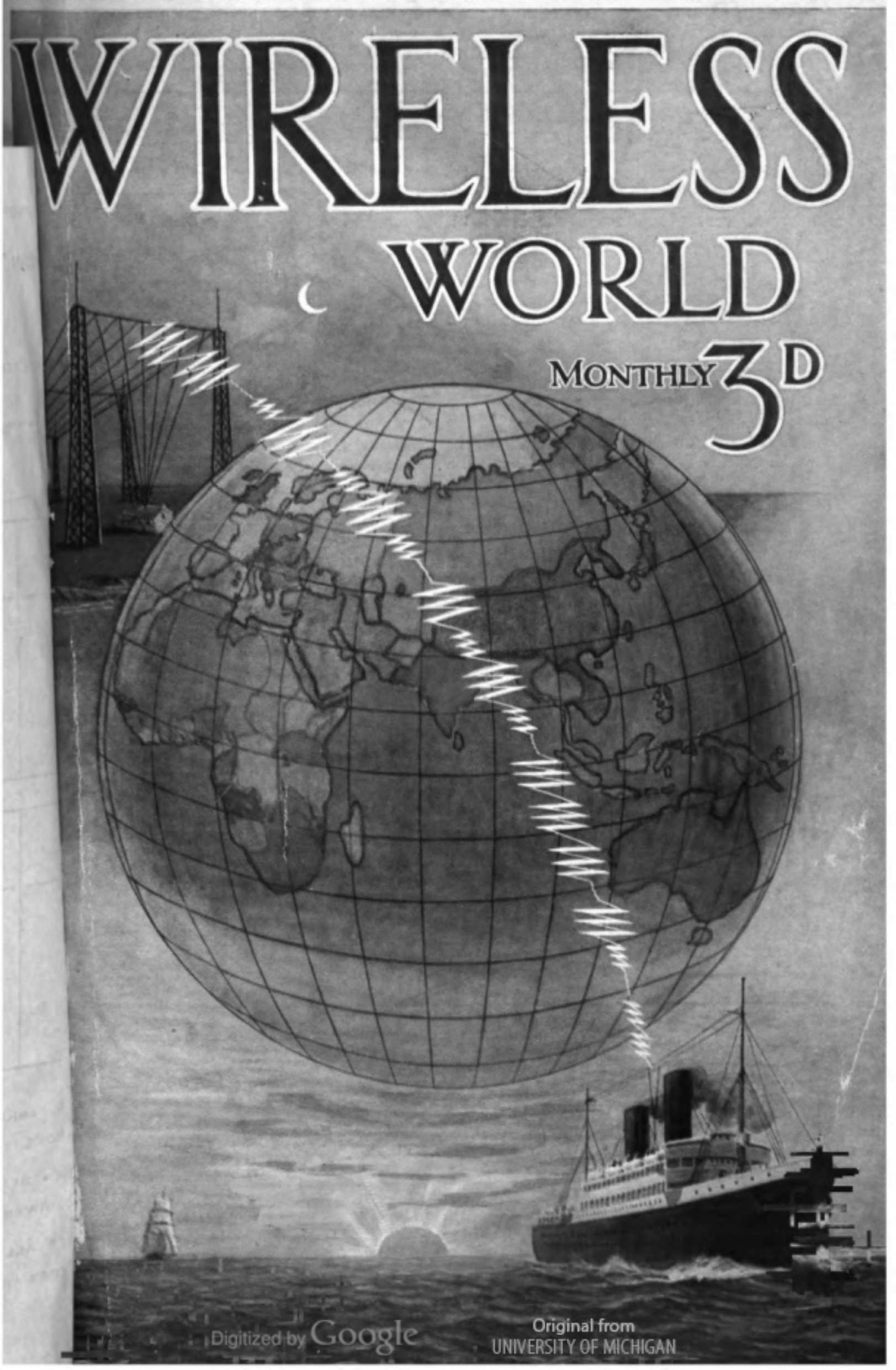
Vol. I. No. 5. (NEW SERIES). Registered at the G.P.O. for transmission to Canada by Canadian Magazine Post. AUGUST, 1913

WIRELESS WORLD

MONTHLY 3D



The Wireless World.

With which is incorporated "The Marconigraph."

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

Registered for transmission by Magazine Post to Canada.

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

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

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

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

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

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THE
WIRELESS WORLD
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The MARCONIGRAPH.

Vol. 1.—No. 5. (NEW SERIES) August, 1913. Subscription 5/0 per annum post free. Price 3d. Post Free 5d.

A FICTION EXPOSED

IN the course of a discussion in the House of Commons on July 15th, Major Archer-Shee gave further currency to a statement which, as far back as October last year, was widely published in the newspapers of this country. The statement was to the effect that a wireless company had been registered and had acquired the rights of the Poulsen-Pedersen system and "to establish communication between England and Canada, receiving a subsidy of £15,000 per annum from the Canadian Government." Speaking in the House of Commons, Major Archer-Shee said, "The Canadian Government had given this contract" (to the Poulsen Company) "for their stations across the Atlantic. At least they have approved of their starting them and have given them a subsidy." The Postmaster-General here intervened and informed the House that it was not the case that the Canadian Government had given a subsidy.

This was the first occasion on which an obviously inspired rumour was officially denied in this country. But the official reports of the Canadian House of Commons even more emphatically expose the inaccuracy of a misleading statement which was allowed to circulate in the Press without repudiation and was artlessly repeated in the House of Commons. We extract the following from the Official Report of the Canadian House of Commons debates for Wednesday, May 14th (Vol. XLVI., No. 93):—

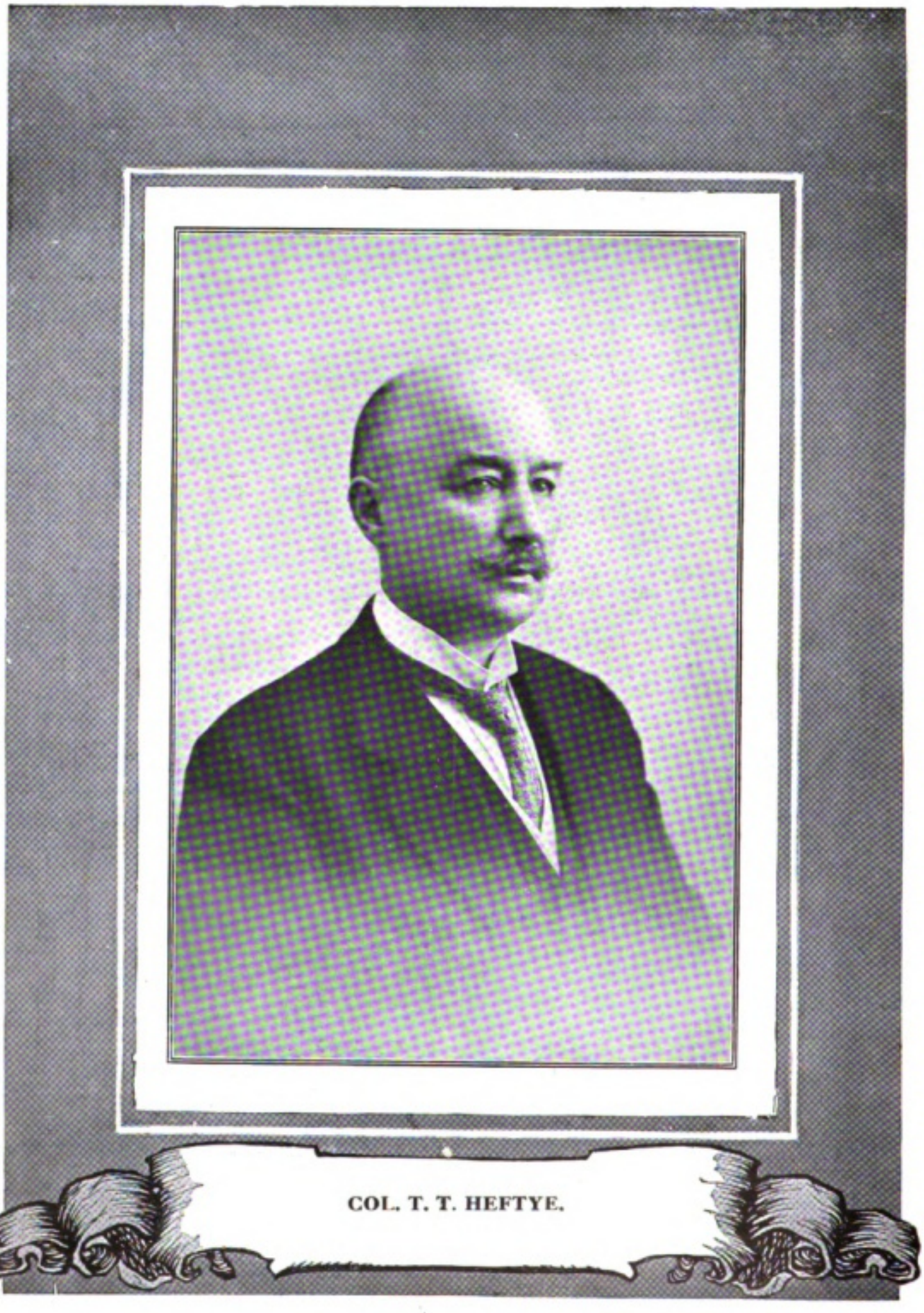
"On the motion of the Hon. L. P. Pelletier (Postmaster-General) House went into Committee on the following proposed resolution (Mr. Deputy-Speaker in the Chair):—

"Resolved, that it is expedient, in connection with Bill No. 188, now before this House, intituled 'an Act to provide for more advantageous telegraph communication between Canada, the United Kingdom, and other parts of the British Empire,' to authorise the Government of Canada, if it deems it to be in the public interest, and under the circumstances and conditions set forth in the agreement in the schedule to the said Bill, to purchase the stations, apparatus, equipment and licences mentioned in the said agreement."

"Mr. MACDONALD: In view of the fact that the Marconi system has been in successful operation in Canada, why does the Postmaster-General discard it and inaugurate this Poulsen system? Has the science of wireless telegraphy reached such a stage that where two systems are used there is no danger of one system intercepting the messages of another?

"Mr. PELLETIER: Nothing in this Bill prevents the Marconi from doing business and being a competitor with this company. The only thing this Bill does is to provide for a new competitor, and that competitor receives no privilege, no subsidy, and no monopoly. It is simply a question of having a competitor who will bring down the prices of transmission."

We must leave the public to draw their own conclusion from a comparison of the two statements reproduced above; it will have served some purpose, however, if it inclines them in future to accept with greater reserve the "Wonderful Wireless Achievements" concerning which information is published on the unsupported testimony of those who are responsible for the alleged "achievements."



COL. T. T. HEFTYE.

Personalities in the Wireless World

COLONEL THOMAS THOMASSEN HEFTYE

Director-General of Telegraphs, Norway

THE ratification of the Norwegian agreement with the Marconi Company for the establishment of a trans-Atlantic service introduces a striking personality in Col. T. T. Heftye, the Norwegian Director-General of Telegraphs. Born in Christiania on April 10th, 1860, Thomas Thomassen Heftye was the son of a prominent banker. His father, a Swiss by birth, spent the greater part of his life in Christiania, and acted as Honorary Consul for Switzerland in that city. He was a man of great ability, and, as proof of the recognition of his splendid qualifications, he was offered the Chancellorship of the Exchequer. But this honour he refused, as he was by nature a man of retiring disposition, and only a sense of public duty made him take up anything like an official capacity.

His son, who is to-day the Director-General of Telegraphs in Norway, entered the University at Christiania when he was 18, and studied there for two years. After that he took up a business career, and for five years was engaged by firms of repute as their representative abroad. This brought him in touch with the ideas and movements of other countries than his own, and did much to widen an already keen intelligence. Besides, he acquired thereby considerable skill in languages, of which his thorough knowledge of English and French is a proof. But the career he had started upon was not to the taste of young Heftye. He wished to become a soldier, and with this end in view he entered a Norwegian military college in 1887. Afterwards he was gazetted to the Corps of the Royal Engineers, and when he had passed the Superior Military Technical Academy he was gazetted as sub-Lieutenant in 1893. Two years later he obtained his captaincy. For five years he devoted himself entirely to his profession, and was rewarded by appointment as Military Attaché at the Legation in Paris in 1900. Everywhere he went he made fast friends, for to his splendid talents were added great force of character, a graceful modesty, and an engaging geniality.

Politically he was a Liberal, and this marked him as a man of original thought. But the holding of such views was detrimental rather than an advantage to him, for at the time when he was entering upon his career it was the fashion for all men of good family to be Conservative, and his whole-hearted support of Radicalism helped to thin the ranks of his would-be supporters. Even his father was Conservative, so that Col. Heftye had to fight, and fight strenuously, for his principles. He did fight, and he won. In 1903 a Liberal Ministry took office, and he was made Minister of National Defence. On assuming this responsible position he was gazetted colonel in the army. Shortly after this, however, his party left office, and with them he resigned his appointment. In 1905 he was first appointed Director-General of Telegraphs, but this post he vacated three years later, when another Liberal Ministry was formed, and he was again appointed Minister of Defence. On this occasion, however, he failed to accept the principles of his party, and, after holding office for only three weeks, he resigned, and took up his old post as Director-General of Telegraphs. Perhaps it was fortunate for Norway that he did so, for the subject of wireless telegraphy soon became so important that the question of a national system could no longer be overlooked. With his usual energy he studied every part of the question, and reached the conclusion that it would be a splendid thing for Norway if she possessed such a system as was mooted. Once he was convinced of its advantages, he threw his whole support in favour of the scheme, and it was largely due to him that the Bill passed the Storthing by the huge majority of 99 out of 115 votes.

EPISODES OF THE MONTH

SHOCK-EXCITATION. AMATEUR LICENCES AND THE NEW POST OFFICE CHARGE. MARCONI DEVELOPMENTS IN BRAZIL. INTERNATIONAL TIME SIGNALS. WIRELESS IN STEAM FISHING FLEETS.

THE reaction of secondary on primary in a coupled-circuit transmitter, and the consequent formation of "beats"—equivalent to the presence of two different frequencies—in the waves emitted from the aerial, has for some time occupied the attention of wireless engineers. The avoidance of such reaction, by the rapid quenching of the spark, forms one of the advantages of the modern Marconi discharger. Dr. Eichhorn, in an article which we have great pleasure in publishing on p. 294 of this issue, deals with other methods for obviating the same phenomenon. The application of these methods—which are based on the researches of Prof. Wien—under various conditions of coupling and spark-length, and the effect on the requisite tuning, is discussed; and though there may not be anything said which is particularly new, the whole subject is reviewed in an interesting way. For the moment we cannot quite see how Dr. Eichhorn can reconcile his definition of the coefficient of coupling as $k=\frac{\nu'_1-\nu'_2}{\nu}$ with his equation for the periods of the two waves $T'=T\sqrt{1+k}$ and $T''=T\sqrt{1-k}$.

* * *

Some dissatisfaction has been caused in amateur wireless circles by the announcement that in future a charge of one guinea "to cover the office expenses connected with the issue of the license and the inspection of the installation" is to be made on all licenses issued. Much of the dissatisfaction rests,. however, upon a misunderstanding of the object of the charge, and upon the mistaken fear that it will have to be paid annually. Licenses are granted under the Wireless Telegraphy Act of 1904, Clause 2 (1), which empowers the Postmaster-General to grant a license to an applicant "whose sole object of obtaining the license is to enable him to conduct experiments in wireless telegraphy." The license is granted "subject to such special terms, conditions and restrictions as the Postmaster-General may think proper," but it is not to be subject to any "rent or royalty." Doubts have been expressed as to whether the charge can be enforced legally, but we understand that the Post Office have been advised that they are strictly within their rights in imposing the charge. As a license is, under ordinary conditions, permanent, there will be no other registration expenses besides the initial outlay of one guinea, unless a station should be so altered and re-equipped in such a manner as to make a new license necessary, and then the fee of one guinea will be charged. This fee applies to all proposed experimental stations, whether they be for receiving only or for both receiving and transmitting purposes. The charge is no doubt due to a great increase in the number of applications for licenses, and there is a good deal to be said in its favour. Indeed, we doubt very much whether any serious experimenters are likely to take exception to the nominal fee which they are called upon to pay. If, on the other hand, the fee will suppress the irresponsible "amateur" who takes only a passing interest in the art of wireless telegraphy, and who, with his toy apparatus, merely endeavours to make himself a public nuisance, no one will be any the poorer, whilst those who conduct genuine experimental researches will gain considerably in influence. This is the class which, after all, counts for anything, and which should receive encouragement. In this connection we may welcome the increase in the number of amateur wireless clubs in this country. The "club" movement has not been in existence long, but already there are about half a dozen clubs either formed or proposed. We are probably only at the beginning of what will ultimately become a very large and useful movement, with associations of amateur experimenters in every important centre

co-operating for the common benefit of their members.

* * *

Vice-Admiral Belfort Vieira, the Brazilian Minister of Marine, in his annual report to the President of Brazil, states that the wireless telegraph service in the Republic has increased during the past year. Wireless stations are to be erected at Rio de Janeiro, Bauru, and Porto Murtinho, which will enable communication to be established with the base of the Matto Grosso squadron. The contract for these stations has been awarded to Marconi's Wireless Telegraph Co., Ltd., and a commission has been appointed, consisting of three officers of the navy and a representative of the Marconi Company. Another station at Santa Martha will communicate with ships south of the Republic. The Minister's report adds that the naval wireless telegraph stations have worked with unfailing regularity. New Marconi stations have been purchased, and, in the opinion of the Minister of Marine, the good results obtained justifies the adoption of the Marconi system in the Brazilian Navy. It is proposed to transfer the apparatus which was formerly used in the Ilha das Cobras station to Abrolhos, and to adapt the former as a training school for wireless operators.

* * *

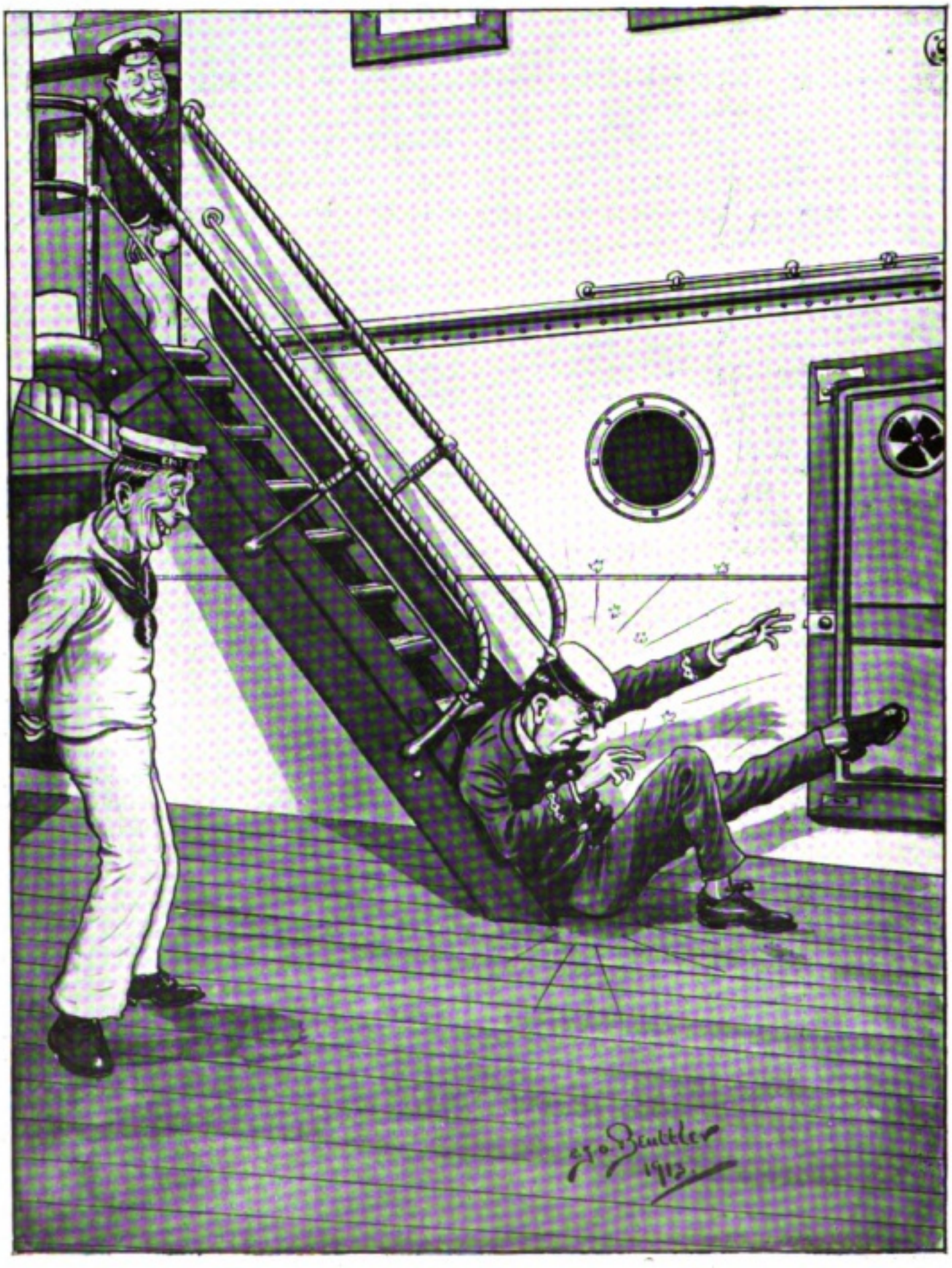
The growing commercial importance of wireless telegraphy was emphasised by the inauguration on July 1st of a new international system of wireless time signals. Up to the present time only two wireless stations have transmitted regular time signals—Norddeich and Eiffel Tower. Each of these two stations had its own system of preliminary signals, that of Paris being rather elaborate and confusing to the inexpert, besides possessing the additional peculiarity (to the British mind) of sending the actual "time" signal at such awkward moments as 10.49 a.m. and 11.49 p.m. The German station has had a far more simple and convenient method—a preliminary signal that could easily be understood, followed by the actual "time" at Greenwich midday and midnight. Paris and Norddeich have a normal range of about 1,000 miles, so that only a limited area had the benefit of the correct time free of charge by wireless telegraphy. At an international conference in Paris last October the new world-wide time signals were formulated, and some idea of the new range to be covered can be gathered from the fact that such high-power stations take part in the new scheme as San Francisco, Timbuctoo, Manila, Mogadiscio (Somaliland), San Fernando de Noronha (Brazil), Paris, and Norddeich. The procedure will be identical at these and other stations, and all time signals will be sent exactly on the hour by Greenwich time, though each station has its own allotted hour, and two or three of them will send two signals during the twenty-four hours.

* * *

That the application of wireless telegraphy to trawlers is now practicable was demonstrated beyond a doubt by the successful experiments carried out in the North Sea during the past month. These were made on the trawler *Othello* and the carrier *Cæsar*, owned by Messrs. Hellyers' Steam Fishing Co., of Hull. Having regard to the size of the trawler, its mast facilities and the work carried on by a vessel of this type, it was decided that the most suitable form of wireless equipment would be a type approaching as nearly as possible the Marconi standard ½-kw. set. Two installations of this power, but of somewhat different designs, were therefore placed aboard the trawler, and light topmasts were carried to take the aerials, whilst two installations, each of 3-kw., were placed in the carrier. An average range of 90 miles was aimed at. The vessels left Hull on June 11th, and proceeded towards the coast of Denmark. At a distance of 270 miles from Cullercoats the *Cæsar* sent and received messages without any difficulty; thus the estimated range was considerably exceeded, and the strength of signals in both directions was such as to indicate that the range of 270 miles could be increased still further. With the *Cæsar's* aerial lowered to 65 feet above the water-level, she communicated with Scheveningen at 195 miles. The *Othello*, which was equipped with a Marconi portable installation, was able to communicate with Cullercoats, 180 miles away, messages being freely exchanged at that distance, and also with the *Cæsar*, a distance of 100 miles. We hope to publish full details of these important trials, together with particulars of the types of apparatus with which it is intended to equip trawlers, in an early issue.

CARTOON OF THE MONTH

Wireless Terms Illustrated



V.—A Sliding Contact

A Transatlantic Wireless Station

IN THE LAND OF BEAUTY, MYSTERY AND PROGRESS

RATIFICATION OF CONTRACT WITH THE MARCONI COMPANY BY NORWEGIAN PARLIAMENT. ITS EFFECT ON THE SHIPPING INDUSTRIES. SITES PROPOSED FOR STATIONS. STAVANGER AND ITS CATHEDRAL. THE PEOPLE OF NORWAY. THEIR INDIVIDUALITY AND SOCIAL LIFE. NAERBO.

NORWAY looms large in the mind of the public at the present moment, for is it not the holiday season, and this, the land of fjords and mountains—double-starred in the mental Baedeker of the tourist—is one of the beauty spots of the world. But it has also been brought prominently to notice by the announcement that on June 28th the Storthing decided to adopt a Transatlantic wireless telegraph scheme which had been negotiated with the Marconi Company.

This scheme is of greater national importance than at first sight seems apparent. Norway has a very large shipping business, the mercantile fleet ranging fourth in the world as far as tonnage is concerned. Many of these ships trade in American waters, and over one million of Norway's sons are settled in the land of the Stars and Stripes. The want of adequate Transatlantic telegraphic facilities has not been relished by the Norwegians, who have lacked hitherto direct means of communication with the North American Continent. Cable-laying was impossible, mainly on account of the high cost, and the only hope, therefore, rested in wireless telegraphy. This alone offers to satisfy the aspiration of Norway to be in direct touch with the American continent, and it can well be imagined with what pleasure the public welcomed its development. Hitherto the country has enjoyed the advantages of wireless telegraphy on but a small scale; there are about six stations scattered along the coast, in addition to one at the Spitzbergen Islands. Only three of these stations, however, are of any importance, viz., Bergen, Ingo and Spitzbergen, and these are employed for communicating with ships.

In September last the Norwegian Telegraph Administration concluded a provisional contract with Marconi's Wireless Telegraph Company, Ltd., for the erection of a high-power station to communicate with a similar station to be erected by the Company in the United States. The price to be paid to the Marconi Company for the erection of the station was £70,000, and the Company were further to receive a royalty of 10 per cent. on the gross receipts of the undertaking for a definite period. This contract was subject to the approval of the Norwegian Parliament, but, before it could be ratified, the Government resigned, and their successors decided to submit the scheme to the consideration of a representative committee appointed by the Storthing. After very careful deliberation, this committee came to the conclusion that the scheme would be of great benefit to Norway, and they decided to recommend the ratification, subject to one or two modifications which were agreed to by the Marconi Company. The committee was presided over by Mr. Mowinckel, a leading ship-owner of Bergen, and among its members was Admiral Sparre, and both these maritime experts spoke strongly in favour of the scheme when the question of its ratification came before the Storthing on June 28th.

The transmitting station will be erected on Ullenhaug, near Stavanger, on the south-west coast of Norway. The Government propose to provide trunk lines connecting all the important towns in the country direct with this station. The electrical energy which is required to produce the waves employed

View of Stavanger.

in wireless telegraphy will be supplied by the town power station, whose power is derived from the immense water supply situated in the range of mountains at the back of Stavanger. The power supplied will be 3-phase alternating current, and the voltage of the transmitting line 30,000 volts. The current will be transformed down to a suitable voltage for running the motors employed in the transmitting station.

The sites for the station near Stavanger, also that for the receiving station at Naerbo, which is about 17 miles south of Stavanger, were chosen some time ago, so that no time should be lost in commencing the constructional work. The Marconi Company were confident that the searching technical investigation that had been made into the somewhat similar contract for the proposed stations for the Imperial chain would result in the final ratification of the Norwegian contract, and as a result of this confidence the Company have progressed with the details of the designs in these stations, and are consequently ready to proceed with the work immediately.

We must leave further details of these important stations until a more opportune occasion, which will occur later. But we cannot depart from the country without recalling some of its historical past and its literary traditions. For it is a land having, in its most characteristic regions, a year of but one day and night—the summer, a perpetual warm, sunlit day, filled with the aroma of trees and plants, and the rest of the year a night of darkness ; a land which is the extreme northern limit of European civilisation, on the outskirts of which the great primitive gods still dwell, and where elves and fairies and mermaids are still regarded, according to an expression of Jonas Lie, as "tame domestic animals." As one of the persons in Björnson's "Over Œvne" (Beyond our Strength) observes : "There is something in Nature here which challenges whatever is extraordinary in us. Nature herself here goes beyond all ordinary measure. We have night nearly all the winter ; we have day nearly all the summer, with the sun by day and by night above the horizon. You have seen it at night half-

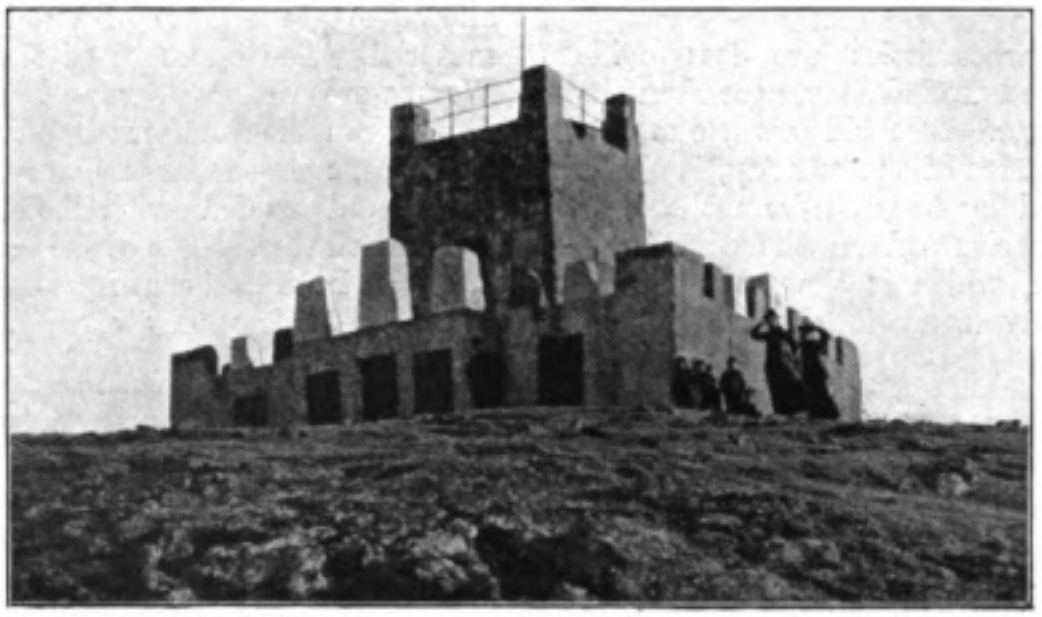
veiled by the mists from the sea; it often looks three, even four, times larger than usual. And then the play of colours on sky, sea and rock, from the most glowing red to the softest and most delicate yellow and white; and then the colours of the Northern Lights on the winter sky, with their more suppressed kind of wild pictures, which are for ever full of unrest and for ever changing. Then the other wonders of Nature! These millions of sea-birds, and the wandering processions of fish, stretching for miles! These perpendicular cliffs that rise directly out of the sea! They are not like other mountains, and the Atlantic roars round their feet. And the ideas of the people are correspondingly unmeasured. Listen to their legends and stories!"

These characteristics are less evident perhaps in and around Stavanger than in the northern parts. The old town, one of the principal centres of the country, is the first to be visited by tourists from the British Isles. It is situated on the coast of the Bukkenfjord, which is the most southerly of the many beautiful inland gulfs for which Norway is so deservedly famous. The broad basin of water is studded with many islands, and its arms extend inland in every direction, some with smiling shores, others flanked by high hills. The city is one of the oldest in Norway, and possesses a population of some 35,000, which makes it the fourth largest township in the country. Its most notable feature is the Cathedral of St. Swithin, for it is the only remaining example of a style of architecture which flourished before the twelfth century. All Norway's oldest buildings are the churches, which took the place of the early heathen buildings known as "Hov." Such buildings are of two distinct types, though both are developed on Norman lines, but adapted to allow the greater use of wood as building material. The churches of the North and West were richer in varied treatment of detail than the Southern buildings. All the churches, even the largest, are built without aisles and roofed with beautifully constructed timber. None of the older examples take the Basilica form, for it was not until after 1150 that this style was used in

A View of Stavanger Fjord.

smaller buildings. The consequence is that St. Swithin's of Stavanger is the only perfect building of this kind extant to-day. In treatment of interior detail the church presents a striking resemblance to the Knights' Hall in Rochester Cathedral, which was built about the same time—that is, early in the eleventh century. The work of building was probably superintended by the first Bishop of Stavanger, an Englishman, Reinald, who had been a Canon in Winchester Cathedral. He therefore took that building as a prototype, and the dedication of the church to St. Swithin is to be attributed to the same circumstance, for the saint, who is supposed to have such influence on English weather, was Bishop of Winchester from 837 to 862 A.D. The building has twice suffered from fire, and is to some extent shorn of its splendour from these causes. Nevertheless, it is still a valuable asset to Norman architecture. Near it once stood the Episcopal Palace of Kongsgard, but the site is now occupied by the Latin School, for the seat of the bishopric was removed to Christianiassund in 1685. The change was due to the wishes of King Christian V., who, as ruler over a kingdom of which Norway and Denmark were units, wished the seat of Church government to be more central. A few years after the town was practically devastated by a disastrous fire, and Christian took the opportunity to cancel its charter in the hopes that it would not again be rebuilt and that the inhabitants would make new homes in Christianiassund. But for reasons which it is impossible now to discover, his kingly pleasure was disregarded, and the town gradually rose again into prominence. Many of the buildings then erected remain to-day, so that Stavanger, with its narrow streets and wooden houses, is a town beloved by the artist and by all who have an eye for the picturesque.

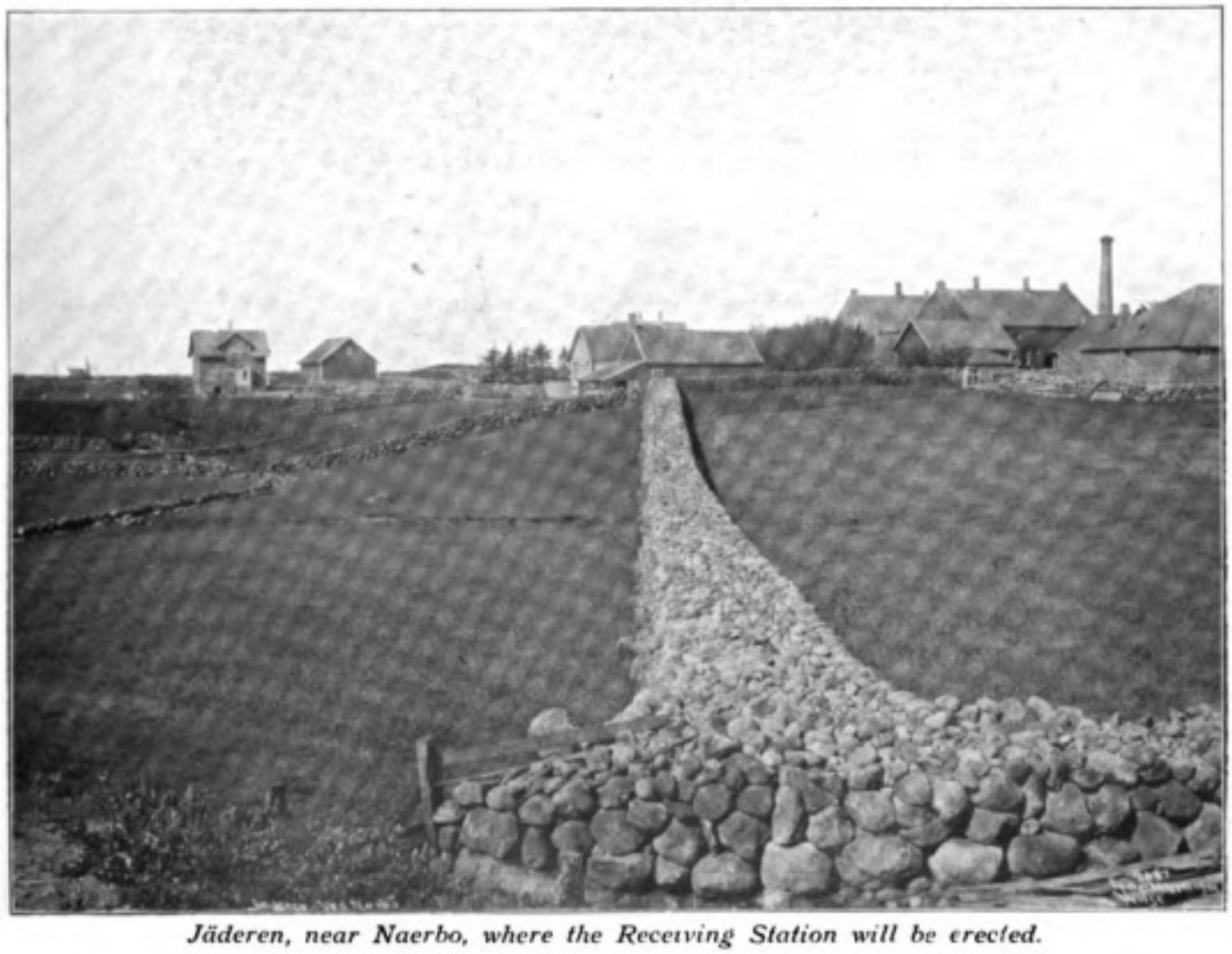
Even yet the national costume is worn by some of the older inhabitants, although it is gradually falling into desuetude, and for this the tourists are most to blame., for the influx of visitors has, to a great extent, modernised the town. Nevertheless, those who are on the look-out for old-world sights are sometimes rewarded. For instance, to see a *stolkjaerre*—that is, a light cart with seats for two persons—whirling along the dusty high road, behind a lean but active nag, which is frequenly driven by a *gut* of very tender years, brings to the spectator a sense of charm.



Old Tower at Ullenhaug, near Stavanger, in the neighbourhood of which the Transmitting Station will be erected.

But Stavanger does not rely merely on the tourist for its good report ; it is a fairly large centre of industry. Along the sides of the wharves are many factories which produce a variety of hermetically tinned and preserved cooked foods, especially sardines and anchovies. This industry is quite of recent date, but the exceptional advantages of position for the supply of raw material and facilities for reaching the world's markets are such that the large businesses of this kind number twenty-four, and others are inaugu-

Interior of St. Swithin's Church, Stavanger.



Jäderen, near Naerbo, where the Receiving Station will be erected.

rated almost yearly. Another flourishing industry is the extraction of iodine from seaweed, which all along the coast of Norway is abundant.

There are one or two famous views which deserve notice. The most noteworthy is from the Vaalandshang, which is typical of Norwegian scenery. But another and more extensive one is seen from the Ullenhaug, two miles outside the city. The hill is surmounted with a tower, the walls of which bear an inscription referring to a naval victory by Harold Haarfager off this coast in 872 A.D. Haarfager, or the *fair-haired*, it seems, had vowed a vow that he would not cut his hair until he obtained possession of the whole kingdom of Norway. The victory here commemorated was the ultimate event which gave him his great desire and released him from his vow. At his death the kingdom was again disunited, but subsequent events do not invalidate his claim to be the first king of United Norway.

It is here, as we have already mentioned, that the Marconi transmitting station is to be erected.

To get to Naerbo, which is some seventeen miles outside Stavanger, and which is to be the site of the Marconi receiving station, it is necessary to take train. The route crosses and recrosses the Ekersunds Elv, and then traverses a wide plain on the coast, finally passing through great tracts of moor and woods, with occasional glimpses of the sea, several lakes, and high masses of gaunt and barren rocks.

A tablet in memory of Jack Phillips, the wireless operator in the *Titanic*, was unveiled last month at Farncombe Church, Godalming, where Phillips formerly sang in the choir.

Capt. Thorwald Nielsen, who will be in command of the *Fram* when she takes Amundsen's party on their expedition to the North Pole, has informed the Norwegian *Aftenposten* that the vessel will carry a wireless station, and that he himself will take a course of instruction in wireless telegraphy.

Sætersdalen Highlanders with Pack Horse.

The New Mercury.

[Poetry which has wireless telegraphy for its subject is still rare. On this account the following poem, which appeared in the *New York Sun*, is particularly interesting. It shows besides marked originality in both idea and expression.]

Dead priests that have sung when the world was young at Mercury's temple place,
Your myth, it was true—it is born anew in the death of time and space!

More swift, more fleet, than the sun-stained feet of the Dawns that trample the night—
More fleet, more swift, than the gleams that lift in the wake of a wild star's flight—
Through the unpathed deeps of a sea that sweeps unplumbed, unsailed, unknown,
Where the forces untamed, unseen, unnamed, have ruled from the first, alone,
Now the ghosts of thought, with a message caught from the tales of the dreaming past,
Unheard, unseen, with nor sound nor sheen, speed through the ultimate vast.

Battered and lamed and shattered and maimed, the liner crawls into port,
And the bolted tire and the volted wire are the toys of the whirlwind's sport,
And the gray sea's teeth in the depths beneath, where the coiled, green serpents play,
Are crumbling, crunching, mumbling, munching, at the cable lengths alway—
But now they may howl, the storms, and growl at the work of the lineman's hands,
For gone is their pride, with the boast of the tide that bit at the deep-sea strands;

For a sentience thrills through the bastioned hills that has neither voice nor form.
Nor recks of the might of the chaos-sprite who lashes the earth with his storm;
Bitted and bridled and shackled and girdled and bound with a linkless chain,
The brute powers cower at the god-like power that dwells in a human brain—
Man has stolen the wings of the deathless Things that range where the spirit is lord—
He is leagued anew with the silence through the strands of a strandless cord.

Where the moonmates dance to the sirens' chants on the floor of a level flood—
O'er the headland's crest and still fiord's breast that are dashed with the dead sun's blood
When the afterglows that are born of his throes coquette with the rising stars—
Through the shine and spray where the noonbeams play at painting a rainbow's bars—
Through the dripping shroud that the hurrying cloud flings over the stark berg's breast,
Unseen, unheard, leaps the Wraith of a Word, like a god on a god-like quest!

Man's feet are clay and they halt and stay with the graveyard worms and clods,
But his plum'd thought flings to the wind its wings in the haunts of the careless gods—
For those old gods live, and they weave and give new meanings to old myth,
And blossoms and gleams of the world-old dreams flower afresh from the truth at their pith—
So the tales that twine 'round the ruined shrine where the priests of Hermes sung,
They were true, they are true, they are born anew in the speech of a younger tongue!

"Shock-Excitation" in Wireless Telegraphy

By GUSTAV EICHHORN, Ph.D. (Zurich).

WIRELESS telegraphy has passed into a new phase of development through the use of quenched sparks for the so-called method of "impact or shock-excitation." Its essence consists in using a very short-lived oscillatory discharge in a primary circuit to excite oscillations in an antenna arranged as a secondary circuit, the life of the primary oscillation being, in the ideal arrangement, just long enough to admit of the transference from primary to secondary of the maximum fraction of the initial energy—that is, the energy stored on the condenser in the primary circuit just before the beginning of its discharge. It may be mentioned that Prof. Braun made some attempt formerly to apply the same principle through the automatic stoppage of the primary circuit of oscillation after the energy has passed over to the secondary circuit (antenna), but he did not succeed on account of the artificial character of the means employed.

According to the theoretical investigations of Prof. M. Wien and Prof. P. Drude, it was considered preferable to keep the damping (consisting principally of spark-damping) in the primary circuit permanently as low as possible. Indeed, Prof. Wien found that in the case of loose coupling the decrement of the emitted waves could, under the most favourable conditions, be reduced to that of the primary circuit.

It is a well-known fact that under ordinary circumstances a pair of coupled circuits give rise to two so-called coupling-waves of different frequencies and decrements, which produce the phenomenon known as "beating"; in the time of a beat the oscillatory energy passes from the primary to the secondary and back again. This will appear clearer by a proper definition of the coefficient of coupling κ, viz., in case of isochronism of the coupled circuits ($\nu_1 = \nu_2 = \nu$, or $T_1 = T_2 = T$), and of strong coupling, through which the individual frequencies will be altered into ν_1' and ν_2', we have $\kappa = \frac{\nu_1' - \nu_2'}{\nu}$, *i.e.*, the ratio of the number of beats to the frequency of the oscillations gives the coupling-coefficient.

The real cause of this phenomenon lies in the special character of the wide spark-gap hitherto employed in the primary of the coupled circuits.

There remains always a certain amount of ionisation in the spark-gap, and therefore the resistance never obtains the required high value after a discharge, and also the tension produced by the reaction of the secondary system just reaches its maximum, so that a fresh excitation of the primary takes place. The energy is oscillating to and fro, and thus makes possible the generation of the two coupling-waves with the periods $T' = T\sqrt{1+\kappa}$ and $T'' = T\sqrt{1-\kappa}$, even if the individual frequencies of the two circuits are the same.

It is perfectly clear that this means a great waste of energy, firstly through the consumption of energy in the primary, and secondly because only one-half of the radiated energy is utilised in the receiving station.

In consequence of the reaction of the two circuits in the sender the decrement of the more feebly damped wave becomes greater, depending upon the degree of coupling; in other words, the possibility of sharp tuning becomes less.

All these well-known disadvantages of the ordinary method of coupled circuits have been eliminated through Prof. Wien's quenched sparks, *i.e.*, by employing very narrow spark-gaps instead of the former wide spark-gap. The characteristic feature in this case consists in using very different decrements in both circuits, that of the primary being much greater than that of the secondary. Of course, at the beginning the damping of the primary must also be very small in order to avoid waste of energy, but it soon increases. In this way, the energy, after it has passed over to the secondary,

does not revert to the primary, but is oscillating in the secondary system only in the individual period of the latter, and is radiated by it. However, this great decrement in the primary would not of itself prevent the reaction of the secondary, but the essential feature of this method of "impact or shock-excitation" lies, as mentioned before, in the particular behaviour of the small spark-gap; it acts by de-ionisation as an interrupter, which disconnects the primary circuit from the antenna, after the latter has stored up the greater part of the energy. From this results the important advantage of the emission of wave-trains of only one frequency.* As necessary conditions for this impact excitation we may especially point out the following:

1. *Sufficient quenching of the spark-gap.*—This depends on the nature of the spark-gap and the spark potential, and can be accomplished either after the first beat or after a number of beats, the former being the better condition for good impact excitation.

2. *Sufficient duration of the first minimum.*—This depends on the closeness of coupling; the time of a beat being shorter with closer coupling, and therefore also the time, in which the current becomes nearly zero, when the de-ionisation can take place. Thus the better the quenching the closer can the coupling be made. Therefore, if the time of the de-ionisation is given, the coupling of the two circuits, and with that the time of a beat, must be regulated in such a way that the latter is just equal to, at any rate not smaller than, the time of quenching.

For *long spark*-gaps the quenching effect is small, therefore a relatively loose coupling is required; by inserting vacuum-tubes into the primary circuit the quenching effect can be improved, as was also first shown by Prof. Wien.

For *short spark*-gaps the quenching effect is good, therefore close coupling is possible. The new Telefunken-system, which is based on Prof. M. Wien's discoveries, works with a coupling-degree of about 20 per cent. By special devices Prof. Glatzel arrived at 40–50 per cent. coupling for an ideal impact excitation.

* In Braun's coupled circuits this was only attainable with a quite loose coupling, which is unfavourable for long distance work.

3. *Sufficient tuning of the coupled systems.*—The effect of putting the two systems out of tune has this effect, that the current-minima of the primary circuit cannot become zero, and consequently there is not much de-ionisation. The worse the quenching effect and the looser the coupling the more perfect must be the tuning of the coupled systems. This makes the working with long spark-gaps, in which the quenching effect is bad, inconvenient for practical purposes. On the other hand, the better the quenching effect the less exact need be the tuning between the two systems, and this has the advantage that the same antenna may be used for a large range of frequencies without being altered. For very good quenching, tuning and degree of coupling are in such relation to each other that, if one of these factors is not regulated to its best value, good impact excitation may be obtained again by altering the other factor.

The advantages claimed for the new method of impact excitation through quenched sparks can be followed in the original papers by Prof. Wien and in other articles published in the *Jahrbuch der drahtlosen Telegraphie und Telephonie.*

In this method, and by using detectors for integral effects, a musical note is produced in the telephone, and the system based on it is called "System der tönenden Löschfunken"—quenched musical spark system.

As already shown, Prof. Wien's method is not an ideal "shock-excitation," as the spark is not quenched directly after the first primary oscillation, but for an ordinary coupling-coefficient of, let us say, $\kappa = 0.16 - 0.20$, there are still a number of oscillations before the quenching takes place.

An ideal impact excitation is realised in a method which I had already devised ten years ago* for measuring instruments. A completely closed circuit, whose decrement can therefore be made infinitely small, is connected with a shunt in such a way that the inductance-coil is traversed by a weak direct current; by breaking the shunt instantaneously an extra-current is induced, which charges the condenser; very feebly damped oscillations are then set up in the closed circuit with magnified amplitudes in comparison to the potential-amplitudes of

* D.R.P. (German Patent) 157056/1903.

the ordinary condenser-discharges. In this method an aperiodic process is concerned, which excites the oscillations and thus represents the ideal form of shock-excitation. The extremely small decrement of this device, which is now employed in all modern wavemeters and station-controllers (in case they are to play the rôle of a transmitter), allows all resonance-measurements of frequencies and of decrements to be made with a hitherto unknown exactitude. It is especially suitable for measuring wave-lengths at a distance. In my laboratory in Zurich, for instance, I found in this way the wave-length of the Eiffel-Tower station in Paris to be 2180–2185 meters, which is exactly the wave-length of this station measured in Paris itself, as I was afterwards informed by Commandant Ferrié, the Managing Director of this station.

Crystals as Detectors

A REPLY TO DR. TUTTON. By H. J. ROUND.

I HAVE read with great interest Dr. Tutton's paper on "Crystals." Is there not, however, a doubt whether what is usually called a crystal is a necessity for the production of a wireless detector of the rectifying type? I am aware that crystals, especially those found in nature, do act as detectors, but I can call to mind one or two substances which one would not call crystals, and which do act as rectifiers—carbon, for instance, is an example of this, and the amorphous carbon, used for arc lamp carbons, is decidedly better than either graphite or diamond—the two crystalline forms. Of course, carbon exhibits the rectifying power to a smaller degree than the crystals, but experiments I carried out a year or so ago on carborundum led me to try the oxides of calcium, barium, strontium, and the still more refractory rare earth oxides used in Nernst filaments. I found that, provided the necessary arrangements were made to keep these substances at the right temperature, rectifying effects as good as carborundum produces, could be obtained, and as wireless detectors they were equally sensitive. The "characteristic" of carborundum suggests strongly a Nernst conductor, with a "heater" in parallel with it, the characteristic of the heater being a straight line.

Possibly this "heater" accounts for the great differences in "characteristic" produced by different masses of carborundum, and it occurred to me that the "heater" was due to a conducting impurity, which roughly obeys Ohm's Law. The idea is partly upheld by two considerations.

Generally crystals from the same mass of carborundum exhibit characteristics which are similar.

The resistance is lower, the deeper the colour of the mass from which the specimen is taken.

I make no attempt to explain the unsymmetrical character of the characteristics for positive and negative currents. One curious thing, however, which has not generally been noted, is that black and gray carborundum in general have their best working point at about 1 volt $-ve$, metal contact, whilst green carborundum takes about the same voltage with the metal contact $+ve$, the best working point is always where the sharp bend from high to low resistance occurs, and is on the side where the characteristic is steepest.

It is not at all necessary to have a crystal point, face or edge; in fact, for consistency of adjustment, a broken point seems always preferable, although the average resistance seems higher, and consequently higher potential circuits have to be used in practice.

I have not tried other crystals to any great extent, but as a usual thing the last statement is generally true. Iron-pyrites, it has been generally noted, gives the best, or at least the easiest obtained good results on a cleavage surface.

The fact that crystals work well as wireless receivers suggests strongly to me that a definite composition is necessary, and not so much a crystal character. If the definiteness of composition remains throughout the whole mass, the wireless operator has many opportunities of hitting a good point—and this condition is undoubtedly best given by a crystal.

Application of Wireless Telegraphy to Time Signals

By COMMANDANT FERRIÉ.

The following is an abstract of a paper read before the Joint Meeting of the Institution of Electrical Engineers and the Association Internationale des Electriciens in Paris on May 24th, 1913. See article in the "Year Book of Wireless Telegraphy and Telephony," 1913, by Mr. A. R. Hinks, F.R.S., for complete information on the subject.

A KNOWLEDGE of time to an accuracy of a few tenths of a second suffices in the great majority of cases, and in particular for navigators, for business purposes, and for the general public. The method of transmitting the signals is then quite easy. At the Paris Observatory and the Eiffel Tower the method now adopted is as follows :—The true hourly signals are comprised of "dots," or series of sparks, lasting about a quarter of a second, which are sent out at fixed hours—viz., during the day at 10 hours 45 minutes, 10 hours 47 minutes, and 10 hours 49 minutes; and during the night at 11 hours 45 minutes, 11 hours 47 minutes, and 11 hours 49 minutes. Each of these "dots" is preceded by a series of preliminary signals with the object of calling the attention of observers and of allowing them to adjust their receivers. In order that the true hourly signals—*i.e.*, the dots—should be produced as exactly as possible at the desired instants, the following arrangements have been adopted :—

ARRANGEMENT AT EIFFEL TOWER.

A special clock in the observatory is provided with an electric contact, which is closed automatically for a quarter of a second at each of the above-mentioned times. This contact is connected by means of an underground cable to a relay controlling the transmitter in the wireless station at the Eiffel Tower. In addition, a Morse key placed near the clock allows the preliminary signals to be produced. A short time before the sending out of the day and night signals the astronomer sets his clock, after having compared it with the master clock of the observatory, the transmitting apparatus is connected to the relay, and the sending out of the signals is effected in the manner described above. The lag due to the mechanical and electrical inertia of the various apparatus between the instant of making contact by the clock and the passing of the wireless spark is measured periodically with great care, and allowance is made for this at the instant when the signal is sent.

The Paris International Conference decided that from July 1st, 1913, the sending of the signals shall be made in a uniform and entirely automatic manner by all the radiotelegraphic stations undertaking the service at predetermined times (differing for each station), the wave-lengths also being uniform (2,500 metres). The Eiffel Tower, which was chosen as the centre of the international time-service, will send its signals at 10 a.m. and at midnight. The morning signals will be made in the following manner :—

A series of warning signals, consisting of the sign for letter "x" (— . . —), will be sent from 9 hours 57 minutes to 9 hours 57 minutes 50 seconds, and this is followed by a period of silence of 5 seconds. From 9 hours 57 minutes 55 seconds to 9 hours 58 minutes, three dashes lasting one second each, and separated from one another by periods of silence also lasting one second, the end of the last dash terminating at 9 hours 58 minutes exactly. During the following minute the letter "n" (— .) is sent five times, the dash lasting one second and the dot a quarter second, the interval between the dot and the dash being also one second. Each of these letters is commenced respectively

at 9 hours 58 minutes 8 seconds, 9 hours 58 minutes 18 seconds, 9 hours 58 minutes 28 seconds, 9 hours 58 minutes 38 seconds, and 9 hours 58 minutes 48 seconds; the dots therefore commence on the round 10 seconds —namely, 10 seconds, 20 seconds, 30 seconds, 40 seconds, and 50 seconds. Three dashes similar to those of the preceding minute also terminate the second minute in such a way that the third dash terminates at 9 hours 59 minutes. During the third minute the letter "n" will be replaced by the letter "g" (— — .), of which the dots, the dashes, and the intervals shall last the same time as in the case of the letter "n," the "g" signals beginning at 9 hours 59 minutes 6 seconds, 9 hours 59 minutes 16 seconds, 9 hours 59 minutes 26 seconds, 9 hours 59 minutes 36 seconds, and 9 hours 59 minutes 46 seconds, the dots of these letters falling on the round 10 seconds as in the case of the n's. Finally, this third minute will finish with three dashes similar to those of the preceding minutes, the last dash terminating at 10 hours.

How to Receive Hourly Signals.

For receiving these hourly signals, termed "ordinary," it is only necessary to have the antenna, of dimensions and height varying according to the distance from Paris, connected with a radiotelegraphic receiver, and to listen to the signals, with the clock or watch to be compared in front of the observer. It is easy for an unskilled person to estimate the difference up to half a second between the hours indicated by the clock and those which correspond with the signals that are heard in the telephones of the receiver. After some practice it is quite easy to estimate one-quarter of a second. In order to reach an accuracy of one-tenth of a second, it is in general necessary to have recourse to simultaneously recording on the same photographic strip the radiotelegraphic signals and the beats of the clock to be compared. Excellent results have in this way been obtained by various physicists and engineers. It frequently occurs, especially in winter, that the Paris observatory is not able to make astronomical observations each night. It is therefore necessary to be satisfied with the times registered by the chronometers of which the rate is known for the setting of the clock which sends the signals. These chronometers, being sufficiently numerous and accurate, cause no inconvenience so long as the cessation of astronomical observations does not exceed a few days. If, on the other hand, the period of cloudy weather continues too long, it is no longer possible to answer for the accuracy of the chronometers. Wireless telegraphy in such cases furnishes a method which allows of the co-operation of other observatories, better situated as regards climatic conditions, in the determination of the state of the master-clock at Paris, and in consequence in the accurate setting of the clock which sends the signals.

Ordinary Night Signals.

Before the ordinary night signals the Eiffel Tower sends a series of 180 short "dots" regularly spaced by one second, less about 1-50th. In each series the 60th and 120th "dot" are suppressed in order to facilitate counting by the observers. These "dots" are produced by substituting for the Observatory clock sending the signals a small clock of adjustable rate and furnished with an electric contact which closes at each complete swing. This series of dots is received, by means of a radiotelegraphic installation, by the Paris Observatory and by other observatories, in each of which an operator, by means of a suitable arrangement, listens to the series of "dots" and also to the beats of the master-clock or of another seconds chronometer. The two regular series of dots thus perceived by the Paris Observatory, for example, constitute an acoustic vernier, and during the time that the 180 radiotelegraphic "dots" last, three coincidences spaced 50 seconds apart occur between the radiotelegraphic "dots" and the beats of the clock. By noting the time indicated by the chronometer at the moment of coincidence, as well as the number of the radiotelegraphic beats at which the coincidence occurs, it is easy to calculate the time of the chronometer at the instant of the first beat of the radiotelegraphic series. If the time (Greenwich mean time) of a coincidence was, for example, 23 hours 30 minutes 25 seconds, the number of the stroke and coincidence being 42, the time of the first beat must have been 23 hours 30 minutes 25 seconds – 41 $(1 - \frac{1}{50})$ seconds = 23 hours 29 minutes 44·82 seconds.

The observer at Algiers, for example, proceeds in the same manner, and determines, after allowing for the state of his chronometer and of the difference of longitude of Algiers, 23 hours 29 minutes 44·13 seconds for the time (Greenwich mean time) of the same first beat. These figures are at once telegraphed by wire to the Paris Observatory, followed by the note "observed" when the Algiers Observatory has been able to make astronomical observations for the determination of the state of its own chronometer. The observatories at Marseilles, Nice, Besançon, etc., do the same. Paris is therefore able to determine the state of its master-clock by utilising in reality all the astronomical observations made by all the provincial observatories. The signals sent out have therefore the maximum accuracy now attainable.

Scientific Time Signals.

The Paris International Conference, October, 1912, has decided that the sending of these series of beats, which it has termed "scientific time-signals," shall be preserved in the international organisation of time service, and that the foreign observatories shall co-operate also, as far as possible, in the same way towards the improvement of the time transmitted by the international time centre of Paris.

By the same method it will be possible to realise the practical unification of the time sent by the different radiotelegraphic stations engaged in the international time service. In each of these stations the scientific time signals sent each evening by the Eiffel Tower will be received and compared with the beats of the master-clock of the observatory with which the station is connected, and on each occasion the time of the first beat will be worked out from the master-clock. As the Eiffel Tower sends, after the ordinary night signals, figures indicating the time of the first scientific signal preceding the latter, each of the other radiotelegraphic time stations will know the amount of correction to be applied to its own time, and will thus be able to take this correction into account for the next subsequent emission of time signals. This practical standardisation has many advantages, especially for mariners sailing within the zone of action of two stations or passing from one zone to another, as they will no longer, as now happens when checking their chronometers, suffer from the uncertainty that arises due to two stations emitting signals which differ by half a second or even more.

The same method also enables land surveyors and astronomers to compare to an accuracy of $\frac{1}{100}$th of a second the time-measuring instruments placed at two or more points of the earth's surface within the zone of action of the same station, and thereby considerably facilitates the determination of differences of longitude.

Calculating "Beats."

It is sufficient, by means of astronomical observations at each point, to determine the difference between the local time and that of the time-measuring instrument, and, taking into account this difference and the rate of working, to calculate the time of the first beat of a series of signals sent by the station, in the same manner as in the case of scientific time-signals. To secure greater accuracy in the comparisons the beats are in general at intervals of about $(1 - \frac{1}{100})$th of a second. When the signals are made in summer-time in hot countries, where natural electric disturbances are intense, it is necessary to substitute dashes for radiotelegraphic dots, as the former are more easily observable through the disturbances, especially when musical sparks are used. At the same time it must be pointed out that the accuracy of coincidence, which is then in respect of the beginning of the dash, is not as good as in the case of dots, especially when the ear only is relied upon. It is likely, however, that the accuracy will be appreciably increased when the signals are photographically registered.

It has already been possible by means of wireless telegraphy to determine the differences of longitude between Paris and the following places:—Brest, Bizerta, Brussels, Algiers, Toulouse, and Nice. In the delimitation of the Franco-Liberian and Franco-German frontiers in the Congo now being carried out, use is made of wireless telegraphy for the determination of the longitudes. Numerous points have been determined in the same manner in Morocco by the Army Staff by using solely the scientific signals emitted nightly from the Eiffel Tower. It is easy to foresee the important

services which this method will ultimately render in the surveying of Central Africa and of similar parts of the globe which are difficult of access, and where ordinary surveying methods cannot be used.

FUTURE DEVELOPMENTS.

When the large wireless systems now under consideration by the Great Powers, and especially by France, Great Britain, and the United States, have been established, it will be possible for the continents to be connected with great accuracy, and also to include some of the more distant islands, of which a large number are at present only imperfectly connected, and by means of wireless telegraphy to encircle the globe for the determination of the differences of longitude between intermediate stations.

France and the United States have already resolved to determine by means of wireless telegraphy the difference of longitude between Paris and Washington with the greatest accuracy now attainable. Preliminary observations were made last March with the object of getting an idea of the difficulties of such a determination, and of laying down a programme of final operations. Notwithstanding the somewhat low powers available at the French and American stations (Eiffel Tower, 50 kw.; Arlington, 60 kw.), and the great distance apart (6,000 km.), it has been possible to make numerous observations in both directions in spite of the serious difficulties caused by the powerful disturbances of all kinds which interfered with the tests. It was even possible on one occasion (one night out of twelve) to carry out a complete conversation between the two stations. A first approximation of the difference of longitude, to an accuracy of a few 100ths of a second, will shortly be published, after the completion of the astronomical calculations. The final observations will probably be made during the winter of 1913–14.

It is interesting to note that in the case of long distances, such as that between Paris and Washington, it is essential to take into account the time necessary for the transmission of the impulse. On the assumption that the velocity is the same as that of light —namely, 300,000 km. per second—the time required for the transmission of the signals from one station to another is 0·02 of a second, which is not a negligible quantity.

EFFECTS OF AIR AND WATER ON WAVE TRANSMISSION.

Special experiments are under consideration for the direct measurement of this time of transmission. Various methods will be employed, and among others the following:— Short signals will be sent, alternately, per group of four, two each from the Eiffel Tower and from Arlington, with the shortest possible intervals of time; for instance, ten seconds between two consecutive signals. These four signals will be recorded in Paris and in Washington by means of photographic galvanometers with a rapid and uniform swing, simultaneously with the vibrations of a tuning fork, which will be used to measure the time. It is probable that it will thus be possible to determine with accuracy the 1–1,000th of a second, and that this will enable the observers to determine the speed of transmission to two significant figures. This may lead to some interesting results in connection with the respective effects of air and water on wave transmission between the old and the new continents, since the velocities are functions of the index of refraction.

It will be seen that the application of wireless telegraphy to time signals is of considerable interest from the practical as well as from the scientific point of view, and we must congratulate ourselves on the results of the International Conference held in Paris in October, 1912, on the initiative of the Bureau des Longitudes, by means of which the co-operation of the efforts of the scientists of all nations has been secured for the benefit of science.

The lengthy proceedings before the Select Committee considering the Imperial Wireless Scheme, occasioned a great deal of interest among amateur statisticians. The committee sat for two months—putting all their days of work on end—and the talk to which they listened fills 1,500 pages of closely-printed foolscap. In round figures, 30,000 questions were asked and answered in at least a million and a half words. By way of comparison, the Bible contains less than a million words.

The Application of Wireless Telegraphy to Ships' Lifeboats

Summary of Evidence given on behalf of the Marconi Company by Mr. G. E. Turnbull before the Boats and Davits Committee.

THE solution of the problem indicated in the title of this article calls for careful thought, not only by those actually engaged in wireless telegraphy, but also by shipowners, shipbuilders, and by others responsible for the drafting of regulations concerning life-saving appliances at sea. In fact, an efficient result can best be arrived at by all these bodies in consultation with each other. There is nothing insurmountable, but there are several points of view which must be understood by all concerned.

Having regard to the size of the wireless apparatus which can be recommended, and the conditions which will govern its use in lifeboats, the complete equipment must clearly be as light and compact as possible, and must be of robust construction. It must be self-contained, always ready for use, and its component parts must be so arranged as to allow of easy access for inspection and maintenance.

The number of sets which it would be useful to place on board a ship depends of course upon the number of persons who would be capable of operating the sets, and to a certain extent upon the modifications which may be under consideration regarding life-saving appliances generally.

The distance over which the set is required to work should, of course, be as great as possible. The range, however, depends more than anything else, in the case of small equipments of the kind that will be required here, on the aerial wires which could be utilised.

It goes without saying that in the application of wireless telegraphy to lifeboats due consideration must be given to it in the ship's regulations, and in the boat drills.

THE APPARATUS.

In designing wireless telegraph apparatus to communicate for a specified purpose over given distances, the principal factors determining the form which the apparatus and its accessories should take are:

1. The height and extent of the aerial wire which can be arranged, and the facilities for its erection and maintenance.
2. The space available for the apparatus and the maximum weight admissible.
3. The electric power in the form best suited for the apparatus, and to the communication the latter is to be capable of effecting.
4. The general conditions under which the apparatus is to work.
5. The training of the persons who are to work the apparatus.

The Marconi Company have constructed and disposed of for military purposes a number of small portable stations, capable of communicating some seven to ten miles over land. The sending and receiving instruments are contained in two separate boxes. The receiver weighs 6½ lbs., and the transmitter 12 lbs. The battery to operate the transmitter is carried in a separate box weighing 13 lbs. All three boxes can be very conveniently carried by one man.

The masts supplied in conjunction with this set may be of the telescopic type, or may be made up of aluminium, steel, or wooden sections. Using one mast of from 25 to 30 feet in height, this small station is capable of working approximately fifteen miles over water and seven miles over land.

This set admirably fulfils the purpose for which it was designed, but it is not altogether appropriate for lifeboat use. The Marconi Company have therefore designed a special

lifeboat set. As the same considerations of lightness do not apply so much here as in the portable set already referred to, the Company have been able to provide more power in the transmitter, and to make provision against the sea atmosphere and bad weather conditions.

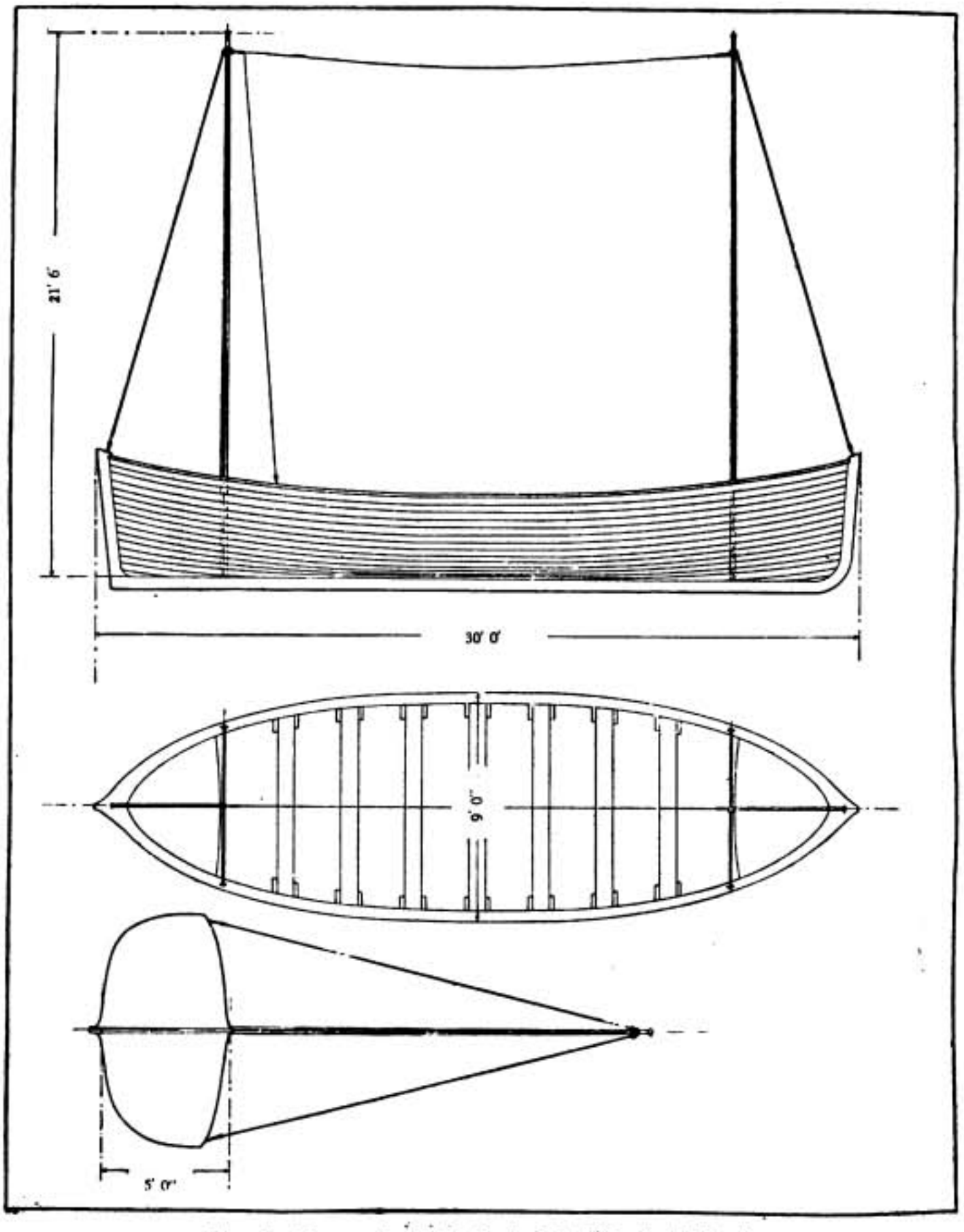


Fig 1.—Proposed Aerial System for 30 ft. Lifeboat.

The electric current, which in the portable set is derived from a small battery, is in this case supplied by a hand-driven magneto

machine which can be relied upon to work for several years without requiring to be re-magnetised. Where the wireless apparatus is used is so intimately bound up with, and dependent upon, the amount of aerial wire which can be suspended, that the size of

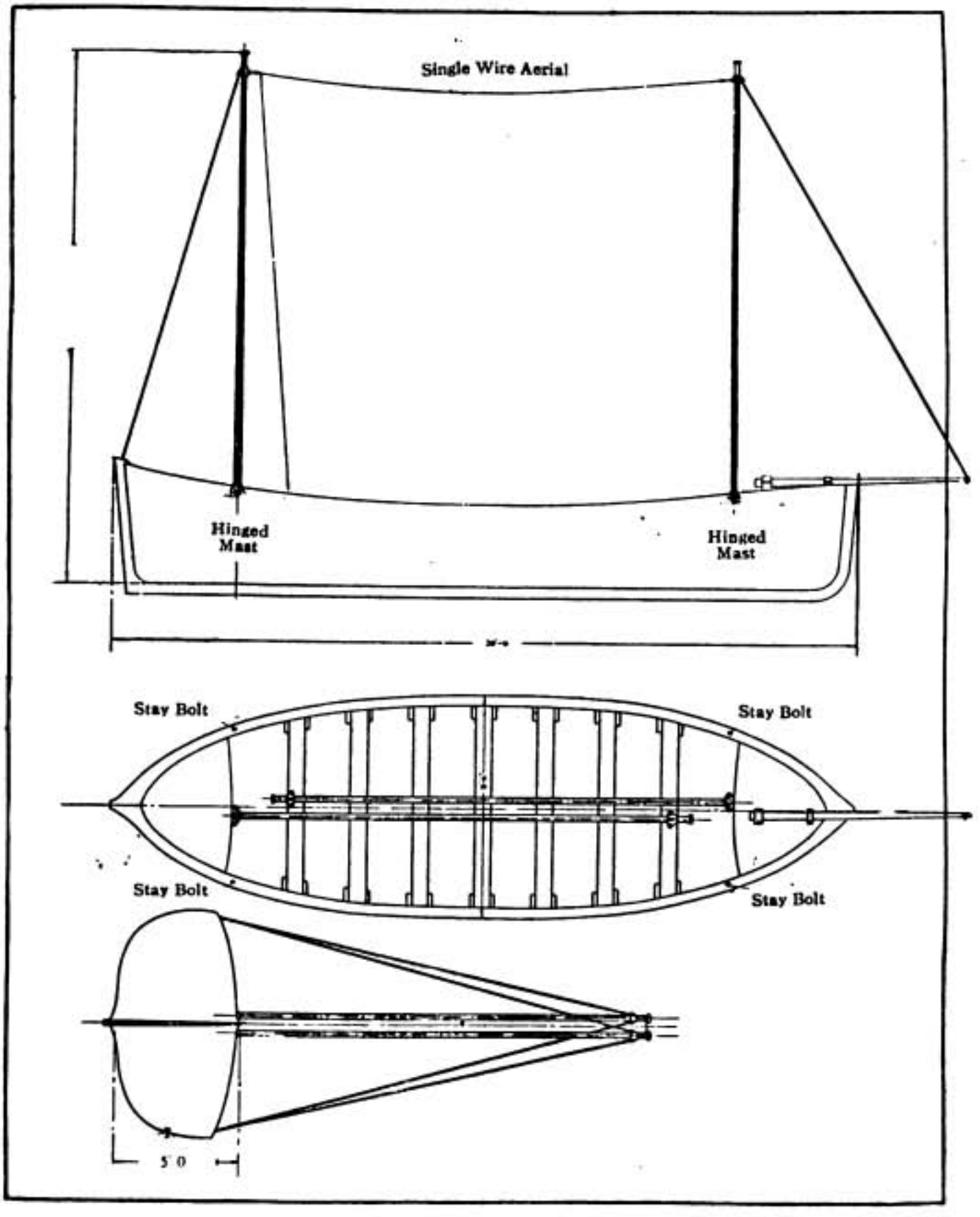


Fig. 2.—Masts hinged to framework of Boat.

to be used in a lifeboat provided with motive power, this magneto can be of a larger size and driven by the engine. The question of the amount of battery or dynamo power to be the battery or dynamo is quite secondary, especially as these things either exist in various descriptions, or can be made at very short notice to almost any size and shape.

The question of aerial wires is important, and calls for the most careful consideration of what has happened in the past in regard to the launching of boats, and the distribution of passengers in them, and also of what is likely to occur with new arrangements and regulations which may be contemplated for the future. It will no doubt help to an understanding as to the practicability of one type of aerial suspension as against another if we make some reference here to the consideration of aerial design in wireless stations of the three following categories: A fixed land station; a ship station; a portable land station.

In the case of a fixed land station where a sufficient area is generally available, and where masts can be erected at a height and distance between them at will, the aerial wires are arranged as far apart and as high as possible consistent with economy in mast height and number of masts. There are, of course, formulæ, established by experience, which decide the best size of aerial for a given power and a given range, but as a general rule it may be said that the range with a given power is proportional to the height of the masts and the distance between them.

In the case of a ship station, the extent of the aerial is limited by the distance between the masts and by the height of the latter, so that to obtain the maximum possible transmitting range of a ship station, more power in proportion to the size of the aerial has to be utilised on board ship than need be at a fixed station on land.

In the case of a portable station, a maximum height has to be arranged for, with due regard to the necessity for lightness and facility in transport. As a rule, therefore, masts made up of sections of wood, or of tubular steel or aluminium, are used for portable land stations. Generally speaking, portable apparatus is required for military purposes, or for the survey of unexplored districts, but in both cases the distances at which masts can be set apart are not limited by space so much as by the span over which the aerial wire can support its own weight with a sufficient margin of security. The possibility of erecting a large aerial by spacing the masts as far apart as practicable is therefore fully taken advantage of.

Having briefly examined these three cases, it will be clear that the principal factor to be considered in applying wireless telegraphy to lifeboats is the dimensions and arrangement of the aerial wire which it is possible to rig. Considering that the lifeboats must be swung out from the davits free of obstruction, that they may have to be launched fully occupied, and that the wireless equipment must be in working order as soon as possible after the boat reaches the water, the method of suspending the aerial should therefore be such as to admit of rapid erection. We have set out in the accompanying sketches, Figs. 1 and 2, two methods of aerial suspension by means of masts. The mast shown in Fig. 1 may be stored on the boat itself or at a convenient point on the deck and stepped in the boat after it is launched. Suitable sockets are provided in which the masts are stood, each mast being stayed by means of three hook-on stays. The mast may be in one piece or made up in sections. In Fig. 2 the aerial is suspended from two masts, hinged permanently on the framework of the boat.

It is a matter to be considered by mariners which of these two systems is the more likely to be easily manœuvred and fixed in position with a boatload of passengers.

In Figs. 1 and 2 we have indicated a normal mast height, though it is quite possible that boat designers will be able to provide a greater height than that shown. As we have already mentioned above, the greater the height the greater will be the range, and as we think this question of the most desirable mast system should be studied out thoroughly by boat builders, we have prepared another sketch, Fig. 3, showing approximately the advantages in the way of increased range which can be expected by providing extra height.

Two other means of supporting an aerial have been suggested—viz., one by means of a kite and another by means of a buoy, towed by the lifeboat at, say, 100 feet from the latter, and carrying a pole of 25 to 30 feet, or even higher. Kites are not suited for reliable communication at all times, owing to varying wind pressures, and the lack of constancy in the strength of signals occasioned by a continuously varying average height of the wire is not conducive to the best results. This is particularly the case when the maximum range of a station

is being attempted. We are not prepared to recommend the exclusive use of kites, but it may be well to have them as a stand-by. Under favourable wind conditions, and with hands practised at kite-flying, a greater range could be covered than with the masts. Further, assuming that only a certain number of boats be provided with masts, kites might be used in the remote event of it being necessary to place wireless sets in boats not provided with masts or with their fittings.

Fig. 3 also shows the ranges which could be covered by suspending the aerial from a kite.

With regard to the possibility of providing a suitable aerial by a method under which a buoy towed by the lifeboat and carrying a pole, the aerial wire descending from the top of the pole to the boat at an acute angle, such an arrangement would present the advantage that the mast and its rigging would not encumber the boat, and any difficulty which might arise in fixing the masts with a boat full of passengers would be obviated. The same attention would not be required as for a kite, but there would be decided disadvantages in bad weather. More complicated compensating devices would have to be arranged to take up the "sag" and relieve the strain in the aerial owing to the swaying of the pole than would have to be arranged in the case of the kite.

The mast method seems the most reliable. All the lifeboats on the vessel could be fitted to take these masts, but the ship need not carry more pairs of masts than the number of wireless sets which it is found advisable to put on board.

OPERATING.

The majority of liners nowadays carry two operators, or one fully-licensed operator and one assistant who has passed a junior examination and is not yet fully certificated. In case of accident the chief operator would be required to stand by the ship's wireless station until ordered by the Captain to leave, but the second operator could be detailed at once for duty in one of the boats carrying a wireless outfit. It would have to be left to the Captain to decide when the chief operator was to leave the ship and take charge of the wireless equipment in another of the lifeboats.

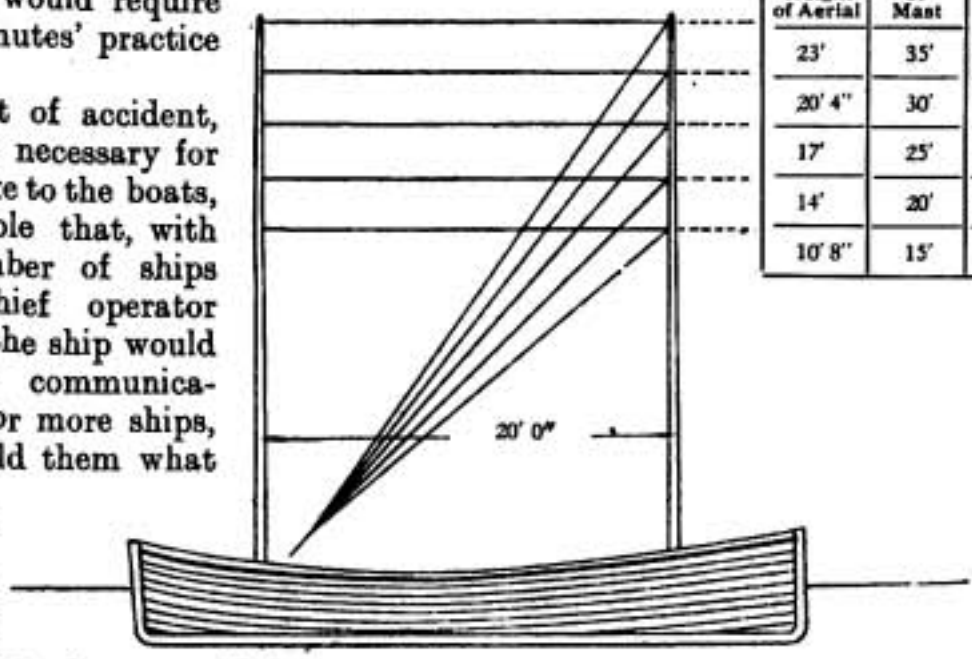
There should, we think, be at least one wireless lifeboat equipment for each operator carried by the ship. As we have shown above, in the majority of cases this would mean two lifeboat equipments per ship. One of these might be appointed for the starboard side, another for the port side, or, as we have previously suggested, every one of the boats might be provided with the accessories to take the masts; each of these sets might be put into a particular boat determined by the Captain, according to the circumstances. If it is found desirable that there should be more than one lifeboat set per operator on each ship, then it would be necessary to provide for instruction in wireless operating of the ship's officers. From the navigating and engineering staffs there will always be on every ship a certain number of men who can be relied upon, failing the operator, to operate these lifeboat sets efficiently. As the sets will be of the most simple pattern, the handling can be learnt in a few hours. A sufficient instruction in the Morse code, and in the transmission and reception of wireless signals, will be the chief object to be attained. Many ships' officers already have a knowledge of the Morse code, so it should not take them very long to be capable of sending out, with the lifeboat set, a message indicating the position of the boat, its name, and a request for assistance; and further to distinguish, what an automatic transmitter could not do, that is, whether the line is clear or not, and whether they were not preventing communication between a lifeboat worked by one of the trained operators and a ship coming to their assistance. It could be arranged that one of the operators give for a short period every day on board instruction to officers in the use of these sets, and maintain or improve their standard of working. Even if there is only one operator on board, and only one lifeboat wireless set, it is desirable that two or more persons in addition to the regular operator should have sufficient knowledge in the working of these small sets. While it is, of course, desirable that the officers should be as efficient as possible in the handling of this apparatus, by no means the same standard of efficiency is required as for working the ship's main installation. The proposal, therefore, does

not mean difficult studies for persons who are not trained operators, for, providing their hearing is good, and they can accustom themselves to detecting wireless signals in a telephone, they should achieve a sufficiently high standard of proficiency in a few months. To maintain that standard would require only a few minutes' practice per day.

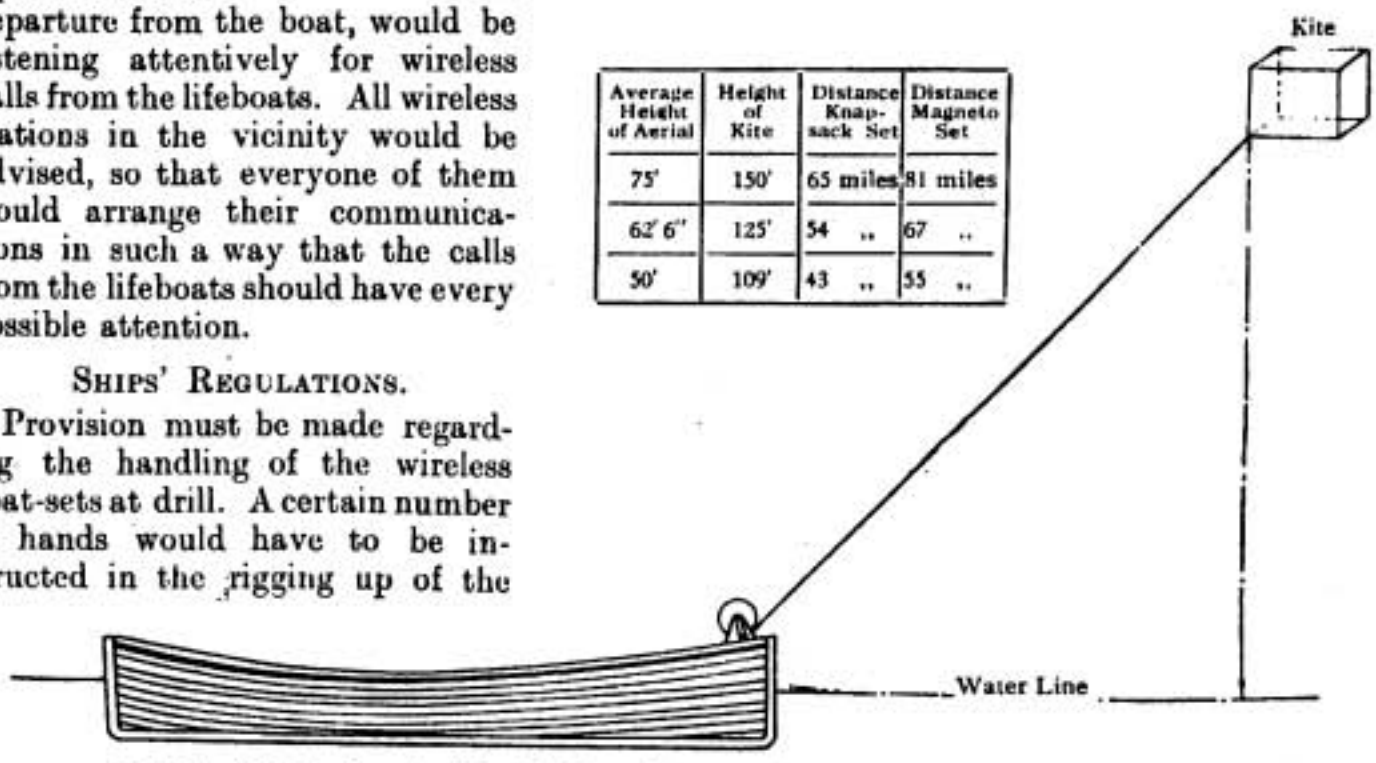
In the event of accident, and of it being necessary for everyone to take to the boats, it is conceivable that, with the large number of ships fitted, the chief operator before leaving the ship would have been in communication with one or more ships, would have told them what had happened, and every ship within hearing, after the chief operator's departure from the boat, would be listening attentively for wireless calls from the lifeboats. All wireless stations in the vicinity would be advised, so that everyone of them would arrange their communications in such a way that the calls from the lifeboats should have every possible attention.

SHIPS' REGULATIONS.

Provision must be made regarding the handling of the wireless boat-sets at drill. A certain number of hands would have to be instructed in the rigging up of the aerial. If it were decided to place the wireless sets in specially-appointed boats, the number of persons to be instructed in the erection of the masts and rigging up of the aerial will naturally need to be less than those who will have to be instructed if it is agreed that all the boats shall be arranged so that the sets of apparatus and masts may be placed in any one of them. Once these principles are decided, the question of proper instruction in drill becomes very straightforward.



Average Height of Aerial	Height of Mast	Distance Knap-sack Set	Distance Magneto Set
23'	35'	20 miles	25 miles
20' 4"	30'	18 ,,	22 ,,
17'	25'	15 ,,	19 ,,
14'	20'	12 ,,	15 ,,
10' 8"	15'	9 ,,	11 ,,



Average Height of Aerial	Height of Kite	Distance Knap-sack Set	Distance Magneto Set
75'	150'	65 miles	81 miles
62' 6"	125'	54 ,,	67 ,,
50'	109'	43 ,,	55 ,,

Fig. 3.—Table showing the Relation between the Range and Height and Aerial.

WIRELESS ON TYNESIDE

A LARGE company of shipowners and others interested in shipping on Tyneside visited the Newcastle-on-Tyne offices of the Marconi International Marine Communication Co., Ltd., at Milburn House on July 10th, and inspected the wireless station which the company have installed there. An explanatory address was given by Mr. Close, the local representative of the company, who later gave a demonstration of the working of the apparatus, and succeeded in communicating with various stations. The intention of the Marconi Company is to use this office in Newcastle for demonstrations to shipowners or others who may be interested or wish to use wireless telegraphy. The station is of the standard 1½-kw. type, employed on the majority of steamers equipped with wireless telegraphy.

The Portuguese Parliament passed a Bill on June 25th for the compulsory installation of wireless telegraphy in Portuguese ocean-going steamers.

The annual meeting of the British Association for the Advancement of Science will be held in Birmingham this year. The inaugural meeting will be held on Wednesday, September 10th, when Sir J. Oliver Lodge will assume the Presidency and deliver an address. In the engineering section (G), over which Prof. Gisbert Kapp will preside, papers have been promised by Prof. Marchant on "Some Effects of Atmospheric Conditions on Wireless Signals," and by Prof. G. W. D. Howe on "The Nature of the Electromagnetic Waves employed in Radio-telegraphy and the Mode of their Propagation." The meetings will conclude on September 17th.

The Budget Committee of the French Chamber has approved a report in favour of the adoption of a Bill ratifying the International Wireless Telegraphy Convention of London, 1912.

View of a portion of the Newcastle Offices of the Marconi Company, showing the standard Wireless Telegraphy apparatus installed there.

THE IMPERIAL WIRELESS SCHEME

EXIT THE SELECT COMMITTEE. TERMS OF NEW CONTRACT OUTLINED. QUESTIONS IN THE HOUSE OF COMMONS. FURTHER OPINIONS OF EXPERTS.

THE past month has witnessed a decisive turn of events in connection with the Imperial wireless scheme. The Postmaster-General attended a meeting of the Select Committee of the House of Commons on July 2nd, and explained that the Government admitted that the Marconi Company were legally entitled to repudiate the contract signed in July, 1912, whereupon the Committee decided that as the agreement was not to be enforced it would be unnecessary to pursue their inquiries further. On July 4th Mr. Samuel made a statement in the House of Commons regarding a new contract with the Marconi Company for the Imperial wireless chain.

In the course of his statement to the Committee, Mr. Samuel said that the Government were advised that the contract was not valid unless it was ratified by the House of Commons, and the question arose whether, one of the parties to the contract having repudiated it, the Government could properly ask the House of Commons to ratify the contract with a view merely to litigation with the other contracting party. Further, said Mr. Samuel, if it were ratified, the Government were advised that it was not a contract with respect to which a Court would order specific performance.

Mr. Samuel was also prepared to state the further intentions of the Government, but objection to this was taken by members of the Committee, on the ground that it did not come within the terms of reference. The Committee considered the question in private, and the Chairman afterwards announced that the following resolution had been passed :—

> The Committee having been informed that Marconi's Wireless Telegraph Company, Ltd., have repudiated the agreement entered into between Marconi's Wireless Telegraph Company, Ltd. (Commendatore Marconi) and the Postmaster-General, and having heard from the Postmaster-General that he is not prepared to enforce the agreement, are of opinion that, as the agreement which formed the subject matter of the reference to it is not to be enforced, it is unnecessary for it further to pursue its inquiry, and it so reports to the House.

In thanking the Committee for the information given to him, Mr. Samuel said he wanted to make it quite clear that in taking the course which they were taking the Government were animated solely by the sense of the legal difficulties of the position and not by any feeling that they had any reason to be dissatisfied with the contract itself. The terms used in the resolution passed by the Committee, he said, "Having been informed by the Postmaster-General that the Government are not prepared to enforce the agreement," suggested that it was within the option of the Government to enforce the agreement and to make the Marconi Company carry out the contract if the Government desired to do so. He had endeavoured to make it quite clear to the Committee, he said, that it was because the Government felt themselves not to be in such a position in regard to their legal capacity to enforce the contract that they were taking the course they had. Mr. Samuel was assured by the Chairman and other members of the Committee that the reason for which the Government did not see their way legally to enforce the contract was entirely understood by every one of them.

In the House of Commons, on July 4th, Mr. Herbert Samuel made a statement explaining the course which the Government intended to take in order to secure the erection of the necessary stations for a system of wireless telegraphy in the Empire. The Government, he said, held the view they held a year ago, that they ought not to ask Parliament to take the risks of inviting open

tenders for the erection of these stations, in view of the fact that they were advised that no firm that would enter into competition with the Marconi Company could be relied on to erect stations of a satisfactory character. The Advisory Committee over which Lord Parker presided declared :—

> The Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain.

The Government had considered again whether the erection of stations on that system should be by a staff of engineers using the powers of the Patents Acts or whether they should endeavour to arrange a fresh agreement with the Marconi Company. It was clear that the Post Office itself was not in a position to undertake the erection of those stations, for they had no staff which could by any possibility accomplish that task. The Board of Admiralty were again consulted on the matter, and he, Mr. Samuel, received from them on June 7th of this year the following letter :—

> Referring to Admiralty letter of January 30th last, which stated that my Lords Commissioners of the Admiralty were unwilling and, in fact, unable without prejudice to naval interests to undertake the work of erecting or working an Imperial wireless chain, I am commanded by their lordships to inform the Postmaster-General that they have carefully considered this matter and must definitely adhere to the opinion already expressed.

The only remaining alternative to contract with the Marconi Company was the creation of a new staff and the employment of an engineer of some distinction and capacity who would supervise the erection of the stations. That course, however, was attended by many serious disadvantages. He was advised that there was no one in this country outside the Admiralty and the Marconi Company who had any actual experience either of the erection or the working of long-range wireless stations—not even the members of the Advisory Committee themselves. If any engineer without that experience were chosen he would have to collect together a staff as best he could ; he would have to prepare fresh designs and he and his staff would have to gain experience in this most difficult undertaking as they went along. The history of wireless telegraphy was strewn with so many failures and disappointments that the Government would have taken indeed a grave risk if they proceeded on the lines he had described. Further, it was likely that the estimated cost would be exceeded. It must not be thought that by the use of the Patents Acts the Government would be free from royalties to the Marconi Company. If the power of the Crown to use the Patents Acts without the agreement of the patentee was exercised the patentee had to receive royalty payment fixed by the Treasury. The Patents Acts extended only to this country, and that would involve obtaining an adjudication upon the royalty payments of each country upon each piece of Marconi apparatus, and a separate adjudication under the various laws of all the six countries in which the stations of the wireless chain would be situated. To adopt this course would necessarily involve very considerable delay compared with the erection of the stations by the Marconi Company, who had their designs ready, their engineers available, and would set to work immediately.

The Select Committee were unanimous with regard to the question of urgency, and in view of the importance of the strategical interests involved, the Government were loth to incur the risk of this long delay which would probably be involved by the selection of an engineer who had first not had experience of what was required and the enlistment of a special staff. At the request of the Government, he, Mr. Samuel, undertook to ascertain on what terms a new contract could be entered into with the Marconi Company. The Company asked as a condition of entering into a new contract, first, that an allowance should be made for the increase which had taken place in the price of materials since July, 1912, when the previous contract was entered into, and they made the proposal that whatever should be ascertained by agreement, or failing agreement, arbitration, to be the actual increase in the cost of the materials needed for the stations during the interval between the signing of the old contract and the ratification of the new should be added to the purchase price of the stations. They ascertained that the additional cost which would be incurred in consequence of lapse of time would be

about £6,500 per station. Mr. Samuel said that he could not but feel that the request with regard to the variation of prices according to the ascertained variation in the cost of materials was a reasonable request and could not be denied. In order to meet the not unreasonable request with regard to payment, he was willing to pay the company interest at the rate of 2 per cent. The company also requested that the contract should not be binding on them for a longer period than August 31st this year; in view of the circumstances, he thought the House would consider this a reasonable proposal.

Time did not permit the Postmaster-General to complete his statement to the House, and in the course of the evening he issued further details, particularly with regard to the following clauses in the contract:—

1. That the royalty should be payable for each station separately, and that if Marconi patents were used in some and not in others, it was to be clear that the royalty should be payable not in respect of the receipts of the Imperial chain, but only in respect of the receipts of the stations where the patents were used.

2. That while the contracts should be for six stations as originally arranged, in England, Egypt, East Africa, South Africa, India, and the Malay Peninsula, the Government should at any time before the completion of the stations in South Africa, India, and the Malay Peninsula, or of any of these three, have the option of calling upon the Marconi Company to cease work upon them should it be desired to install other apparatus. It was provided, however (*a*) that the company should be recouped for any actual expenditure they had incurred, and (*b*) that if the Postmaster-General desired to install some other system of wireless telegraphy, he should not give preference to any other contractor if the Marconi Company could show to his satisfaction that they were able to provide that alternative system with equal efficiency and economy.

3. It will be made clear that the stations during the course of their erection and during the trial period provided for in the contract should be available for Government experiments, provided that their normal working would not be impaired.

4. The company had previously guaranteed the speed of transmission of 50 words a minute by automatic apparatus, except during periods of exceptional electrical disturbance of the atmosphere, and a speed of 20 words a minute by hand signalling apparatus at all times. They are now in a position to guarantee a speed by automatic working of 75 words a minute.

5. It has been urged in discussion on the contract that such parts of the stations as engines and dynamos, which are not peculiar to the Marconi system, ought to have been obtained by competitive tender, and that had this been done the price of the stations would have been less. It is the case, however, that the Marconi Company had invited competitive tenders for such portions of the plant, and the price which they quoted for the stations was based upon the result of that competition. They have now agreed that the list of sub-contractors who had tendered should be submitted to the Postmaster-General, and that the selected sub-contractors should be approved by him.

6. Clause 11 of the original contract provided that if the Government desired to install in any of the stations erected by the Marconi Company apparatus in addition to or in substitution for theirs they should "seek but should not be bound to act upon the advice of the company." It has been suggested that this might enable them to obtain information of inventions by their competitors which those competitors would desire to keep secret. One Postmaster-General, on the other hand, has stated that it was never intended, nor did the terms of the contract require, that any such secrets should be communicated to the company, and that what was proposed was that the nature of these inventions which it was proposed to substitute should be communicated to the company in general terms. It is now agreed, however, that the provision in clause 11 should be omitted.

7. In clause 18 of the original contract it was provided that with regard to any new stations to be erected by or for the Government, not by the Marconi Company, where the company "had reason to suspect infringement of their patents," they should have the right of inspection to ascertain whether or not such infringements had, in fact, taken place. This provision has been subjected to criticism on similar grounds.

The company, in view of their experience of the many infringements of their patents that have taken place in various countries of the world, and in view of the costly litigation in which they have been frequently engaged, were unwilling to agree to the omission of this clause. It has been arranged that the provision in the new contract shall run : "If they satisfy the Postmaster-General that they have reason to suspect" that their patents are being infringed they shall have the right to nominate, with the concurrence of the Postmaster-General, an independent engineer of high standing to make the inspection.

There are also a small number of minor and drafting amendments embodied in the contract.

QUESTIONS IN PARLIAMENT.

The Postmaster-General has had to answer a large batch of questions almost daily in the House of Commons regarding the Imperial Wireless Chain. On July 9th he informed several members that he had no official information as to the results of experiments which were said to have been made with the Goldschmidt system, but he was making immediate inquiries.

On the 10th he informed the House that he had received a letter from the British representatives of the Goldschmidt system, conveying information which had appeared in the newspapers of the preceding week, and inquiring respecting the contract for the Imperial Wireless Chain. He at once asked them to arrange for representatives of the Post Office and the Admiralty to attend a demonstration of the working of their system, but he had not (July 10th) received a definite reply from the company.

On July 11th Mr. Samuel stated that the decision not to invite tenders was adhered to by the Government after the repudiation of the contract of July, 1912, partly as a consequence of the report of the Technical Advisory Committee presided over by Lord Parker. That report stated that according to the result of their investigations "the Marconi system was at present the only system of which it could be said with any certainty that it was capable of fulfilling the requirements of the Imperial chain." He was asked whether the objection to the contract being thrown open to public competition might be overcome by requiring the parties tendering to give a substantial financial guarantee for an efficient service. To this he replied in the negative. "We want," he said, "to be sure that the contractors will be able to perform the services required. A financial guarantee will not be adequate ; actual tests are essential beforehand."

On July 11th he was still waiting permission from the Goldschmidt Company to send Post Office and Admiralty officials to watch any demonstration that they might be in a position to make.

In answer to further questions on July 14th, he stated that representatives of the Goldschmidt system accepted the invitation of the Parker Committee to demonstrate the working of their system, but only over a distance of 382 miles between Hanover and Slough. Members of the Committee were in attendance at Hanover and engineers were sent to Slough to watch the tests, but the demonstrators did not succeed in transmitting any intelligible communication of any kind. On seeing the paragraphs recently sent to the Press by the company to the effect that they had established communication between Hanover and Tuckerton in the United States, he (Mr. Samuel) at once asked the company to allow the demonstrations to be witnessed by officers of the Post Office and the Admiralty, but the company had replied that they were not in a position to give any demonstrations until the first week in August. Under the circumstances he did not propose to invite tenders for the work. Mr. Samuel stated further that the Goldschmidt experiments took place between July 3rd and 4th, the company communicated to him on July 5th that these experiments had been made, and he wrote to them, he thought, on July 6th or 7th, asking that demonstrations should be made before his officers at the earliest possible date. A telegram was sent on the following day, and another letter was sent two or three days afterwards. About July 12th he received a letter from the company stating that they were not in a position to give any demonstration until August. So far as he was aware, the statement that by the Goldschmidt system messages had been sent "over a far greater distance, and under more difficult conditions" rested entirely on Dr. Goldschmidt's statement.

With regard to the Poulsen system, Mr. Samuel said that the general results of the experiments in the United States were before the Scientific Advisory Committee when they made their report, and they were not such as to lead the committee to conclude that the Poulsen system was capable of fulfilling the requirements of the Imperial chain. The agreement between the Canadian Postmaster-General and the representative of the Poulsen system was entered into in April of this year, and was of a wholly different character from that proposed for the erection of stations for the Imperial wireless chain. The Canadian Government did not propose to employ the Poulsen Company to erect any stations to be owned and worked by the Government; the station was to be erected by the Poulsen Company at their own cost, it was to remain the property of the company, unless purchased by the Canadian Government, and it would be worked by the company at their own risk.

On July 15th Mr. Samuel was again asked whether the tender of the Goldschmidt Company would be accepted, subject to the results of demonstrations being satisfactory, but he replied in the negative. He replied that he had not sufficient confidence that the tests would be satisfactory to begin with to make it reasonable to adopt the suggestion made by an honourable member.

Mr. W. Guinness obtained leave on July 16th to discuss the new Imperial Chain on a motion for the adjournment of the House. Mr. Guinness's object was to call attention to the refusal of the Postmaster-General to allow any other company than the Marconi Company to tender for the erection of the stations. Several members took part in the discussion of the motion, including Mr. J. J. Mooney, who served on the Select Committee and who informed the House that in the mass of correspondence put before that Committee he came across a letter in which the Poulsen Company promised to do in a few months what in seven years they had not done, for the date of the letter was 1907.

Mr. Herbert Samuel, in referring to rival wireless telegraph systems, emphasised the fact that there was all the difference in the world between promise and proved capacity. In 1907, he said, the Poulsen Company then at work sent a representative to the Post Office, who said that the company had absolutely no doubt of being able to establish a thoroughly satisfactory service in America; their wireless experiments in Germany, he added, had been most successful, and they hoped soon to introduce their system into England. That, said Mr. Samuel, was in 1907, and from that day to this the Poulsen Company had established no trans-Atlantic service. Some months ago he was pressed to adopt the Poulsen system on the ground that they had established a day and night communication between San Francisco and Honolulu. On July 11th the Foreign Office telegraphed to the British Consul at San Francisco asking whether the Poulsen Company had a wireless service by day in operation; he replied on July 12th, "No. Non-completion at Honolulu is causing delay." Mr. Samuel laid stress on the fact that the expert committee who reviewed the existing systems had reported that "the Marconi system was the only one of which it could be said with any certainty that it could be capable of fulfilling the requirements of an Imperial Chain." He also communicated to the House the four opinions that he had received that day; they came from the Engineer-in-Chief of the Post Office, the Inspector of Wireless Telegraphy (who had been at the Admiralty and was now at the Post Office), the President of the Institution of Electrical Engineers, and Lord Parker. All were to the effect that it would not be advisable to invite tenders from the Poulsen Company and the Goldschmidt Company at the present moment. Mr. Samuel observed that nothing would induce him to change a course which he knew to be in the public interest.

The motion was talked out by Mr. Austen Chamberlain.

In the House of Commons on July 21st, on the motion of Mr. Masterman (Financial Secretary to the Treasury) a return was ordered containing "copy of agreement between Marconi's Wireless Telegraph Co., Ltd., Commendatore Guglielmo Marconi, and the Postmaster-General, with regard to the establishment of a chain of Imperial wireless stations, together with a copy of the Treasury minute thereon."

On July 23rd the Prime Minister informed the House of Commons that it was proposed to give Friday, August 1st, provisionally, as a day for the discussion of the contract.

LEGAL REPORTS.

Wireless in Australia.

THE Judicial Committee of the Privy Council dismissed the Australian Government's petition for leave to appeal against the decision of the High Court of Australia making an order for the inspection by the Marconi Company of the wireless telegraph plant installed in the Commonwealth stations. The petition was heard in London on July 4 by the Lord Chancellor, Lord Dunedin, and Lord Atkinson, and at the close of the arguments for the Commonwealth their Lordships refused leave to appeal, without calling on counsel for the Marconi Company.

The following summary of the proceedings appeared in the *Times* :—

"On February 13th, 1912, the Marconi Company brought an action in the High Court against the Commonwealth of Australia, under the Patent Acts, 1903–9, and the Judiciary Acts, 1903, for the alleged infringement of the Marconi letters patent in the six States of the Commonwealth. The system of wireless telegraphy used by the Commonwealth is the invention of Mr. Balsillie, the engineer for radio-telegraphy for the Commonwealth Government, and was assigned to the Government by him. Mr. Balsillie asserted that it was an entirely different system from that attacked in the case of Marconi and others *v.* The British Radio-Telegraph and Telephone Company. On March 21st the Marconi Company took out a summons for an order to inspect and examine the plant erected by the Commonwealth. The High Court made no order at that time, but declared that the company were not to be prejudiced in any application they might afterwards make for inspection of the plant and works of the Commonwealth. During the hearing it was stated that the wireless telegraphy used by the Commonwealth would form the subject of an application for letters patent, supported by a complete specification which would probably afford the respondents all the information required without an actual inspection. On September 23rd, 1912, applications accordingly were lodged in the Patents Office in Melbourne for two inventions by Mr. Balsillie, accompanied by complete specifications. The respondents obtained inspection of these specifications.

"On December 11th the respondents took out a summons for an order for inspection of the plant. The Commonwealth opposed the summons in an affidavit filed by the Postmaster-General's Department. The ground of the opposition was that, in the opinion of the Postmaster-General, it would be prejudicial to the public interest to allow any inspection of the wireless telegraphy stations of the Commonwealth.

"On March 20th last the High Court (Mr. Justice Isaacs dissenting) made an order for inspection. The view of the majority of the Court was that the opinion of a responsible Minister of the Crown was not conclusive, but could be examined by the Court, and that there was nothing to warrant even a conjecture that the inspection would disclose anything which could reasonably be called a State secret. The view of Mr. Justice Isaacs was that the Court was bound to accept and act upon the opinion of the responsible Minister unless it was clearly shown that the inspection could not be prejudicial to the public interest, and that it had been established that the evidence and inferences pointed in a contrary direction. From this decision the Commonwealth Government now sought special leave to appeal, urging that the matter of law involved was of great public importance."

Patents Action.

THE following particulars of the action brought by the Marconi Wireless Telegraph Co. of America against the National Electric Signalling Co. (Fessenden) appeared in the *Electrical World* of New York.

There are two distinct suits comprising the present litigation, the first referring to Marconi's United States patent re-issue No. 11,913 (original No. 586,193, filed December 7th, 1896, and issued July 13th, 1897) and to No. 609,154 (filed February 1st, 1898, and issued August 16th, 1898) of Sir Oliver Lodge, while the second suit is based upon United States patent No. 763,772, issued to G. Marconi, June 28th, 1904, on application dated November 10th, 1900. *Prima facie* evidence in both cases was begun

in August, 1912, by Mr. W. R. O. Wiegant, who stated that he had been employed by the defendant National Company, and who described in detail the arrangement of apparatus which constituted the alleged infringement. In October and November of the same year Mr. Frank L. Waterman, of New York, closed the complainant's proofs with his expert testimony. The first evidence in defence was taken last February, and was not completed until April last. The rebuttal case of the first suit was opened before Judge Veeder on June 16th with evidence of Mr. G. Marconi, which continued for three days. This was followed by other evidence.

The only claim of No. 11,913 in issue is as follows :—

"3. The combination, in an apparatus for communicating electrical signals, of a spark producer at the transmitting station, an earth connection to one end of the spark producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end and a circuit through the contact, substantially as and for the purpose described."

Mr. Marconi and Mr. Waterman gave rebuttal evidence on this claim, maintaining that it should be held to cover any system of radiotelegraphy utilising earthed waves. The "imperfect contact" element is considered the keystone of the combination, since the complainant claims it to include all oscillation detectors, even those of the "good contact" crystal or electrolytic types. The National Company urges that the patent should be read in the light of wireless knowledge at the time of its application date, and that Mr. Marconi's claims should be limited to the original intentions of the inventor, as shown by his early lectures and publications. The complainant goes so far as to classify the hysteresis-type magnetic detector as within claim 3 above, stating that while it may not be an "imperfect contact" device, it acts like one, and is therefore an equivalent. The defendant company is attempting to show that the crystal and electrolytic detectors are outside the claim quoted, since, if read in the light of the specification, the "imperfect contact" is a resistance-varying device which controls power from a local battery, and makes signals thereby. It is claimed by the National Company that when the crystal or electrolytic detectors are used all response given is produced by power received on the antenna, the local battery being used only to increase the sensibility of the detector, and the work of Dr. G. W. Pierce, as well as of the company's experts, is pointed out in confirmation of this view. Mr. Marconi also states that in addition to his invention of the combination, including an imperfect contact, he is also entitled to a monopoly covering the use of earthed waves for wireless telegraphy.

The Marconi re-issue patent was sustained as to claims 3 and 5 against the De Forest Wireless Telegraphy Co. in 1905 by Judge Townsend. In that instance infringement was determined mainly by defendant's use of the De Forest-Smythe "goo" detector, which was held to be a true anti-coherer resistance-changing device. The bearing of the earlier decision upon the present case does not seem very direct, except in that Judge Townsend appeared to feel that he was extending a liberal range of equivalents to Marconi by placing the "goo" detector within the coherer class.

The Lodge patent, No. 609,154, has in issue claims 1, 2 and 5, of which the first is representative :—

"1. In a system of Hertzian wave telegraphy, the combination with a pair of capacity areas of a self-inductance coil inserted between them electrically for the purpose of prolonging any electrical oscillations excited in the system, and constituting such a system a radiator of a definite frequency or pitch."

The second suit, No. 31, upon Marconi's patent No. 763,772, in which the rebuttal testimony is not completed, alleges infringement of 15 claims of the patent, including the following :—

"8. At a transmitting station employed in a wireless telegraph system the combination of a transformer whose secondary is connected to an open circuit, including a radiating conductor at one end and capacity at the other end, a variable inductance being included in said circuit, and whose primary is connected to a condenser circuit discharging through a means which automatically

causes oscillations of the desired frequency, substantially as described.

"10. A system of wireless telegraphy, in which the transmitting station and the receiving station each contain an oscillation transformer, one circuit of which is an open circuit and the other a closed circuit, the two circuits at each station being in electrical resonance with each other and in electrical resonance with the circuits at the other station, substantially as described.

"19. In a system of wireless telegraphy the combination at a receiving station of an oscillation transformer; an open circuit comprising, in part, an aerial conductor connected with one end of the primary coil of the oscillation transformer; a connection from the other end of said coil to capacity; a variable inductance in said open circuit, and electrical connections from the secondary coil of the oscillation transformer to a receiving instrument, battery, condenser, wave-responsive device and a variable inductance, substantially as and for the purpose described."

This is the United States patent of Marconi on "four-circuit tuning," and it corresponds to the British 7,777 patent of 1900, which was sustained by Mr. Justice Parker against the British Radiotelegraph & Telephone Co. in 1911. The defence of the National Company is said to be based upon anticipations of the patent in the work and publications of Tesla, Fessenden and others.

Interrogatory Allowed.

In the Chancery Division on July 9th Mr. Justice Eve had before him a summons in an action brought by G. Marconi and Marconi's Wireless Telegraph Company, Ltd., against the Helsby Wireless Telegraph Company, Ltd. The action was to restrain infringement of the well-known wireless patents granted to the inventor in 1900. Leave was asked for by plaintiffs to administer certain interrogatories as to the state of the defendant company's plant since an inspection was made of it by the plaintiffs. In giving judgment, his Lordship said that but for the fact that the Court of Appeal in a recent case had refused to allow an interrogatory which he had allowed, he would have entertained no doubt that the plaintiffs were entitled to put the interrogatory in question. The plaintiffs alleged infringement by reason of an installation in Milton Road, Liverpool, and an inspection of that plant was made by the plaintiffs in May last. He gathered that the result of that was that the plaintiffs were of opinion that there had been alterations made in the construction of the installation between its erection and May, 1913. They wished to know in what manner the construction had been altered. It was suggested that such an interrogatory was a fishing one and an endeavour to establish, by means of an admission, that which the plaintiffs could not prove otherwise, and it ought not to be allowed. His Lordship thought, however, that in the present case the facts were capable, and that the admissions of the defendants would save a great deal of time, trouble, and expense. The interrogatory would be allowed and must be answered within fourteen days.

Apology to Mr. Marconi.

The libel action brought by Mr. Marconi against the Berlin weekly paper *Die Welt am Montag*, has been settled by agreement. The responsible editor has undertaken to print in his journal a statement admitting that it was not true that Mr. Marconi testified before the American Commission of Enquiry into the loss of the *Titanic* that his company had sought to make money out of that disaster—the libel of which Mr. Marconi complained—and expressing regret for publishing this statement. The statement is withdrawn, together with the inferences drawn from it by the journal.

The Share Market

London, July 24th.

Business on the Stock Exchange during the past month has been on the smallest possible scale. In the first place the strike on the Rand, which at one time assumed very serious proportions, caused considerable anxiety as to the position here should the flow of gold from South Africa be interfered with. Fortunately these difficulties have, for the time being at any rate, been surmounted.

The market for Industrials has been very quiet and there is little change in the prices of the various Marconi Issues.

Ordinary, 3⅛; Preference, 3; Canadas, 10/-; Spanish, ⅛; American, $\frac{13}{16}$.

D

COMPANY MATTERS.

Marconi International Marine Communication Company (Limited).

CONTINUED DEVELOPMENT OF THE BUSINESS.

The 13th Ordinary General Meeting of the Marconi International Marine Communication Company (Limited) was held on June 23rd at the offices, Marconi House, Strand, Mr. Godfrey Charles Isaacs, the managing director, presiding.

The Assistant Secretary (Mr. H. W. Corby) having read the notice convening the meeting and the auditor's report,

The Chairman said: Gentlemen, Commendatore Marconi has been obliged to remain rather longer in the United States of America than he had contemplated, and I am taking the chair in his absence. I assume that we may follow the usual custom and take the directors' report and the accounts as read. The report and accounts are before you, and you have seen—I am sure, with some satisfaction—that the business of the company continues to develop. The figures are set out in the directors' report, and indicate during this last year a very substantial increase in the receipts and in the number of ships equipped; consequently the net profit shows a proportionate increase, amounting to between £9,000 and £10,000 over that of the preceding year. One of the items which is of particular interest, I think, is that of the ships' telegrams traffic and subsidies, etc., the revenue from which during the past year has exceeded £100,000. The number of ships equipped up to the end of last year was 580, and to date it has reached 686, and is still continuing to increase in much the same ratio.

We are conducting a business which has an immense organisation, and which serves a very valuable purpose to the mercantile marine. I do not know that there is another industrial business which plays a more important part in the world than does wireless telegraphy on ships at sea. During the past twelve months there were a very large number of instances where it is more than probable, in past times, when there was not wireless telegraphy, that many ships would have sailed from their ports and would never again have been heard of. In practically all cases where wireless telegraphy has been employed not only have all the passengers been saved, but the ships themselves. I do not know yet what part wireless telegraphy may play in reducing the cost of insurance to ship owners. It seems self-evident, however, that it will do so, for whereas in the past a number of ships would have been total losses, in very many instances—in fact, I think in every instance where a ship has been fitted with wireless telegraphy during the past year—both ships and cargo have been saved.

LEGISLATION RESPECTING WIRELESS TELEGRAPHY.

There has been a considerable amount of legislation during the past year in nearly all countries which have a mercantile marine providing that ships should be fitted with wireless telegraphy. There has been a certain limit to which this law applies. In most cases it touches only ships carrying 50 persons or more, whether they be passengers and crew or crew alone. I think myself that this is likely only to be a beginning of such legislation, and that as time goes on we shall find that the law will be made to apply to every ship that sails from a port. Personally, I cannot see why it should not be so, for whether there be 50 persons on a vessel, or 25 or less, it seems to me that if there be a means of safeguarding the lives of those who leave port, it should be applied in every instance. In this country we are expecting similar legislation. Exactly what line it will take I am not yet in a position to advise you, but I contemplate that it will go rather further than that which has so far been enacted in other countries. I do not think there is anything more I can usefully add. I shall be very pleased to answer any questions which shareholders may desire to put to me, and in the meantime I will propose, "That the report of the directors submitted, together with the annexed statement of the company's accounts at December 31st, 1912, duly audited, be received, approved, and adopted."

Mr. Henry Spearman Saunders—I second that. I am sure that the shareholders are all satisfied with the progress which the company has made during the past year.

The motion was carried unanimously, without discussion.

Captain Henry Riall Sankey, R.E., proposed:—"That Major Samuel Flood Page and Mr. Alfonso Marconi, the retiring directors, be re-elected directors of the company." He remarked that Major Flood Page and the company had grown up almost together, and they were all very sorry that that gentleman was not with them on that occasion. He had been seriously ill for some time, but they hoped that he would soon be among them again. As regarded Mr. Marconi, his name was quite sufficient to ensure his re-election.

The Chairman formally seconded the motion, and, having declared it carried unanimously, said:—I have now to move, "That the remuneration of the directors for the year 1913 shall be the sum of £1,000, subject to such further sum, if any, as may be determined at the next general meeting of the company."

Mr. Alfonso Marconi seconded the motion, which was carried unanimously.

The Chairman—It is now my pleasure to propose, "That a dividend at the rate of 10 per cent. for the year ending December 31st, 1912, on the 204,056 shares issued be paid on July 31st, 1913, to the members who are on the register as the present holders thereof."

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

Messrs. Cooper Bros. & Co. were re-elected auditors for the ensuing year.

Share Issue.

The following circular was issued on July 11th:

"During the past few years the business of the Marconi International Communication Co., Ltd., has undergone rapid expansion, as is clearly shown by the following figures, which have

been extracted from the Annual Reports to the Shareholders:

Year.	Ship Telegraph Stations.	Traffic Revenue.	Dividend.
		£ s. d.	
1910	250	40,535 15 8	5%
1911	350	64,165 16 8	7%
1912	580	100,325 3 10	10%

"The number of ships equipped at this date is 686, the installations being the property of this Company.

"At the present time the Company have large orders in hand, and much further business lies ahead. Further capital outlay is consequently necessary, and in order to provide the additional funds required, the directors now offer to the shareholders 102,028 shares of £1 each (part of the total unissued balance of 145,944 shares) at the price of £1 5s. per share in the proportion, so far as practicable, of one new share to every two issued shares. The Spanish and General Wireless Trust, Ltd., have bound themselves in consideration of a commission of 1s. 6d. per share on the whole issue, and an option over the remaining 43,916 unissued shares of the Company at the price of £1 5s. per share, to take up at the same price any of the shares now offered which are not taken by the shareholders, or those in whose favour they renounce their rights.

"Marconi's Wireless Telegraph Co., Ltd., who by virtue of their holding in this Company are entitled to an allotment of 94,395 of the above shares, have made arrangements for passing on the benefit of their allotment to their own shareholders.

"A special settlement on the London Stock Exchange will be applied for in due course."

Applications had to reach the Company's Bankers by July 19th.

Compania Nacional de Telegrafia Sin Hilos

During the past year the Compañia Nacional de Telegrafia Sin Hilos quietly concentrated their efforts upon the development of wireless telegraphy in Spain. In their annual report the Directors refer to the successful completion of seven of the first group of eight long-distance stations in Spain and the Canary Islands. Further proposals have been submitted, and are now under the consideration of the Government, with the object of extending the original scheme.

Favourable opportunities exist for the extension of the wireless telegraph service in the North African territory under Spanish influence, and the company have entered into negotiations with the State Departments concerned with a view of establishing in North Africa stations that will be capable of conducting all classes of communication. Steady progress is being made with the erection of the stations comprised in the second group.

The Cadiz and Vigo stations are working satisfactorily, and traffic through these stations continues to increase daily. The Spanish Coast stations have suffered somewhat in competition from stations on the French Coast, but it is hoped that a satisfactory arrangement will be made shortly, and that the disadvantages under which the Spanish Coast stations have hitherto been worked will be removed. The Barcelona and Soller stations are also working excellently, and with the opening of stations at Santander, Finisterre, Malaga, Cabo de Palos, Huelva, etc., traffic receipts will increase very appreciably.

Wireless telegraphy has again demonstrated to the country its reliability as a means of communication from shore to shore. The latest demonstration was afforded by the breakdown of the Canaries cable. During that time communication between the Peninsular and the Canaries was carried on through the Marconi stations, and so reliable was the service that a petition has been granted with a view of making this wireless service a permanent one.

The State Department are at present negotiating with the English and Italian Post and Telegraph Departments with a view of establishing direct communication between the east coast of Spain and Italy and Aranjuez and Vigo and this country.

The report refers to the demonstrations carried out in Spain with the Marconi portable wireless telegraph station in 1912. Some of the demonstrations were witnessed by their Majesties the King and and Queen Dona Maria Christina, and high officials of the Government and the Army. Trials were conducted between Madrid, La Granja, Burgos, and San Sebastian, and the results were so satisfactory that the War Office, by Royal Order, arranged to purchase two stations.

In addition to this the company have also secured orders for equipping vessels of the Spanish Navy, among which may be mentioned the *Princess de Asturias*, which has been equipped with a wireless telegraph station. The official tests of this station gave excellent results. The company have also installed a 15-kw. station on the armoured cruiser *Espana*, and tenders have since been submitted for the remaining ships now in course of construction for the Ministry of Marine.

The company succeeded in obtaining all the orders for wireless telegraph apparatus placed by the Ministry of Marine during the past year.

Compagnie Française Maritime and Coloniale de Télégraphie Sans Fil

The annual report and accounts of the Compagnie Française Maritime et Coloniale de Télégraphie Sans Fil were presented at the annual meeting held in Paris recently. A dividend of 10 per cent. was paid on the ordinary shares, and 10,150 frs. was added to the reserve. The scope of the company has considerably increased, and in order to enable it to carry on its operations in a wider sphere it has become necessary to increase the capital, for which the necessary arrangements have been made.

CONCERNING RECORDS

THE following is a copy of a letter signed by Mr. Godfrey C. Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., which appeared in the *Electrician* on July 18th last :—

"In your issue of the 11th inst., page 557, you say that you understand that a record has been created by the Goldschmidt system; the station at Hanover, equipped with 150 kilowatt Goldschmidt Alternator, has been able to transmit to Atlantic City in the United States, a distance of about 4,000 miles. May I point out that this is not quite accurate? The distance between Hanover and the Tuckerton station, Atlantic City, is 3,385 nautical miles, and I think it will not be disputed that the station at Hanover only sent out the letters "PAX," which represent the call letters of the station, and that the Tuckerton station did not reply. You will appreciate, I am sure, that there is a great difference between a station receiving the call signals which it is awaiting and its being able to receive messages in code or otherwise.

"The fact, too, that a machine is able to send out for two or three hours on three consecutive days station call letters, after which it is moved to Berlin for repair (which I think you will find will also not be disputed), is very different from a machine being able to work continuously day and night, week after week, and month after month, in sending and receiving messages, which is what would be demanded of it in conducting a commercial service. May I also point out that, given that the call signals "PAX" were sent from Hanover to Atlantic City, and were received there by the Tuckerton station, this would not constitute a record, for some years ago Mr. Marconi received signals at Buenos Aires which were transmitted to him by our Clifden station, a distance of over 6,000 miles, which achievement was reported in the *Electrician* on October 7th, 1910, on page 1085, by the following paragraph :—

It is announced that Mr. Marconi, who has recently landed in Argentina, has notified Marconi's Wireless Telegraph Company of London that he has successfully accomplished wireless communication between Clifden (Ireland and Buenos Aires, a distance of 6,000 miles.

The Editor's comment on the above letter is as follows :—

"In the note to which reference is made we did not suggest that the performance was a record as against other systems. We merely meant that it was a record so far as the Goldschmidt system was concerned; but perhaps we ought to have been more explicit."

Berne Notes

THE CONVENTION.—The International Convention, which was signed in London on July 5th, 1912, came into operation on July 1st last.

The convention provides for the organisation and control of the wireless services on ships. Two of its most important requirements are that there shall be a constant wireless watch on all ocean-going passenger steamers, and a free interchange of communication between ships and coast stations. (The Convention is published in full, together with the service regulations, in the YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, 1913.)

Among the countries which have already ratified the Convention are Denmark, Egypt, United States of America (with a slight reservation), Holland, Russia, Belgium, and Belgian Congo.

APPOINTMENTS, ETC.—The Berne Bureau has been informed that Mr. Alfred Massé has been appointed by the President of the French Republic Minister of Commerce, Industry of Posts and Telegraphs.

Mr. G. A. A. Alting von Gensau has been appointed Director-general of Posts and Telegraphs for Holland in succession to Mr. G. J. C. A. Pop.

Mr. J. J. Stieltjes has decided to retire from the office of Chief of the Department of the Posts, Telegraphs and Telephones of the Dutch East Indies; he will lay down his duties on August 3rd.

STATIONS.—The Minister of Marine at Athens has reported to Berne (Circular 48) the opening at Salonica of a Greek coast station for official service.

A public service station has been opened at Lisbon. The range of the station is 350 kilometres, wave-length 600 m., call letters C.R.F., coast tax 40 centimes per word.

A "Hero" of the Siege of Adrianople

THIS month we are able to give our readers a photograph of the splendid cart set which did such historic work during the siege of Adrianople.

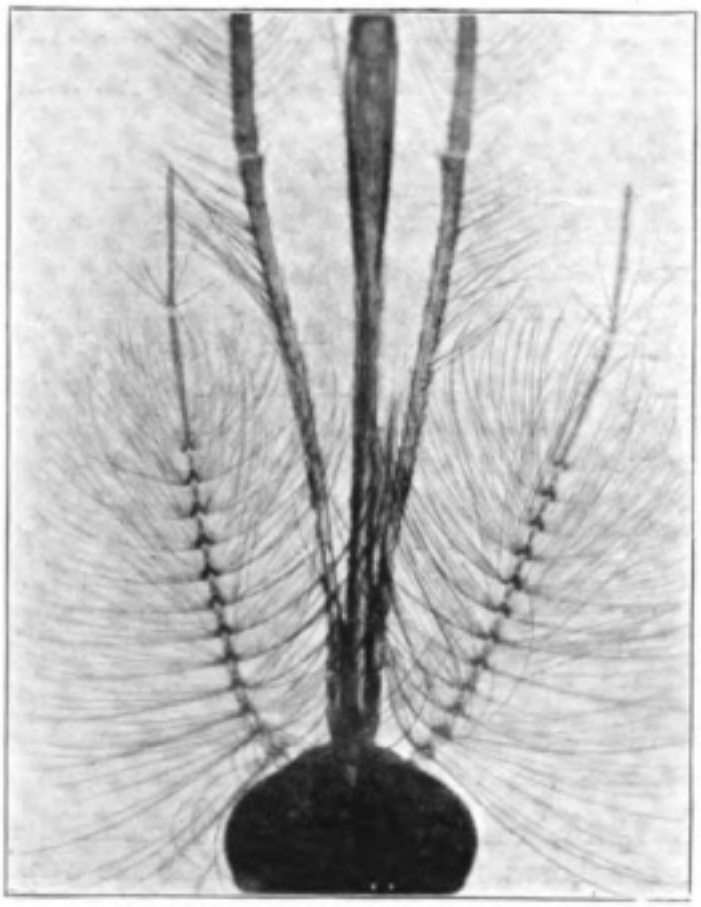
Before the outbreak of the Balkan War, this station had been sent by the Turkish Government, for experimental work, to the plains outside the city; but when the advancing Servian and Bulgarian hosts instituted a state of siege, it was taken within the city walls. It became the only means of communicating with the outside world; not once did it fail during the whole of the 153 days that the siege lasted. Constant messages were sent to Ok Meidan, the chief station of the Turkish Government, which is situated in the environs of Constantinople. The beleaguering armies endeavoured their utmost to tamper with the communication, and with this end in view set up cross stations, which were to intercept the waves and to nullify the messages by "jamming." Their efforts, however, were unsuccessful; in not a single attempt did they succeed in their purpose, and it is reckoned that some half-a-million of words safely reached the Turkish metropolis from Adrianople. This is a splendid feat, for the distance between the two cities is over 130 miles, and as the station is only a 1½-kw. cart type (which, it should be remembered, is not supposed to do the work of, or be as powerful as, a properly installed land station, however serviceable it may be for campaign work), it demonstrates the fact fairly conclusively—nor is this the only instance, rather it is common knowledge among all who have had to work with Marconi apparatus—that the Marconi stations can always do more than they are actually guaranteed to do, while the accuracy of the parts and the excellence of workmanship enable them to stand a strain which less well-made apparatus would be unable to bear.

Turkish Soldiers with their Marconi Portable Wireless Station in Adrianople before the Siege.

Wireless Telegraphy in Nature

By H. W. VENTON

WIRELESS telegraphy is as old as the hills. Long before man inhabited this earth the secret of distant communication without the medium of wires was already known to some of the inhabitants of this planet. And this communication did not depend upon the power of vision; for, in the vast majority of cases, it was possible where the two or more communicants were far removed from each other and where it was quite impossible for them to see each other. In the insect world wireless telegraphy appears to have been in use as long as insects have been in existence; indeed, science has recognised that Mr. Marconi has been anticipated by these tiny creatures by the fact that it has named one of the principal parts of a wireless installation after one of the organs of the insect. The "antennæ" of a wireless telegraphic apparatus, of course, derived its name from the antennæ of insects.



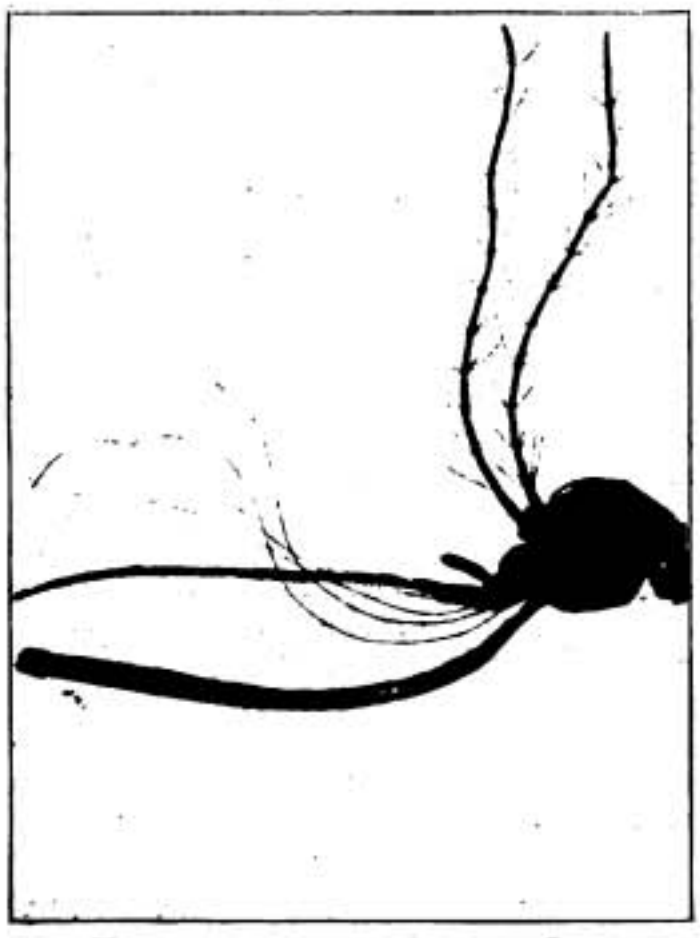
Head and Antennae of Male Gnat

It is very remarkable, too, that both the mechanical and the natural antennæ seem to possess the same functions. The function of the man-made antennæ is to "pick up" the electrical waves; and the function of the antennæ of insects is also to pick up waves, though whether these be electrical or not in character has not, as yet, been absolutely determined.

Those who are unacquainted with the habits of insects would doubtless be surprised at some of the incidents connected with the communications between distant individuals which have been absolutely established. As an illustration of the manner in which certain butterflies and moths can make their presence known the one to the other, I will mention a little experiment which I tried some time ago, and which anyone sufficiently interested may repeat for himself. I had a good specimen of a live female emperor moth, and having heard of their alleged power of attracting males of their species, I put her into an ordinary two-pound jam jar and tied a piece of net over the top. I then went to the edge of a wood not far distant and set the jar upon the grass. I had not long to wait. In less than three minutes I saw something fluttering above the jar, and in another moment a beautiful specimen of a male emperor moth was scrambling over the net in an endeavour to get within. In about a minute longer another male had arrived, and in less than a quarter of an hour there were five blindly endeavouring to force their way inside.

It is practically certain that the power by which this communication is effected resides in the antennæ. In nearly every instance it is the male insect which is attracted from incredible distances to seek the female. And when the antennæ of the two sexes are examined we find a remarkable difference

between them. The antennæ of the male is nearly always more elaborate than that of its mate. It has generally a great many more branches and these branches are very much more finely divided than those of the female insect, besides which they are covered with innumerable tiny hairs, in most cases more delicate than the finest cobweb. From these facts one would judge that the antennæ of the male insect is a most delicate receiving instrument, by means of which the faintest waves emitted by its mate are picked up.



Head and Antennae of Female Gnat

Whether or not these waves are emitted by the female antennæ it is difficult to determine; the whole question of distant insect communication is, as yet, unsolved.

Accompanying this article are two illustrations showing the head and antennæ of the male and female gnat. The difference between them is exceedingly striking, and the fact that these insects seem to possess the power of distant communication to a remarkable degree, combined with the extreme difference in the antennæ, seems distinctly to point to the fact that they are the external organs of a wireless telegraph plant similar in many respects to that used by mankind.

During recent years remarkable discoveries have been made with regard to the capacity of animals, including, of course, insects, to generate electricity; and it will not do for us to dismiss from our minds as utterly incredible the possibility that the waves received by the antennæ of insects are electrical ones. As an instance of the electrical susceptibility of insects it may be mentioned that glow-worms are exceedingly responsive to atmospheric electrical disturbances. Some time ago a gentleman who kept a large number of these little insects in his study noticed that on the approach of a thunderstorm their light became brilliant, and that it could be seen, even in weak daylight, which is very unusual. There is a centipede which is named *electricus* on account of the fact that it is able to emit electrical discharges; and among the higher, or rather larger, animals there are some which have complete storage batteries inside them. There are many fishes which are able to render themselves almost immune from attack on account of the fact that they can give severe shocks to an enemy seeking to destroy them; and not only is it possible to measure the voltage of the discharge, but it is also equally possible to light small electric incandescent lamps for a minute or two at a time, by connecting wires to the negative and positive portions of their bodies.

It is, of course, quite possible that insect "telepathic" communication may be non-electrical in character, and may be due to no special sense, but to one of the five senses known to us developed to a hypersensitive degree. Indeed, in many insects these organs appear to be organs of hearing; for the antennæ vibrate to a tuning fork of a particular note. But this does not invalidate the assumption that the antennæ of insects are comparable with those of a wireless plant, for, whatever these organs are for, they are to "pick up" waves of some kind; and during recent years science has come to regard all kinds of force and motion,—whether it be electricity, sound, light or heat, as the result of vibrations, the only difference between them being in the length of the waves of which they are the manifestation.

Australasian News

NEW USE FOR WIRELESS.—An unusual use was made of the wireless installation of the steamers *Maheno* and *Wimmera* during recent heavy weather in the Tasman Sea. The *Maheno* was proceeding to Auckland, and the *Wimmera* was going in the opposite direction. A message was sent from the *Wimmera* asking the *Maheno* if there was a doctor on board, and as Dr. Scott, a passenger from Tasmania, was travelling on the *Maheno*, a reply was sent accordingly. Then the instruments began to work, and there came to the *Maheno* news that Captain Entwistle was not well, and some particulars of his symptoms. Dr. Scott supplied the *Maheno's* operator with a prescription which was despatched to the invisible *Wimmera*.

* * *

HOURS OF WORKING.—According to the *Sydney Sun*, the purser of the American mailboat *Ventura* complained recently about the closing of the Sydney Station on Sundays. "We got into communication with Sydney and Brisbane on Thursday last," said Mr. Baker, "and spoke to both stations daily. But, when we were approaching Sydney on Sunday, we sent a wireless inquiring about atmospheric conditions, and, to our surprise, Sydney station replied to the effect that the station was officially closed on Sundays, and that no messages would be sent to the *Ventura* or any other vessel. "This is a most serious state of affairs," continued Mr. Baker, "for accidents will happen on a Sunday as well as any other day. It is to be hoped that if ever a ship is in trouble off the coast, and within range of the Sydney stations, that the operators will not be so officious."

* * *

GOOD WORK ON THE "ZEALANDIA."—Some fine performances have been achieved by the wireless station on the R.M.S. *Zealandia* recently. On the voyage to Vancouver from Auckland messages were sent to Sydney, 1,104 miles; Wellington, 1,000 to 1,200 miles; R.M.S. *Marama*, 1,100 miles; Suva, 1,189 to 1,785 miles; Awanui, 300 miles (received messages at 1,800 miles); Sonoma, 1,575 miles; Triangle Island, Vancouver, 1,200 miles. On the outward voyage from Vancouver some of the longest distances covered were:—Triangle Island, Vancouver, 2,250 miles; Estevan Point, Vancouver, 1,853 miles; Honolulu, 1,200 miles; Suva, 850 to 1,000 miles; Wellington, 1,100 miles; and Sydney, 1,320 miles. A message was also received from Triangle Island, Vancouver, when the steamer was 3,090 miles away. This is a record for a low-power station. During the whole voyage the *Zealandia* was kept informed of all the latest news by wireless, and not a day passed without the vessel being within range of some station or vessel.

* * *

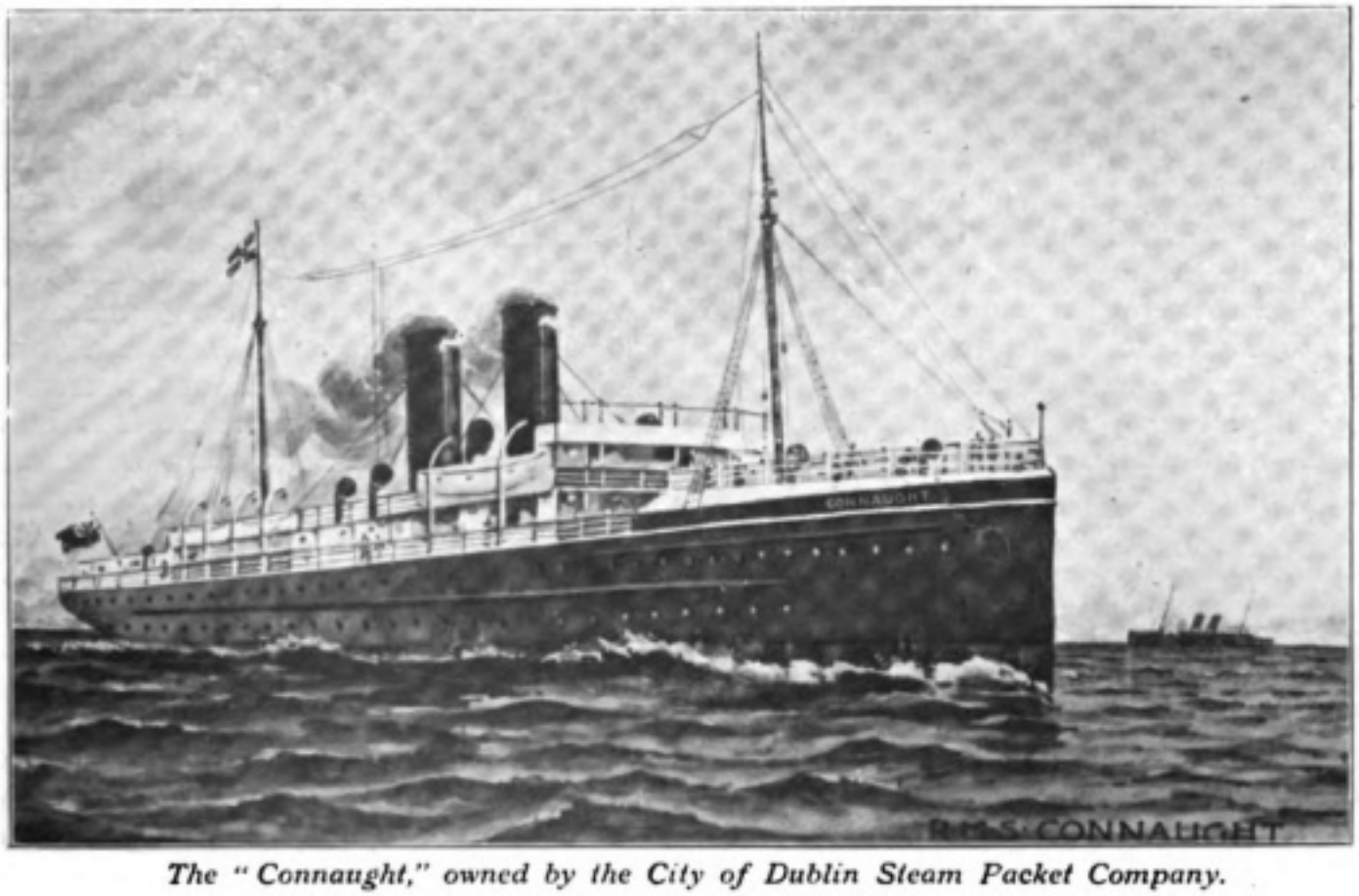
DUTCH EAST INDIES STATIONS.—Rapid progress is being made in the Dutch East Indies with the erection of wireless stations, and these will prove most useful, especially as many steamers trading there are now fitted with wireless. The most powerful station in the Dutch East Indies is at Sabang, an island and coaling station north of Sumatra, with a minimum range of 1,000 miles, which brings it within reach of Colombo on one side and Batavia on the other. Other wireless stations have been installed, and are now working at Batavia, Sitoebondo (East Java), Koepang (the capital of Dutch Timor), and Amboina (Moluccas), while a sixth one is to be erected at Menado (Celebes). Menado is connected by cable with Macassar and Java, and as the stations at Amboina, Koepang, and Sitoebondo are inter-connecting, they will bring the eastern parts of the archipelago in regular wireless communication with other parts of the world. Apart from the above Government stations, the Royal Dutch Oil Company has wireless stations at Balik, Papan, and Samarinda (Borneo). The Royal Packet Company's new steamers, *Tasman* and *Houtman*, will both be fitted with wireless, and this is likewise the case with several of the company's steamers trading in the eastern part of the Indies, so that travellers to Java will practically remain in continuous wireless contact with the rest of the world.

Maritime Wireless Telegraphy

The oldest steamship company in Great Britain and Ireland is the City of Dublin Steam Packet Company, which was established in 1823. Four of its twin-screw mail steamers, the *Ulster*, *Leinster*, *Munster*, and *Connaught*, are employed under contract with His Majesty's Government in carrying the mails between England and Ireland. They are fine vessels, each with a length of something like 370 feet, and a gross tonnage of over 2,600 tons. The engines are twin-screw, and the boilers are capable of developing 9,000 h.p., which gives the vessels a speed of 24 knots. The vessels are flush-decked, and have, besides the usual accommodation for passengers, a splendid reading saloon, a ladies' drawing-room, and a smoking-room. The first-class accommodation is all amidships, but the cabins for the second-class passengers are equally well placed and roomy. Each of the vessels is lighted throughout by electricity, and the fittings are on as lavish a scale as those of the modern liner. Everything that can be thought of has been installed for the convenience of the passengers, and, as an instance of what such convenience includes, mention may be made of the post-office which is installed in each of the ships, with a staff of forty sorters, who have large and commodious offices set apart for their special use. Each of the ships is fitted with the latest type of Marconi installation. This, by the way, calls for a special remark, as by a regrettable oversight the vessels had been omitted from the list of ship stations appearing in the *Year Book of Wireless Telegraphy and Telephony*. Readers who are anxious that their list shall be as complete as possible will do well to make a note of this fact in their volume.

* * *

A dispatch from New York dated July 2nd states that practically all the ships then in port have been equipped with wireless telegraph apparatus in compliance with the Act recently passed by Congress, and which came into effect on July 1st. The new law requires that all freight steamships, foreign and home, touching at American ports, and carrying more than fifty persons in their



The "Connaught," owned by the City of Dublin Steam Packet Company.

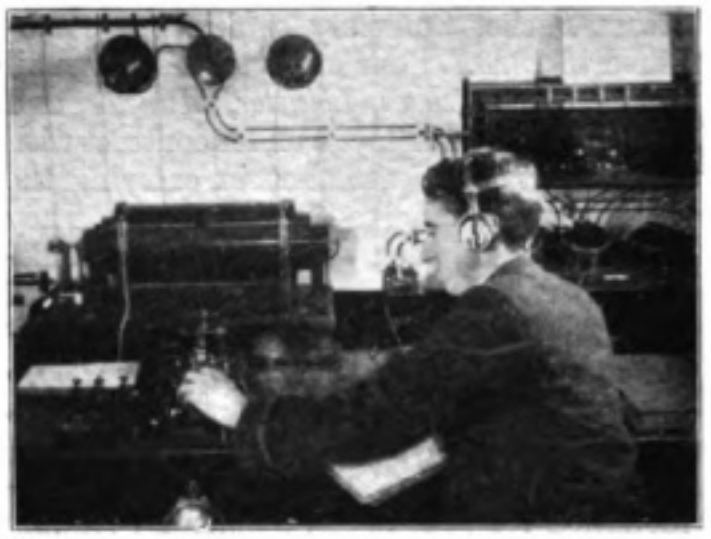
crew, shall be equipped with wireless apparatus. The law also makes it necessary to have two operators on board, so that the wireless apparatus will never be without the service of an operator.

* * *

The Northern Navigation Company of Midland, Ont. (Canada), of which Mr. James Playfair is the President, is one of the most important lines plying on the Great Lakes, being particularly known for its excellent passenger service. On June 2nd the new 6,000 ton flagship of the company's fleet was launched at Port Arthur, and named the *Noronic*. Every modern improvement will be embodied in her design, including a wireless telegraph installation Her dimensions are: length over all 385 ft., moulded breadth 52 feet, and moulded depth 28 ft. 9 in., and there are six decks. The *Noronic* will sail between Sarnia, Sault Ste. Marie, Port Arthur, and Duluth, connecting at Port Arthur and Fort William with the Grand Trunk Railway.

* * *

As an instance of the striking advance in the conditions of British-Australian shipping, it is worthy of mention that the connection of the White Star Line with the Australian trade has been a long and honourable one. Commencing with sailing vessels somewhere back in the sixties, it has, within recent years, been developed by vessels of the largest type in the trade. Within the last twelve years the development has been phenomenal through the introduction of such magnificent vessels as the *Afric*, *Medic*, and *Persic* (12,000 tons), *Runic*, and *Suevic* (12,500 tons), and on July 24th the biggest steamer ever dispatched south of the line was sent by the White Star Line on her maiden voyage to Sydney. This was the *Ceramic*, an 18,500-ton, triple-screw, Harland and Wolff-built steamer, which left Belfast on July 8th for her trial trip. The *Ceramic* is armed, and is the first liner on which firing practice has been actually carried out. The guns are two in number—4.7 quick-firers. They throw a 45-lb. shell a distance of six miles. It is the intention of the White Star Line to mount guns in all their vessels employed in the regular Australian trade. The new liner is of the following dimensions: Length overall, 674 ft. 9 in.; breadth extreme, 69 ft. 5 in.; depth to upper deck, 48 ft.; indicated horse power, 9,000; gross tonnage, 18,481. The *Ceramic* has been built on the latest and most approved principles, with a double bottom extending right fore and aft, and with twelve transverse water-tight bulkheads carried to the upper deck. To describe her spacious accommodation, her



A corner of the Wireless Telegraphy room on the "Ceramic."

artistic decorations or her life-saving appliances would soon exhaust the space at our disposal; therefore we will content ourselves with the statement that she is equipped with a 1½ kw. Marconi station.

* * *

The application of wireless telegraphy to the Mercantile Marine has scarcely ever impressed itself with such force as it did in the Mersey on July 11th, when the King and Queen opened the new Gladstone Dock. The spectacle on which their Majesties looked when they embarked on the *Galatea*, the Dock Board tender, was indeed unparalleled. There were 109 ships in review, which were of a gross tonnage of 225,000, and the two lines made a total length of 10 miles. There was the giant *Mauretania*, ready to sail on the following day; there were other great liners on either side of her, including the s.s. *Ceramic*, which had only arrived in the Mersey that week for her maiden voyage to Australia. The *Empress of Ireland* had her passengers on board, and left for Montreal half an hour after the close of the review. Arriving alongside the *Mauretania*, the King and Queen went on board and inspected the vessel. Their Majesties visited every quarter of the ship; they spent nearly an hour on board, and took tea there.

A Pawn in the Game

(Serial Story)

By BERNARD C. WHITE

CHARACTERS IN THE STORY.

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

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

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

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

CHAPTER V. (*continued*).

"Oh, Miss Gwen, but she was very kind to you. She said, 'Miss Thrale mixes in the highest society, you know; quite the highest. I understand, and from a very good source, that a nobleman has offered her his hand and that she has refused. Miss Thrale has rather peculiar ideas, not peculiar but just up to date, though a little *difficile*, you know. But I don't understand modern times. Girls are all skimpy skirts and thin ankles, they swing walking sticks, and they talk like men. Miss Thrale talks like a man sometimes—but there! What her mother would say, poor dear, if she saw her now, I can't think! Mrs. Thrale was a great lady, and she carried herself like a great lady. I never saw Mrs. Thrale in anything but a grey silk; her dresses always swept along the ground, and they took yards ot stuff. She gave me one once which she said was no use to her. It made me a beautiful best dress for many years, when I was slimmer. It was the best I ever had, and after I had finished with it as a dress it made me two nice silk petticoats. But Miss Thrale's dresses! why there's hardly enough stuff in them to make a duster. But she is a dear young lady, so kind, so pretty; she always asks me after my sciatica, and sometimes she brings me roses from the Hall. Still, I can *not* make out why she should throw herself away on that young man at the Vicarage.'——But there, Miss Thrale," finally remarked Dupont, "you don't wish to hear all the *bavardage* of an old woman. I will refrain from repeating the comments of so silly an old thing on your personal affairs."

"No, Mr. Dupont, don't stop, please. Do tell me. What did she say about Charles? I know the villagers think him very queer, and they think me queerer still to be engaged to him. But all that is unofficial, whereas old Mrs. Bundross is the mouthpiece of such important local associations as the Mothers' Meeting. I don't go to Mothers' Meetings, and if I did I shouldn't get at the opinion which prevails there, so I'm simply dying to know what she said about Charles."

"Well, Miss Thrale, here we are at the 'Coventry,' and we must go out. But afterwards I will tell you if you want to know."

"Oh, what a pity! The conversation was so interesting. I wish the 'Coventry' were ten minutes further on."

"Never mind, we will continue the *histoire intime* after dinner. It will go nicely with the dessert. But I hope I am not com-

promising Mrs. Bundross in your eyes. I can assure you she was very nice and very confidential, and I feel myself a little of the *grossier* to give away her confidences; but, after all, what she said to me I expect she do tell to everybody, so I think there shall be no harm done."

"No, no, of course not. It does not matter a straw what the dear old thing thinks or what she says. It only amuses me. I am very curious to hear what she thinks of Charles."

"Well, you see, Miss Thrale, I promise you to do that, but we will eat for our health and drink to your health first."

By this time the cabmen had been duly paid, and the couplets of the party reunited. They made their way, an animated group, into the restaurant, and under the leadership of the Bohemian supped *à la Bohème*. The toast of the guest of the evening was duly proposed and drunk with much applause, and the conversation, which at first was general, became more and more intimate, till at last the party divided itself into two groups, the Bohemian and his "*amies*" talking art and Fabianism in excited undertones, and Herr Beulner, Dupont, and Gwen making another little group at the head of the table. A moment when the conversation lapsed was taken advantage of by Dupont to continue the dissertation on Mrs. Bundross's views.

"Ah, I said I promise to tell you Mrs. Bundross on Mr. Summers. Here it is," and he entered into a brilliant exposition of his subject, so brilliant that Gwen and Herr Beulner were convulsed with laughter. It made the oaken panelled room gay with merriment, and many were the curious glances thrown at this odd party by the diners at other tables. The talkers themselves were oblivious to all this. They were too much engrossed in their subject.

"Oh, Miss Thrale, the old grue do tell the most curious tales about the workshop of Mr. Summers. She do say he in league with the Devil. That he makes a wonderful piano which he plays on for hours and hours."

"Oh, how funny!" ejaculated Gwen. "Fancy Charles playing on the piano for hours and hours. I can as soon see him making mince pies. He has no more music in him than an owl. You should sit behind him in church and hear him sing hymns and you would soon realise how far off the mark poor Mrs. Bundross is. But I expect she has heard tales of Charles's invention. He's wonderfully clever at Wireless, and has rigged up a special machine of his own, though I did not know it was talked about in the village. How do people find these things out? They must spend all their time in watching the movements of other folks."

"Ah, wireless, that is it, Miss Thrale. Mrs. Bundross say that he do take up the new invention, and that he has rigged himself up a telegraph pole which is the most absurd thing you ever saw. She says there are two masts and some queer bits of wire which don't do nothing, and she thinks that he really intended to make a telegraph line and found he could not do it, so left it off in disgust."

"Oh, that's it. Those are the aerials she is thinking of. They do look rather stupid to people who don't know anything about it. But Mrs. Bundross is all wrong about not succeeding. Charles can get messages from Poldhu, and on one occasion I know he got news from Constantinople. But he said that that was a "freak" I don't know what it all means, but I think it shows he knows his business."

"Oh, that is really interesting, Miss Thrale, for our friend Mr. Beulner here *s'y connait*. Of course, he studied it in Germany."

"Yes, Miss Thrale," remarked Beulner, "but I was not satisfied with it, and as I had the opportunity of coming to England with Dupont, I came with the idea of learning something of Marconi. Of course, I have read up all about it, and I have now fitted up a little place at Hampstead, but my station is not very powerful, still I think it would reach to Sotheby. I suppose you could not get Mr. Summers to communicate with me It would be such fun. It would give me practice, and I would learn more after a conversation with him than I could by simply receiving stray messages."

"Well," said Gwen, "I'm sure Charles would be delighted to communicate with you. I will tell him all about it, and perhaps he will."

"But then, Miss Thrale, I'm not quite sure of the new system, and although I know much about it in theory, in practice I am not so certain. I wonder if he would come to my

place and see my apparatus, or, better still —but I don't know whether I am asking too much—if I were to see his! I could rig mine up on the same plan, and that would make things much more simple."

"Well, I do not see why it shouldn't be done. I am sure Charles would be delighted to help you. Why don't you come down and see us one day? You know the neighbourhood. Say one Saturday afternoon, and you could go over things together."

"And then," chimed in Dupont, "perhaps one day Mr. Summers would do us the kindness to make the exposition of his airship. Oh, yes, Miss Thrale, we know all about it, because we saw it ourselves. We saw it sail across the heavens, and Mrs. Bundross do tell us that it was Mr. Summers' airship. Oh, it was magnificent. It was *tout d fait un objet féerique*. I am dead with envy to see the beautiful airship again."

"Yes, it's a splendid idea! We'll get him to send it off again. Charles loves to show things to people who are really interested, and there are so few of those that any who come his way are welcome. You will be doubly so, for Herr Beulner can tell him all about wireless in Germany; I am sure he would like to know more about the ins and outs of it. So why not fix up for Saturday week? I don't think he's busy then, and the evenings are still long enough to practise in the open. I will tell him you are coming."

"Oh, Miss Thrale, that is very gracious of you; you have already been kind. Now you add to your kindness. We will not forget, and we will be there as you say; but now we have talked long enough. We have tired you, I am afraid, and unless we get you a taxi now you will tire your friends, for it is nearly half-past eleven, and they will be thinking you lost in London, or killed by the motor 'bus. *Garçon, fais venir un taxi.*"

With that the party made preparations to go. Courtesies were interchanged, the invitation and acceptance of Gwen's appointment were renewed. Dupont accompanied her to the taxi, and, after directions had been given to the driver, bid her farewell with a final wave of the hand and a magnificent bow. Together he and Beulner watched the taxi disappear, then Dupont turned to his companion and put his hand on his arm.

"*Voila! nous sommes y arrivés.* Did I not say to you, *mon ami, cherchez la femme.* Haroun al Raschid was no fool when he say that, and I am no fool because I follow the suggestion of Haroun al Raschid."

Beulner emitted a sound which was something between a snort of cynicism and a grunt of satisfaction.

"Ach," he said. "Don't be so much of an optimist. There is many a slip 'twixt cup and lip. By a stroke of luck we have found out the right bait to use for our fish, but I think it is a shy fish and difficult to be caught, and don't forget, too, the hook is wireless, so that the fish, even if we tickle his gills, may escape us."

He laughed at his joke, and Dupont joined in. The Frenchman was much too pleased with his evening's work to pay any great attention to gloomy forebodings.

CHAPTER VI.

IT IS THE UNEXPECTED THAT HAPPENS.

But circumstances ruled otherwise. First of all the airship was the subject of a mishap. It took place in this way. Gwen, on returning to Sotheby the evening following the lecture, paid a visit to Charles in his den, and told him the upshot of her conversation with Dupont and Beulner. To her surprise, her usually placid and benevolent *fiancé* demurred. He said his airship was not ready to show to anybody, and he half hinted that Gwen was abusing her privileges as confidante in giving information to such comparative strangers as these foreigners.

"You know," he said at the conclusion of a very definite speech, delivered while he sat on the edge of the table with his hands thrust in his trousers pockets, "you yourself said you didn't like them, and yet there you are—as soon as you get talking you lose your judgment, and instead of keeping to general topics you must needs discuss my doings with them. That's not what I call the game. I have worked *sub rosa* so far, and now that the thing's nearly completed I am not going to have it blabbed about all over the place. You've taken too much upon yourself this time, my young lady, that's the truth. I shan't . . . ."

"Oh, Charles," Gwen interposed, "do stop talking nonsense; what do you mean by 'working in the dark,' when everybody could see your airship if they wanted to?

I have not let out any secrets, because you have not told me any. In fact, I think it's a shame. I'm supposed to be your pal, but you don't really tell me anything. You just put me off with some silly 'make-believe,' and all the real interesting part of your work you keep to yourself. Perhaps if I knew *more* about it I should know whether I was blabbing, as you call it, or not. But really, Charles, I didn't tell them anything—they seemed to know it all before; all the village knows it, from what M. Dupont said. Still, what's more to the point—why do you keep everything so dark as though you were afraid to trust me? *That's* not sport, if you like."

Charles was about to defend himself of the soft impeachment, but he was not allowed to.

"Oh, yes, now you'll say I cannot understand. But I *can*, I know I can. And *how* can you tell? You haven't tried to see whether I can or not."

"But Gwen, I've promised to show you."

"Yes, yes, and you'll take a month of Sundays thinking over your promise, and then you'll forget all about it, and I'm to think myself happy to be allowed to know so much."

"But if you did learn to steer the airship, it wouldn't be any good to you."

"How are you to tell—how's anyone to tell, I should like to know? Well, all I can say is, it's not much fun making love to you, if you spend all your time in this smoky little hole, and I'm to be left outside. I don't think I ask much. Many girls would be expecting to be taken to parties and all that sort of thing, but all I have to look forward to is a mild country walk when some part of that miserable little piece of apparatus has been completed."

"No, I own it's rough luck, and I'm beastly sorry I'm such a pig; but you took me unconditionally, you know, and I think I told you what it would be like. Never mind, dearie, I'll try to make amends. You shall begin this game, if that will please you, but it'll be an awfully hard grind, you know. No end of work, and it will be a long time before you can do anything or be any good at it. Only remember, you must make this promise. You are *not* to tell *any* of your friends what I am doing, and as for those chaps Dupont and Beulner, you have got to keep them off somehow."

"There, that's better; you are a dear old thing to give way like that. I know you will be fidgetted to death teaching me, but I think when it's done you will find it much more interesting to have someone to talk the thing over with, and it will give me so much to think of in this dead-and-alive ditch."

"But how about the promise?"

"Oh, I can give that right enough, but you don't expect me to go and tell Dupont that the whole thing about your knowing wireless and airships is a lie, because that wouldn't wash; and as I promised them to see you, I think you will really have to give some sort of show just to make my word good. But I can easily put them off for a bit. All the rest I can honestly promise, every little bit—and you are a dear, dear Charles! I'll make it up to you by learning ever so quickly, and then you'll be glad you have got an apprentice."

"An apprentice who would coax the heart out of a stone, that's what it is, and I'm not a stone, and I'm not an old fogey, so I'm practically bound to give you lessons. But what's the fee?"

What the fee was doesn't matter. It was paid down promptly to the satisfaction of both parties in the compact. Then Charles, raising a somewhat dishevelled head, asked when the first lesson was to be. There was no time like the present. Both agreed, so it was given forthwith.

Now, preliminary lessons are not interesting. They are all facts and figures and axioms and miserable little details that cannot be understood in a hurry. Everything seems so pointless, and none of the practical part to which such knowledge leads is apparent; Charles was therefore anxious to make his teaching as interesting as possible, and so he prepared the airship for a trial spin, thereby hoping to demonstrate certain laws of motion. All went well while he manipulated the machine, but towards the end of the lesson he gave the apparatus into the hands of his pupil in order that she might experiment for herself. Of course, he looked over her, and directed her as much as he could; but the evening was falling, the keyboard at which they were working was difficult to see, and moreover the gloaming is not the time to choose for strictly scientific work, especially when your

fiancé is leaning over the table frowning at the black and white keys with the nape of her neck so provokingly attractive above the soft ruffles of her collar. What was to be expected happened, and its immediate outcome was the unexpected. There was a little shriek. The keyboard was deserted, the airship was allowed to go its own giddy way, and a sudden vertigo led it to make a brilliant dash for the shed at the bottom of the garden. Scarcely had the shriek and the accompanying laughter of a throaty tenor voice died away before there was a dull thud and the noise of grating steel. Then was the laughter changed to mourning.

"Oh!" from Gwen, and "Damn!" from Charles, was all that was said at the moment, but the silence that followed was—to use an Americanism—thick. It held such a deal of concentrated mental energy that carbon dioxide would be light compared with it. Immediately followed a hurried movement to the scene of the disaster, and what a sight was before the perpetrators of the accident! There on the gravel path by the side of the shed lay the poor airship, its silken envelope deflated and torn, and its shining wires twisted beyond recognition. It looked piteously helpless in its mangled condition, a very mockery of its former glittering pride. Together, would-be professor and pupil took up the remnants and brought them to the table in the den. But it was evident that the damage could not easily be mended. Weeks of trouble would have to be spent before the model could resume its former shape. Summers was not a little vexed at the catastrophe. Here, in one ill-advised moment, he had brought the labour of many months, even years, to nought. Just, too, when he had hoped he was near achieving something great, something more than mere proficience in guiding a toy. All this was knocked on the head. He would practically have to start all over again, and there was no one to help him. Mechanically he picked up the twisted steel bands, and smoothed them out, laying them in a little pile on one side of the table. Gwen watched him do this, with something like remorse tugging at her heart. Why had she interfered in his work? It had all come about through her persistence. She felt herself a very mean little cad, although she knew she was not actually to blame for the disaster. But her dominant sentiment was connected more personally with Charles. She understood exactly how he was feeling. She knew what it was like to have finished a painting, and then to have it spoilt by the varnish; so she quietly tip-toed up behind Charles and gave him a soft consolatory kiss, and squeezed his hand. Immediately he turned round.

"Oh, my dear, it's got to be done all over again."

Then he seemed to shake off his despondency.

"Anyhow," he added, "this settles the question of showing the thing off to Dupont and Beulner. The thing's so absolutely dished that even if the King of England wanted to see it he'd have to wait. Well, it's no good crying over spilt milk. Let's come and get some supper."

That night Gwen wrote to her good friends making all necessary excuses for the postponement of the event. She explained that the thing could not be in working order again for several months, and she carefully worded the letter so that her recipients should have no grounds for construing therefrom any definite invitation for a demonstration in the future.

Dupont, when he got this letter, nearly had delirium. He went up to the sleepy Beulner and nearly shook his head off as he expatiated on the contretemps. "Oh, how this is a *débâcle! Ah, Mon Dieu! Mais il me fait ronger les ongles.*" He was much too excited to talk English, but poured out volumes of the best French known to Montmartre—and very expressive it was! Beulner grunted. He was not so deeply interested as his companion, and his view of the question was that it gave him a little more time in England, and that he liked England.

Whatever else the mishap to the toy may have resulted in, it caused Dupont to write numerous letters to Berlin; not only letters, but telegrams sometimes, and often he would appear greatly worried, even to distraction. There were many causes for such perturbation. Presumably the airship was the chiefest, for hardly a day passed without he made some mention of it to his friend.

But there was another, in the political situation of the moment. Serious friction was reported in the relationships between England and Germany.

(*To be continued.*)

Answers to Correspondents

By OUR IRRESPONSIBLE EXPERT.

EXPERIMENTER (Grantham).—A quenched spark is a piece of spark squashed flat between two circular brass plates.

* * *

ENTHUSIAST (Park Lane).—We are returning your Postal Order, as we are sorry that we cannot at the moment supply Amateur Installations larger than 2,000 kilowatt. Try Samleigh's.

* * *

INQUIRER (Clapham).—No, continuous waves are not used for ship installations, for the obvious reason that undamped waves only get a few feet off the aerial before they encounter damp waves, which completely spoil the effect.

* * *

PRACTICUS (Southampton).—You are mistaken in thinking there is no difference between "Aerial" and "Antenna." "Aerial" is the term used in ordinary business, and "Antenna" when operators are talking to passengers.

* * *

NEW HAND (Glasgow).—We are interested to hear that on your last ship, using a five-inch plain aerial spark, you were able to jamb a ship fifty miles away. The twenty-three other operators who were held up on the particular occasion are waiting round the Head Office prepared to jamb you at a much shorter distance.

* * *

STUDENT (Edinburgh).—Logarithmic decrement is a combination of Logarithms and Decrement. An explanation of logarithms will be found in any good book on logarithms, and an explanation of decrement in any good book on decrement. We hope this clears away your difficulty.

* * *

APPLICANT (Tooting).—Yes, applicants have to pass rather severe examinations in sending, receiving, auction bridge and dancing before joining the Operating Staff. In some cases, if the examiners think his other knowledge is satisfactory, the applicant may take poker as an alternative to auction bridge, but in no case is a knowledge of Wheatstone bridge any advantage.

* * *

MUSICIAN (Bayreuth).—The music of "God Save the King," which you recently heard in your receiver, was caused by a careless workman at our Chelmsford works attaching a gramophone record to a five-kilowatt set instead of the usual disc discharger. Question two.—Yes, tuning the aerial to the antenna is covered by the Marconi tuning patent Nr. 7777777 of 1777.

* * *

AMATEUR (Manchester).—We are surprised to hear that you have failed to get a good earth by grounding your aerial in a flower pot. We can only suggest that you have the earth in the pot analysed and compared with the lists of Specific Conductivities to be found in the Manuals of Fleming, Erskine Murray, etc. On the other hand, your aerials may be damaged by wireworms. In answer to your second query, yes, it is rather dear at 28s., but then, you see, nobody who has made a trip to sea in charge of a wireless installation ever has the courage to write a book on Wireless Theory; so you will have to put up with what you can get. Question three. To make a good umbrella aerial, stick an old umbrella in a chimney pot and bring the lead down the flue.

* * *

NOTE.—*A number of other replies have been very avoidably held over.*—ED.

"One dot more or less does not often alter the complexion of things, but an extreme example is 'Pop Hearts' for '606 Pearl Street.' It is stated that the operator who performed this feat was in love."—*Telegraph & Telephone Age.*

"Extract from an Official Report:—'Mr. —— has nothing to complain of. It is true he lives close to the office, but he overlooks the fact that we deliver telegrams *four miles in diameter*.' By, wireless will have to be cheapened if it is to carry telegrams of these dimensions. It may even be necessary to institute a supplementary service, aviation, for instance."—*St. Martin's Le Grand.*

Contract News

Orders have been received from the Greek Government to forward two Marconi landing stations and one automobile station for the use of the Ministry of Marine at Athens.

* * *

The North-Eastern Schools of Wireless Telegraphy have ordered a Marconi 1½-kw. and emergency set, which they are having installed for instructional purposes.

* * *

The Brazilian Government have given further orders to the Marconi Co. for a 5-kw. and emergency set, which is to be shipped out immediately to Rio de Janiero.

The following vessels have been equipped with Marconi Apparatus during the past month.

Ship.	Owners.	Call Letters.	Apparatus.	Remarks.
Katoomba	McIlwraith & McEacharn ..	VKM	1½ kw. and emergency	—
Isis	P. & O. Steam Navigation Co.	GAP	,,	Passenger vessels sailing between Brindisi and Egypt.
Osiris	,, ,, ,,	GAQ	,,	
Mimiro	Tyser Line	MKH	,,	These vessels go eastward to Australia and New Zealand, returning through the South Atlantic.
Whakarua	,, ,, ...	GBZ	,,	
Sardinian	Allan Line	MDN	,,	Passenger vessels between Canada and Glasgow (refitted).
Hesperian	,, ,, ...	MSN	,,	
Kingstonian	Leyland Line.	MHM	,,	Trading between Liverpool and Boston, chiefly engaged in cargo transport, but with accommodation for passengers.
Indian	,, ,, ...	MHB	,,	
Columbian	,, ,, ...	MNV	,,	
Montcalm	C.P. Railway	MLZ	,,	Passenger vessel between Canada and Avonmouth (refitted).
Empress of Britain ..	,, ,, ...	MPB	,,	Mail vessel between Liverpool and Canada (refitted).
Belgic	White Star Line	MYD	,,	Passenger between Liverpool and Australia (refitted).
Teutonic	,, ,, ...	MTC	,,	Passenger between Liverpool, Quebec, and Montreal (refitted).
Mashobra	British India S.N. Co. ..	GMS	,,	—
Andania	Cunard Line	GAH	,,	Passenger vessel sailing between Southampton and Montreal.
Bellaventure	Harvey & Co.	VOM	,,	Cruising in Newfoundland Waters.
Bonaventure	,, ,, ...	VOO	,,	Hitherto engaged in seal fisheries.
King Orry	Isle of Man S.P. Co.	MPE	,,	This fleet of mail and passenger boats carries on a regular service between the Isle of Man and Liverpool.
Ben-My-Chree ..	,, ,, ,, ...	MBQ	,,	
Viking	,, ,, ,, ...	MVQ	,,	
Empress Queen ..	,, ,, ,, ...	MEQ	,,	
Huntsman	T. & J. Harrison	GLB	,,	—
Ingoma	,, ,, ...	GDV	,,	South African Trade.
Crown Point	Furness, Withy & Co. ..	GHM	,,	Engaged in North Atlantic service.
Rewa	The Admiralty	MQB	,,	
Rohilla	,, ,, ...	MQA	,,	Engaged in Admiralty transport service.
Dongola	,, ,, ...	MNH	,,	
Plassy	,, ,, ...	MNJ	,,	
Templemore	Johnson Line	MBY	,,	North Atlantic Service (Cargo).
La Marguerite ..	Liverpool & N. Wales S.P. Co.	GJU	,,	Passenger service, Liverpool and Llandudno.
Narragansett	Anglo-American Oil Co. ..	MEC	½ kw. and emergency	Oil transport.
Katuna	Bucknall S.S. Lines	GEH	,,	—
Kathlamba ..	,, ,, ...		,,	—
City of Baroda ..	...nd Line	GPC	,,	Part of large contract to fit these passenger vessels sailing between Liverpool, Bombay, and Karachi.
Paris	London, Brighton & S.C. Rly.	GLC	,,	Newhaven and Dieppe Service.
Den of Glamis ..	C. Barrie & Son	GBM	,,	General transport.
Exmouth II. ..	Metropolitan Asylums Board	—	,,	Training Vessel.

INSTRUCTION IN WIRELESS TELEGRAPHY

Generation of Electric Waves and Construction of the Induction Coil

Fourth Article.

[The first article of this series appeared in the May number of THE WIRELESS WORLD, in which number there also appeared particulars of the examinations to be held when the course is completed, and full details of the prizes offered by the Marconi Company to successful candidates. A further announcement appears on page 337 of this issue.]

THE methods employed for causing an aerial to oscillate, and thus radiate electric waves, fall under two headings—viz., **Direct Excitation** and **Indirect Excitation.**

In this article we shall deal with only the first of these methods.

29. **Direct Excitation of the Aerial.**—An aerial connected to earth, as shown in Fig. 1,

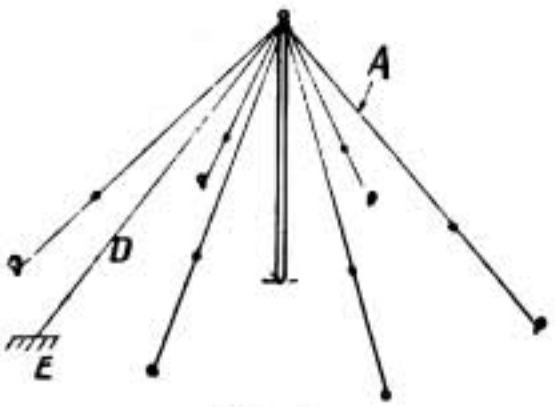


Fig. 1.

is electrically the same as a condenser with its two plates or "sides" connected by a conductor, as shown in Fig. 2. The aerial wires, A, Fig. 1, corresponding to one "side" of the condenser, A, Fig. 2; the earth, E, Fig. 1, corresponding to the other "side" of the condenser, B, Fig. 2, and the connecting wires or "down-leads," C, Fig. 1, corresponding to the short circuiting lead, C, Fig. 2.

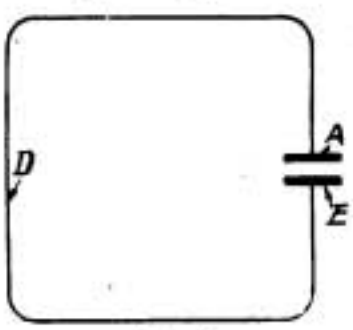


Fig. 2.

Now it has already been explained (paragraph 26) that if a condenser be charged up and then short circuited, the charge of electricity will not immediately come to rest, but the condenser will over-discharge itself, and the current will oscillate backwards and forwards until, owing to the resistance of the path of discharge, the charge of electricity comes to rest.

In order to cause a circuit, consisting of a condenser short-circuited by a wire to oscillate, it is, therefore, only necessary to give the condenser an initial charge of electricity, and to do this we must apply a "voltage," or pressure, of electricity across it.

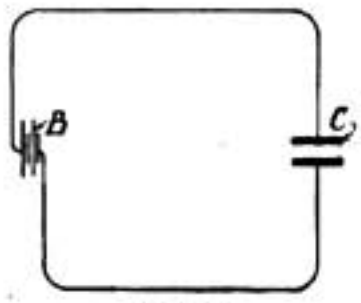


Fig. 3.

This can be done by connecting a battery across the condenser, as shown in Fig. 3, which will charge the condenser up to the same voltage as the battery; but in applying a voltage in this way to a condenser, whose two "sides" are connected together to form an oscillating circuit, as shown in Fig. 2, the electricity, instead of charging up the condenser as desired, will simply flow through the short-circuiting wire, C.

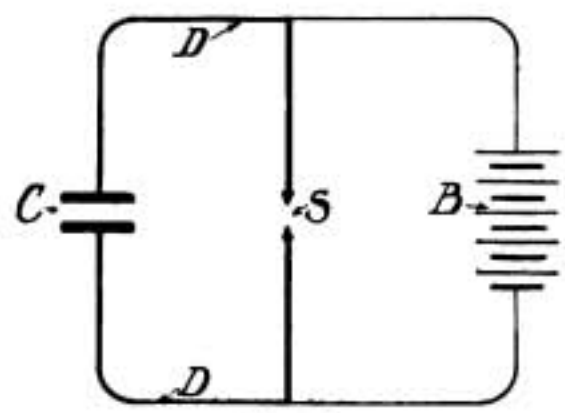


Fig. 4.

It is, therefore, obvious that during the time the condenser is being charged, we must break the circuit through the short-circuiting wire, as shown in Fig. 4, at the point marked S.

This, however, destroys the oscillating circuit, as it prevents the discharge of the condenser through the circuit, C, which discharge is required to produce the oscillations.

In order, therefore, to get the conditions right, both for charging up the condenser and for discharging it through the circuit, C, it is necessary to devise some form of mechanism for automatically breaking the discharge circuit and connecting the battery to the condenser at one moment, and then "making" the discharge circuit and "breaking" the battery circuit at the next moment.

This method is not used in practice, as, apart from the fact that it would be somewhat complicated in operation, an additional drawback arises in that a very large battery would be necessary in order to charge the condenser up to a sufficiently high voltage to store up the energy that is required.

It should be here explained that the power in any oscillating circuit depends upon three things:

(1) The capacity of the condenser.

(2) The number of times per second that it is charged and discharged.

(3) The initial voltage to which that condenser is charged.

As already explained (paragraph 28), the capacity of the condenser is limited by the wave-length it is desired to produce.

Further, the number of times per second it can be charged and discharged is limited by other practical considerations, which will be dealt with later, so that the only method we have of increasing the power in the oscillating circuit we are considering is by increasing the voltage applied to the condenser.

As the object of these articles is to explain the working of a small portable station, we will only consider the apparatus that would be used in such a station.

The wave-length would be probably about 150 metres, and the aerial used for such a station would probably consist of about six wires, each wire about 75 feet long, supported at the common end by a mast about 30 feet in height; such an aerial, known as an "umbrella" aerial, is shown in Fig. 5.

The capacity of this aerial would not be more than about ·0005 of a microfarad, and

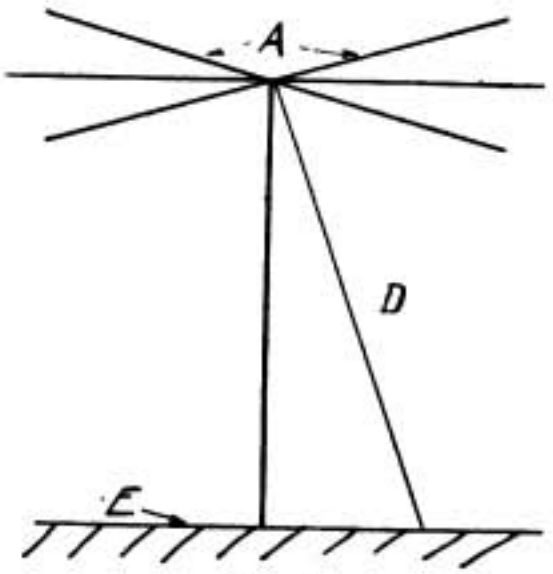


Fig. 5.

assuming that we charge it and discharge it at the rate of 100 times per second, the initial voltage to which it would have to be charged in order to use up 20 watts of power would be about 20,000 volts.

To charge up this condenser to 20,000 volts by the method described in the preceding paragraphs would require a battery of about 1,400 dry cells or 1,000 accumulators, which shows how impracticable this method would be.

Our problem, therefore, becomes how to obtain a voltage of 20,000 volts by some method which will not be either too costly or too elaborate.

30. **How to obtain a voltage of 20,000 volts by means of an induction coil.**—In paragraph 3 we explained briefly the principle of a transformer and induction coil, and we showed that if a current flowed round a piece of soft iron, that piece of iron became a magnet so long as the current was passing round it, but as soon as the current ceased to flow the iron became demagnetised. We also showed how, if another coil of wire were wound round the magnet thus formed, a current of electricity would be induced in this secondary coil.

Now the voltage, or pressure, of the electricity induced in this secondary coil depends upon two things:

(1) The **rate of change** in the number of

magnetic lines of force which pass through the secondary coil.

(2) The **number of turns of wire** with which the secondary coil is wound.

The quicker the rate of change in the number of magnetic lines of force the greater

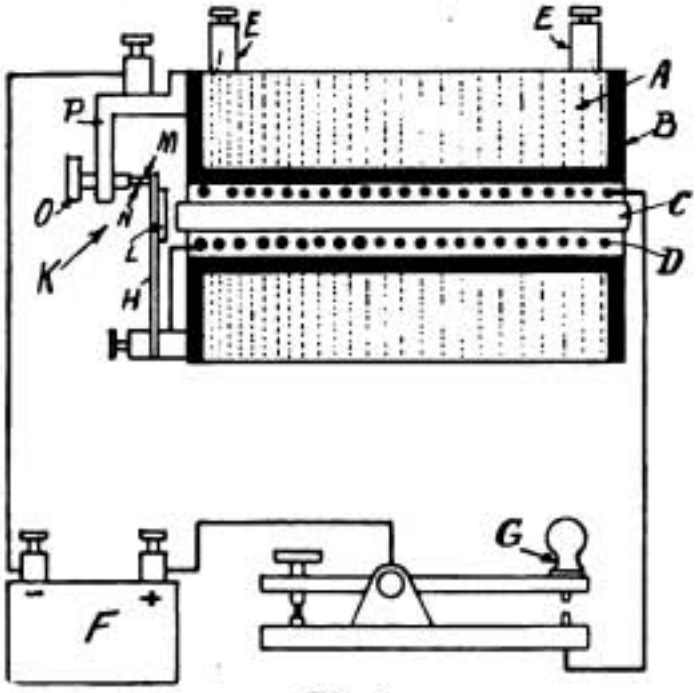


Fig. 6.

the resultant voltage across the secondary coil. Also the greater the number of turns in the secondary coil the greater the resultant voltage across it.

By using a very fine wire in the secondary coil we can wind a very large number of turns in a small space.

31. **Construction of an Induction Coil.**—We may now describe how an induction coil is actually made, and the means by which it can give automatically a continuous stream of high-voltage impulses, or sparks, when a low-voltage battery is applied to its primary terminals.

The mechanical construction is shown in section in Fig. 6, and the electrical connections are shown diagrammatically in Fig. 7.

The secondary coil, A, is wound with about 5,000 turns of fine wire on an ebonite bobbin, B, the bobbin having a hole through the middle sufficiently large to take the primary coil with its iron core, the two ends of the secondary coil are brought one to each of the terminals, E, E, which are called the high-tension terminals of the induction coil.

The iron core, C, is made of a bundle of very soft iron wire, bound together with cotton tape, and round this core is wound the primary winding, D, consisting of about 25 turns of fairly thick wire, through which the current from the primary battery has to pass in order to magetise the iron core. One end of this coil is taken straight to the positive terminal of the battery, F, through the manipulating key, G. The other end of the coil, however, instead of being connected straight to the negative terminal of the battery, F, is connected to the spring arm or trembler blade, H, of the contact breaker, K.

This trembler blade carries on its lower side a small piece of soft iron, L, and on its upper side a platinum contact, M. Another platinum contact, N, is carried on an adjusting screw, O, by a brass bracket, P, in such a way that it comes immediately opposite the contact, M, the spring of the trembler blade being adjusted so that normally the two contacts M and N, are making contact. The brass bracket is connected to the negative side of the battery, F.

The action of the coil can best be followed by referring to the diagram of connections in Fig. 7, the contacts, M and N, being in contact if the arm of the manipulating key, G, is depressed, the electrical circuit through the primary coil is completed and a current will flow from the positive side of the battery, F, through the manipulating key, G, through

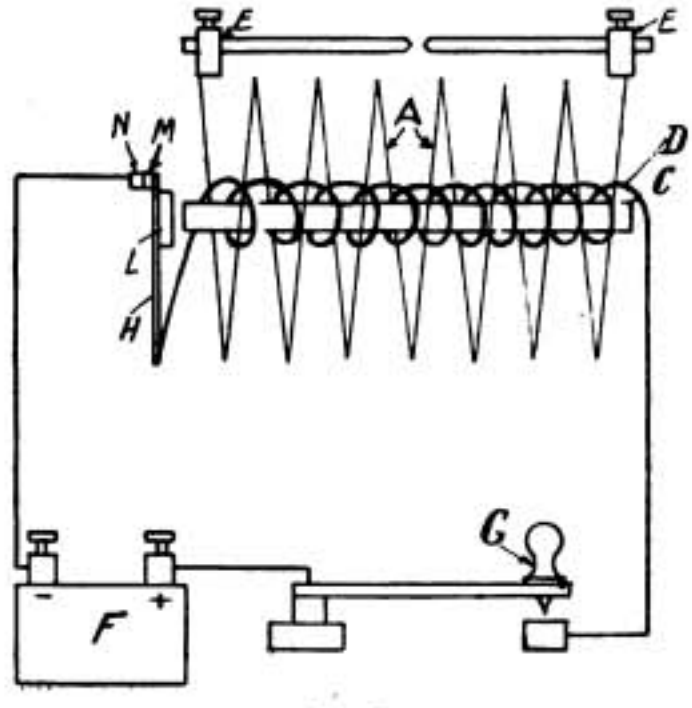


Fig. 7.

the coil, D, through the trembler blade, H, through the contacts, M and N, through the bracket, P, and back to the battery, F.

The effect of the current passing through the coil, D, is to magnetise the iron core, C, and the first effect of this magnetisation is to

induce a voltage across the secondary coil of wire. This high voltage, however, is only a momentary impulse, for it depends, as already stated, upon the rate of change in the number of magnetic lines of force passing through the secondary coil, so that as soon as the iron core is fully magnetised by the primary current, the *change* in the number of magnetic lines ceases, and therefore the voltage across the secondary falls to zero.

If, however, the primary current flowing round the iron is interrupted, the iron core becomes demagnetised, and there is again a rapid change in the number of magnetic lines of force passing through the secondary coil, and we get a second high voltage across the secondary coil.

Now this interruption of the primary circuit is effected automatically by the contact breaker, for as soon as the iron core becomes magnetised it attracts the piece of iron, L, Fig. 7, which, as already explained, is fixed to the trembler blade, carrying the contact, M, thus separating the contact, M, from the contact, N, and interrupting the primary circuit.

As soon as the circuit is thus broken, the iron core, C, ceases to be a magnet, and therefore ceases to attract the piece of iron, L, allows it to fly back to its original position, and the primary circuit is again completed through the contacts, M and N, coming together again.

The same cycle of events repeats itself in rapid succession so long as the manipulating key, G, is kept depressed.

The resulting effect in the secondary coil is, therefore, a corresponding number of high voltage impulses across the coil, one impulse being induced when the magnetism in the iron grows owing to the primary current passing around it, and a second impulse being induced in the opposite direction when the magnetism of the iron collapses owing to the primary current ceasing to pass around it.

As a matter of fact, the magnetism in the iron grows comparatively slowly as compared with the rate at which the magnetism collapses on breaking the circuit, and as the voltage across the secondary coil is proportional to the *rate* of change of magnetic lines of force, we get a very much bigger voltage during the collapse of the magnetism than during the growth of the magnetism : that is to say, we get a higher voltage when the primary circuit is interrupted than when it is completed.

Fig. 8 shows diagrammatically the voltage induced across the secondary of an induction coil. The upper part of the curve shows the voltage impulses due to the making of the primary circuit, and the lower part of the curve showing the voltage impulses due to the breaking of the primary circuit.

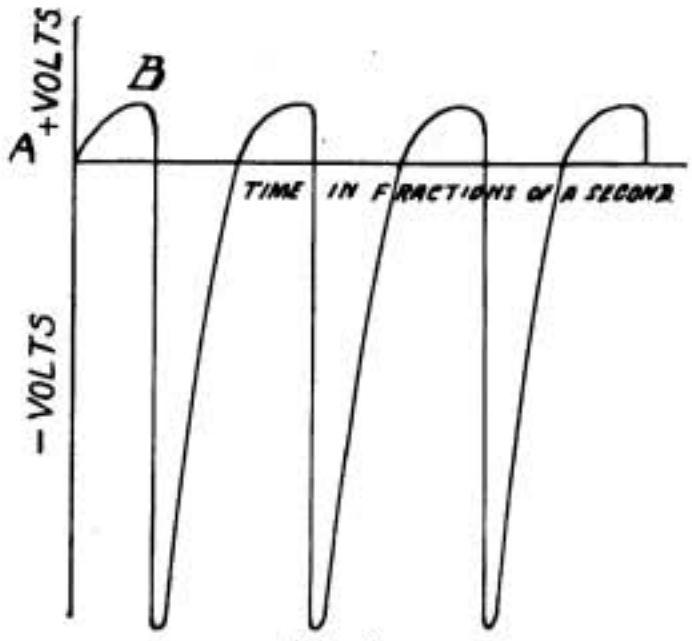


Fig. 8.

From A to B the magnetism in the iron core is growing comparatively slowly, and the voltage induced across the secondary only rises to about 1,000 volts.

At the point B the primary circuit is broken, and a very high voltage, namely, about 20,000 volts, is induced across the secondary in the opposite direction owing to the very rapid collapse of the magnetism in the iron.

32. **Application of a high voltage to an oscillating current.**—Having shown how we can obtain a high voltage by means of an induction coil, we must now study the application of this high voltage to a simple oscillating circuit.

We showed how, in the case of a low voltage battery being used for charging the condenser, it would be necessary to make some form of mechanism which would alternatively make or break the battery circuit or the discharge circuit.

In the case of an impulsive high voltage generator, such as the induction coil just described, such mechanism can be dispensed with by making use of other phenomena observed with high voltage currents.

Air in its normal state is nearly a perfect insulator: that is to say, for all practical purposes it will not conduct electricity. If, however, a sufficiently high voltage is applied across an air space the insulation of the air is broken down, allowing the current to pass through the air space, causing a spark to occur, and the effect is to make the air space momentarily into a conductor.

Further, once the spark is formed it will be maintained by a very small current, even though the voltage across it drops to a very small value, but as soon as the spark ceases the air space returns to its normal state of insulation.

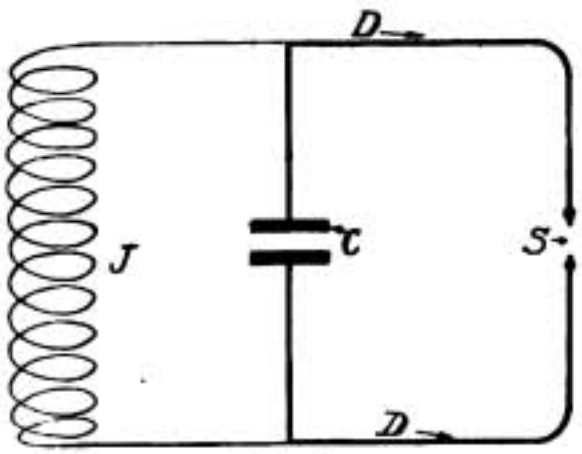


Fig. 9.

By applying this phenomena we can construct an oscillating circuit such that during the time that the condenser is being charged the short circuiting wire is broken by an air gap, but as soon as the voltage across the condenser rises to a certain maximum, depending upon the length of the air gap, the insulation of the air gap is broken down, a spark occurs across it, and for the moment the gap, instead of being an insulator, becomes a conductor and allows the condenser to discharge itself as though the short circuiting wire were not broken.

As already explained, the condenser not only discharges itself, but over-discharges itself, and the current oscillates backwards and forwards a number of times, until, owing to the resistance of the short circuiting wire and the spark gap, the oscillations die down, until the current flowing is not sufficient to maintain the spark. The spark then goes out and the air gap assumes its normal insulating properties until the next high voltage impulse is applied to the condenser, when the same cycle of events takes place.

Such an arrangement is shown diagrammatically in Fig. 9, where A is the secondary of the induction coil, B is the condenser, C the short circuiting wire, and D the spark gap.

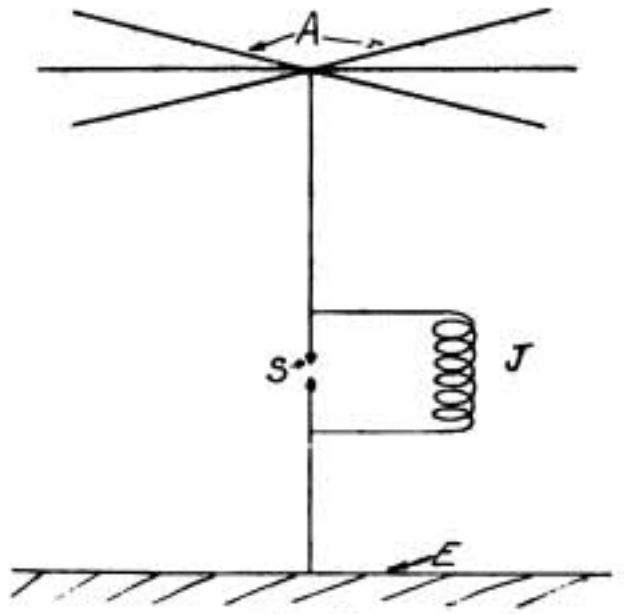


Fig. 10.

Up to the present we have been considering the method of excitation as applied to the closed oscillating circuit shown in Fig. 2, but as this is equivalent to the aerial shown in Fig. 1, it is obvious that this method of direct excitation can be applied equally as well to an aerial or open oscillating circuit. Such an arrangement is shown diagrammatically in Fig. 10, where A is the secondary of the induction coil, B is the aerial or antenna, C the earth, and D the spark gap.

An aerial directly excited in this manner is usually called "plain aerial," and is extremely efficient for obtaining compara-

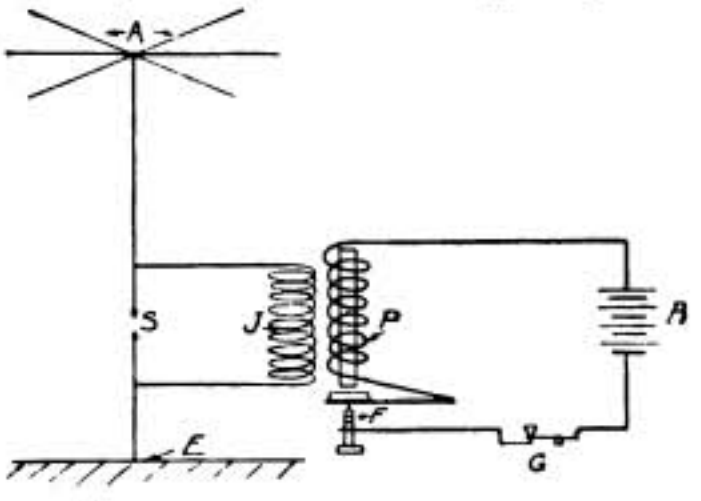


Fig. 11.

tively long range with the use of a small power.

A complete diagram of connections of such

a transmitter is shown in Fig. 11, where A is the aerial, B the earth, C the spark gap, D the secondary of the induction coil, E the primary of the induction coil, F the contact breaker, G the manipulating key, and H the battery.

Our Prize Scheme

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

Those competing for prizes will be divided into three categories :—

1. Members of Territorial units and recognised cadet battalions.

2. Members of Church Lads' Brigade and Boys' Brigade, and recognised cadet corps.

3. Members of the Boy Scouts Association.

The series of articles will be completed probably in March, 1914, when examinations will be held under proper supervision for those in the above categories who wish to offer themselves.

On the result of this examination proficiency certificates will be given by the Marconi Company to those qualifying.

The following prizes will also be awarded :

(1) Territorials and Cadet Battalions.—1st prize, 10 guineas ; 2nd prize, 5 guineas ; 3rd prize, 2 guineas ; and 5 prizes of 1 guinea each.

A complete set of field station wireless telegraph apparatus will be given to that unit to which the first-prize winner belongs.

(2) Boys' Brigade, Church Lads' Brigade, and Cadet Corps.—1st prize, 3 guineas ; 2nd prize, 2 guineas ; 3rd prize, 1 guinea ; and 10 prizes of 10s. 6d. each.

A complete set of field station wireless telegraph apparatus will be given to the unit containing the first-prize winner.

(3) Boy Scouts Association. — 1st prize, 3 guineas ; 2nd prize, 2 guineas ; 3rd prize, 1 guinea ; and 10 prizes of 10s. 6d. each.

A complete set of field station wireless telegraph apparatus will be awarded to the troop to which the first-prize winner belongs, and another set to the troop obtaining the highest percentage number of certificates of proficiency, irrespective of prizes.

Further details as to date and places of examination will be published in course of time in THE WIRELESS WORLD.

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

The Admiralty have placed with Messrs. Samuel Baikie & Son, Kirkwall, the contract for the erection of the buildings for a wireless station at Brough Head, South Ronaldshay, Orkney. This station is part of the work in the Orkney Islands for which a vote of £20,000 is included in this year's Naval Estimates.

The erection of this station will bring "the adjacent islands of Great Britain" a little nearer. The inhabitants of Ronaldshay, where the station is to be erected, only heard of Queen Victoria's death on the day before the funeral. But in St. Kilda it was worse at one time of day, for St. Kilda history records that the ministers on the western island were still praying for George IV. when Queen Victoria came to the throne.

HINTS FOR AMATEURS

A Long Distance Amateur Station

By P. S. X.

THE aerial for long distance receiving is of the ordinary flat ship station type, consisting of four wires of No. 16 gauge single strand copper wire spaced at 4 feet apart, and each wire 240 feet long, each end being insulated by porcelain insulators and also a long stick of round wood impregnated with shellac varnish. The average height of this aerial is 45 feet, one end being 60 feet and the other 30 feet; the high end is connected to the instruments and the wires at the lower end all free.

The aerial for sending and short distance receiving is of the 6-wire cylinder type, hung at an angle of about 25° to the vertical and 40 feet long, the lead-in wires being taken from the lower end to a plug board in the instrument room. The natural wave-lengths of the two aerials are 520 metres and 120 metres respectively. The lead-ins are taken into the cabin through ebonite tubes, thus perfectly insulating them from the earth. Now that the description of the aerials is completed, it will be best to consider the receiving instruments next.

Detectors.—The first and most essential instrument is, of course, the detector. There are five of these in a bank, with shorting switches and connecting switches arranged in the following way. All the cups holding the crystals are all connected together, and under each cup is a brass screw penetrating to the inside of the mounting board; against this screw presses a fairly strong piece of strip spring brass, connected at one end electrically to the main pillar of the detector *B* in Fig. 1. Now in front of the detectors is a long piece of strip brass with a hole drilled into it exactly in front of each detector in such a way that when a long brass plug is inserted it penetrates into the interior of the box and pushes the spring S away from the cup screw C, and thus unshorting the detector; and as the terminals are connected, one to all the detector cups and the other terminal to the brass strip A, it is obvious that it also will connect the pillar B of the detector in circuit; thus we unshort the detector and connect it in circuit in the same operation. And unless the plug is in place in the detector wanted they are all shorted and disconnected.

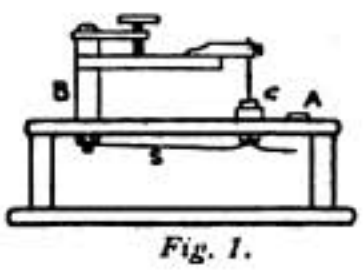


Fig. 1.

The crystals used are two galena and two silicon and one universal stand for testing various crystals. The advantage of having two of each type is that one can be made to work better than the other, and *vice versâ*, thus obtaining a perfect adjustment; if you feel that you have one adjusted you have no compunction in trying to better the other one, and so on. The galena crystal has a very light copper spring of No. 32 gauge wire resting lightly on it, while the silicon has either a rounded blunt brass or steel point resting on it with a very delicate adjustment.

Tuning Instruments.—The tuning arrangements consist of two loose-coupled transformers and one double-slide tuning coil. One of the transformers is for long waves up to 3,000 metres, and the other one tunes only to 800 metres, which is very convenient for the reception of short waves. The primary is varied on both transformers by means of the well-known slider arrangement touching one wire at a time, thus getting more efficient working. The primary wires are of No. 20 gauge copper enamelled wire, and the secondaries are No. 28 enamelled wire taken off in sections to a point switch placed on the end of the secondary coil. The secondary slides in and out of the primary on two brass rods, thus very easily altering the coupling. The diameter of the primary in the large transformer is 4½ inches, and wound 11 inches long; the smaller one is 2½ inches diameter, and wound 4 inches long.

The double slide coil is about 2½ inches diameter, and wound 10 inches long with No. 22 enamelled copper wire.

Variable Condensers.—The variable condensers used with the above transformers are of the rotary plate type, with press-pahn paper used as the dielectric. There are two of these condensers, each of ·002 microfarads capacity. One is placed across the secondary winding of the loose coupler and the other can be placed either across the primary winding for the reception of long waves or in series with the ground for short wave stations. Protractors serve very well as indicators for the amount of condenser inserted.

Telephone Condenser.—There are three different types of telephone condensers, any of which can be used at will for the purpose of experimenting. One is a glass plate tinfoil, fixed capacity, another is a paraffined paper and tinfoil, and the third is a paraffined paper, unit type, varying from ·00002 to ·008 microfarads by means of inserting plugs.

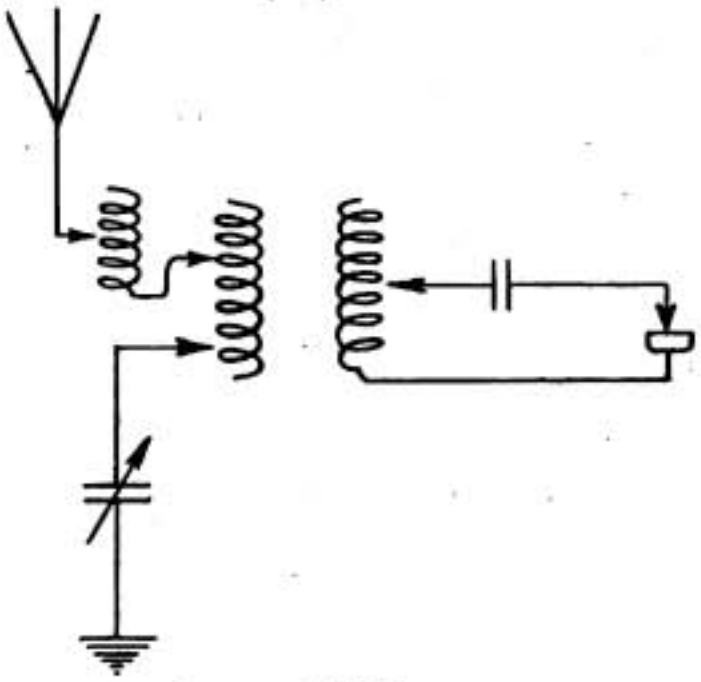


Fig. 2.

Telephones.—These being of a well-known American make and of a total resistance of 2,000 ohms per pair. I have tried many 'phones, and I have never yet found a better pair than the "Murdoch" 'phone, being fairly cheap and very comfortable to wear for long periods of listening in.

Loading Coil.—There is one large loading coil made in two sections, each tuning 3,500 metres; thus, with it in series with the aerial, a very large wave-length may be received. In addition to the instruments, there are several switches and an aerial plug-board for using either aerial on receiving or sending at will, and also for grounding the aerials when not in use. Another switch is provided for changing tuning instruments quickly.

There is also a complete portable set, which includes all the instruments required for efficient reception, viz., loose coupler, one variable condenser, one galena and one silicon detector, fixed telephone condenser, head telephones and a test buzzer, all mounted in a case with a box cover. This set may be seen in the lower left-hand corner in the photograph.

This practically finishes the receiving instruments, and a few words may now be said about their power.

Most stations within a fairly large radius have been received, the farthest being the Marconi station at Las Palmas in the Canary Islands. This has only been received a few times, and, I think, only on freak nights, but the station at Cadiz can be heard working quite clearly every night on 600 metres; and stations such as Soller, Algiers, Pola, Barcelona, Aranjuez, Madrid, Rochefort, Bergen, Crookhaven, etc., are easily received all the time. Paris can be heard easily with the telephones about 4 feet away from the ears, and Cleethorpes with 'phones about 8 feet away. Clifden is quite loud. Seaforth, which is only a few miles away, is, of course, deafening, and can be heard with 'phones 16 feet away quite easily. Ship stations are received about 1,100 miles away, and have occasionally been heard in the Mediterranean, but very seldom, and only when the detectors are working perfectly. The receiving diagram is shown in Fig. 2, and I find this works best for this station.

The Sending Instruments are at present rather roughly made, being only knocked together before new ones are made.

The spark coil is an ordinary motor cycle ignition coil with an extra screw fitted to the trembler so as to give a very high trembler speed, thus giving off a very high note in the

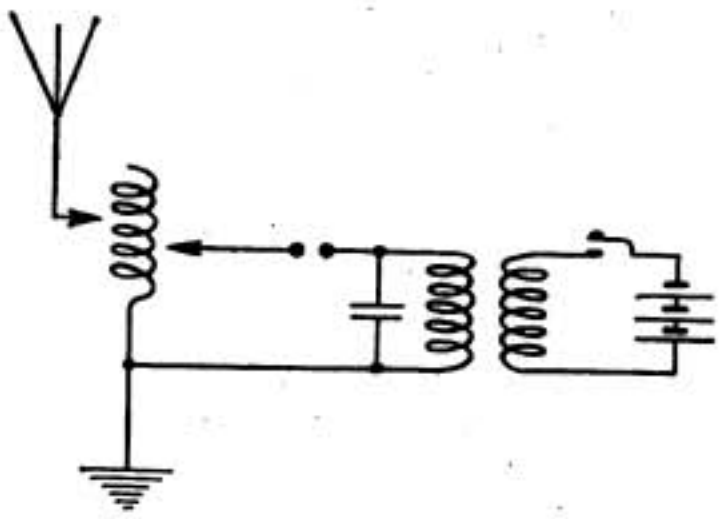


Fig. 3.

spark. As the trembler is high speed, more current can be used, thus giving greater distances; this is generally 8 volts 2 amperes, and occasionally 12 volts 2 amperes.

The Spark Gap is of zinc, turned with a spherical face. The tuning is effected by a

helix of No. 8 copper wire wound on an 8-inch drum. This gives a variation from 50 metres to 235 metres, and gives quite a sharp, definite wave. The condenser is of the Leyden jar type, consisting of two pint jars. The connections used in the transmitting circuit are shown in Fig. 3.

There is a difference of opinion as to the best type of instrument to use. I have tried several different types of crystal and liquid detectors, but I have never found any one better than the galena with a light copper spring resting on it.

There is also much difference of opinion as to the best size wire to wind a loose coupler. This, again, depends on the station, and must be experimented on until the best results are obtainable.

AMATEUR NOTES.

"A Long-Distance Amateur Station."

WE have printed the above article as we received it, and we welcome it as an example of the kind of contribution suitable for our Amateur Section. At the same time, it must not be thought that we approve of everything we publish in such articles; for instance, we feel inclined to protest against the introduction of certain Americanisms, such as Loose-Coupler—awful word—and Loading Coil. Wireless telegraphy has a sufficiently good vocabulary of its own, developed by its English pioneers, to manage without borrowing from other people. An oscillation-transformer is the strictly correct word for the former piece of apparatus, and if the colloquial term, "Jigger," is hardly more elegant etymologically than the "Loose-coupler," it is at any rate sanctified by constant use by the men who have made wireless what it is. And "Tuning Inductance" or "Variable Inductance" is surely a better term than "Loading Coil."

We notice also that P. S. X. carries his Trans-Atlantic tendencies to the point of using an auto-transformer in his transmitter. And, by the way, where is his telephone-receiver in the sketch of the Receiving Circuits? We approve of his plan of using duplicate detectors so that "no compunction may be felt in trying to better the other one" while in the act of reception. On the other hand, we think that if he were to keep a good Carborundum crystal, with a properly-adjusted battery and potentiometer, always going as a "stand-by," this would take the place of the various duplicates.

* * *

London has hitherto been without a wireless club, but at a meeting held on July 5th an association was formed under the title of "The London Wireless Club," having for its object "the bringing together of all amateurs interested in wireless telegraphy and telephony." At that meeting Mr. R. H. Klein, of 18, Crediton Road, West Hampstead, N.W., was elected Hon. Secretary *pro tem.* The next meeting will be held in September, and in the meantime amateurs intending to join the club should communicate with Mr. Klein. We are glad to learn that already sufficient support has been given and promised to ensure the success of the club.

* * *

The Cheshire Radiographic and Scientific Society started with the intention of limiting its membership to 17, as the headquarters (Sale) is a private house. But the movement

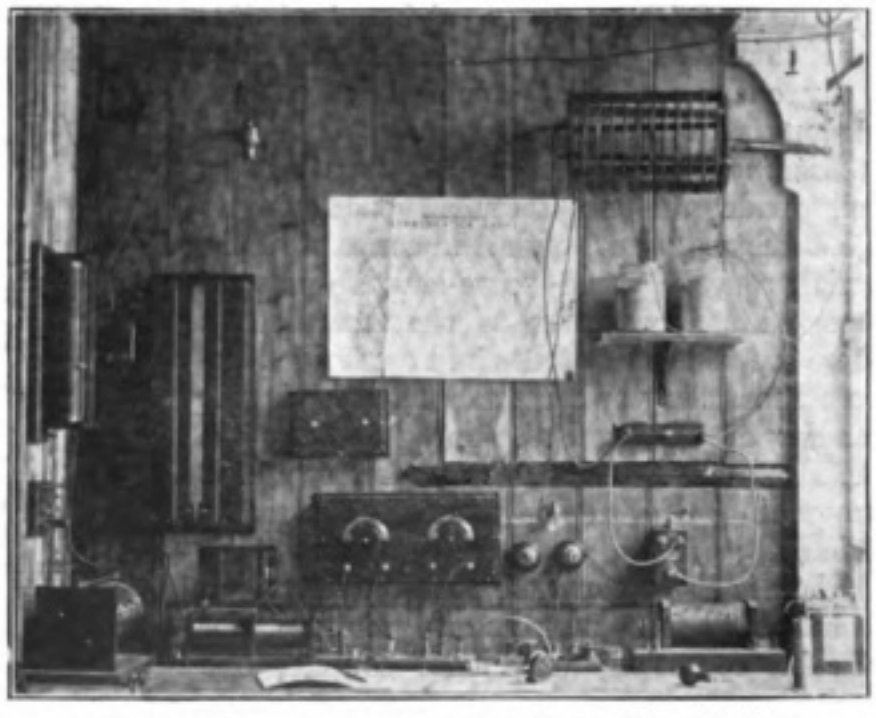


Fig. 4. Receiving Apparatus, P. S. X.'s Station.

has grown rapidly, and so many applications for membership have been received that it is proposed to obtain suitable headquarters, and to accept further members. The society will hold a public exhibition in the autumn.

* * *

The Newcastle and District Amateur Wireless Association was formally established at a meeting held on July 8th. The number of members enrolled is satisfactory for a beginning, but the association is appealing to "*bona fide* experimenters" in the district to join its ranks. A committee has been formed to arrange for a club-room and station, and soon the association hopes to be established in convenient headquarters. A temporary executive has been appointed consisting of Mr. Collard, Chairman; Mr. Mann, Treasurer; and Mr. C. M. Denny, of 24, Eversley Place, Heaton, Newcastle-on-Tyne, Hon. Sec.

* * *

The Northampton and District Wireless Club, which was recently formed, has a membership exceeding forty. A meeting was held at the Y.M.C.A. rooms on July 2nd, over which Mr. F. H. Wright presided. During the course of the discussion, suggestions were made for the establishment of a station and club library, and it is expected that when the headquarters of the club have been definitely decided upon (probably within the next month or two), the installation and library will be a feature. The secretary of the club is Mr. E. H. Coleman, of 90 St. James' Park Road, Northampton, who will be glad to hear from gentlemen in the district interested in wireless telegraphy.

* * *

At a meeting of the Liverpool and District Amateur Wireless Association, held on July 3rd, it was announced that Colonel W. H. Walker, M.P., had consented to become the first President of the Association, and that he had given the club substantial financial assistance. The Hon. Secretary reported the results of some experiments carried out on the River Ribble, at Clithero. The question of efficient safeguards against lightning was discussed, and the opinion was expressed that in the case of a high aerial all metal guy ropes should be earthed through a two-way switch with a wide break, so that in addition to the aerial being short-circuited to earth, the instruments themselves would be entirely disconnected, with a break sufficiently wide to prevent arcing. The receiving circuits should also be provided with a well-designed lightning arrester. A description was given of a compact type of receiving set suitable for portable use, which, though only wound with little wire, is capable of bringing in long wave-lengths. There are no sliding or other contacts with this set.

* * *

Capt. Fuller, R.E., recently lectured on wireless telegraphy in the College Hall, Liverpool. He showed various lantern slides of Army field stations, and not the least interesting part of his lecture was the practical advice offered to amateurs as to arrangement and construction of the apparatus. At the close, the visitors inspected the college installation. This has been fitted up by Mr. Robert W. Sloley, with the help of some of the college boys during their spare time, most of the apparatus having been constructed in the physical laboratory.

* * *

Nearly three hundred amateurs have taken the Government Wireless examinations at the Brooklyn Navy Yard, and have been given licences to operate stations in the vicinity of New York. All such stations have been assigned calls beginning with the figure "2" followed by two letters of the alphabet, thus: "2AB," "2AC," etc. It is unlawful for such stations to use any call other than that named in the Government licence.

* * *

AT the Imperial Scout Rally, which was held in Birmingham in July last, eight troops entered the wireless competition. Communication was maintained throughout the week between two small stations five miles apart. Both stations worked very well considering the difficulties, but it was evident that the boys have still much to learn to enable them to attain proficiency. We would strongly urge upon them to study the course of articles now appearing in THE WIRELESS WORLD.

F

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.

S. B.—*Tuning Coil.*—The tuning coil I am making consists of a cardboard cylinder 12 in. long, 4 in. diameter, with two wooden ends 4½ in. diameter. The cylinder is wound with one layer of No. 26 enamelled wire. The bar for the slide is fixed across the heads. 1. Must the cylinder be left hollow, or is there any iron core put inside? 2. Must the enamel be scraped off where the slide makes contact with wire as it is slid along? I am using the old-fashioned coherer, with an electric bell at the receiving station. 3. Can I use a tuning coil and crystal detector in place of coherer, with just the ordinary bell, without having to buy telephones, as they are expensive?

Answer.—1. Yes; the iron core would be worse than useless. 2. Certainly. 3. No; quite impossible. You must make up your mind to get hold of a telephone of some kind; if you cannot get a high-resistance one, you might use a low-resistance one, and find an old scrapped motor-car ignition coil to use as a telephone transformer. (See countless replies in earlier numbers of the WIRELESS WORLD.)

P. J. P.—*Compass Aerial, etc.*—Will you explain the following: (1) How the "Compass" aerial is slung when the ship carries an ordinary commercial aerial as well? I am familiar with the construction and working particulars of the "compass" aerial and accessories, but do not know how it is kept clear of the commercial aerial. I have an idea it is slung much lower down, from a cable stretched from a point about half-way up the foremast to one of the smoke-stacks. Is this so?

(2) What are the names of the radiophares now working, or under construction, on the French coast? (3) Are there any working or proposed in Great Britain? If so where?

Answer.—(1) The "compass" aerial is suspended either from a stay between masts or from a bracket fixed to one mast. In either case its level is lower than that of the commercial aerial, some 3 or 4 feet spacing being allowed. Sometimes it is supported from a stay sloping between the top of a smoke-stack and a point high up (not half-way down) one mast. (2) Creach de Ushant, Ile de Sein, Havre. (3) No.

T. F. N.—*Receiving Inductance.*—I have constructed an ordinary two-slide receiving inductance, the dimensions of the helix being about 52 cms. long, 13 cms. in diameter, and approximately fifteen turns of wire per centimetre of length of coil, the wire being No. 22 s.w.g. enamelled copper. I wish to calculate the inductance of this. Is the following the correct formula to use, or is it meant for a helix of considerably greater comparative length?

$$L = l\,(\pi D\,N)2$$

Where N = number of turns per cm.
D = diameter in cms.
l = length of helix.

I presume this gives the inductance in centimetres. How can the inductance in henries be calculated? What is the definition of a "henry" in comparison with other electrical units?

Answer.—The formula will be successfully accurate. Yes, it gives the inductance in centimetres. Divide by 10^9 to reduce to henries. When, in a circuit, a current varying at the rate of one ampère per second produces a back E.M.F. of one volt, that circuit is said to have an inductance of one HENRY. The usual unit of inductance in wireless is the MICROHENRY, one-millionth of a henry—and therefore equal to a thousand centimetres.

X. Y. Z.—*Crystal Work.*—I have a small wireless installation, and receive from Nordeutch, Poldhu, Cleethorpes, Paris, etc., etc. Could you please tell me why I get Paris, Bolthead, and many others on one place, and Nordeutch, Cleethorpes, Whitehall, and Poldhu, and most other stations on another. Is it owing to the resistance in the crystal? I have trouble in adjusting my silicon. Is there any other crystal I could use to give me the same results, but easier to adjust. I do not wish to use a battery in my circuit, as I have had enough bother with it. Also, why is it that even when I have the crystal well adjusted, and am waiting for F.L., I get nothing through until I pass a current through the circuit, and then it comes through as usual?

Answer.—You must be more explicit before an answer can be given to your questions. You give no possible clue as to what "one place" may mean. Is it on the aerial tuning inductance, the aerial tuning condenser, the jigger-secondary, the coupling, or some particular place on the crystal? We do not sympathise with you in your remarks about the use of a battery for crystal work. A battery and potentiometer are no trouble if arranged properly; and, as a matter of fact, we are not inclined to recommend any crystal except Carborundum, which requires them. Carborundum is robust, stable, sensitive, and easy of adjustment. Your last question is equally ambiguous. Do you mean that you can get no signals from F.L. to "come through" until you have passed a *momentary* current through the crystal, or that you keep the current flowing? In any case, we are surprised, our experience being that F.L.—at such a short distance, as at a receiving station in England—will come through almost anything; in fact, it is said to have come through a bedstead.

W. S.—*Wave Lengths.*—We are told that the natural wave length of an aerial is approximately 4·5 times its total length. How are the words "total length" to be construed in the case of a T-shaped aerial? I take it that the wave length of this would be the same as that of a L-shaped aerial, *i.e.* the wave length is practically unaltered by the addition of the second arm of the T. If the two free ends of the T are at different heights from the ground, will the fact that the two arms have different capacities mean that sharp tuning for radiation will be rendered impossible? I am using a zincite-pyrites detector and 3,000 ohm 'phones, and obtain signals from F.L., K.N.D., etc., just loud enough to be comfortably readable (with my present aerial). Would it be possible to work a non-polarised relay in conjunction with a Lodge-Muirhead wheel coherer, and obtain satisfactory records?

Answer.—You are right in supposing that the natural wave-length of a T aerial is nearly the same as that of an inverted L aerial formed by removing half the cross of the T. More accurately, it is equal to that of a "twin" inverted L aerial of the same length as the half T. If the free ends of the T are at different heights from the ground, the two arms will certainly have slightly different capacities, but this will largely be compensated for by the fact that

their inductances will be different in the converse proportion, so that the natural wave-lengths of the two branches will not differ by more than very little, if at all. You might make sure of this with a wavemeter, and if there is an appreciable difference, adjust to equality by cutting off a little of one branch. It is certainly important that each should have the some wave-length. If your signals are only "comfortably readable" on a zincite-pyrites receiver, we fear there would be no chance of your getting a Lodge-Muirhead coherer to work a non-polarised relay.

BRUM.—*Continuous Waves.*—I read that a succession of continuous waves would not be audible in the phones of a receiver owing to their inaudibly high frequency, and are therefore split up into groups, and the phone diaphragm oscillates at the frequency of the groups only. How is it that in the latter case the diaphragm no longer oscillates at the wave frequency of each group, and does not give, as I should have expected, a rapid succession of high notes? Does this breaking up also cause each group to have only one effective wave, thus giving one diaphragm oscillation per group?

Answer.—No wireless waves, either continuous or non-continuous, make the telephone diaphragm vibrate to the wave-frequency. In the first place, no diaphragm has yet been made which would vibrate at the rate of fifty thousand per second—the wave-frequency of the slowest waves in use; and, in the second place, the impedance offered by the coils of the telephones to alternating currents of such frequencies would be so great that the current passed would be too small to operate the telephones. This is where the "detector" comes in, performing the function of rectifying the oscillating currents into pulses of uni-directional current. These pulses are used to charge up the telephone capacity, and this discharges through the telephone coils. In the case of non-continuous waves, which are sent out in wave-trains either separated by periods of inactivity (see diagram on p. 167 of the June issue of THE WIRELESS WORLD) or waning to zero and then increasing again, each wave-train is converted by the detector into a group of uni-directional pulses, which add up in the telephone-capacity, and then, discharging through the telephone-coils, produce a single movement of the diaphragm. Thus each wave-train produces a movement of the diaphragm, and the several trains, which form a "dot" or "dash," following each other—in the case of the modern Marconi discharger—at perfectly regular intervals, produce a musical note in the telephone. The truly continuous wave, on the other hand, has no succession of "trains." From the moment the transmitting key is pressed to the moment when it is again raised, the uni-directional pulses delivered by the "detector" remain at a dead level. The telephone diaphragm gives one "click" when the key is pressed, and one more when it is raised, but no note is produced in between. If, however, the continuous waves are split up by some means into regular groups, then, of course, each group produces a movement of the diaphragm, and a musical note results. Thus the "breaking up" does not, as you suggest, cause each group to have only one effective wave, but enables the detector to deliver a large number of effective groups of uni-directional impulses instead of only the one produced by the pressing and raising of the transmitting key.

A. D.—*Atmospheric Troubles.*—On page 180 of the June issue of THE WIRELESS WORLD the statement is made that "signals from atmospheric discharges have no particular wave-length of their own." I have a receiving station here (Glasgow), in which I employ a tuning coil 20 in. by 5 in., containing 630 feet of wire, and find that "atmospherics" are always loudest and most numerous when I have all my inductance "in." How is this? I have a friend who has had the same experience. Also, about how far do the waves set up by an atmospheric disturbance travel? Recently the weather here has been very thundery, and one day I happened to mention to my friend (whose station is 25 miles away) that I had heard very strong "atmospherics" the night before. He replied that he had heard none at all. The prevailing conditions in Glasgow were:—rain at intervals, extremely heavy lowering clouds, no audible thunder, but very close. My friend suggests that the signals, being free and ungoverned, were impeded from reaching him by the heavy clouds. I think this is unlikely. What is your opinion?

Answer.—1. What is meant is that "atmospherics" are of all wave-lengths (though the majority are very long), and moreover are extremely highly damped; so that cutting out by tuning is impossible. The first wave of a proper train of waves produces a small effect on the receiving aerial, the second—if the receiving circuits are properly "tuned"—finds things just in the right state to be "helped on," the third adds still more to the combined effect, and so on; so that such a train has very little effect unless the circuits are so tuned as to allow this cumulative effect to take place. An atmospheric, on the other hand, produces an effect which may be compared to a violent "twang" given to a tuned string, and sets the aerial which it strikes vibrating to the aerial's own tune. Even so, however, the effect produced is greater if the aerial's own time-period is somewhere near the time-period of the one or two swings of the atmospheric, and as the majority of atmospherics are of extremely long wave-length, they are more in evidence when the circuits are tuned to long waves.

2. Hundreds—even thousands—of miles. It is held by certain writers that a large number of atmospherics received in England have their origin in the Equatorial region of South America. On the other hand, the production of local atmospherics is by no means impossible, though without further details we should not like to hold that your results are an example of this. For instance, you do not mention whether your friend got his ordinary received signals on that day at normal strength—an important point; or he may have been listening on a short wave, and thus missed the majority of X's which were going.

M. B.—The probability is that you are not in tune for the very long wave-length of the second station you mention: moreover, it has a directional aerial. We regret that we cannot answer the kind of questions you ask in paragraphs 2 and 3 of your letter. It would be contrary to etiquette to make public our own confidential information.

Correspondence.

The Reception of Signals.

To the Editor.

SIR,—It gave me great pleasure to find your answer to my letter in the first issue of THE WIRELESS WORLD.

With regard to the second portion of my previous letter, I beg to state that with the following adjustments:—A.T.J. at zero, A.T.C. at three, tuning switch on the second stop and the change-over switch on "STD. B 1." with telephones and detector across two middle terminals of tuner, the maximum strength of signals was obtained with the intensifier handle at 45°, a few degrees either side cutting out signals altogether. I have since discovered that the angle varies with the amount of A.T.C. in circuit, i.e., the larger the percentage of capacity the greater the angle. Also very fine tuning, 2° or 3° being sufficient to cut one station out and bring another in, although both apparently on the same wave-length.

In fact, I often use it when "jamming" is very bad, as it is then possible to read the station required, all others being absolutely "out of it." Also the telephones used are the ordinary pattern supplied to ships, and in series with the detector. With the same adjustments, except that the change-over switch is on the "tune" side, produces no signals in the telephones whatever, no matter how close the transmitting station.

Yours, etc.,
"OPERATOR."

Wireless in the North.

Negotiations are proceeding for the erection of a wireless telegraph station near Stonehaven. It may be recalled that in the House of Commons recently the Postmaster-General, while declining to provide underground wires to Aberdeen, suggested to provide a wireless service, so as to prevent Aberdeen being cut off from the south in time of storm. It was said that the station would be at least 12 miles south of Aberdeen, but if the field that is under negotiation is acquired it will be nearly 20 miles south of Aberdeen.

Patent Record

The following patents relating to wireless telegraphy have been applied for since we closed for press with the July issue of this magazine:

No. 13,945. June 16th. Michel de Lezinier. Rythmatic control—synchronous differentiated or syntonic by Hertzian waves from a distance, and without relays of teledynamic machines and receivers.

No. 14,034. June 17th. Valdemar Poulsen. Apparatus for closing and interrupting electric currents.

No. 14,035. June 17th. Emile Girardeau. Supplying radiotelegraphic antennae.

No. 14,927. June 28th. Wm. T. Ditcham and the Grindell Matthews' Wireless Telegraph Syndicate. Arrangement for producing electro-magnetic oscillations particularly for use in radio-telephony.

No. 15,097. June 30th. Wm. J. Lyons. Electric telegraph receiving apparatus of the selective type.

No. 15,283. July 2nd. Edward D. Carden. Method of and means for determining the electrical characteristics of high-frequency oscillation circuits.

No. 15,457. July 4th. T. Thorne Baker and Galletti's Wireless Telegraph and Telephone Company. Transmission of wireless signals.

No. 15,566. July 5th. Sterling Telephone and Electrical Co., Ltd., and Wm. Barnes Allcock. Radial selector switches.

No. 15,673. July 7th. John G. Balsillie. Wireless telegraph transmitter.

No. 15,674. July 7th. John G. Balsillie. Wireless telegraph receivers.

No. 15,696. July 8th. Geo. Horatio Jones and Leonard V. Harbor. Method for aerial signalling and intercommunicating with wireless telegraphy.

No. 15,869. July 9th. Emile Girardeau. Method of indirect excitation for oscillatory circuits.

Rubber Tiling

One of the most noteworthy features of modern enterprise is the careful attention given to detail. This is a tendency to be commended, for just as it is the little things which make up the sum of our existence, so it is the little comforts—luxuries if you will—and conveniences which ameliorate present conditions of existence. This amelioration is not confined to one class, all share in the general advancement, and, if any, it is the mass of the less fortunate of our fellow-men who have benefited in the greatest proportion. Houses, means of conveyance, amusements, and dress, all are now recognised to be subjects worthy of serious and trained thought and skilled invention. But it is of the progress in ocean travelling that we wish more particularly to make mention. Nowhere is the advancement more marked: the traveller on a modern ocean liner has no inconveniences to put up with. When he boards the vessel which is to take him across the wilderness of many waters, he no longer leaves behind him all the amenities of life ashore. Ease and comfort travel with him. He can have his smoking-room, his lounge, his tennis, his gymnasium, his swimming bath, and practically everything which he may be accustomed to on land. To give an instance of how even the minutest detail has been carefully studied, he will find, on such a steamship, for example, as the *France*, the hall lounge, the corridors, and the bath-rooms cleanly tiled, the last-named especially white and shining, with what looks like tesselated pavement. But the weight of the ordinary porcelain flooring would be too heavy for the vessel, and too noisy in the rather limited space. This flooring, however, silences the tread, and yields slightly to the pressure of the footstep. It is a unique substance, especially adapted to use on vessels, though it is literally employed all over the world, particularly in public buildings, and as a matter of fact in Buckingham Palace itself. It is known as "Silvertown Rubber Tiling," and is manufactured by the Indiarubber, Gutta-Percha, and Telegraph Works Co., Ltd. It is manufactured as tiles, in a variety of shapes and colours, which can be arranged to form any sort of pattern, while the colour can be toned to any scheme of decoration desired. The flooring on the *France* was specially designed and constructed, and the effects obtained bear witness to the splendid advance made in this particular branch of domestic comfort and hygiene.

Marconi Athletic Club

CRICKET SECTION

Fortune has been something of a fickle jade to the Marconi cricketers this season, for success has almost invariably fallen to their opponents. Nevertheless, most of the matches were closely contested, and some very good play by many members of the elevens can be recorded.

The cricket match between the Office and Chelmsford Works at Acton, on June 21st, resulted in a good win for the Works team. Scores: Works, 98; Office, 43.

The results of other games are as follows:

June 28th, at Fulham, *v.* Fulham Palace II.: Fulham Palace, 167 for 7; Marconi's, 115.

July 5th, at Acton, *v.* Clissold: Clissold, 155 for 6; Marconi's, 125 for 7.

July 12th, at Acton, *v.* Fulham Palace II.: Fulham Palace, 116; Marconi's, 93.

On several occasions two elevens have been placed in the field.

On June 28th, at Acton, the second eleven played against the Dots C.C., and after a closely contested game the Marconi Club proved winners by 8 runs. Scores: Marconi's, 86; Dots C.C., 78.

On July 5th the same eleven played at Richmond against Fulham Wesleyans, and after an enjoyable game the Club were beaten by 18 runs. Scores: Fulham Wesleyans, 77; Marconi's, 59.

TENNIS SECTION.

The Monthly Doubles Tournament was held on July 5th, Mr. Douet and Mr. A. E. Merritt proved the winners, and the Consolation Prize was awarded to Miss Bate and Mr. F. Noakes.