, in consultation, at personal interview if possible, with the O. C., Signal Squadron Cavalry Division would draw up the following scheme for inter-communication; make arrangements for the distribution of the signal equipment and the detailing of the relay posts. For this the General Staff are responsible.

The following draft order for Force Operation Orders would then be prepared :—

Communication.—Communication will be established between headquarters and the Cavalry Division both by wireless and by a chain of relay posts, as early as the situation permits, on the lines: Daula, Baraut, Bagpat, Kutana. Detailed instructions have been issued separately.

The signal company at Divisional headquarters is jointly with the Signal Squadron

of the Cavalry Division responsible for maintaining communication between Force headquarters and the Cavalry Division.

The distribution of the equipment, personal, would be as follows :—

With Headquarters.—Two wireless wagon stations, one wireless pack station, despatch riders.

With Cavalry Divisional Headquarters.—Three wireless pack stations, dispatch riders.

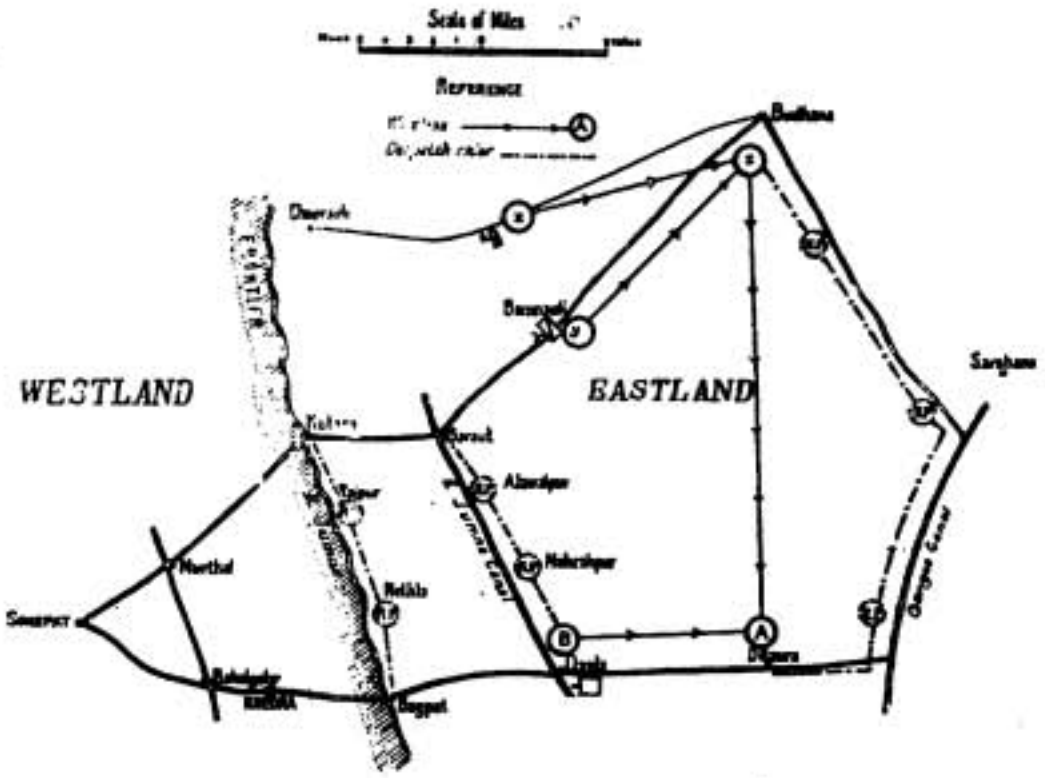
Force Headquarters would leave "A" wagon station at Dilaura all day as central signal station.

"B" wagon station would march with the Force Headquarters to Daula, where it would establish a post, and receive messages from "A" station for definite period, say, 10 a.m. till 1 p.m.

Pack station (C) would at first be in reserve ; but, if not needed, would move on and establish post at Bagpat as soon as possible. "B" station would then close, and move to Bagpat. Cavalry Division Headquarters would leave pack station (Z) at Budhana ; would march to (Y) station with the Division and attach (X) station to the reconnoitring detachment pushed out to Chaprauli. Previous information would have been given of the intention to establish (Y) station at Bamnauli 10 a.m. ; to open communication with "A" wagon station. This would allow pack station to close, and follow the Division to Baraut, where it would set up at about 2 p.m. Communication with the reconnoitring detachment (X) station would be ordered at definite hours, say, 10 a.m., 3 p.m. and 8 p.m. Communication between each headquarters and their nearest wireless station would be kept up by dispatch riders in pairs ; a pair being ready detailed as "next for duty," at the wireless station, and with the G. O. C.

Arrangements would also be made to supplement the wireless communication by a complete system of dispatch riders, just as if no wireless existed.

Major Legard then describes the system



of dispatch riders, and he gives some notes from the draft order on the subject of intercommunication. He states : "Wireless telegraph stations will be established at Baraut and at Kutana as early as the situation permits, if possible by 2 p.m. and 4 p.m. respectively. A chain of relay posts will be established on the line Baraut-Daula by 1 p.m., on the line Kutana-Bagpat by 3 p.m. The intermediate posts at Maheshpur and Nethla will be furnished by Force Headquarters. Posts at Baraut, Alawalpur, Kutana, and Rajpur will be furnished by the 2nd Cavalry Brigade. Each post will consist of : one N.C.O. and four dispatch riders. The officer detailed to

command the posts will report at Cavalry Divisional Headquarters at 9 p.m. for special instructions."

The table below shows the method of hourly transmission of wireless messages, from Cavalry Division to Force Headquarters.

	Method.	From	Through	To
a.m.				
6	Wireless	Z (Budhana)	—	A (Dilaura)
7	Dispatch rider and wireless	Z ,,	A (Dilaura)	Headquarters
8	,,	Z ,,	A ,,	,,
9	,,	Z ,,	A ,,	,,
10	,,	Y (Bamnauli)	A ,,	,,
11	,,	Y ,,	A ,,	B (Daula)
12	,,	Y ,,	A and B	Headquarters
p.m.				
1	,,	Y ,,	B (Daula)	C (Bagpat)
2	,,	Z (Baraut)	B ,,	C ,,
3	,,	Z ,,	B ,,	C ,,
4	,,	Y (Kutana)	—	C ,,
5	,,	Y ,,	—	C ,,
6	,,	Y ,,	—	C ,,

The proposed action of the Signal Company is as follows, according to Major Legard :—

On the second day, the Cavalry Division crossed the Jumna at Kutana at 5 a.m., and marched on Lursauli, whence it operated in the triangle Lursauli, Deoru, Murthal, and finally withdrew to camp at Murthal.

The Headquarters moved from Bagpat at 4.30 a.m., and after a heavy engagement near Kheora, halted for the night near Bahalgarh.

"A" wireless wagon station would be left as central station at Bagpat. "B" station would proceed with Divisional Headquarters and be established near Kheora by 9 a.m. It would then accept all messages received meantime from "A" station. "A" station would then close.

"C" pack station would be in reserve with Force Headquarters.

CAVALRY DIVISION SIGNAL SQUADRON.

"Y" pack station would remain at Kutana to transmit messages sent by dispatch rider to "A" wagon station at Bagpat.

"Z" station would accompany Cavalry Division Headquarters in the hope of being able to set up a station during the day. This would not have been possible, and messages would have been sent by dispatch riders or helio to Kutana and thence after 10 a.m. "B" station at Kheora.

"X" station would have rejoined Headquarters at 8 a.m., with 30 Lancers, and been in reserve, ready to accompany any reconnoitring detachment.

USUAL SIGNALLING.

The signal stations at Kutana and Bagpat were established on high ground, commanding a good view of the country for a distance of 6 to 8 miles westwards, in the direction in which the troops were operating.

Signallers with the Cavalry Division and with headquarters would be instructed to call up these stations at Kutana and Bagpat, as circumstances required to supplement other means of command. Well-mounted staff officers might also have been very usefully employed to carry verbal reports direct from the Cavalry Division to the Force Headquarters.

At 5 p.m. a service of dispatch riders would be organised to work between Murthal and Bahalgarh, preferably of cyclists. Relay posts would not be needed as the distance is only 4 miles.

The relay posts on the lines: Budhana-Dilaura, Baraut-Daula, Kutana-Bagpat, would have been withdrawn by the officer in charge, Army Signals, as the need for them gradually ceased.

The Share Market.

LONDON, *December* 19, 1913.

The Share market has been dull in sympathy with Stock markets in general. Marconi International Marine Communication shares have been dealt in up to 1 1/16 cum dividend. There is a steady demand for these shares and for the shares of the Canadian and American Companies.

Prices as we go to press are:—Marconi Ordinary, £3 7s. 6d.; Marconi Preference, £2 12s. 6d.; Canadian Marconi, 16s. 9d.; American Marconi, 16s. 10½d.; Spanish and General, 8s. 9d.; International Co., £1 8s. 9d., ex dividend.

* * *

The United States Transport *Thomas*, which arrived in San Francisco on November 13th from Manila, reported that on September 24th, when the ship was near Guam, the scores of the Pacific Coast League baseball game were received on board, over a distance of 4,700 miles.

The Transatlantic Station in Norway

A Report on the Work at Stavanger

STAVANGER is an old and venerable town, for its importance as a port was recognised by German merchants as far back as the Middle Ages. Every year these merchants sent their ships of commerce to Stavanger and Bergen, there to exchange cargoes of spices and beer for salt and dried fish. Relics of this venerable past are still to be found in the curious old houses which border the steep and narrow streets of the older part of the town, where even the more modern buildings are constructed of wood. Behind, the tower of Udlanhaug rises in lonely majesty on the top of the hill. It was built to commemorate what was perhaps the most important battle in the history of Norway, where, more than a thousand years ago, Harold Hairfair, the last of the petty kings, was killed, and the way was made plain for the ultimate unification of the kingdom.

Mr. O. Frost, the Marconi Engineer in Charge of the Construction Party at work on the Stavanger site.

It is on the slopes of this hill that the new Marconi Wireless Transatlantic Station is being built, so that from the same spot where once the Vikings watched the fortunes of their warriors as the armies engaged in the fierce struggle, now surging forward, now stubbornly retreating according to the fortunes of the battle, the spectator will now see the outward and visible signs of a nation's—nay, a world's—struggle with the elements, a complex web of iron and steel whereby the Twentieth Century takes light and sound captive, and makes them acknowledge her victory and do her bidding.

Here ten steel masts are being erected, and what was before waste land will now be utilised to the greatest good of mankind.

It may be interesting to mention some of the incidents in connection with the preparation of the foundations for these masts. Excavation on such a stubborn mountain is no light task. First the workmen drill a hole in the rock some ten feet deep, then insert a cartridge and blast it so as to increase the excavation to a size sufficient to contain the charge of dynamite. After they have ignited the fuse they walk away. But they are in no hurry—no Norwegian workman ever was in a hurry; and the fact that they are engaged in a very dangerous occupation does not seem to occur to them, for, after all, are they not expert exponents of the material they use, quite inured to its eccentric behaviour and proof against surprise? Nevertheless, they have a care for their fellow workmen, for as they retreat they cry "Se op! Se op!" A minute later and the eruption will take place, the broken rock will be scattered far and wide, and the fragments flying through the air will loom large through the clouds of smoke and dust. To the workmen nothing could be simpler; they know exactly where to drill the necessary holes and how much dynamite to use to obtain the desired result, and they have attained such accuracy in this respect that seldom is a fraction of rock more than that absolutely necessary dislodged.

The Norwegian labourer is very independent, and usually prefers "piecework" to "time." Often several friends will join

together and secure a contract, which they will carry out between themselves. A group of this kind usually comprises four to six individuals. If they are particularly anxious to secure the price of the contract they will work for long hours and very steadily without much intermission for rest or meals.

For instance, in the making of a road, six men, it may be, will contract to do a certain length at a given price — one will supply horse and cart and the others will provide their equivalent of labour; one will break stones, another will set them, and so forth; and when they have finished the contract that part of the road will be complete in every detail.

It is in this way that the road up to the Marconi Station is being constructed; it is in two sections, the first part leading from the main road to the machine house, and the other part, which is very circuitous owing to the steep ascent, leads to the top of the hill and the Marconi masts.

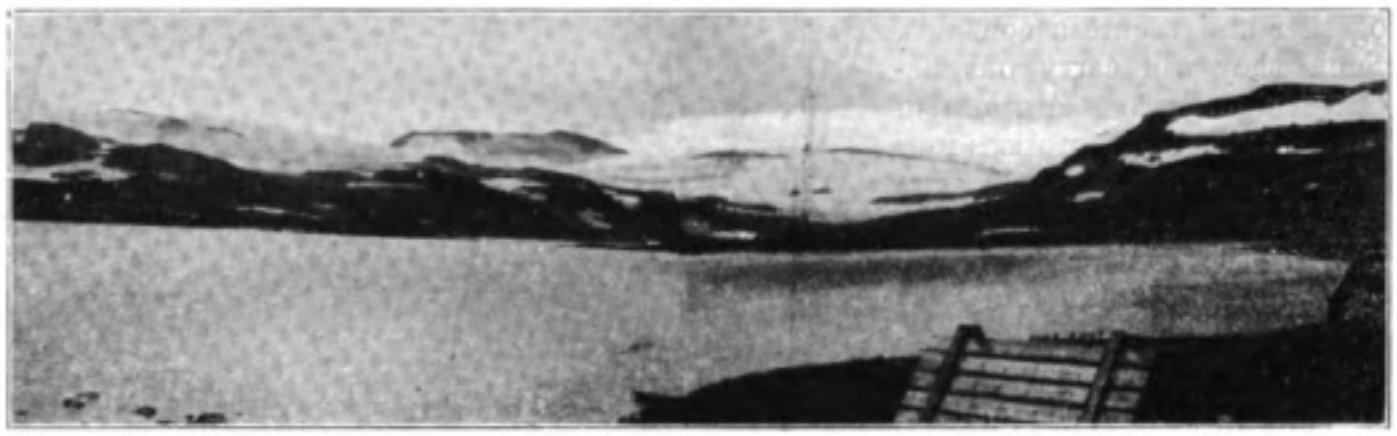
At the bottom of the hill a cottage is situated named "Fieltun" (The Mountain Knoll), which has hitherto been used as a country inn. From this place there is a fine view over the Hafrs-Fiord, and it has therefore been a favourite excursion for the Stavanger people to go out there and take afternoon tea during the summer. The innkeeping had, however, to stop as soon as its purchase for the Marconi Station was complete, for the house, on account of its position, was too useful to be allowed to remain a little insignificant tea-shop. Therefore it is now used as a temporary office for the Marconi engineers and the Government's officials, but it often happens that on a sunny afternoon visitors enter the hall and expect to be served with tea. Needless to say, in this respect they are disappointed, though if they like they can find in its new use abundant food for thought, which should last them many a day.

The temporary Office of Works for the new Station. This was formerly a refreshment hall.

About 500 yards from these offices a landing stage has just been finished; at this spot motor lighters and small steamers discharge loads of cement, sand and other materials for the wireless station. Only small ships can enter here, and larger boats have to discharge their loads at the celebrated old Stavanger harbour.

Here, where once upon a time none but German sailing ships made anchor, there are now to be seen steamers of all nationalities. Just as in the old days, the chief export article of Stavanger is fish, not only salt and dried fish, but tins of delicious sardines, of which Stavanger exports more than any other town in the world, or nearly one million pounds' worth every year. During the past autumn, however, the inhabitants of Stavanger have been in great distress, for the sardines have not yet reappeared.

Blasting a hole in the rocks for the foundations of one of the masts.



Snow in Midsummer: one of the sights to be seen on the railway journey from Kristiania to Bergen.

Shoals of them usually arrive off the coast about August, and consequently it is during this month that the inhabitants expect to make by far the largest amount of their year's income; but for some reason or other the little fish have forsaken their usual haunts, and the town will be deprived of its principal source of revenue, while the tourist visiting Stavanger will miss the characteristic smell of fish, which persistently hangs over the town much in the same way as a fog occasionally hangs over London.

The "Hermetic" factories will have to reduce the number of men employed, perhaps even to close down for a time, for want of fish to fill their tins.

Stavanger is only accessible from the sea, and the journey to the capital, Kristiania, is celebrated for its varying scenery. The traveller can go by boat the whole way to Kristiania, but this is a journey of about three days' duration, and many people therefore prefer to take the boat going north to Bergen, a very beautiful old town, whence one can go by rail across the country to Kristiania. This journey is famous, for the route winds its way in curves right up to the eternal snow at Finse, where winter sports can be enjoyed even in the hottest part of the summer, and where the four seasons of the year may be experienced in the course of a single day.

A bird's-eye view of Bergen from the Wireless Station at Stavanger.

Contract News

Vessels fitted with Marconi Apparatus since the last issue of *The Wireless World*.

Name.	Owners.	Installation.	Call Letters.
Glenetive	Caledonia S.S. Co.	1½ kw. and emergency	MEZ
El Cordobes	British and Argentine Steam Navigation Co.	"	MHO
Galiano	Canadian Government	"	—
Scindia	Anchor Line	"	MHJ
Berrima	P. & O. Steam Navigation Co.	"	MFF
Pera	" " "	"	MGB
Khiva	" " "	"	MGZ
Baron Erskine	Hogarth & Son	"	MHF
San Valerio	Eagle Oil Transport Co	"	MHZ
San Hilario	" " "	"	MIZ
El Toro	Lobitos Oilfields, Ltd.	"	MHD
S. Y. Alberta	J. B. Cohn, Esq.	"	MHW
Limerick	New Zealand Shipping Co.	"	MHU
Highland Hope	Nelson Line	"	MEO
Chaleur	Royal Mail Steam Packet Co.	"	GMN
Chignecto	" " "	"	MBV
Historian	T. & J. Harrison	"	MHT
Raeburn	Lamport & Holt	"	MES
Kelvinian	J. Black & Co.	"	MGQ
Carpentaria	British India Steam Navigation Co.	"	MHG
New Londoner	Tyne and Tees S.S. Co.	½ kw. and emergency	MDQ
Parana	Royal Mail Steam Packet Co.	"	GLK
Nonsuch	Bowles Brothers	Emergency Plant added	MYH

Orders have been received to equip the following Vessels with Marconi installations since the last issue of *The Wireless World*.

Name of Vessel.	Owners.	Type of Installation.	Call Letters.	Remarks.
Potosi	Pacific Steam Navigation Co.	1½ kw. and emergency	MII	Liverpool to Valparaiso.
Inca	" " "	"	MIF	
Magellan	" " "	"	MIH	
Corcovada	" " "	"	MIE	
Sorata	" " "	"	MIJ	
Orduna	" " "	"	MGP	Pacific Coast Mail.
Orbita	" " "	"	MGI	
Orca	" " "	"	MGO	
Imperial	Cia Sud Americana de Vapores	"	CAI	South American Pacific Ports.
Baron Erskine	H. Hogarth & Sons	"	MHF	General cargo.
El Corro	Lotutos Oilfields, Ltd.	"	MHE	Oil tank steamer.
Crown of Toledo	Crown S.S. Co., Ltd.	"	MHV	General cargo.

The following Vessels have been fitted by the Société Anonyme de Télégraphie Sans Fil.

Name.	Owners.	Installation.	Call Letters.
Sir Ernest Cassel	R.L.O.	1½ kw. and emergency set	SFP
Madioen	Rott. H.	½ kw. and emergency set	PGI
Ambaca	E.N.N.	" " "	CSY
Malange	E.N.N.	" " "	CSN
San Miguel	E.L.N.	" " "	CSS
Ioannina	N.S.N. Co.	" " "	SVI

Europe's Time Signaller

THE EIFFEL TOWER SERVICE. AN EXPLANATION OF THE SIGNALS.

LITTLE did M. Eiffel suspect the uses to which his Tower was destined to be put. It has lately taken on itself some of the functions of a newsagent by dispatching wireless each morning and evening news to the French warships and the military posts in Morocco, and as all know, it was chosen by an International Conference in 1912 to signal the hour to the rest of Europe. This is done at a number of fixed times, and the signals themselves are of two kinds—the first of which are " ordinary " hourly signals, exact to a quarter of a second, while the second signals furnish the mean time according to the Observatory of Paris to the scientific observatories of other countries.

Automatic time signals are at present transmitted by way of experiment from the Eiffel Tower at 10 a.m. daily ; and at the second International Time Conference, held in Paris last October, the question of definitely putting them into operation was discussed, and it was finally decided to postpone doing so, as the signals do not give entire satisfaction, and they will have to be modified.

On November 15th, however, one or two alterations were introduced into the Eiffel Tower service. Thus, the duration of the signals sent out each evening at 11.30 p.m. are extended to five minutes instead of three minutes, while before the morning and night signals there is transmitted daily a series of six dashes of five seconds each, separated by intervals of five seconds also. The two six-figure code signals sent after the time signals at night represent in minutes, seconds, and one-hundredths of a second the precise time at which the first and last of the 300 rhythmic beats are sent out. These 300 beats have a periodicity of 0·98 seconds ; this is to say they are seconds diminished by one-fiftieth.

Apart from these time signals there are a number of signals connected with the meteorological service. These are of two kinds, the first of them affording an indication of the barometric situation of Europe as a whole, and derived from information supplied by Iceland, Ireland, France, Spain, the Azores, and America ; the second of them sending out similar information regarding the state of the weather for fourteen stations in Western and mid-Europe, from Stornoway to Rome, from Prague to Biarritz and Stockholm. These telegrams are, of course, all coded, and numerals are employed to convey intelligence concerning the strength and direction of the wind, the state of the sky, and the state of the sea.

The Central Meteorological Office have issued a manual of the Eiffel Tower wireless service, from which we make the following extracts relating to the two meteorological reports that are transmitted.

These reports are preceded by the initial letters BCM (Bureau Central Météorologique).

(1) The morning report is transmitted at 10.49, immediately after the time signals commencing at 10.45 a.m. This time may be modified at a later date when the new time signals come into force. *Note.*—See letter from Commandant Ferrié.

(*a*) Six groups of 7 or 8 figures indicating the barometric pressure, the direction of the wind, state of the sky, and state of the sea. (This last figure appears in the groups containing 8 figures.) These groups are preceded by one or two initial letters indicating the name of the station referred to. R=Reykiavik (Iceland) ; V=Valentia (Ireland) ; O=Ushant (Brittany) ; CO=La Carogne (Spain) ; HO=Horta (Azores) ; SP=Saint Pierre (America).

(*b*) Following the six groups of figures general atmospheric conditions for various parts of Europe are telegraphed in plain language (French).

(*c*) Groups of 7 or 8 figures giving the same observations for Paris : C=Clermont-Ferrand ; BI=Biarritz ; M=Marseilles ; N=Nice ; A=Algiers ; SY=Stornaway ; SH=Shields ; HE=Helder (Holland) ; SK=

Skudesnaes (Norway); ST=Stockholm; P=Prague; T=Trieste; R=Rome.

(*d*) General forecasts for France concerning the state of the sky and wind.

(*e*) The direction and force of the wind at the Eiffel Tower, 305 metres above ground, and probable wind for evening. This last information, for the use of aeronauts, is preceded by the initials FL; the velocity of the wind is indicated in metres per second.

Second Weather Report.—A second report is sent at 17 (5 p.m.). It amplifies the morning report and takes into account variations which have been observed since 7 a.m., and to give a more precise forecast for the next day.

(*a*) The report consists of 8 groups of figures similar to the morning report for the following places: Paris: BR=Brest; BI=Biarritz; N=Nice; V=Valentia; SK=Skudesnees; R=Rome; CO=La Corogne.

(*b*) Forecasts of the weather.

(*c*) The direction and velocity of the wind at the Eiffel Tower at 16 (4 p.m.) and a forecast for the wind and weather for the following morning. The report is made from observations made at 14 (2 p.m.).

EXAMPLE OF MORNING WEATHER REPORT.

BCM — R5132811 — V57422445 — O64522544—CO67530183 - - - - - Depression N.W. Europe forte pression S.W. Paris 6512031 * * * * * * Probable vent W. modéré averses Nord et Est—FL SW. 13 probable W. 10.

EXAMPLE OF EVENING WEATHER REPORT.

BCM—Paris 6262030—BR 65224455—BI — XXXXXXXX — N 62222211 — V60022425—SK 36024655—R 6142030—CXXXXXXXXX — Baisse barometrique Baltique stationnaire — Manche — Vents tournant N.W. fortes Manche Mediterranée. Averses—FL W. 10 probable W. 8.

The translation of the above is effected in the following manner: The first three figures represent the barometric pressure in millimetres and tenths of a millimetre, the figure 7 always preceding the figures telegraphed. The 4th and 5th figures indicate the direction of the wind. The 6th the direction of the wind. The 7th the state of the sky. The 8th the state of the sea.

The first group in the morning report is R5132811, which is translated below.

R = Reykiavik; 513 indicates that the barometric pressure was 751·3 millimetres; 28 = direction of the wind N.W.; 1 = force of the wind, nearly calm; 1 = sky, slightly cloudy.

The second group, V57422445.

V = Valentia; 574 = barometric pressure; 757·4 millimetres; 22 = direction of the wind W.S.W.; 4 = force of wind, moderate; 4 = state of sky, covered; 5 = state of sea, very choppy.

When observations have not come to hand XX is sent, thus the third group of the evening report is BIXXXXXXXX, which signifies that the report from Biarritz had not arrived in time to be dispatched from FL.

For further information on the subject of time signalling, etc., we would refer our readers to articles which appeared in THE WIRELESS WORLD for August, 1912 (p. 297) and October, 1912 (p. 454).

Direction of Wind. 4th and 5th Figures.				Force of Wind. Designation velocity in metres. 6th figure.			State of Sky. 7th Figure.		State of Sea. 8th Figure.
00	No wind	18	S.S.W.	0	Calm	from 0-1	0	Fine	0 Calm.
02	N.N.E.	20	S.W.	1	Nearly calm	1-2	1	Light clouds	1 Very smooth.
04	N.E.	22	W.S.W.	2	Very light	2-4	2	Cloudy	2 Smooth.
06	E.N.E.	24	W.	3	Light	4-6	3	Very Cloudy	3 Slight waves.
08	E.	26	W.N.W.	4	Moderate	6-8	4	Covered	4 Choppy.
10	E.S.E.	28	N.W.	5	Fairly strong	8-10	5	Rain	5 Very choppy.
12	S.E.	30	N.N.W.	6	Strong	10-12	6	Snow	6 Rough.
14	S.S.E.	32	N.	7	Very strong	12-15	7	Mist	7 Very rough
16	S.		—	8	Violent	15-18	8	Fog	8 Very high Sea.
	—		—	9	Gale	18-	9	Storm	9 Tempestuous.

Answers to Correspondents

BY OUR IRRESPONSIBLE EXPERT

MARINER (Cardiff).—The wireless compass is an apparatus which enables a ship to see where it is going without looking.

S. PARKS (Darjeeling).—Yes, most of the Indian land stations are fitted with tea aerials. You are wrong, however, in supposing that the "sausage" aerial originated in Germany.

SCEPTIC (Surbiton) writes as follows: "Sir,—I recently received what was alleged to be a Marconigram from my brother on board one of the large liners. I had previously suspected that wireless was a fraud, and when I found that this so-called telegram was *not in my brother's writing* my suspicions were confirmed!"—Answer: My dear Sir, if your brother's writing is no better than your own alleged writing it is a credit to wireless that any message came through at all.

MUSICAL (Birmingham) writes: "Dear Sir,—I am very much worried about my multiple tuner. I have turned the intensifier handle at all speeds, but fail to produce any tunes. My mother is very anxious to hear 'The Rosary' on it, so I should be glad of your advice." Answer: We strongly suspect you have burnt out the insulation by trying to play rag-time. Set the tuning switch at 600 meters and try "What are the wild waves saying?"

CONSTANT READER (Margate).—An "X" in wireless is something which comes when it is not wanted. There are two main sorts—the atmospheric kind and the retransmission variety. Both are a great source of annoyance to operators, hence the name "X," which is a polite sign for bad language. Means have been found to eliminate the first kind to a great extent, but no "X" eliminator yet devised has been able to keep out the retransmission messages. They creep in through the strongest insulation.

J. G. W. (Leeds).—The wireless telephone is a telephone without wires, poles, exchange girls or other similar obstructions. It is invented regularly every week in one or other of the halfpenny papers. It depends for its working on the production and emission of continuous waves. The present wire telephone seems to necessitate (on the part of the subscriber) continuous raves. The great difficulty encountered at present in wireless telephony is to find a microphone strong enough to carry the wireless current and bad language as well.

AMATEUR (Tooting).—Carborundum is used in the Marconi crystal receiver. It has been found that this substance resists mildew very well and is not easily bent. It acts by virtue of its high resistance. The current finds such difficulty in passing through one way that it does not think it worth while to go back again. The current is thus rectified and produces a tick in the telephones. The Fleming valve acts in a similar way by making things hot for the current. We hope this is clear.

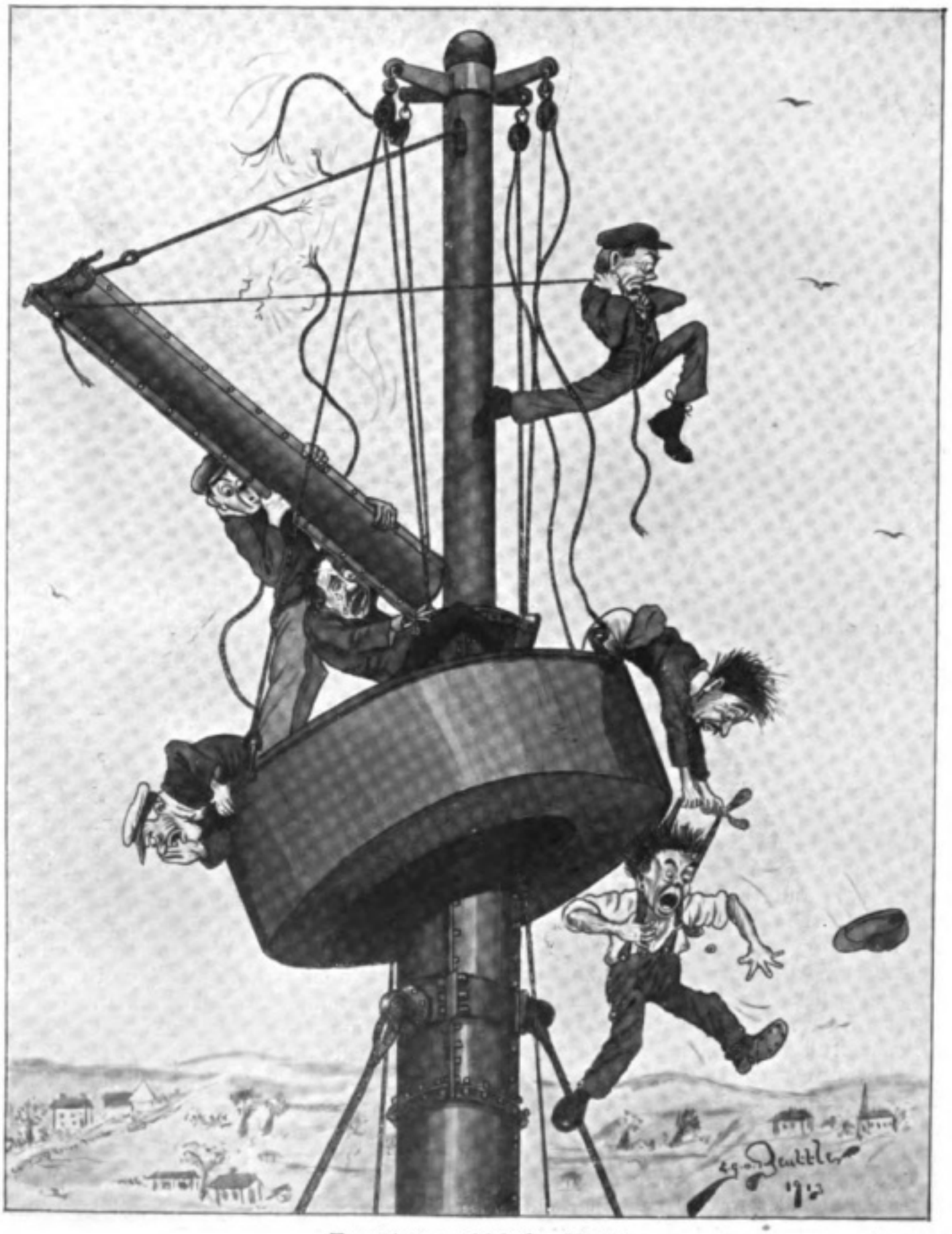
TWO WIRELESS MISTAKES

According to the Paris *Daily Mail*, during the recent French army manœuvres an invitation was transmitted by wireless asking several officers to "lunch." The sapper was unacquainted with the English word "lunch," and sent "punch." As a result the officers who were invited had their lunch first and went, expecting only liqueurs. To avoid being rude, they had to eat another lunch, and were much discomfited.

This reminds us of the newly married officer (probably in the same regiment) who invited an intimate friend to lunch, and afterwards sent a wireless message to him: "What do you think of my wife?" The sapper who sent it (probably the same sapper) sent it as "What do you think of my wine?" The friend, who was busily engaged in getting rid of the nasty taste of the officer's wine, sent a wireless back: "Rather sour and no body." The victim of the duel died shortly afterwards. The reader will draw probably the same conclusion from both stories.

CARTOON OF THE MONTH

WIRELESS WORRIES—I.



Erecting a 400-ft. Mast.

D

NOTES OF THE MONTH

A WELSH STATION. HOW WIRELESS AIDS THE BANANA TRADE. PUBLIC CONTROL IN THE UNITED STATES. FRENCH-AMERICAN EXPÉRIMENTS. MARCONI DIVIDEND ANNOUNCEMENTS.

MUMBLES wants a wireless telegraph station, and the Swansea Chamber of Commerce are supporting the local demand for one. At a recent meeting of the Chamber the question was introduced by Mr. A. G. Moffatt, who said he thought it would not be long before all passenger boats would be bound to have a wireless installation, even those which carried passengers across to Devonshire! The question was where were the messages to be received ashore? It was essential, he contended, there should be a station at the Mumbles, for if messages had to be received at Poldhu or Fishguard there would be considerable delay in the case of anything occurring in or near the Channel. The advantage of the Mumbles was that there were tugs always ready there, and as most of the ocean-going vessels touching Swansea were fitted with wireless, it was essential that they should be able to get into direct communication with the port, and it was agreed that the matter should be brought before the Harbour Board with a view of the two bodies co-operating to secure their object.

* * *

Another proof of the value of wireless telegraphy as a commercial asset has just come to the notice of the public in a rather curious manner. A tax has been proposed on bananas, and this has served to draw attention to the remarkable organisation of this transport business. The writer can remember the time when a banana was a rarity, or at least an important item on the dessert list. Now this delicious and nutritious fruit floods the market. Hawkers leave Covent Garden Market every morning with barrows laden with this delectable commodity, and it forms one of the staple food supplies of the poorer population. The fruit is packed while green and rushed thousands of miles to the great markets of the world in a few days, so that it may be in prime condition when it is sold to the public. And so carefully is this business of transportation organised that millions of bananas are brought from the tropics every day for home consumption, but great judgment has to be used in the packing and transport of this perishable cargo. The banana must be neither too green nor too ripe, and every care has to be taken that the vessels carrying the fruit may not be delayed on their long journey. As a precaution against the latter possibility, wireless telegraphy has been found to be of invaluable assistance. Every vessel engaged in the trade is equipped with a wireless plant, so that if, through bad weather or any other cause, the transport should be delayed, she can send out a wireless call for assistance, and all the help possible can be offered her so that as much time as possible may be gained, and the chances of her cargo rotting in the hold may be reduced to a minimum. How many, we wonder, of the consumers of bananas have realised what an important part wireless has played in supplying them with their delicacy.

* * *

Speculation has been rife as to the intention of the United States Government with regard to the acquisition of the telegraph and telephone lines. Inquiries made at Washington by a representative of the *Electrical World* of New York indicate that the report that the Washington Administration is to embark on a policy of Government ownership is based primarily on an investigation now being made by Congress man David John Lewis, of Maryland, rather than on the present attitude of the Administration itself. Some colour has been given to the report that the Postmaster-General is interested in the matter by the announcement that the Alaska military cable and telegraph system will be transferred from the War Department to the

Post Office Department. This system comprises 2,500 miles of submarine cable, 1,200 miles of land line, and ten wireless telegraph stations. Major Charles McKay Salzman, of the Army Signal Corps, has been transferred to the Post Office Department temporarily in connection with the proposed change in control of this property. The War Department wants to be relieved of its duty with respect to the Alaska lines, pointing out that they are not needed now for purely military purposes. Whether any particular significance with respect to the larger subject of government control of other lines can be attached to this matter cannot be learned in Washington.

* * *

A delegation of French scientists, composed of Martial Simonin, of the Observatory of Paris, Captain A. Carrier, of the Colonial Infantry, and Lieutenant Gignon, of the Navy, recently visited Washington for the purpose of renewing wireless experiments between Arlington station and Eiffel Tower. A similar delegation, composed of Lieutenant R. B. Coffman, C. A. McGruder, George S. Gillespie, and G. A. Hill, of the Naval Observatory, Washington, together with Commander H. H. Hough, naval attaché at Paris, represented the United States at Paris in connection with the experiments at Eiffel Tower.

This is the second series of an extensive programme of experiments which has been mapped out by the naval officials of the two countries to use the wireless apparatus at their disposal for fixing the difference in longitude between Paris and Washington, and also obtaining other data for use in connection with astronomical calculations which would otherwise be impossible.

The officers of each navy will work alternately in Washington and Paris, in order to eliminate error, as far as possible, arising from personal equation. The astronomical instruments used in the observations will also be exchanged between the two countries to correct any slight variations due to mechanical imperfections in the construction of the apparatus.

* * *

The following circulars, signed by the Secretary, Mr. Henry W. Allen, were issued on December 13th to shareholders in Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., Ltd.

WIRELESS CO.

"I beg to inform you that at a Meeting of Directors of this Company, held on the 11th instant, it was

Resolved—

That an interim dividend of ten per cent., equal to two shillings per Share, less Income Tax, upon the 750,000 Ordinary Shares, numbered 1 to 500,000 and 750,001 to 1,000,000, be, and the same is hereby declared, on account of the current year; that the said dividend be payable on the 31st January, 1914, to the Shareholders registered on the books of the Company on the 24th December, 1913, and to Holders of Share Warrants to Bearer; and that the Transfer Books be closed from the 24th to the 31st December, 1913, inclusive.

Warrants for the dividend upon the registered Shares will be forwarded by post on the evening of the 30th January next.

Notice will be given in due course regarding the deposit of coupons for the payment of dividend on Bearer Shares by advertisement in newspapers in London, Brussels, Italy, Montreal, Buenos Aires and the United States."

The Preference dividend of 7 per cent. per annum to 31st December, 1913, was paid on October 1st last, and consequently the Preference Shares and the 750,000 Ordinary Shares will not rank equally for any further dividend which may be declared in respect of the year 1913.

INTERNATIONAL CO.

"I beg to inform you that at a Meeting of the Directors of this Company, held on the 11th instant, it was

Resolved—

That an Interim Dividend of five per cent., equal to one shilling per Share, less Income Tax, upon the Capital now issued and paid up, be, and the same is hereby declared, on account of the current year; that the said dividend be payable on the 31st January, 1914, to the Shareholders registered on the books of the Company on the 24th December, 1913, and that the Transfer Books be closed from the 24th to the 31st December, 1913, inclusive."

Administrative Notes

THE Consul-General for Argentina in London reports the publication of a law by which all ships entering or leaving Argentina ports with 50 or more persons on board must possess a wireless telegraph installation, under the charge of a competent operator. For use on river steamers the wireless must have a range of not less than 200 kilos. (about 125 miles) and for sea-going vessels a range of at least 500 kilos. (about 310 miles). Vessels not complying with the regulations will not be cleared.

Compulsory Wireless on Ships.

* * *

THE Government of India has sanctioned the attachment of 18 men drawn from volunteers from the British units to No. 41 (Wireless Signal) Company for six months, with effect from November 15th, 1913, for instruction as operators in wireless telegraphy. These men receive four annas per diem, in addition to the regimental pay, proficiency pay and allowances. The qualifications are as laid down in India Army Order 492, September 15th, 1913, omitting sub-paragraph (vi) and paragraphs (v) and (vi). Preference is given to young soldiers of mounted units who are first-class signallers. The men must be willing to transfer eventually to No. 41 (Wireless Signal) Company. For the purpose of signalling inspections, qualified signallers absent on this duty are counted as first-class signallers of their unit.

India Army Regulations.

* * *

AN ordinance has been issued which consolidates the laws on wireless telegraphy in Mauritius. Under this ordinance no person shall establish any wireless telegraph station or install or work any apparatus for wireless telegraphy in any place or on board any ship registered in the Colony except under and in accordance with a licence granted by the Governor. Every such licence shall be in such form, and for such period, as the Governor may determine, and shall contain the forms, conditions, and restrictions on and subject to which it is granted. No person shall work any apparatus for wireless telegraphy installed on any merchant ship, whether British or foreign, while that ship is in the territorial waters of the Colony, otherwise than in accordance with prescribed regulations.

Regulations in Mauritius.

* * *

AN ordinance has been issued providing for the regulation of wireless telegraphy in Southern Nigeria. Under this ordinance no person may establish a wireless telegraph station or install or work any apparatus for wireless telegraphy in the Colony except under a licence granted by the Governor. Merchant ships in the territorial waters of the Colony must not use wireless telegraphy in such a way as to interfere with naval signalling, or with the working of wireless stations established in the Colony. Merchant ships must not work wireless telegraphy whilst in any harbour or bay of the Colony, except with the special permission of the Governor.

Wireless in Southern Nigeria.

* * *

THE new law passed by the Canadian Parliament regarding the wireless telegraph service on Canadian vessels sailing on inland waters comes into force on January 1st, 1914. Section 4 of the Act reads as follows: "From and after January 1st, 1914, no passenger steamer, whether registered in Canada or not—(*a*) licensed to carry 50 or more persons, including passengers and crew, and going on any voyage which is or which includes a voyage of more than 200 nautical miles from one port or place to another port or place; or (*b*) licensed to carry 250 or more persons, including passengers and crew, and going on any voyage which is or which includes a voyage of more than ninety nautical miles from one port or place to

Wireless on the Canadian Lakes.

another port or place; or (*c*) licensed to carry 500 or more persons, including passengers and crew, and going on any voyage which is or which includes a voyage of more than twenty nautical miles from one port or place to another port or place shall leave or attempt to leave any Canadian port unless such steamer is equipped with an efficient radio-telegraph apparatus, in good working order, capable of transmitting and receiving messages over a distance of at least 100 nautical miles by night and by day, and in charge of a person fully qualified to take charge of and operate such apparatus.

"2. The owner, master, or other person in charge of any passenger steamer which leaves or attempts to leave any Canadian port contrary to the provisions of this section shall, on summary conviction, be liable to a fine not exceeding $1,000 and costs, and such fine and costs shall constitute a lien upon such passenger steamer.

"3. This section shall not apply to passenger steamers plying on the rivers of Canada, including the River St. Lawrence as far seaward as a line drawn from Father Point to Point Orient, or on the Northumberland Straits, or on the Georgian Bay, or on the lakes of Canada other than Lakes Ontario, Erie, Huron and Superior; and the provisions of paragraph (*c*) of sub-section 1 of this section shall not apply to steamers making voyages on Lakes Ontario, Erie, Huron and Superior the regular route for which is not at any point more than seven miles from the shore.

"4. This section shall not apply to steamers calling at Canadian ports solely for the purpose of obtaining bunker coal or provisions for the use of such steamer, or through stress of weather, or for repairs."

* * *

THE call letters SOW have been assigned to the s.s. *Carioca*, owned by the Brazilian Government.

* * *

THE Marconi depot at Genoa has been transferred from Molo Vecchio to Piazza della Commenda, No. 67.

* * *

THE Post Office wireless telegraph station at the Lizard has been closed and the staff transferred to the new coast station at Land's End, which was opened for commercial work on December 1st, 1913.

* * *

THE following Marconi stations have been opened to the general public service. Full particulars concerning them will be published in an early issue of THE WIRELESS WORLD:—

Cabo de Palos: Call letters, EAP; range, 270 miles; continuous service; Coast tax, 4½d. per word (minimum, 10 words).

Finisterre: Call letters, EAF; range, 270 miles; continuous service; Coast tax, 4½d. per word (minimum, 10 words).

* * *

IT is stated the Canadian Government have decided to erect a wireless station on Chatham Point, British Columbia.

* * *

THE Norwegian Post and Telegraph Department is said to have under consideration a scheme for the erection of a series of wireless telegraph stations around the coast from Christiania to the Swedish frontier in the south and to the Russian frontier in the north. There will be fourteen stations in all.

* * *

THE Portuguese Government are contemplating an extension of the system of wireless telegraph stations on the Continent and in its colonies. The stations at Lisbon and Oporto are well advanced, and that at the capital will be equipped with apparatus of sufficient power to communicate over a distance of 2,200 miles by day, and twice that distance at night.

* * *

As a result of the recent storms and floods in Ohio, Pennsylvania and West Virginia, especially in the Ohio valley, the proposition to construct a chain of wireless stations from Pittsburgh to Cairo, Ill., is again being brought to the attention of the public. According to the *Telegraph Age*, the city council of Youngstown, Ohio, have taken the matter up in earnest and have granted a franchise for the establishment of a wireless station in that city.

Maritime Wireless Telegraphy

WE are indebted to Turner, Davidson & Co., Ltd., who act in London on behalf of Lane & Dawson of Sydney, N.S.W., for a cutting from an Australian contemporary, which we print below. It will be noticed that wireless telegraphy was utilised to fix a charter while the vessel was at sea, and we would commend the matter to the attention of our readers, not only for this interesting fact, but further because it demonstrates the value to owners of sailing vessels of wireless telegraph equipments.

"WIRELESS CHARTER.

"*Sydney Bound Six-Master Fixed. A New "Departure.*

"There are not many sailing vessels carrying a wireless outfit, but the *Everett G. Griggs*, a six-master, is one of the few, and because of this has just made a good deal.

"The vessel left Tacoma, Puget Sound, on 7th July, with a full timber cargo on board for Sydney, consigned to Davies and Fehon, and is, therefore, 67 days out. She may be expected to show up at any time. During the last fortnight Lane and Dawson have been trying to pick her up, and they sent a message to the Sydney G.P.O., with particulars of a wire for Captain Sterling concerning a charter-party. On receipt of these particulars, the radio people got in touch with half a dozen steamers fitted with wireless, and these joined in the search for the big barquentine. This morning at 2 o'clock the answer came back, having been received by the Brisbane radio from a steamer, name not known, but which had been in touch with the *Everett G. Griggs*. Captain Sterling, who is owner as well as master of the sailer, was in a position to act promptly, with the result that the vessel has been chartered at a profitable rate to carry a cargo of 4,000 tons of coal to Callao, on the west coast of South America. Mr. Lane, principal of the firm of Lane and Dawson, referring to the matter, said:—

This is probably the first time a sailing vessel has been fixed by wireless, and as showing the value of such an installation it can be said that the rates for this charter could not be repeated to-day, because there has been a decrease since the *Everett G. Griggs* was placed under offer.' The only other sailing vessel trading to Sydney to have a complete wireless outfit is the White Star training ship *Mersey*. The *Griggs*, as she is known, is not a stranger to Sydney, nor is Captain Sterling, and on the last occasion when she was in these parts the captain announced that he intended reorganising the wireless department on board, which was only a small affair, into something on a larger scale. He has done this. This morning's message did not indicate the position of the vessel, but it is reckoned she is somewhere to the east-north-east, and may be heard of direct in a day or two. Her wireless call letters are 'V.G.R.'"

* * *

On November 15th last, at one o'clock a.m., the wireless station on board the s.s. *Gelria* was in communication simultaneously with the coast stations at Olinda (distance 1,540 miles), Cadiz (1,755 miles), and Dakar (710 miles), thus linking up the continents of Europe, Africa and South America.

* * *

The Federal authorities at Baltimore, Maryland, have fined the captain of a North German Lloyd steamer, which has just arrived at this port, the sum of £20 for neglecting to maintain constant wireless service on board his ship. There was one wireless operator, but not two as required. This is the first fine under the law passed recently.

* * *

Great suspense reigned at Sault Ste. Marie on account of the non-arrival on schedule time of the Great Lake s.s. *Huronic* of the Northern Navigation Co. The *Huronic* when in Lake Superior on her way from Sarnia to the Soo encountered heavy gales and was reported to be in difficulties. The

anxiety on the part of the friends of the passengers on board was, however, happily allayed by a wireless message from the ship that was relayed on to Soo advising them that the vessel had taken shelter from the storm and was proceeding undamaged. The liner arrived at her destination some twenty-four hours overdue.

* * *

Birkenhead was recently *en fete* for the launch of a new P. and O. liner, the *Khiva*, which is being built by Messrs. Cammell, Laird & Co. for this well-known steamship line. The *Khiva* is a striking example of the developments of mercantile shipbuilding of the first class, and represents the latest phase in the construction of the intermediate passenger and cargo boat. She is built of steel, and carries a Board of Trade passenger certificate. She has a top-gallant forecastle for the accommodation of the native crew, and bridge and poop-houses fitted for the accommodation of passengers, officers, and engineers. The vessel is divided by eight water-tight bulkheads, all extending up to the upper deck. Accommodation is provided for 79 first-class passengers, in cabins on the upper and bridge decks, and 68 second-class passengers, in cabins also on the upper deck. Refrigerating machinery has also been installed on the vessel, and large chambers have been set apart for the storage of meat and provisions. Steam is supplied by four boilers, each having four furnaces. A Marconi 1½-k.w. set will be installed on the vessel, the receiving and sending house for the operator being erected on the bridge deck.

s.s. "Khiva"

* * *

The owners of the British steamer *South Point*, bound from London for Philadelphia, received a wireless message on November 8th, advising that this vessel broke down in mid-Atlantic and has been picked up "by the British steamer *Rappahannock*, 700 miles west of Queenstown.

A Pawn in the Game

(Serial Story)

By BERNARD C. WHITE

For Synopsis of the Characters in the story, see previous chapters.

CHAPTER X.

"THE COURSE OF TRUE LOVE NEVER DID RUN SMOOTH" (*contd.*)

THEN, too, whenever they were all together Braithwaite seemed to take most of Gwen's attention, and practically controlled the entire conversation. Matters, however, reached a climax one day when, after Charles had suggested an excursion across the Downs for mushroom picking and had been put off by one of the usual excuses, he found on his return from a solitary walk that the two had been spending the afternoon at Chittingham's latest attraction, a third-rate picture palace. Charles determined to have the matter out and made an early opportunity to speak to Gwen alone. In a tone that left no room for refusal he invited her into his study. Then the accumulated chagrin of the past few days was given voice, and he spoke with bitterness and impatience which she was little accustomed to, and which, indeed, was so unlike the speaker's usual procedure that when he came to think of it afterwards, he could only explain his conduct by the fact that he was overwrought with worry and was more used up than he was aware by the efforts entailed in bringing his recent invention to completion.

"Look here, Gwen," he said, "I am rather tired of this game. For the past fortnight you have been behaving abominably to me, and as for that fellow Braithwaite, the way you are carrying on with him is a scandal. All the village is talking about it, and though I may be a bit of a softy in the usual way, I am not going to be made a fool of before the whole neighbourhood. If you are really anxious to improve your acquaintanceship with—my friend—you are quite at liberty to do so. But you can't expect me to stand that kind of thing without a murmur. I have always let you have your own way and you can have it now; you have only got to tell me that you prefer your own friends to my humble self, and I will retire gracefully, but—there's no need for you to get angry, you know perfectly well that I have good enough cause for my remarks—but, I was going to say, you needn't expect that you can dangle me by the end of a string, so that you can call me to your side as soon as you have finished with the other fellow. Now what are you going to do? You can take me or leave me as you choose, but you have got to do either one thing or the other. If you don't want our engagement broken off, you must at least expect to fulfil your part of the bargain, and that is to fall in with some of my wishes and some of my plans, or if you don't always want that, to ask me to take part in some of yours. Of course, I quite understand your interest in fresh faces, and I shouldn't dream of getting in the way of your pleasure, but all I ask is that you may do sufficient to keep up appearances, and to show at least that you are willing to give up something for me. If you can't see your way, the best thing for us is to break the engagement entirely; don't let's have any silly make-believe."

He broke off abruptly, and poked the fire, for the evenings were getting chilly, then sending the irons clattering to the hearth, he waited for her reply.

Gwen was furious. The onslaught was so sudden that she had scarcely time to think of defending herself. In her heart of hearts she knew that Charles had some reason for his remarks, but that made them all the harder to bear. She came closer to him, her face white with suppressed emotion, her lips compressed, bloodless and trembling.

"I think you are a cad." She whispered rather than spoke the words, looking Charles full in the face. "A terrific cad, to speak like that. You have no right to. If you don't think I know how to behave, you had

better find somebody else, for I'm not going to be taught what I ought to do by you. You are not even a sportsman to trust me, and I hate a man who isn't a sportsman. If you don't like what I have been doing, why didn't you speak to me before? You have let things go on as though you didn't care, and then you bully me for them afterwards. It is positively cowardly, and I am not going to stand it!"

She turned round, struggling against her feelings. Charles noticed the action, and immediately reproached himself for having spoken so harshly. He would have given worlds to have taken back his words, but it was no good now. However, he did attempt to make the *amende honorable*.

"Come, Gwen," he said, in a conciliatory tone, "it is not quite so bad as that. I don't think I'm a cad or a coward. You know you *have* been teasing me horribly lately by the way you have been flirting with young Braithwaite, and I'll own that I was nettled just now. But don't you see it's rather rough luck on a chap to be treated in quite the way I have been? You must own that it's not altogether nice to see the person you love most carrying on with somebody else, for you can't deny that you *have* been flirting, and flirting desperately. There's no getting away from that."

"I'm sure I haven't," Gwen objected; then added illogically, "and, even if I have, there's nothing better to do here; besides, as I said before, can't you trust me?"

"Yes, that's all very well, you know, but it's playing with fire, for you really are awfully headstrong. You'll get into a mess before you know where you are, and I'm sure Braithwaite is not worth the fuss you are making of him. You must own you don't look before you leap, or at least those foreigners of yours ought to have taught you that. Whatever their purpose was, they were up to no good. You yourself must acknowledge that."

Poor Charles! In his efforts to be conciliatory he had made a false step, and given Gwen a chance for recriminations. She took advantage of it, and fired up immediately.

"Well, if you weren't a cad before, I think you are one now. You bring up those foreigners against me, and if, as you say, they were up to no good, you were almost as much to blame in cultivating their acquaintance, for if you didn't agree with my knowing them, you needn't have invited them to your show. And then to turn round and speak as you did just now of your own friends is a miserable action. I'm sure it shows up your quality of friendship in a very unfavourable light"—and she put a fine sarcasm into her words. "It was I certainly who made the acquaintance of Dupont and Beulner, and you have every right to say what you like of them, but it would be well to remember that Braithwaite is *your* friend, and if I take up with him it is with a person whom *you* chose to cultivate. If he's good enough for you, I don't see why he shouldn't be good enough for me, and, if you don't think him good enough for either, then why do you pretend to be friendly with him? It is the most downright piece of snobbery and humbug I have ever heard."

"But——"

"I suppose you are now going to make excuses. I don't see how you can very well. All I have got to say is if your affections are as valuable as your friendship I think I am well quit of both, *of both*—mind you."

With that she turned away from the window where she had been standing and went towards the door. Charles said nothing. He dared not speak, for he knew he could not explain himself. She turned at the door, and the handle rattled in her nervous grasp. Then Charles roused himself.

"Gwen!" he called in a choking voice. "Gwen!"

She said nothing, only turned to look at him, her lips still compressed and bitter. But as she passed out, Charles saw that there were tears in her eyes.

Here was a *debacle*! After Gwen left him, Charles sat for some time in profound meditation staring into the fire. He did not know what to do. The quarrel was altogether most absurd. In spite of contrary appearances, he thought he could gauge Gwen's feelings better than she could herself, and he was positively certain that in the long run she would find Braithwaite's company irksome. That was not to say that she would ever renew advances to him. He was aware that she was much too proud to do that kind of thing, but he did not want her to spoil herself by an infatuation, real or supposed, with one whom he was convinced was entirely unworthy of her, and who was

merely amusing himself. As he thought of the whole episode, something like despair crept into his heart. Nothing could be done, at least he himself could do nothing, for whatever steps he might take would be interpreted as the action of a self-interested person. That was not really the case. His affection was much too deep for mere self-interest, and he would willingly have obliterated himself if he thought that by doing so she would be happier; but his convictions pointed to an opposite conclusion, and this only gave an added sting to his gloomy forebodings. Try as he would, he could see no likely way out of the uncomfortable situation, either for her or himself, and he was forced to the rather hopeless conclusion that it was best to let things take their appointed course, and see what would come of it all. To him this was not only the cruellest course, but the most difficult to pursue, for he would have to take the part of an unwilling spectator who watches every phase of a rather dingy drama, and is powerless to assist either by action or advice.

It was no wonder that he could not concentrate on the book which he held in his hands when such thoughts were driving through his brain, and what made matters worse was he could hear the light-hearted conversation in the adjoining room. Gwen's laughter rang out frequently, and it was usually followed by Braithwaite's cultivated ululation. As he noted it, it struck him that this word was the only one which would express its combination of calculated harmony and its effort to express both flattery and condescension, tinged with just a touch of conceit. Gwen's merriment sounded a little forced. Charles's accustomed ear could distinguish that; but after the scene which had just been enacted between them this was not surprising. Nevertheless it was not calculated to add balm to his already injured feelings; in fact, it so worked on his nerves that he was just going to take up his cap and brave the stormy night in order to get away from the sound, when a ring at the door bell stopped him in his purpose. Had it been at any other occasion, he would not have noticed the occurrence, for visitors were frequent at the Vicarage, and might be expected at any hour of the day. As it was, he only waited in his study until the visitors, whoever they might be, should be out of the way. He heard the maid go to the door, and then usher the visitors into the drawing-room. They were men, by their footsteps, but he was surprised when a tap came on his own door, and the maid announced that some gentlemen from London had come to see him. He immediately went to his visitors, and found three of them, all clad in mackintoshes and bowler hats, for the night was rainy. There was nothing about them to signify whom they might be, or what they might want, though the fact that Braithwaite was with them, and seemed to know them, caused him some astonishment; but he was not long left in doubt of their mission. At his appearing they rose simultaneously, and one of them, assuring himself that his host was Mr. Summers, informed him that they had come on important business. With a quick look to see if the door was shut, he told him without further ado that he was under arrest. Charles was staggered. Already shaken by the quarrel with Gwen, he was not in the least prepared to face an emergency of this kind, and, turning pale to the very lips, he staggered backwards as if he had received a blow. Then quickly recovering himself, he demanded the reason for this action, and asked to be shown the warrant. This request the detectives immediately complied with, and he read there that he was charged with complicity in selling valuable military secrets to a foreign government (unknown). He read it through, scarcely comprehending its meaning, and looked inquiringly at the detective.

"That, sir, is the warrant," replied the officer, "which I was charged to execute this evening. I understand that the case is important, and I have been given orders to bring you direct to London. I trust, sir, you will not hinder me in the duty that I have to perform, but I must add that if you compel me to use force, I have been given full powers to use my own discretion as long as I fulfil my undertaking; but I have no doubt you will help me. May I rely on such assistance?"

Charles gathered his scattered senses together. "Of course, I shan't hinder you in any way," he said, "but you will understand that this has come as rather a shock

to me, and I don't know quite what to do. My father will be very upset if he thinks I have been placed under arrest, especially on such a charge. Of course, I protest my innocence, but that has nothing to do with what concerns us now. I don't know whether you understand how I am placed. It will do me a great deal of injury if the knowledge of this unhappy affair were to get about."

"There's no need that it should do so, sir. We had instructions that everything should be done as quietly as possible, and I see no reason why you shouldn't say that you have been suddenly called away to some friends. I quite sympathise with you about what you should say to your father. Or, better than that, you have been negotiating with the Government about some apparatus, haven't you? Couldn't you tell him that you are wanted immediately to explain some difficulties to the authorities?"

"Yes," said Charles, relieved to think that there was some way of ameliorating circumstances, "I think that would be best. Will you allow me to go to him?"

"Certainly, sir; but I should be glad if you will be as quick as possible, for my instructions were not to allow a moment's unnecessary delay."

Charles thanked him and went out of the room. He found his father and sister and Gwen together in the dining-room, and, with as much composure as he could command, he told them of what had happened; but even the most euphemistic phraseology could not make the news very palatable, and blank astonishment, mingled with some degree of consternation, was apparent on all three faces. Mr. Summers was the first to speak. "Poor old chap! What a thundering nuisance these officials are! I wish you had never muddled up in the business. They are worrying your very life out; but let's hope you will be able to settle their questions without much difficulty—and, if you can't—well, see them to blazes. Anyway, when you are away, keep us posted up with news of how you are getting on. We shall be worrying about you till we hear. Now, Alice, come along, for I am sure Charles would like to have a little talk with Gwen before he goes. We'll be in your study, old boy, till you want us."

With that he left the room, followed by his daughter. Charles did not see them go out. He was looking at Gwen, his heart torn with mingled affection—and yes, it was true—a little resentment and pain. She had turned deadly white, and did not stir from the chair she was sitting in, only twisted her handkerchief as though she would wring the thin fabric into shreds.

"Gwen," he said, but he dared not come closer, "I have been arrested."

She leant abruptly forward, and her eyes stared with fear.

"Yes," he continued, "I am charged with selling military secrets to a foreign Government, so I do not know what is going to happen to me; there are three detectives waiting to take me away. I am to go to London, but what happens then I do not know. Only nobody here is to know about it, not even Pater or Alice. As far as the neighbours are concerned, I have gone off to visit some friends. I shall not tell Pater any more than what I have just said; only I thought you had better know, in case I want any help. You know more about my private affairs than anybody else, and, should I need it, you will help me, Gwen, won't you?."

"Yes," she said, "yes," and then, hesitatingly, "of course."

There was silence for a minute, which Charles interrupted with the remark, "I'm awfully sorry that this should have happened just now, because I didn't want to force myself on you in any way, but I have no one else whom I can speak to. There's one thing more I do want to say, though, while we are alone. I don't know how long I shall be away—it may be months, it may be years. It's just this, if I should not be able to clear myself of this charge, I should not think of asking you to reconsider the decision you made this evening; but I don't see how I can be convicted, and, if I am right in my belief, perhaps you will be able a little later on to think of me more kindly. I am sorry I spoke so abruptly just now; I know I was a bit harsh, but I can swear to you that I still love you, and if you think you will be able to love me—not now, but when you have had plenty of time to make up your mind—then perhaps you will let me renew our engagement."

He waited for Gwen to make some re-

mark, but she said not a word, only continued to wring that unoffending handkerchief as though murder were in her heart. She was proud, she was ridiculously proud, for although she loved Charles wholeheartedly, and much too deeply for such a little tiff as that which had lately occurred to alter her affection, yet she could not have given way just then to save her life—no, not if all the universe were tumbling in ruins beneath her feet. When he got no reply, Charles's heart sank, but he was never one to be beaten in his purpose. He drew off a ring which he wore on his finger. It was an old sardonyx cut square and engraved with the crest of the family, "a mailed fist," the deep stone being attached by a swivel to the gold band which passed round the finger. He came near and offered it to Gwen.

"Gwen, don't be angry if I ask you to take this. We've been old pals long enough to understand each other. Whatever happens, I don't see why we shouldn't always be pals, so will you keep this for me while I am away? Keep it until you are absolutely determined that you don't want me, and if in a year's time you feel you really don't, then send it back, and I'll know what you mean. That's not asking too much of you, old girl, is it?" and there was a caress in his voice as he stooped down to her. Gwen moved slightly, but the action was more as if to get out of his proximity than for any other reason. Nevertheless, although her attitude was apparently so cold, it was not entirely due to pique. It was practically subconscious, for she was bewildered by the situation and by her conflicting emotions. She was still young and unsophisticated, and this sudden climax of events after her unusually quiet and peaceful life, found her unprepared for the emergency. She did not even offer to take the ring. Charles let it fall into her lap. Then, to end this painful scene, he went to the door and called his sister, and asked her to pack a dressing case for his journey. She had already done this, and there was no sense in delaying longer. With a last word to Gwen, and an affectionate good-bye to his father and sister, he left them together, and went to meet his new acquaintances in the drawing-room.

"Gentlemen," he said, "I am at your service. How do we get to London tonight?"

"There is a motor-car waiting for us. It will not take us long to reach our destination," was the reply.

"Let us be going, then," said Charles.

One of the men relieved him of his bag, then, putting on his grey coat and jamming his hat on his head, for the storm outside seemed to be increasing, he went to the door. After seeing his companions out, he slammed it behind him, and his heart was heavy as he went out from the warmth of his old home into the darkness of the autumn night.

It was a miserable little group that sat in the dining-room after Charles had left. Old Mr. Summers was more upset than he cared to own. He sat in his armchair trying to read, but the result was a failure. Presently he put his book down and sat glaring into the fire, now and then making ejaculations which indicated the train of his thoughts. He stigmatised the whole episode as "devilish rot," and all Government officials, more especially those at the War Office, as "bloodless" and "nincompoops." Miss Summers was weeping quietly, while Braithwaite felt and looked uncomfortable. There was a feeling of tension in the air, for the recent events had taken them by surprise, and they had all guessed by Charles's demeanour that the matter was of greater consequence than his words implied. Gwen seemed the least affected. As far as outward demeanour went, she was simply dull and apathetic, and had the others been less concerned with their own affairs, they would, under the circumstances, have been surprised. As it was her attitude passed unnoticed. Presently she rose to go, and the ring which had remained in her lap fell to the floor. She took it up mechanically and placed it on her finger. Then with just a good-night and a kiss to Miss Summers, she went out. Braithwaite was waiting in the hall to help her into her cloak, and was evidently prepared to accompany her home. At first she refused, but custom was stronger than her personal feelings, and together they trudged through the muddy lanes. The young man endeavoured to start a conversation, but she would have none of it, nor even deigned to reply to his remarks, so that the walk was finished in silence, and, as a matter of fact, her companion did more

to further his cause by his silence than he would have done by talking or showing sympathy; for, had he known it, Gwen was violently angry with him. Strung up as she was, he seemed to her to be the embodiment of the whole affair. The row had come about through him, and although reason told her not to judge a man without apparent cause, she laid the arrest at his door. She did not even say good-night to him when they parted, but leaving him at the gate, walked quickly up the drive and let herself in. Then, without waiting to take off her wet cloak, she went to her bedroom and, throwing herself into an armchair, sat with her hands clasping her knees in gloomy thought. She was perfectly oblivious to everything but her miserable feelings, and when she woke from her reverie she found herself cold and stiff. She rose and went downstairs to warm herself, but all the house was in darkness and the inmates had long since gone to bed. Mechanically she began to undress, but her brain felt strangled, and it seemed to her that her heart lay like a leaden weight against her side. She could not get to sleep, but twisted about as though in her body she was actually suffering the tortures of her mind. Had she analysed it, it was remorse which was wearing her out, but she only knew that she hated herself more than she could bear. At last the dawn began to glimmer. It was as though the herald of a new day had brought fresh hope, a clearer air, a softer influence. She ceased from kicking against the goad of recent events, and in the end she wept. The cleansing tears ran hot as they coursed down her cheeks; but gradually these, too, became softer and calmer, till at last she sank to sleep. When the maid came to wake her mistress in the morning she found her still sleeping, and, with a good sense uncommon to her kind, left her sleeping.

CHAPTER XI.

A KINGDOM FOR A STAGE.

Meanwhile Summers had been driven quickly to London to the War Office. Sir Henry Dever was waiting for him. The iron man of war received him very kindly, and did his best to mitigate the unpleasantness of the proceedings, for it was unpleasant, to say the least of it. Charles was told that he must consider himself practically under arrest, and that for an indefinite period. Arrangements had been made for him to sleep at an hotel for the night, but he was not to be without his escort, who would remain with him, although they had orders not to interfere with his liberty in any way if he, on his part, would give his parole not to attempt to escape from them. Then he would be drafted to the wireless station at Caister, where preparations were already in hand for his coming. He was there to build an airship after his design—two, if time permitted. He would be given every assistance by the authorities, and a sufficient complement of men had been drafted to the station to ensure the utmost rapidity of execution.

"But," Charles objected, "I have none of my plans, and I can't get on without them."

"That matter has been settled," replied Sir Henry, and at the same time drew from his pocket a familiar packet. To Charles's intense astonishment, they were all his papers—the rough drafts, and it seemed every sheet that he had ever scribbled upon with notes of his invention. "These," said the Under-Secretary, "I think, are the plans you want. They have been secured under your very eyes, Mr. Summers, and I think that is sufficient proof that we have acted wisely in taking the course we have. This incident alone establishes the fact that you are not careful enough to be allowed to act on your own responsibility. Braithwaite has secured all these papers, and you have not even discovered your loss, although they were in my possession two days ago."

Summers felt confused and annoyed, especially as he had to acknowledge that Sir Henry was quite correct in his assumption.

"But," continued Sir Henry, "I want to make it quite clear to you that there is every need to push on as fast as you can with your work. War may be declared any day, in fact it is not a question of days, but of hours."

(To be continued.)

INSTRUCTION IN WIRELESS TELEGRAPHY

Crystal Receivers (III.)

(Ninth 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 on page 461 of the October number.]

BEFORE leaving the subject of crystal receivers one important point still requires explanation, namely, why it is necessary to adjust the initial voltage across the crystal to the exact point where the effective resistance of the crystal commences to decrease rapidly.

63. Referring again to the characteristic curve of a carborundum crystal shown in Fig. 1, which has already been explained in paragraph 58 of the December number of the WIRELESS WORLD, it will be remembered that we showed how a certain increase in the voltage across the crystal will have a greater effect upon the current passing through the crystal after the point A is reached than before that point is reached.

Although it is obvious that the crystal will be more sensitive when the point A is reached, it is not quite so obvious why it is necessary to adjust the initial voltage across the crystal exactly to the point A, and not to any point beyond it, such as the point, B, shown in Fig. 1.

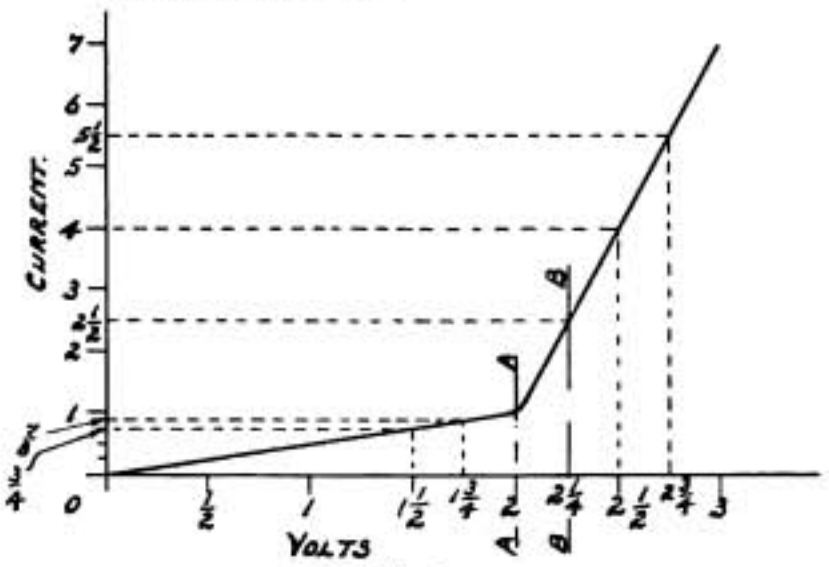


Fig 1.

As can be seen from this curve, a given increase in voltage will cause practically the same increase in current passing through the crystal whether this increase be applied at the point B or the point A, but we must remember that the **extra voltage** provided by the oscillatory current in the secondary of the jigger is an alternating current voltage, that is to say, a voltage varying from a positive value at one instant to a negative value at the next instant.

Since the **initial voltage** applied across the crystal is a direct current voltage obtained from the potentiometer, it follows that the alternating current voltage will at one instant be assisting the direct current voltage and at the next instant opposing it.

For the sake of argument let us put these voltages into figures.

Let us suppose that the initial voltage across the crystal to bring it up to the point A is 2 volts, and the voltage required to bring it up to the point B is $2\frac{1}{4}$ volts, these voltages being positive volts.

Let us also suppose that the value of the alternating current voltage varies from *minus* $\frac{1}{2}$ a volt to *plus* $\frac{1}{2}$ a volt, it is obvious then that during the time that the oscillations are being received the **resulting voltage** across the crystal, if the initial voltage be adjusted to the point A, will vary from $1\frac{1}{2}$ volts to $2\frac{1}{2}$ volts. Similarly, if the initial voltage across the crystal be adjusted to the point B, the **resulting voltage** will vary from $1\frac{3}{4}$ volts to $2\frac{3}{4}$ volts.

Now let us draw two separate curves showing the **result of this variation in voltage on the current passing through our telephones,** taking our figures from the curve shown in Fig. 1.

The curve in Fig. 2 shows the resulting current in the telephones when the initial voltage of the crystal is adjusted to point A.

At this point the value of the current passing through the crystal and telephones *before any oscillations are produced in the*

secondary is 1, therefore we may draw a heavy line DD representing the normal value of the current.

When the negative part of the first oscillation is applied across the crystal, the result, as already explained, is to reduce the voltage to 1½ volts, thus the current passing through the telephones will be reduced, but, as will be seen by referring to Fig. 1,

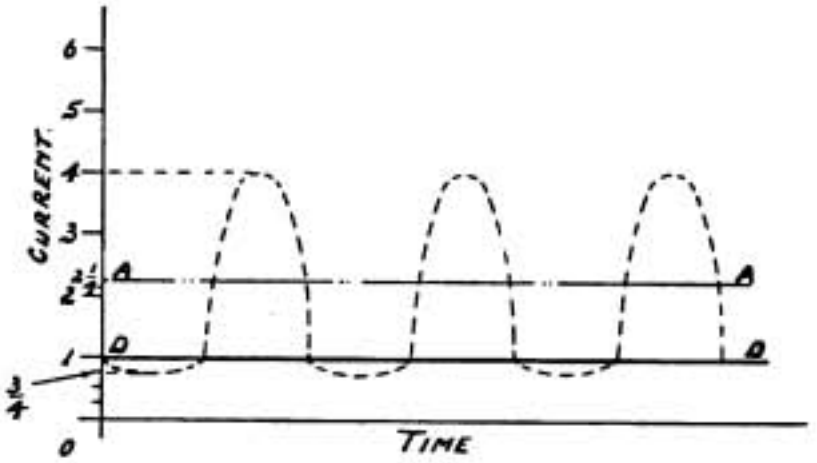


Fig. 2.

owing to its being on the flat part of the curve, the reduction in the amount of current passing through the telephones is extremely small; by reading from the curve we find it is reduced to the value of ¾.

Therefore, the curve representing the actual current passing through the crystal and telephones when the negative part of the first oscillation is applied will dip just below the line DD.

The next half of the oscillation is positive and therefore has the result of increasing the voltage across the crystal to 2½ volts.

By referring again to Fig. 1 it will be seen that the effect on the value of the current is to increase it to 4.

We may, therefore, continue our current curve in Fig. 2, which will now show the current rising to the value 4 above the normal line DD.

A similar cycle of events will take place for each oscillation, with the result that we get a series of high peaks above the normal current line, and a series of very shallow peaks below this line.

These oscillations are taking place at the rate of perhaps millions per second, according to the length of wave which is being received.

If the wave length received is 100 feet, the number of oscillations per second, as explained in the July number of THE WIRELESS WORLD, will be 10 millions per second.

These variations are infinitely too rapid for the diaphragm of the telephone to follow, and it will therefore be deflected to an extent corresponding to the **average** value of the current passing through it.

Referring to Fig. 2, the average current passing through the telephones when the oscillatory voltage is applied across the crystal is shown by the dotted line AA, drawn approximately half way between the highest and lowest point on the curve. This value is somewhere about 2¼, and therefore the sound produced in the telephones will be proportional to the difference between the normal current passing through the telephones and the increased current due to the oscillating voltage applied, *i.e.*, the difference between 1 and 2¼.

Now let us see what takes place **if we adjust the crystal to the point B;** obtaining our values of current as before from the curve in Fig. 1, we find that the result of the oscillatory voltage is to vary the value of the current from ⅞ to 5½, and we may therefore draw a new curve as shown in Fig. 3 representing this variation in the value of the current.

Again, these variations in current are too rapid for the diaphragm of the telephone to follow, so that it will again be deflected to an extent corresponding to the average value of this current.

The average value of this current will be about 3, so that we may draw a dotted line, BB, representing the average value of the

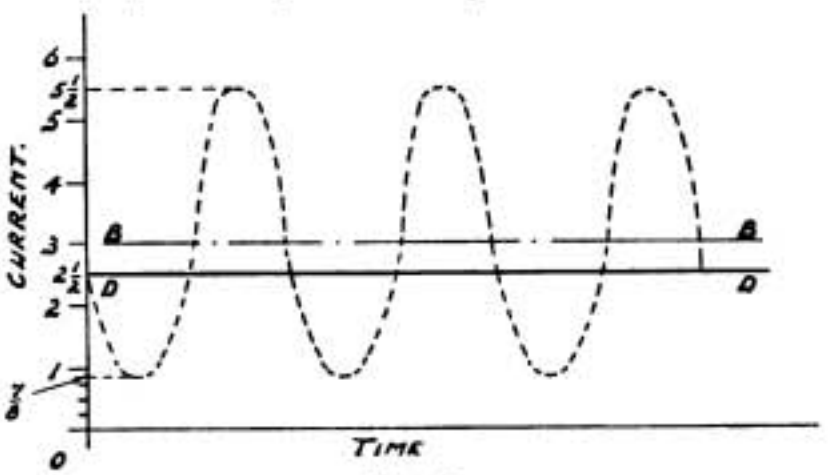


Fig. 3.

current passing through the telephones when the oscillatory voltage is applied across the crystal.

But we have already increased the *normal* value of the current passing through the telephones to the value of 2½, as shown by

the line DD, Fig. 3, this being the current which will pass through the crystal and telephones when the initial voltage of 2¼ volts is applied to bring it up to the point B, Fig. 1.

The strength of the sound produced in the telephones will be proportional, not to the total current passing through the telephones, but to the difference between the current passing through them when no oscillations are being received and the current passing through them when the oscillations are being received.

When the crystal was adjusted to the point A, this difference in current was the difference between 1 and 2¼, so that the strength of the sound was proportional to 1¼, but when the crystal is adjusted to the point B, the strength of the sound will be proportional to the difference between 2½ and 3, which is only ½.

64. Tuning a Receiver.—We will suppose that our receiver is of the two circuit type, that is to say, that it has a primary circuit and a secondary circuit, both of which must be in tune with the wave-length it is desired to receive. The only means we have of telling whether the receiver is in tune is by the strength of the signals in the telephones. If either circuit of the receiver is out of tune, the signals are weakened, so that provided we have a variable inductance or condenser in each circuit, and **provided we can hear at least weak signals in the telephones,** it is a simple matter to tune up the receiver by listening to the strength of the signals and adjusting first one circuit and then the other circuit, until the sound is at its loudest.

If, however, we are so much out of tune to begin with that the signals are inaudible, the difficulty of tuning up is increased enormously.

In the case of a single circuit receiver, the difficulty is not so great, for we have only one circuit to adjust, and therefore we can vary it slowly from its maximum wave-length to its minimum wave-length, and consequently we are bound to pass the point where the receiver is in tune with and therefore will respond to the signals, provided, of course, those signals are within the range of wave-length of the receiver.

In the case of a two circuit receiver, however, if signals are inaudible to begin with, we have no means of telling which circuit is out of tune or when the two circuits are in tune with each other.

If, however, we know the wave-length of the signals we wish to receive, and we have an instrument close to our receiver which can be made to emit a similar wave-length, the process of tuning up becomes quite simple.

Such an instrument is called a tuning buzzer.

Since our detector and telephones are actuated by the secondary circuit of the receiver, we should first cause the tuning buzzer to induce waves into the secondary circuit only, and we should then adjust this circuit until the buzzer signals in the telephones are at their loudest.

Having accomplished this, we should next move the tuning buzzer to a point remote from the secondary circuit, but close to some part of the primary, or aerial circuit, so that no oscillations can be induced from it directly into the secondary circuit, but only through the primary circuit.

Now if the primary circuit is very much out of tune with the wave-length emitted by the tuning buzzer, it will not respond to the oscillations, and therefore no oscillations will be induced in the secondary circuit, but if we vary the wave-length of the primary circuit, we shall reach a point when it is in tune with the wave emitted by the tuning buzzer. Oscillations will then be induced in the primary circuit, which will in turn induce oscillations in the secondary circuit, as the secondary circuit has already been tuned to the same wave-length. Thus when by varying the adjustment of the primary circuit we reach a point when the signals in the telephones are again at their loudest, we know that we have reached the point when the primary circuit is in tune with the tuning buzzer, and therefore both circuits are in tune with the wave-length emitted by the tuning buzzer.

65. The Tuning Buzzer.—The essentials of a tuning buzzer are, therefore: (1) that it can be caused to emit feeble oscillations, and (2) that the length of these oscillations can be adjusted to any pre-determined value.

To accomplish these *desiderata*, the tuning buzzer has two circuits; firstly, an oscillating circuit, consisting of an inductance coil with an adjustable condenser, and,

secondly, a generating circuit by which the oscillating circuit is excited.

The construction of the oscillating circuit of a tuning buzzer is identical with that of the wave-meter, which was described in the October number of the WIRELESS WORLD. It consists of a fixed inductance coil connected in series with an adjustable condenser, the latter being provided with a scale and pointer by means of which the value of the wave-length to which that circuit is adjusted is indicated.

There are several ways by which this circuit can be excited. The one most commonly used is shown diagramatically in its simplest form in Figure 4, where L is the inductance coil, C the condenser forming the oscillatory circuit, and where B is a battery connected across the inductance coil through the contact S. If the contact, S, is depressed, thus completing the circuit from the battery through the inductance

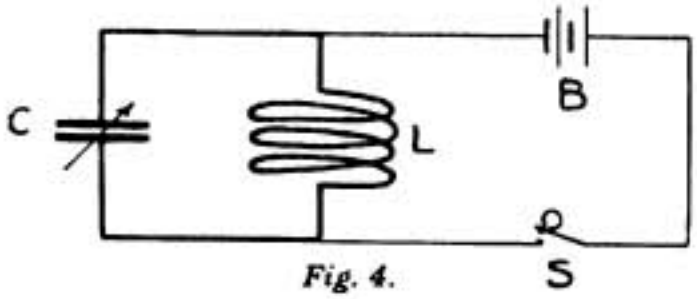


Fig. 4.

coil, a continuous current will flow through this coil. If this circuit be broken by releasing the contact, the current will be instantaneously interrupted.

As already described in the May number of the WIRELESS WORLD, the property of inductance is similar to the mechanical property of momentum, and, therefore, when the current is instantaneously interrupted, the energy due to its momentum is expended in the oscillating circuit of which this inductance forms a part. The result is practically to give this circuit a kick, causing it to oscillate to its own natural frequency; thus every time the battery circuit is made and broken, we produce a group of oscillations in the oscillatory circuit corresponding to the wave-length to which that circuit is adjusted.

If a battery of only two or three volts be used and the inductance included in the battery circuit be a reasonable amount, the oscillations set up will be sufficiently strong to affect our receiver circuit.

This, however, is not quite sufficient, since each group of waves will only give a single click in the telephones. Some automatic arrangement must be used to rapidly make and break the circuit in order to

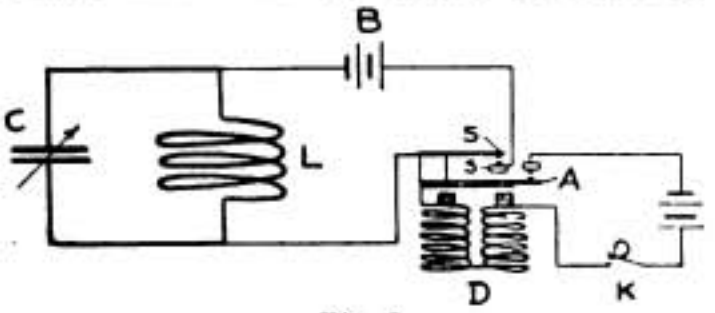


Fig. 5.

produce a continuous buzz or note in the telephones to facilitate the tuning up of the receiver, it being very much easier to distinguish when a buzz or note reaches its maximum strength than if only a number of single clicks were audible.

One method by which this rapid making and breaking of the circuit can be accomplished is shown diagramatically in Fig. 5, where the battery circuit, B, through the inductance, L, is made through a pair of contacts, SS, one of which is mechanically connected to the armature, A, of an ordinary electric buzzer, D, so that when this armature vibrates it causes the extra pair of contacts, SS, to alternately make and break the battery circuit through the inductance L.

In this case two batteries are required, one for working the buzzer and the other for the inductance circuit.

The Canadian Government has been notified by a wireless dispatch, sent by the steamship *Alcazar*, from Hudson Bay, of the wreck of the steamship *Cearense*, which sailed from Halifax on August 30th for Port Nelson. The wreck occurred 14 miles from Root Creek. All on board were saved. The vessel had a cargo of 2,484 tons of bituminous coal, 336,000 feet of lumber, and part of the materials necessary for the installation of the wireless station at Port Nelson.

The *Journal Officiel* of November 7th states that of the loan of 90,000,000 frs. contracted by the Indo-Chinese Government on December 26th, 1912, a sum of 596,800 frs. has now been allocated for the construction of a wireless telegraph station at Saigon.

E

Amateur Regulations in U.S.A.

A NEW form has been issued in the United States respecting amateur licences. The form differs but little from its predecessor, except that in the first paragraph the words, "*receiving for pleasure* radiograms or signals and of *transmitting for pleasure* radiograms or signals," etc., have been replaced by "of transmitting private radiograms or signals," etc.

The elimination of the words "for pleasure" will be welcomed by all serious-minded experimenters, and the elimination of "for receiving" comes about as a matter of course, as the law does not require that receiving apparatus be licensed.

Below we give a copy of the new form.

Form 765 Number

LICENCE FOR .....AMATEUR RADIO STATION
(General or restricted.)

DEPARTMENT OF COMMERCE.

BUREAU OF NAVIGATION (RADIO SERVICE).

1. PURSUANT to the act to regulate radio communication, approved August 13th, 1912, ..., a citizen of the State of ....., having applied therefor, is hereby granted by the Secretary of Commerce, for a period of ..... year, on and subject to the restrictions and conditions hereinafter stated and revocable for cause by him, this License to use or operate the apparatus for radio communication (identified in the Schedule hereinafter) for the purpose of transmitting private radiograms or signals, notwithstanding the effect thereof extends beyond the jurisdiction of the State or Territory in which the said station is located: Provided, that no interference other than may result under the restrictions contained in this License shall be caused with the radio communication of stations of the Government of the United States or licensed stations.

2. The use or operation of apparatus for radio communication pursuant to this License shall be subject also to the articles and regulations established by the International Radiotelegraphic Convention, ratified by the Senate of the United States and caused to be made public by the President, and shall be subject also to such regulations as may be established from time to time by authority of subsequent acts and treaties of the United States.

3. The apparatus shall at all times while in use and operation be in charge of a person or persons licensed for the purpose by the Secretary of Commerce, and the operator of the apparatus shall not wilfully or maliciously interfere with any other radio communication.

4. The station shall give absolute priority to signals or radiograms relating to ships in distress; shall cease all sending on hearing a distress signal; and shall refrain from sending until all the signals or radiograms relating thereto are completed.

5. The station shall use the minimum amount of energy necessary to carry out any communication desired, and the transformer input shall not exceed $\frac{\text{one}}{\text{one-half}}$ kilowatt.*

6. The station shall not use a transmitting wave-length exceeding 200 metres.

7. The station shall not use a transmitter during the first 15 minutes of each hour, local standard time, whenever the Secretary of Commerce by notice in writing shall require it to observe a division of the time, pursuant to the Twelfth Regulation of the Act of August 13, 1912.

8. The President of the United States in time of war or public peril or disaster is authorised by law to close the station and cause the removal therefrom of all radio apparatus, or may authorise the use or control of the station or apparatus by any Department of the Government upon just compensation to the owners.

9. The Secretary of Commerce and Collectors of Customs or other officers of the Government authorised by him may at all reasonable times enter upon the station for the purpose of inspecting and may inspect any apparatus for radio communication of such station and the operation and operators of such apparatus.

10. The apparatus shall not be altered or modified in respect of any of the particulars mentioned in the following Schedule except with the approval of a radio inspector, or other duly authorised officer of the Government.

SCHEDULE OF STATION AND APPARATUS.

Name of owner .....
Age .....
Location: State ..... ; County .....
City or town ..... ; Street..... ; No.....
Official call.....
Name of naval or military station, if within 5 nautical miles .....
Power: Transformer input .....; W.†
Antenna: Type (T ⊓, fan, umbrella, etc.) .....
.....
Height.....
(Above ground)
Horizontal length .....
Wires: Number in vertical part ..... ;
In horizontal part.....
The normal sending and receiving wave-length shall be ..... metres
(Not exceeding 200)
and the station is authorised to use the following additional wave-lengths, not exceeding 200 metres:
.....metres ..... metres.

Satisfactory proof has been furnished that the station was actually operating August 13th, 1912.

This License expires on .....191 .

* Strike out "one" if the station be within 5 nautical miles of a naval or military station; otherwise strike out "one-half."

† Not to exceed 1,000; or if the station be within 5 nautical miles of a naval or military station, not to exceed 500.

Practical Hints for Amateurs

Designing a Station

By F. WALFORD PERRY

THE station described in this article is in South London, all the apparatus, except the headphones, being home-made, good working results having been obtained.]

There are two aerials, both of the cage or "sausage" type; by means of switches either or both may be connected up to the instruments.

The larger aerial is an inverted "L" suspended between two masts 150 feet apart, the mast at the free end being 80 feet high and that at the lead-in end 60 feet, giving a total length of aerial of 220 feet.

The wires, of 16 gauge aluminium, are six in number, and are spaced 2 feet apart on 5-feet wooden hoops, which were made by dissecting an ordinary wooden hoop and joining the sections end to end, giving a light hoop of one thickness of wood.

Aluminium was used for lightness, but in other respects it is unsatisfactory and copper should be used if lightness is not the chief essential.

The second aerial is similar, but is much lower, being gracefully draped over the house and trees.

Two hundred volts alternating current from the house mains is the source of power for the transmitting gear—this is stepped up to 7,000-8,000 volts by means of an oil insulated closed core transformer.

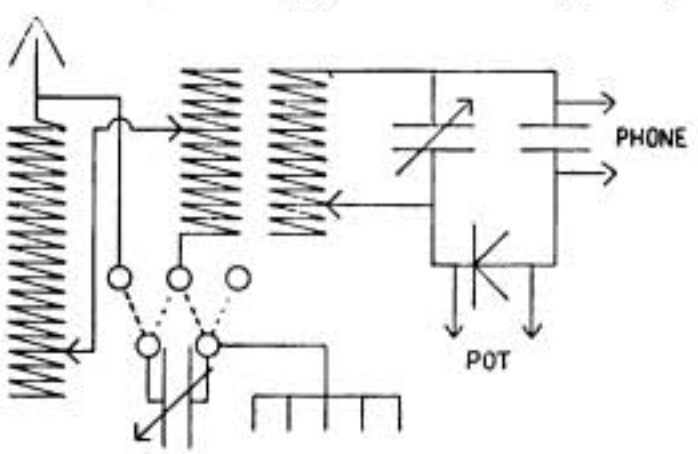


Fig. 1.

The high-tension current charges a ·02 mfd. oil immersed condenser, which is divided into two parts; these can be used in series or parallel, according to the wave desired.

The condenser circuit is completed by one-turn primary of an inductively-coupled jigger, a spark gap enclosed in asbestos-lined box for silence, and a variable sliding inductance.

Tappings are provided on the secondary of the jigger, which is wound with eight turns of 3-20 cable on a 9-inch square frame.

The connections of the transmitting gear are those of the Marconi 1½ k.w. ship set, and the waves emitted are 200 and 400 metres, the latter being the normal.

A rotary spark gap is provided, which gives a spark frequency of 250-300 per second. It will be noticed at the top of Fig. 3.

A lamp shunted across a few feet of the earth wire, and a hot wire ammeter in series, complete this part of the station.

Three complete sets of receiving apparatus are fitted; the one shown on the left of Fig. 2 is mainly used and calls for no special comment beyond that the connections shown in Fig. 1 have been used and found to be simple, and to admit of fair tuning by means of the condenser across the secondary.

The set seen on the left of Fig. 3 has been called the "cheese-box." The inductances are wound on 15 and 13-inch drums, the primary being 18 D.C.C. and the secondary 24 D.C.C.; it is well adapted for long waves and gives slightly better results than the first set on all waves longer than ship ones.

The third set uses a magnetic detector, which is connected to an earth arrester

gap through a simple form of tuner shown in Fig. 2. It is less sensitive than the Zincite-Bornite detector used in the other sets, but has been found equal to the ordinary ship "maggie."

On the larger aerial the best transmitting results have been good signals at a station in Essex 55 miles distant, and No. 5 size signals on a ship (magnetic detector) 33 miles away. Stations as far distant as Malta S.D. are heard, and under favourable conditions, and at night, most European coast stations within 800 miles can be heard.

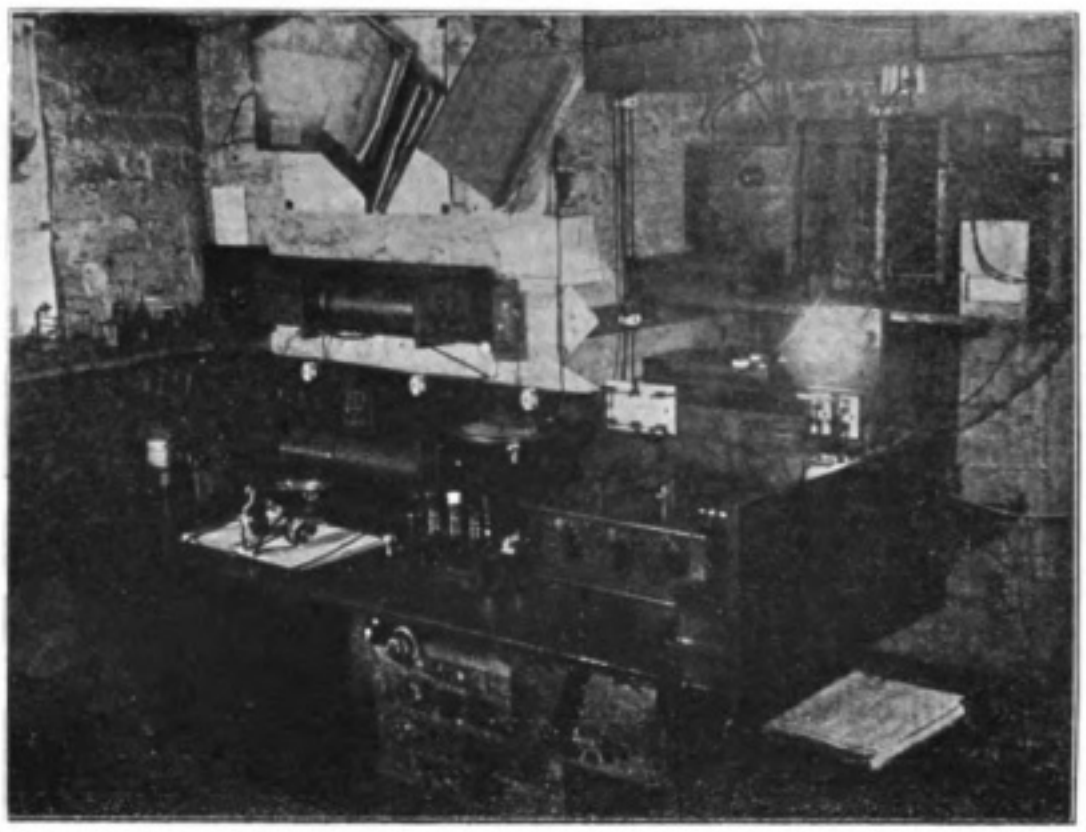


Fig. 2.

It is reported in the Press that the trials and experiments with hydro-aeroplanes which have recently taken place at Cromarty have induced the Admiralty to organise an even more important series of experiments with a view of determining how far wireless telegraphy will extend and emphasise the value of aircraft in naval warfare.

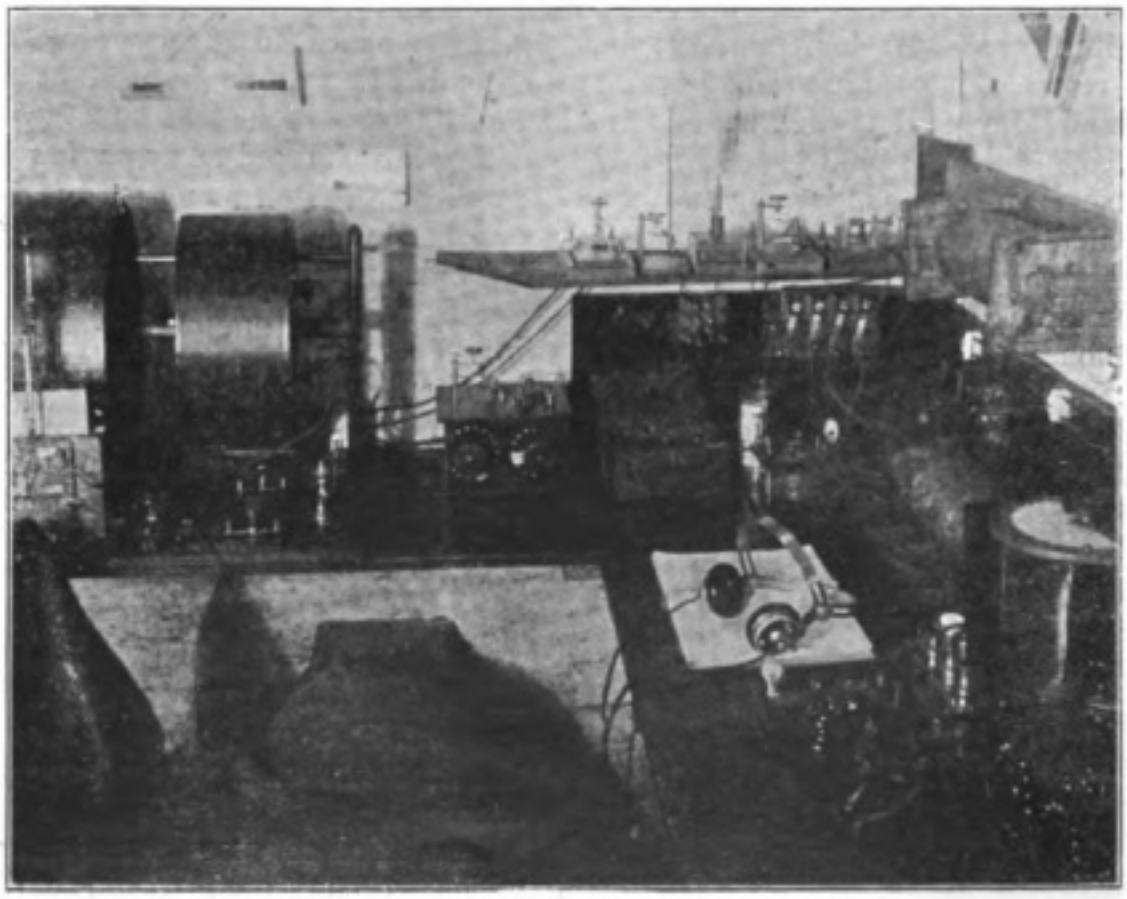


Fig. 3.

AMATEUR NOTES.

A GENERAL meeting of the Wireless Society of London was held last November, when the rules of the Society, which had been drawn up by a committee, were unanimously passed. Mr. Russell Clarke said it was proposed to have first-class standardised apparatus in the Society's laboratory, and about £70 worth of apparatus had already been promised by members. To make this Society self-supporting and flourishing the original subscription was fixed at one guinea for metropolitan members and associate members, 10s. 6d. for country and foreign members, and 10s. 6d. entrance fee. The President, Mr. Campbell Swinton, gave a short address on the object and progress of the Society, and called on Dr. W. H. Eccles to outline the research work initiated by the Radio-Telegraphic Committee of the British Association and to indicate how members of the Society could help in this work.

* * *

Dr. Eccles said that the committee recognised its duty to be the undertaking of work which could not be performed by individual experimenters. Discharges from the atmosphere in the immediate neighbourhood of a station (causing sparking in the aerial, or permitting a vacuum tube to be lighted) were called "statics" or "atmospherics." Disturbances arriving from a long distance were termed "strays," and the British Association had decided to investigate these natural electric waves, which travelled over a large part of the earth. About 70 per cent. of strays received at stations in the North and South of England could be traced and identified, but to trace them to their source —perhaps thousands of miles away— required a world-wide network of observers. Already the British Association was prepared to start work with 200 or 300 observers in British and foreign colonies, the United States, and ships in various seas. By the examination of records received it was hoped to determine the laws and nature of "strays," and also (since the same set of observers would serve) to determine the influence of meteorological conditions on long distance transmission. The committee was preparing official forms, so that all information might be collected on a uniform plan; specimen copies of this form would soon be available to members, but, for the present, the committee would only accept official assistance from, say, a dozen members of the Society scattered up and down the country. There were, however, many unofficial ways in which members could be of immense assistance to the committee. For example, any member passing a directional aerial should observe the direction from which disturbance proceeds during X-storms. There was much to be done, too, in the way of recording sunset and sunrise variations in the strength of signals received from, say, Coltano. Hitherto the difficulty had been to measure strengths of signals, but accuracy could be gained by practice, and the calibrating laboratory of the Society would doubtless prove invaluable. Two members working simultaneously on long and short aerials, or on two differently tuned receiving sets in the same aerial, should record the frequency and strength of the strays received; these would not be the same in each case. If members would work along these and similar lines, and if a subcommittee of the Society would sift reports before transmitting them to the B.A. Committee, the latter would be helped enormously and this country would become the centre of such research.

* * *

The second exhibition of the Derby Wireless Club was held on December 3rd at the Mechanics' Institute. The room was crowded to excess from 4 until 11 p.m., much to the benefit of the Society's exchequer. Permission had been obtained from the Post Office to erect a temporary aerial, and many visitors availed themselves of the opportunity of hearing wireless signals for the first time. Sir Henry Norman, M.P., the President of the Club, lent a number of instruments, and Repton School also exhibited some instruments, while among other exhibits were a "Brown Relay" and mirror galvanometer for wireless. There was also an automatic transmitter at work throughout the evening, and another transmitter, which required neither mains, accumulators nor batteries. Much excellently designed and ingenious apparatus was shown—far too many things to note in detail. The District Society of Model Engineers co-operated and displayed a number of models of all kinds—the largest being a 6-ft. steamship. The

whole of the arrangements reflected very great credit to the assiduity and zeal of Mr. A. Trevelyan Lee, the hon. secretary.

* * *

Mr. Hyde, of Seacombe, presided at the November meeting of the Liverpool and District Amateur Wireless Association. As usual there was apparatus brought forward by several of the members for inspection and discussion. This was followed by a short lecture by a member on "Terrestrial Magnetism." The lecturer dealt with the position of the magnetic poles of the earth as compared with the geographical north and south poles and with the questions of variation or declination, inclination, and intensity at any place, secular variations, annual variations, diurnal variations, and irregular variations. The subject of inclination or dip was fully gone into and illustrated by experiments, and the lecturer concluded by advising members not to overlook the question of "Terrestrial Magnetism," as he was of opinion that it was a factor in the matter of wireless telegraphy.

* * *

The December meeting of the Association was presided over by Mr. G. Irvine. A member described the construction of an apparatus he had designed. A single telephone wire with an earth return is used as a wireless aerial, and the "far" end insulated from earth and phone when used for wireless purposes. The ordinary telephone circuit is connected when wireless sending or receiving had been completed; the connections at the far end are controlled from the opposite end at which the wireless set is situated, without the use of any additional line wires. The subject of the best design and connections for umbrella aerials was under consideration, also the question of the most suitable wires for aerial use.

* * *

At a meeting of the Birmingham Wireless Association presided over by Mr. J. J. Shaw, Mr. E. E. Robinson, who is associated with Sir Oliver Lodge in his practical and experimental work, delivered an interesting address. He dealt with ordinary vibrating bodies, elasticity and inertia, then passed on to some early experiments. Mr. Robinson's lecture, which was well illustrated by lantern slides and which included a number of interesting experiments, was thoroughly enjoyed by a large attendance of members. The meeting of the Association held on December 5th marked a novel departure, when Mr. Shaw lectured on the Seismograph and Seismology.

* * *

In the October number of THE WIRELESS WORLD it was announced that a number of students of wireless telegraphy in Edinburgh had decided to form a wireless club, to be called "The Edinburgh Wireless Club." Since then the labours of the committee have not been fruitless, despite the difficulties to be contended with, and which have been successfully overcome. It is the intention of the committee to provide for the erection of a complete wireless installation. As far as possible this will be the work of the members themselves, and so room will be given for instruction in the principles underlying wireless telegraphy. Mr. W. D. Owen, the president, has consented to give all the help and advice necessary to make this particular part of the club's work a complete success.

* * *

Nor is the theoretical side of wireless telegraphy neglected. The reading of papers on various matters connected with radio-telegraphy by members and others will help to broaden the outlook of members with regard to the comprehensiveness of the subject. Although formed by prospective operators in wireless telegraphy, it is the intention of the club to welcome into membership all amateurs who take an interest in wireless telegraphy. The secretary, George Scott Creighton, will be pleased to hear from any one in the Edinburgh district who has not already communicated with him.

* * *

At the annual meeting of the Gateshead and District Scouts' Association the hon. secretary, Mr. R. B. Hindmarsh, reported that a wireless telegraphy section had been formed—the first of its kind in the North—possessing two complete stations which were licensed by the Postmaster-General.

* * *

At the opening meeting of the Manchester and District Wireless Club, held at 15, Abbey Hey Lane, near Openshaw, Manchester, the following committee, etc., were elected:—

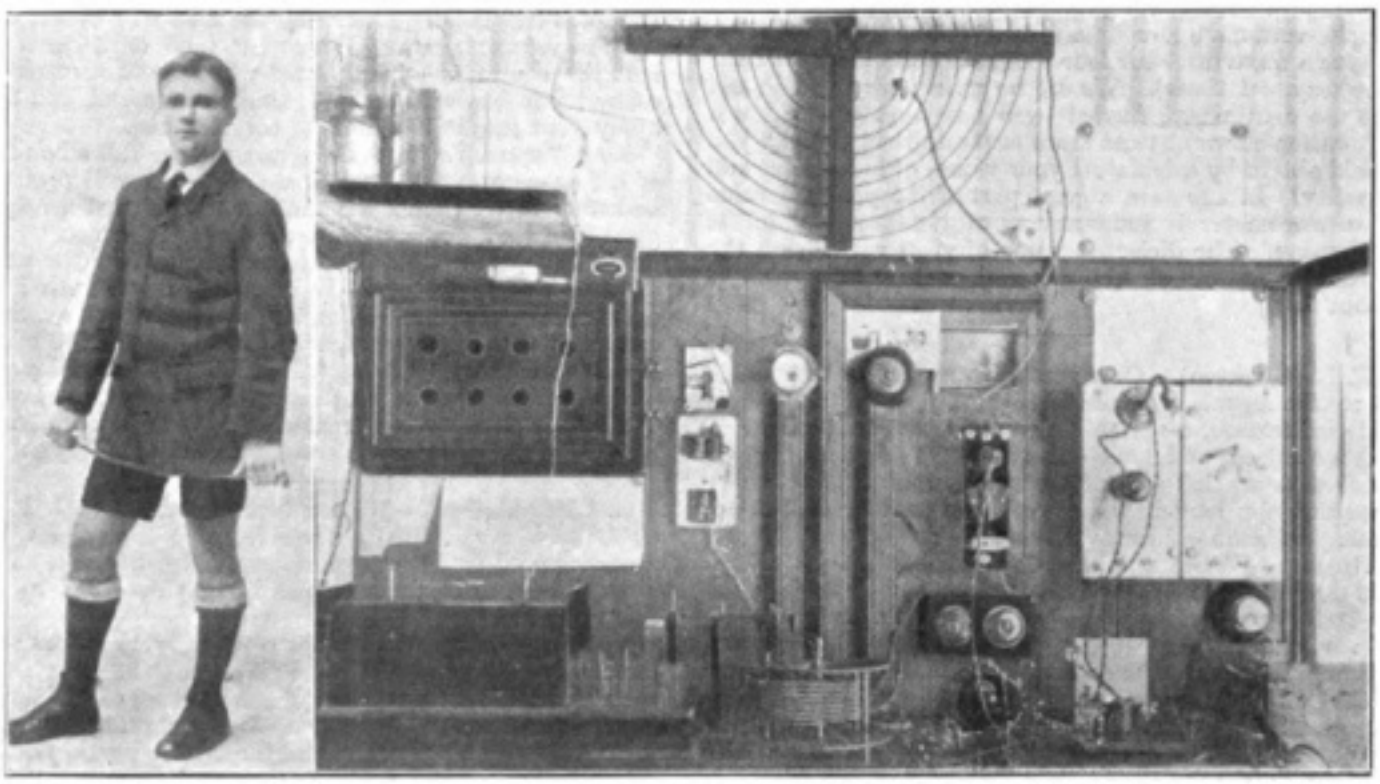
C. Heap (Secretary), S. Waterhouse (Treasurer), F. Goddard, J. D. Walker and R. J. Richardson. The objects of the club were fully explained by the chairman, and its policy discussed. The committee were authorised to negotiate for the acquisition of a club-room. All interested and wishing to join this club should communicate with the Secretary at the above address.

* * *

An example of the unrelenting measures adopted to suppress amateurs abroad is furnished by a case which recently occurred in the Hamburg Police Court. The chaplain of the English Church at Hamburg and Mr. Olson, an official of the Seamen's Home, were fined six shillings for working an unauthorised wireless installation. It was shown that wireless apparatus had been set up on the spire of the English Church, and was used to communicate with incoming British vessels, and it was also alleged that they had tapped messages sent out by the Imperial Wireless Station at Nordreich. Their original impression that it was an outrageous case of espionage was abandoned by the authorities, and the Public Prosecutor only asked for the infliction of a fine. The judge concurred with the view that the defendants had offended in ignorance and accordingly imposed only a small fine.

* * *

We have received a communication from a reader in a small inland town in New Zealand—Gore—which though a hundred miles from the nearest port is regularly supplied with copies of THE WIRELESS WORLD. Judging from his letter the lot of the amateur in New Zealand is not altogether a happy one. The penalty for erecting an aerial for the transmission or the reception of wireless messages is £500, in addition to which all the apparatus is liable to seizure. Notwithstanding this there are a number of enthusiastic amateur experimenters in wireless telegraphy who are making strong efforts to have their existence recognised by the authorities. Our correspondent is anxious to know the position with regard to amateurs in this country and he desires to correspond with amateur experimenters in this country. We shall be glad to forward his name and address to anyone who would like to get in touch with him. This communication from the Antipodes is another welcome indication of the influence of THE WIRELESS WORLD in bringing amateurs throughout the world in touch with one another.



A case of considerable interest was recently heard in a New Zealand Court at Hastings (Hawke's Bay), when Eric H. Battershill (shown in the illustration on the left) was charged with having established a plant for the purpose of receiving communications by wireless telegraphy without having obtained the consent of the Postmaster-General of New Zealand. Defendant promised not to use the apparatus again, and was convicted and ordered to come up for sentence when called upon.

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.

J. H. (Ipswich).—With reference to your repeated advice "Use a Wavemeter," could you give the following advice to help readers to make one: (1) What is the best ratio of C to L? (2) Could you give particulars of an inductance coil which would be suitable for λ up to 600 m and state its approximate L? (3) With air dielectric for condenser $C = \frac{A}{4\pi d}$. Would the above information be near enough for amateurs who cannot afford a calibrated instrument? (4) For use in making a fixed wavemeter could you give the dielectric values for glass and mica for frequencies corresponding to 100, 200, 300, 400, 500 600 λ?

Answer.—Ratio is not important for a wavemeter. Using a carborundum crystal—by far the most suitable for the purpose—an excellent wavemeter may be made with a capacity of ·001 microfarad (maximum value), which, of course, requires an inductance of rather over 100 microhenries to give a range up to 600 metres. As it is advisable to arrange things so as to be able to get on either side of the tuning point even for the maximum wave of the range, the inductance should be made rather larger than this; you might start with 35 turns of No. 22 wire on a 4-inch diameter former.

Instead of calculating your values of inductance and capacity and then combining the results to calibrate your wavemeter, it will be best for you to calibrate it by comparison with standard fixed circuits. The simplest forms of standard circuits, for your purposes, would be a series of simple vertical one-wire aerials; taking each of these to give a wave just over four times the actual length of the wire (say, 4·1 times). We see no reason why you should not use a thin wire carried by a box kite, and obtain a calibration-curve at least more accurate than the one you would obtain by calculating your values of inductance and capacity. In any case, a great part of the practical value of a wavemeter is independent of the accuracy of its calibration. The dielectric value of glass varies with the particular nature of the material, but a fair value is about 7.

P. B. (Brighton).—Over what distance will it be possible to receive signals with the following apparatus: A single slide inductance, a variable condenser, a potentiometer, a single headgear of 1,000 ohms, aerial of 4 line wires, height 75 feet, using 300 feet of aerial wire? Is a transformer necessary for long-distance work and will an additional tuning inductance improve the signals?

Answer.—(1) See replies to G. L. and G. H. D. in May and July numbers (1913).

(2) Do you mean a telephone-transformer or an oscillation transformer—a "jigger"? If the former, you would not need one as your telephones are 1,000 ohms resistance. If the latter, a jigger is always better than a direct-coupled circuit, since such far better "tuning" and selectivity can be obtained. The direct-coupled circuit, however, is at its best in the hands of an amateur, for the following reasons: it is more simple to adjust, and it means only one long inductance; whereas a jigger means that the amateur's short aerial has to be lengthened by a long inductance so as to be in tune with the long waves which most amateurs set out to receive, and in addition the jigger-secondary must comprise a long inductance so as to form, with a small condenser, a circuit which is tuned to the same waves. Hence the direct coupled circuit can compete far more successfully with the jigger in amateur wireless than it could hope to do in commercial wireless; especially as selectivity does not matter much to the amateur who does not mind missing a word now and then from "jamming."

W. A. J. (Colwyn Bay).—Submits a sketch of his aerials and asks if he is working on the right lines. His aerial rods are 3 feet 6 inches long, and he uses 4 aerial wires No. 18 w.g. 12 inches apart.

Answer.—We cannot be sure from your sketches exactly where your instruments are or where your lead-in comes; from the text it would appear to enter at the roof-window (the only one shown), but from the sketch itself it seems to be aiming at some lower entrance. If it comes in at some lower window we should prefer to have a simpler aerial with its free, insulated ends at the roof-mast and its down-lead coming slanting down direct from the 33 feet mast to the instruments. The objection to your plan is that the second part of your aerial is running so close below the top horizontal part, which is always bad. It is like having the go and return leads in an alternating-current circuit close together under the same sheath—which helps to prevent the leads from picking up induced effects. If your down-lead has to come in at the roof-window, we should recommend bringing it in as direct as possible from the roof-mast, the free ends in this case being at the 33-feet mast. But really the best way by far is to try for yourself; surely, too, that kind of thing forms half the charm of experimental wireless. You could so easily try it first with a simple single-wire aerial, and then apply your results to the more complex one.

Your "spreaders" are too short to take full advantage of a four-wire aerial; still, the four wires will probably be rather better than a less number, though not nearly so good as if they were each spaced three feet or so.

We do not quite like the idea of your making the whole of your down-lead of 3-ply rubber-insulated wire; on occasion this plan leads to serious trouble in wet weather; especially if there is sea-water about. One of the effects is that the rubber gets coated with a conducting layer of water, which forms a condenser with the internal wire. We should advise you to make your down-lead similar to the rest of the aerial until it wants to enter the house.

G. L. (Dukinfield).—I have been informed that I can either have my sending set working at a high or low frequency by adjusting the spark-gap and condenser. How is this done, and which is best to employ—high or low frequency?

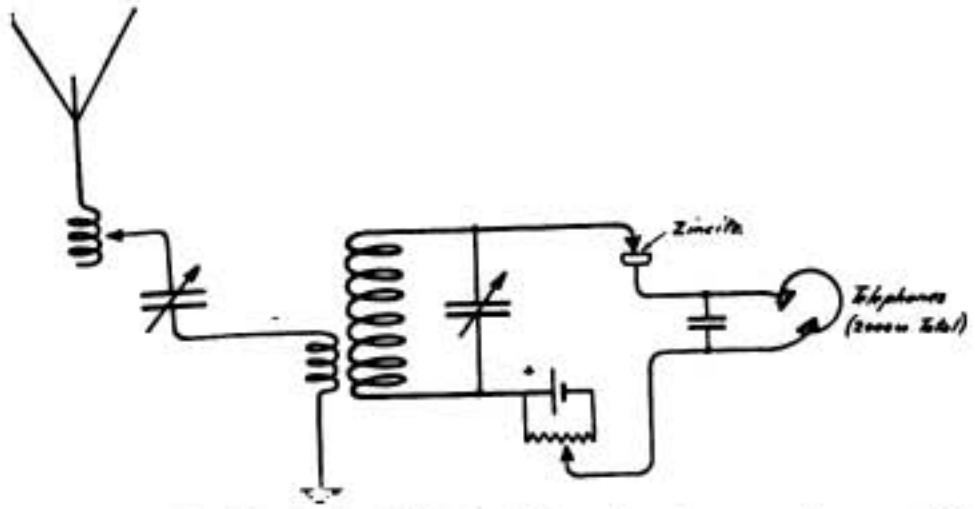
Answer.—Taken without its context, your informant's remark is rather cryptic. We think that he means that the number of sparks per second can be changed by altering the length of gap and the value of the capacity, which is true. The shorter your gap and the smaller your condenser the more rapid will be your sparks, up to a certain point The best arrangement should be found by experiment, using the readability of the received signals as the test. But your friend should have used the word "spark-frequency," and not "frequency" alone, if this is what he meant; "frequency" by itself nearly always means an alternating or oscillating frequency.

A. G. C. B. (Chelmsford).—Is it possible to connect a buzzer (electric bell with gong removed) to a pair of wireless 'phones, battery and manipulating key, so that when the circuit is closed through the key, the buzzer can be heard by the person who is wearing the 'phones? If so, would you be so good as to explain connections. (2) The best means of arriving at the resistance of a pair of 'phones.

Answer.—(1) There are several good ways of doing this. You can put your battery, manipulating-key, and buzzer all in series with a resistance, and connect your telephones across that resistance; then the varying potential difference at the ends of the resistance will drive small currents through the telephones and give you the signals. By making the resistance a variable one you can regulate the strength of the signals—the smaller the resistance the weaker the signals. The total resistance should not be too great compared with that of the buzzer coils, or it will spoil the action of the buzzer. A resistance variable from 0 to 30 ohms should be suitable. Another way is to wind a few turns of wire round an iron core (say $\frac{1}{4}$ in. diam.), and a much larger number of turns (say 25 times as many) of smaller wire on top of these. Connect the few turns in series with buzzer, battery and key, and the many turns across your telephones; then the interrupted current in your buzzer-circuit will induce suitable currents in the telephones. Signals might be varied in strength by making the iron core to slide inside the two coils.

(2) A Wheatstone Bridge (see any text book of electricity) is the best. If you have a voltmeter of known resistance, you could use it as a small reading ammeter, or rather milliameter, by calculating what current must flow through it to produce a deflection of one subdivision of its scale: then you could put it *in series* with your telephones, and apply such a voltage as to cause a suitable deflection; thus, knowing the applied voltage and the current passed by it through the telephone resistance, plus the known voltmeter resistance, you could find the resistance of the telephones. But really the resistance of telephones is a very poor indication of their value. They are best tested on actual signals.

M. X. X. (Blackburn).—(1) According to Dr. Eccles a "Perikon" detector works best when the zincite is — ve and the difference of potential is 0·45 volts. (2) At the foot of page 373 of the Year-Book of Wireless Telegraphy and Telephony, 1913, are the following words: "If it had been fully recognised that choking coils in the primary circuit could be used for bringing the system into resonance with the frequency of the alternator." How is this explained?



Answer.—(1) Best connections shown in accompanying diagram. (2) In a transmitting set such as is shown in your diagram (which however omits the all-important spark-gap) there are, if we neglect for the moment the aerial circuit, two distinct circuits—the low-frequency and the high-frequency circuits. The condenser comes into both of these. The high-frequency circuit consists of the condenser, the jigger-primary, the spark-gap and the leads joining all these. The low-frequency circuit comprises the condenser, the air-core chokes, the transformer as a whole, the primary choking coil and the alternator armature itself. This circuit would appear to be made up of two separate circuits, the one including the alternator and the transformer-primary, the other including the transformer-secondary and the condenser; but the effect of the transformer is to link these two into one, so that the low-frequency circuits can be treated as one whole. This whole circuit has to be tuned to the frequency of the alternator just as the high-frequency circuit has to be tuned to the frequency of the wave which it is required to transmit; although in the first case the frequency is 40 a second and in the second case it is one and a half millions a second (since you are using a 200 metre wave). Thus, just as the high-frequency circuit has to have its capacity and inductance adjusted so that $n = 1/2\pi\sqrt{CL}$, so the low-frequency circuit must have its $N = 1/2\pi T\sqrt{CL}$, the introduction of the extra factor T (the transformation ratio of the transformer) being the difference produced by connecting the condenser to the alternator through the transformer instead of directly. In practice the tuning of this circuit is best done by adjusting the inductance until the resonance obtained causes the maximum spark to occur across the spark-gap.

CALL (S. Wales).—I have recently erected two aerials about a quarter of a mile apart. The one aerial is 300 feet long and 60 feet high at one end and 25 feet at the other. The high end has suspended from it 3 wires, which come down to the instruments. At a point some 6 feet from the vertical wires I have suspended from the aerial and insulated from it an umbrella aerial composed of 6 wires, 75 feet long. The large aerial is for long distance receiving and the umbrella aerial I intend using to communicate with my house a quarter of a mile distant, where I have another aerial, 35 feet high at high end, coming down 50 feet to a 20-foot pole, and from there back to the kitchen window, making a V aerial. I want to transmit only on the umbrella aerial, at 30 watts on 200 metre wave length, and simply receive at my house, but my difficulty is how to arrange a call signal. I have in mind a coherer and bell. Should I be able to operate a coherer over this distance and make it selective by tuning, so that it would not be operated by outside stations? Would there be any advantage in making the call on the large aerial at the transmitting end?

Answer.—You should be able to get a coherer-receiver to work well over such a distance with very small powers, say, an ignition coil sparking a plain aerial. It will be practically impossible to make the receiver so selective by tuning that it will only respond to your call; you had better devise a special relay with some kind of dash-pot arrangement so that it will only respond to a long dash—a piston working in oil, for instance. On the whole, we think you had better stick to your plan of using the umbrella aerial for transmitting your call, for although your longer aerial has a better average height, you would have to reduce its wave-length by a condenser in series in order to use your 200 metre wave, for which the receiving aerial at your house is suitable. If you have any trouble, however, in getting strong enough signals, you might try the big aerial. And, by the way, you had better keep the big aerial carefully insulated while you are sending on your umbrella close at hand, or you will be losing energy by inducing in the big aerial.

(A number of replies have been unavoidably held over owing to pressure upon our pages.)

F

The Central Telegraph Office

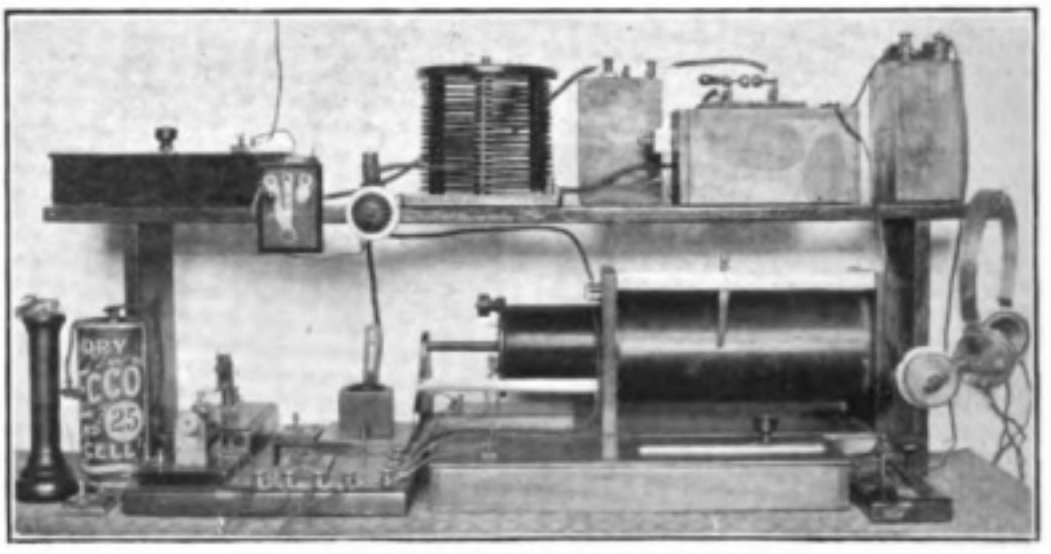
EXPERIMENTAL WIRELESS SOCIETY

IN a Department such as the Central Telegraph Office, consisting of some thousands of operators, it is not surprising to find many flourishing societies. Although probably the smallest society in that office, the "Experimental Wireless Society" is certainly not excelled in the enthusiasm of its members for its tenets.

Once a telegraphist always a telegraphist, and telegraph operators, whether on or off duty, are always drawn to the fascinating "dot and dash"; but the members of this society go a step farther, and after busy days in the operating galleries they are to be found surrounded by a very definite atmosphere of "Morse."

The members are not in receipt of stupendous salaries, and in order to possess a wireless installation much originality and constructional ability are called for. In almost every case the apparatus used is entirely home-made, and when one remembers that a workshop, or even a well-stocked tool chest, is out of the question, it will be readily understood that many hours of labour and great perseverance have been necessary to produce the really beautiful instruments it has been the writer's privilege to inspect. The apparatus is, of course, designed to suit the individual local conditions, and the installations have to be confined to the back gardens and any available space within the members' houses.

The erection of the "aerial" is perhaps the most difficult matter to overcome, and to manœuvre a 40 ft. scaffold pole into a garden 30 ft. long, with only the domestic clothes line for tackle, is not a task to be undertaken by frivolous persons. This particular aerial is only 28 ft. in length, but it has, nevertheless, been the means by which messages have been received from most of the British and Continental stations. The apparatus connected with it had to be specially designed and constructed, as, of course, such a small length of aerial is quite unusual. One fortunate member possesses an aerial of a length greater than that of many ship installations! Another, greatly daring, screwed a number of gas-pipes together, and forced the standard up the chimney, terminating his aerial at the top of it. Modern suburban houses are not, however, built for students with such proclivities, and it is not to be wondered at that in one case the local builder had to be called in to reset a chimney that had become dislodged in consequence of the strain of the aerial anchored to it. One member sends and receives to a colleague a mile or two away, but he has a transmitting range of five to six miles. All the installations are eminently successful, and time signals and meteorological messages are received from Continental stations, as well as ordinary messages exchanged between ships and coast stations. The efforts of learners at the several wireless schools afford an extensive field for investigation into mysterious "codes."



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Personal Items.

The marriage took place at the Parish Church, Waenfawr, on November 19th, of Mr. Harold B. F. Childs, chief engineer of the Marconi Station at Cefndu and Miss Enid Mary Williams, only daughter of the Rev. R. A. Williams. The presents included one from Mr. Marconi, and another from the engineering staff of workmen at the Cefndu Wireless Station.

Marconi Orchestral Society.

The first concert of the newly-formed Marconi Orchestral Society was held at Marconi House, on November 27th, and was an unqualified success. With one or two exceptions the items were contributed by members of the society, and all of them, vocal and orchestral, reached so high a level of excellence that the conductor, Mr. H. F. White, and the members of the society well merited the unstinted praise that was bestowed upon them. During the interval the swimming challenge cup and medals, presented by Capt. H. Riall Sankey, and the lawn tennis challenge cup, presented by Mr. D. Willock, were awarded to the successful competitors.

It was a source of great satisfaction to the organisers of the concert and to the large audience to have with them the Managing Director of the Marconi Company, Mr. Godfrey C. Isaacs. After handing out the prizes Mr. Isaacs congratulated the Marconi Musical Society on the rapid development it had made within a very short time. He presented the society with a cheque for 25 guineas, and expressed the hope that next time a concert was held they would give him timely notice of it so that not only he but some members of his family and friends might have an opportunity of attending. He also intimated that the directors of the Marconi Company would offer a cup for competition between the Marconi House and Chelmsford orchestras. Finally, Mr. Isaacs referred to the proposal of the staff to hold a dinner, and he asked the staff instead to accept an invitation from the directors of the company to dine with them.

This dinner was held on Saturday, December 20th, at the Criterion Restaurant, London, Mr. G. Marconi presiding. About four hundred members of the staff, including a number of visitors from the works at Chelmsford, accepted the hospitality of the directors, and the enjoyment of the evening was enhanced by the rendering of a high-class musical programme. Altogether, the gathering was a notable one, and the tenor of the few speeches made during the evening clearly evinced the interest of the directors of the company in the welfare of the staff of the Marconi Company.

The Marconi Athletic Club.

The Football Section of the above club is at present being well supported by its members, and the results of the matches played during the present month have been very encouraging. The first eleven continue to do well in the Western Suburban Alliance, Division 1, having obtained the maximum number of points from the four games played. After a most disastrous start the second eleven have now got together a very good side. Of the last four matches played, two have been won, one drawn, and one lost.

Patent Record.

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

26402. November 18th. William T. Ditcham. Radio-telephony.

26833. November 21. Peder Olaf Pedersen and Valdemar Poulsen. Multiple arrangement of H.F. electric current generators.

26934. November 22nd. Soc. Marius Latour et Cie. Transformation of the frequency of H.F. alternating currents for wireless telegraphy and telephony.

27175. November 25th. William J. Mellersh Jackson (Sig. Ges. M.B.H., Germany). Radio-telegraph station.

27183. November 25th. B.T.H. Co., Ltd. (Allegemaine Elt. Ges., Germany). Methods of tuning alternating current circuits.

27329. November 27th. R. C. Galletti. Production of electric impulsive discharge.

27480. November 28th. Marconi's Wireless Tel. Co., Ltd., and H. J. Round. Receivers for wireless telegraphy.

28183. December 6th. André Blondel. Method of determining the location of radio-telegraphic lighthouses and the like.

Do you know the metal Ivanium ? It is a light engineering alloy which can withstand the action of sea-water perfectly, and is worth while remembering by all who go in for mechanical construction, especially if such construction has to withstand sea-water or atmospheric conditions. Ivanium is quite easy to work, and has besides many additional advantages to other alloys. Its tensile strength is 11·1 tons per square inch. It is equal to the finest gunmetal, very tough, non-magnetic, and non-poisonous. It does not clog the file, while nuts and bolts made of Ivanium do not seize. It can be screwed, tapped, or nailed with the greatest ease, and does not tarnish, rust, or oxidise, and its polish is lasting. A multitude of uses can be found for such a desirable metal, and not least of these is its adaptability for wireless telegraph parts.