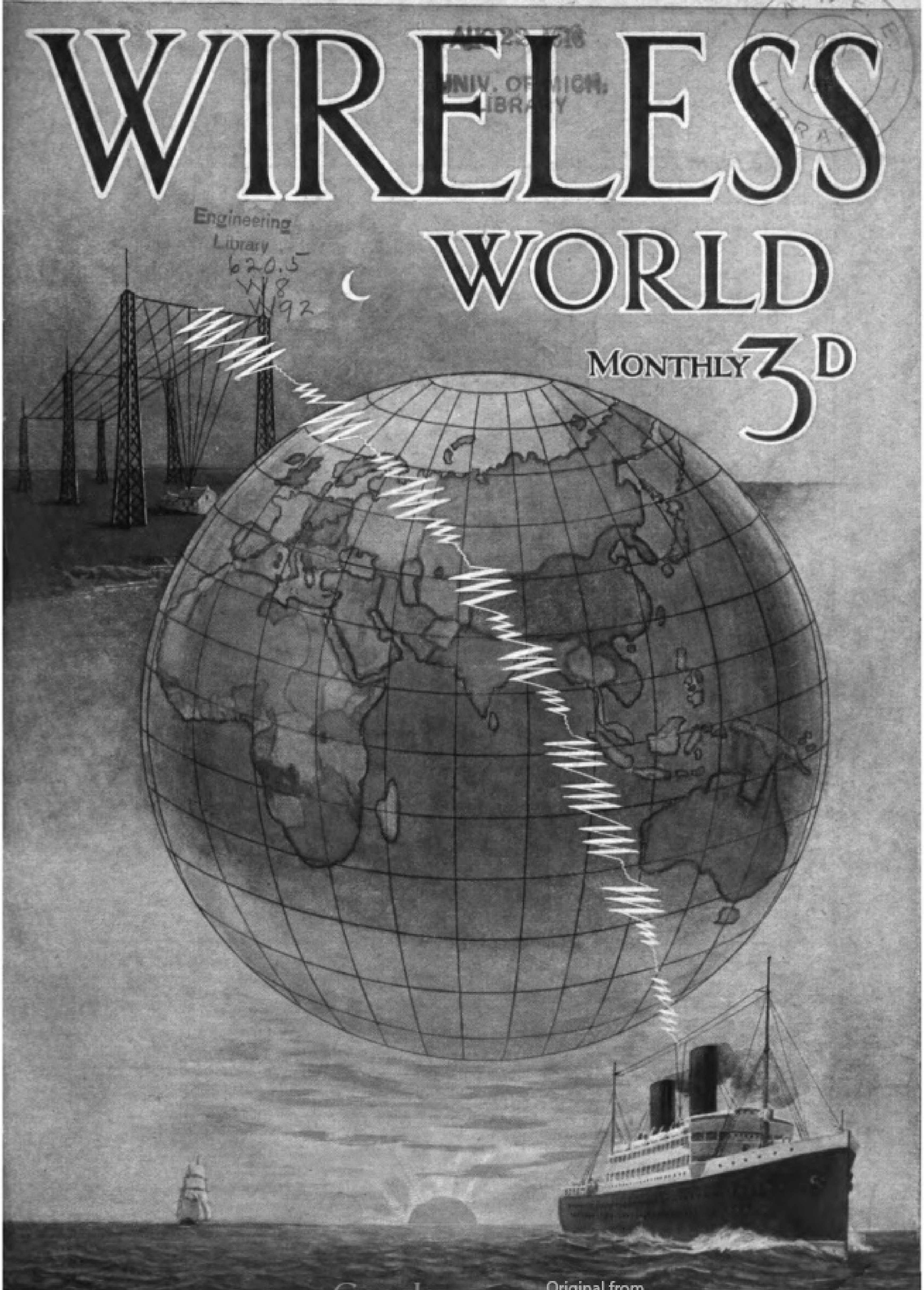
Vol. II. No. 19. (NEW SERIES).
Registered at the G.P.O. for transmission to Canada by Canadian Magazine Post.
OCT., 1914



Sullivan Instruments

Sullivan "Universal" Galvanometers and Shunts for Land and Sea Use

Testing and Signalling Instruments of every description for Submarine Cables.

SULLIVAN TELEPHONE RECEIVERS for Wireless Telegraphy and Telephony, as used by the principal Governments and Wireless Telegraphy Companies—resistance values from 5 to 15,000 ohms.

Fast Speed Wheatstone Automatic Transmitters and Receivers, guaranteed at 400 words per minute, and Wheatstone Apparatus generally.

Precision and Standard Measuring Equipments for D.C. and A.C. (high frequency) determinations, Condensers of Low Power Factor, etc.

All instruments guaranteed, and accompanied, if desired, with Certificates of Accuracy from the National Physical Laboratory at cost price.

H. W. SULLIVAN,

Winchester House, London, E.C., England.

Works: Liverpool House, Middlesex Street, London, E.C.

Telegrams: "Deadbeat, London." **Telephone** { Office: 3518 London Wall. Works: 3518a " " }

Codes: Western Union (Universal Edition); A.B.C. (5th Edition); Engineering (2nd Edition).

Silk and Cotton Covered H.C. Copper Wire, Resistance Wires, Fuse Wire, Binding Wires, Charcoal Iron Core Wire, Asbestos Covered Wire

P. ORMISTON & SONS, 79 CLERKENWELL ROAD

LONDON, E.C.

Established 1793. 13259 Central.

"Ormiston, London

Braided and Twisted Wires, Bare Copper Strand & Flexibles of any Construction, Wire Ropes & Cords, down to the finest sizes, in Galvanized Steel, Phosphor Bronze etc.

NORMAN, SMEE & DODWELL

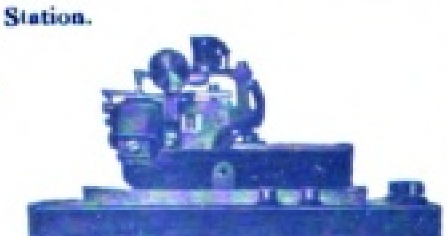
MANUFACTURERS OF HIGH-CLASS VARNISHES for Coach Builders and Decorators, Railway Carriage and Locomotive Builders, and Ship Builders. Special Insulating Varnishes for Electrical Purposes

Offices and Factory: MILES LANE, MITCHAM, SURREY.

"Wireless" TELEPHONE RELAY

IMPROVED FORM will MAGNIFY CURRENT over 100 TIMES.

For INCREASING the RANGE of a Receiving Station.
For RECORDING Messages and TIME SIGNALS.
For operating LOUD SPEAKING TELEPHONES.
For working CALLS and RELAYS.



Also BEST RECEIVERS made for Wireless and other RELAYS and Loud Speakers.

For Particulars and Prices apply Patentee and Sole Manufacturer,

S. G. BROWN, 4 Gt. Winchester St., London, E.C.

THE
WIRELESS WORLD

Vol. 2.—No. 19. (New Series) October, 1914. Subscription 5/0 per annum post free. Price 3d. Post Free 5d

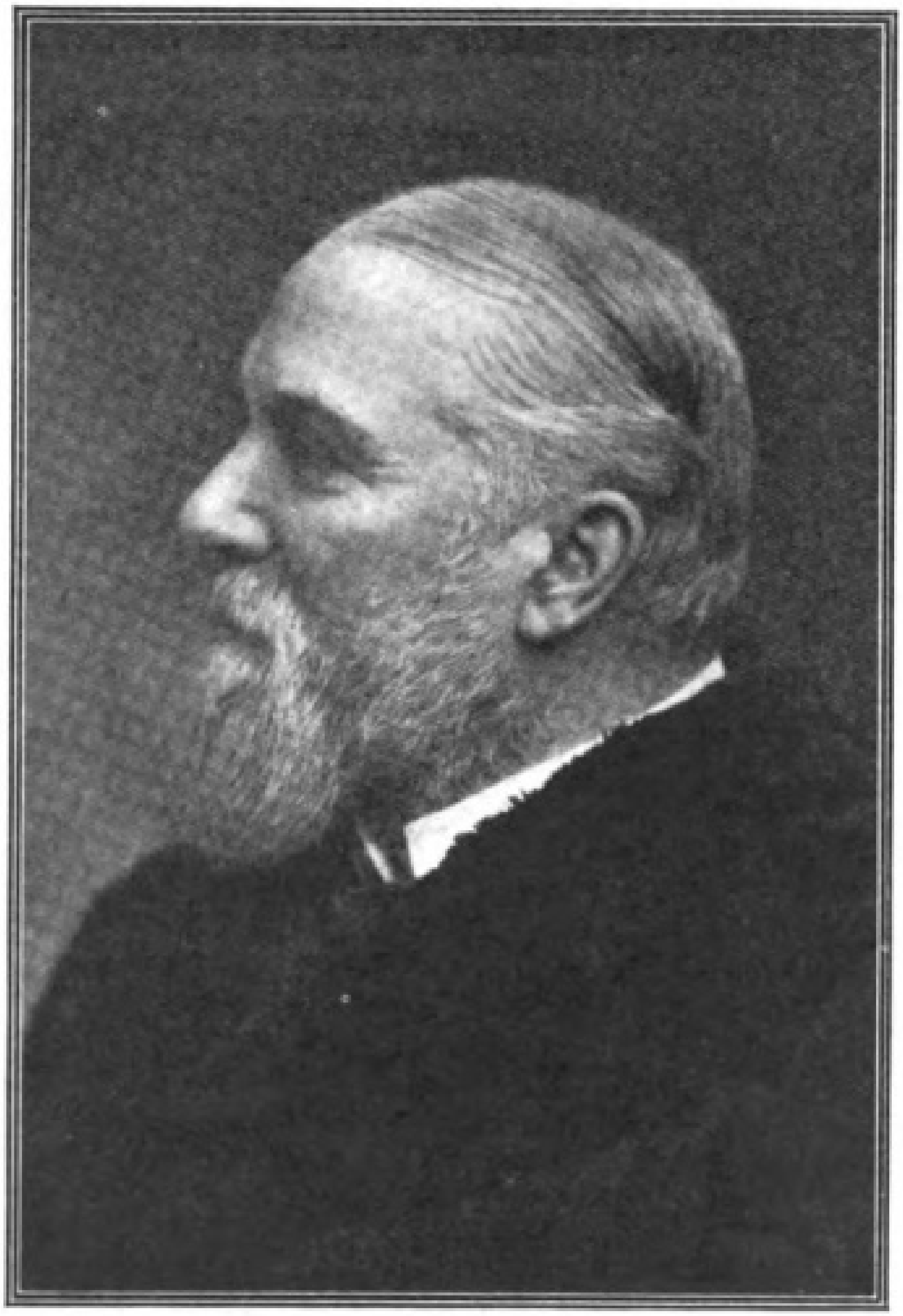
"Britannia Rules the Waves"

THERE is probably no one in the whole of the British Empire who has not heard or sung "Rule, Britannia!" But how many, we wonder, have pondered over the text of that imperishable song to find how literally true are the words from it which we have placed at the head of this page. The past month has furnished us with many remarkable evidences of the prophetic truth and inspiration of these words. Within less than a week from the declaration of war the seas were swept clean of the enemies' shipping, and the few vessels that have so far eluded capture of the British and French fleets remain in impressive impotence, unable to carry home the cargoes with which they were laden, or to harass British merchantmen.

One of the German vessels in this class was the converted cruiser *Kaiser Wilhelm der Grosse*, whose exploits are recorded in another column. Her sinking did more than show that our Fleet commands the sea; it showed that in consequence of Britain's wireless supremacy, we command also the long-distance air-communications, and we think we may justly claim that the destruction of the converted German cruiser was the first wireless victory of this war, due in no inconsiderable measure to the demolition of the Togoland wireless station.

The main German wireless stations at Nauen and Hanover have no means of ascertaining the position of British warships afloat and recommunicating such positions to their cruisers, for no German ship afloat in the far-distant waters has a wireless installation of the necessary strength to enable them to communicate direct with Germany, and accordingly what has been done is for German ships receiving knowledge of the position of our ships of war to fling such news into the air, to be caught and re-transmitted to their nearest station on land, and by them again sent forth with all the energy of their full power to warn their vessels within the radius of their station. German vessels off the West Coast of Africa or in the Indian Ocean have now, since the destruction of the stations at Dar-es-Salaam and Kamina, no station other than that at Windkoep, to which they send their messages, and certainly there are not many German ships afloat in a position to send a warning to the latter place, the station of which is, for safety's sake, nearly 200 miles inland.

As a consequence of this, the destruction of the station at Kamina meant that it was quite impossible to get any message as to the position of British ships of war sent to the *Kaiser Wilhelm der Grosse*, which has thus fallen the first victim to Britain's wireless supremacy. It is betraying no secret to say that we are in constant and full communication with our Allies, to our infinite advantage, cables having been cut in certain instances. Britain's supremacy in wireless is proving a big factor in the situation, especially as the enemy's long-distance communications have been destroyed. The station on the island of Nauru which has been destroyed is the last of the German wireless stations in the Pacific.



SIR JOHN HENNIKER HEATON BART.

Personalities in the Wireless World

Sir JOHN HENNIKER HEATON, Bart.

(Born 1848. Died September 8th, 1914).

THE death of Sir John Henniker Heaton removes a notable figure from our midst. Sir John was passing out of public life some time before his death, but what an original, lively and useful part he played in it! A former colleague of his in the House of Commons has put it on record that "he possessed the most terrifically concentrated mind I ever met in a Member of Parliament," and those who ever heard the late baronet speak on the subjects nearest to his heart know that such a description in no way exaggerates his particular genius. All his efforts were devoted to the one department of State—the Post Office. For years no one paid the slightest attention to his zeal for postal and telegraphic reform; for some ensuing years most people thought him a bore; and at the end everybody agreed with him and proceeded to give him nearly everything he wanted.

Sir John's faith in wireless telegraphy never wavered from the time of Mr. Marconi's arrival. He regarded it as a means that would bind the different links of Empire and cheapen and facilitate communication between the Mother Country and the Dominions Overseas. One sentence in a letter written to him by Mr. Marconi some years ago particularly pleased Sir John Henniker Heaton. It ran: "I sincerely hope that the good work to which you are now devoting your efforts may be crowned with complete success, and that before long your desire to see a service of penny telegrams to New Zealand may be realised by the help of wireless telegraphy." Sir John's comment on this was typical of the man. He said: "That this was no idle statement is well attested by the achievements which stand to the record of the Marconi Company, and which lead me to realise the truth of the remark made to me some time ago by Sir Joseph Ward, then Premier of New Zealand, that 'the rapid improvement made in Marconi wireless telegraphy can only lead to the attainment of cheap telegraphic communication.'"

On another occasion Sir John said: "The world watches Marconi as one of the gifted leaders born for our time. His system is a powerful factor in our crusade for cheap Imperial communications."

This great "crusader" had achieved victories which have vitally affected inter-Imperial relations, and his success in bringing about Empire penny postage would alone give him an important niche in the world's history. But he has other achievements to his credit, as the following brief account of his career will show.

John Henniker Heaton was a son of the late Lieutenant-Colonel Heaton, and was born at Rochester in 1848. He was educated at Kent House School and afterwards at King's College, London, but at the age of 16 he left England to seek his fortune at the Antipodes. He became a landowner in Australia, and also part proprietor of more than one newspaper in the Commonwealth. He represented New South Wales as a Commissioner at the Amsterdam Exhibition in 1883 and at the Indian and Colonial Exhibition of 1886, and he also represented Tasmania at the Berlin Telegraph Conference in 1885. In the latter year, having returned permanently to England, he was elected to the House of Commons as member for Canterbury, a constituency which he continued to represent until he retired from Parliament at the dissolution at the end of 1910. He seldom spoke in the House except on subjects connected with the Post Office

In 1899 the freedom of the City of London was conferred on him in recognition of his services, and that of the City of Canterbury the same year. He was four times offered the distinction of K.C.M.G., but declined it on each occasion. He accepted, however, a baronetcy, which was conferred upon him in January, 1912.

Operating Building at Belmar.

IN the July number of the WIRELESS WORLD we published a full description of the British station—at Carnarvon, in North Wales—which had been erected to communicate direct with another station then nearing completion, in New Jersey, U.S.A., and which, between them, would provide greatly extended facilities for trans-atlantic wireless telegraph communication between the two continents.

The completion of the American station, or rather stations (for the system employed is duplex, and the transmitting and receiving stations are some distance apart), provides an opportunity for mentioning some of the prominent features. It is unnecessary to describe the plant and equipment of the New Jersey stations, for these are practically identical with the plant and equipment erected at the Welsh stations. In North Wales the transmitting station is a few miles east of Carnarvon, on the Cefn-du mountain, whilst the receiving station is at Towyn.

In New Jersey the transmitting station is at New Brunswick, about 50 miles S.W. of New York, and the receiving station at Belmar, some 70 miles S.S.W. of the capital. Private land lines connect these stations with New York, which will thus be in direct communication with London when the more propitious times ahead of us permit the opening of the service.

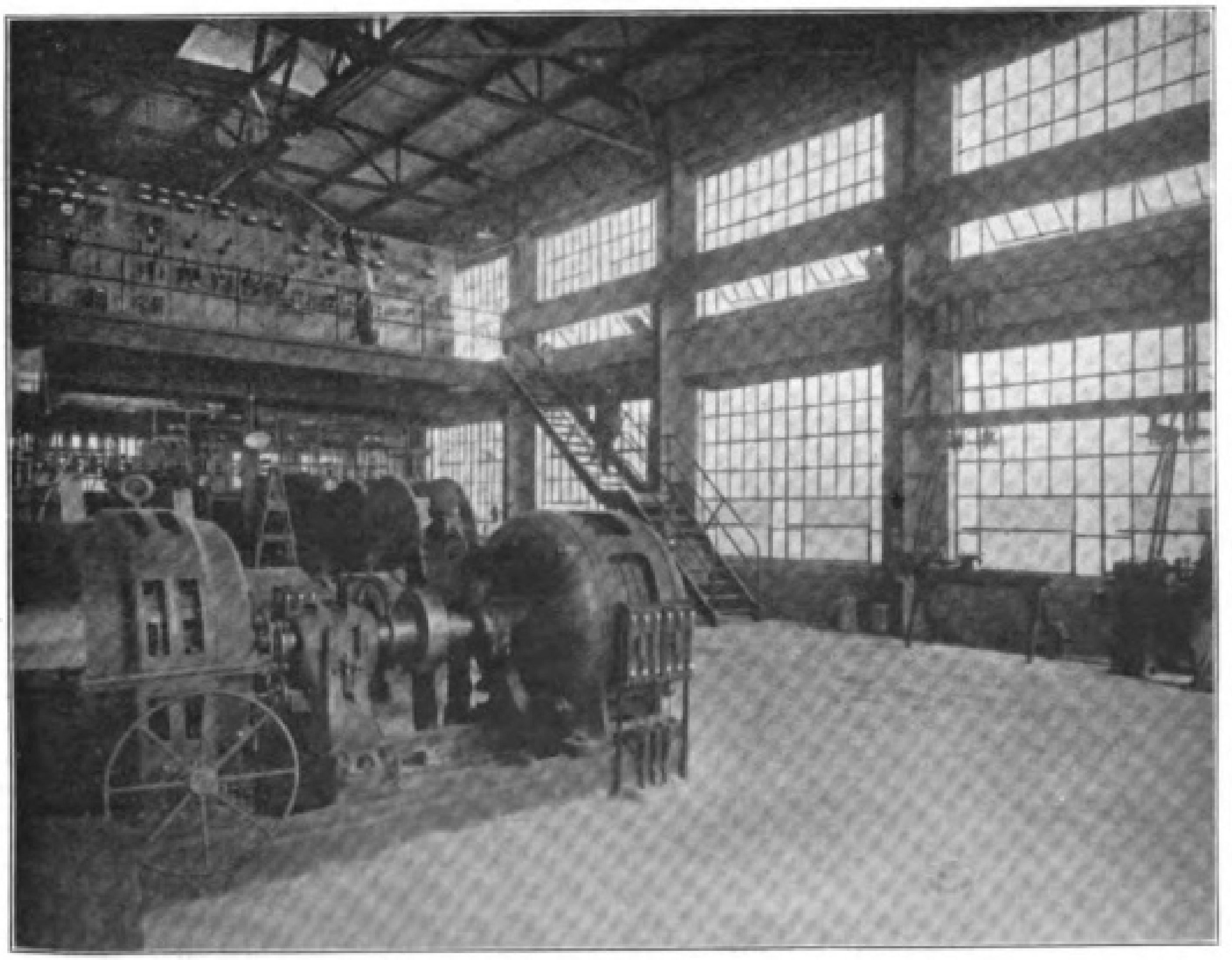
The station at Belmar introduces another note into the harmony of orchard and farmland of New Jersey.

The beautiful spot stretches uphill overlooking Shark River, the famous salt water inlet, which in the summertime is crowded with sailing boats and launches, for here the well-to-do of New York come to spend the hot months and renew their strength for the rigours of the city winter.

The road leading to the Marconi station runs along the top of a bluff overlooking the river, while the operating house is at the foot of the hill and quite close to the river bank. Here the receiving aerial connects with the first great mast rising from the top of the hill, then pointing westwards they stretch for almost a mile, supported by six other masts each three hundred feet in height. The big end of these aerials is carried down at an angle of 30 degrees. These are supplied with steel-running ropes attached to anchors consisting of a pillar fifteen feet high with heavy iron weights free to slide up and down. The heads are provided with a view to keeping the balance of the wires and thereby ensuring a definite tension at all times, so that when the wind blows, or sleet encrusts the aerials, the spans between the masts will sag down and the counter weights rise and thus make the tension constant. The chief difficulty experienced in building the operating house was in making the foundations water-tight, for the hills are intersected with hidden water streams. But skilled architecture has overcome this disadvantage, which, however, was a great asset to the engineer, for it has facilitated the grounding system for the wireless plant, some features of which may be mentioned here.

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

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



The Power House at New Brunswick.

the centre of the system to the point it enters the ground is approximately the same.

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

Lounge in the Hotel at Belmar.

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

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

The Marconi Company have not concentrated all their attention on the technical plans of this station. The utmost provision has been made for the comfort of the engineers and operators and all employed on the station. No detail has been too small for their consideration, and as a result the Belmar station is a model establishment, and those who are fortunate enough to be appointed to work at this station have every reason to "thank their lucky stars."

To give an instance of the forethought employed by those responsible for the welfare of their employees, it would surely have been sufficient to have provided the married men on the station with comfortable, well-furnished homes, and the unmarried men with an hotel equipped with every modern convenience; but they have done more than this. Recognising the natural beauties of the high bluff on which the station is located, they have determined to assist Dame Nature in her profession as beauty specialist. A landscape gardener has been employed, and the grounds occupied by the station have been laid out in beautiful manner, with rustic bridges and parterres of flowering plants, which set off the dull green of the trees and make delicious contrast against the background of dark undergrowth. From the river only the standing masts appear above the densely wooded slopes, so that Belmar station is among the most picturesque of the Marconi stations.

The operating building, which is designed on the same plan as the rest of the station, has an equipment second to none. It is

The Hotel at Belmar Station.

The Cottage of the Engineer-in-charge.

Piazza of the Belmar Hotel.

over 82 feet long, and contains a generously-proportioned office for the manager, and a similar one for the engineer-in-charge; also a large store-room and a cloak-room. The room containing the tuning apparatus runs the full length of the building, and is connected by a Lampson tube with the receiving room adjoining. Near by is the charging room for small accumulators, and the main operating room with five large tables, which, when fully manned will require thirty operators.

The hotel, built for the convenience of the large staff necessary for the maintenance of the 24-hour service at the station, is of dark red ornamental brick with a lighter red tile roof. The verandah runs the whole circuit of the building, which is slightly raised from the ground on a well laid-out parterre. The structure is fire-proof, and contains 45 bedrooms. There is an excellently appointed hotel lounge and smoking room. The dining-room is furnished with small tables, and from the deep windows the diner can look out beyond the wide sweeping shore line of the Shark River to the wide expanse of the Atlantic.

The kitchen is equipped with every modern convenience, and is in the charge of a French chef. To give an illustration of the completeness of arrangements it may be added that the cold storage and refrigerating plant has a capacity of six hundred pounds of ice *per diem*.

The bedrooms are charming—that is the only word that can describe them—while the private sitting-rooms will be a delight to all who can afford this added luxury. Attached to the hotel is a twelve-acre vegetable garden, which supplies all the necessaries in this branch of the catering.

The manager, and the engineer-in-charge have private residences built on the same plan as the hotel, but naturally smaller, though not less complete in every detail. The married operators' cottages, which consist of a living-room, kitchen and four bedrooms, have been equipped by the Marconi Company with every convenience.

Already Belmar has become a "sight" for touring motorists, who avail themselves of the opportunity to spend a quiet hour also at the hotel, or to wander through the beautiful country with its hills covered by thick woods of laurel, birch, oak, maple and pine trees; or, again, to wander through the undergrowth in search of spoils from the wild grape vines, huckleberries, mulberries and blackberries.

Spinney and coppice, wood and open meadow-land offer of their abundance, and the countryside teams with wild life. To any with a bent for natural history there is an unending source of amusement, while to those whom sport claims for devotees there is an equally wide range of interest. Fishing and shooting and, what is perhaps the most sportsmanlike of sport, long tramps over the miles of open country with a chance of bringing home a mixed bag at the end of the day.

The earth has many pleasant places, and Belmar is one of them.

Living Room in Chief Operator's Cottage, Belmar.

Aerials and their Radiation Waveforms. VI.

By H. M. DOWSETT.

EVERY wireless installation to-day transmits on the fundamental wave of its aerial circuit, and no system, except the Marconi system, has ever transmitted with deliberate intention, in practice, on anything but the fundamental wave.

But from 1900 to 1911—for eleven years—the Marconi Company carried out a great deal of useful work, both experimental and commercial, using the first harmonic of the aerial, a method of transmission known technically as "Tune A."

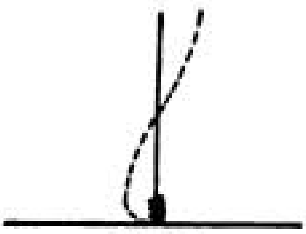


Fig. 1.

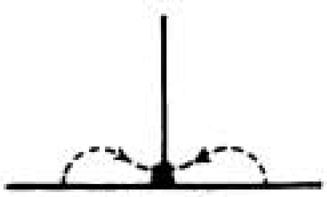


Fig. 2.

This method, interesting in its scientific adjustment, and in the very different behaviour of its radiation from that of "Tune B"—the method of fundamental wave transmission—has received practically no attention in wireless text books.

The circuits used for "Tune A" are clearly described in G. Marconi's patent specification No. 7,777 of 1900.

The aerial circuit in oscillation may be represented by Fig. 1.

The transmitting jigger secondary is given sufficient length to have, when earthed, approximately the same oscillation constant as the wave to be radiated.

The primary circuit is tight-coupled to the secondary, tuned to it, and then an aerial is coupled to the jigger whose free period when insulated agrees with that of the jigger.

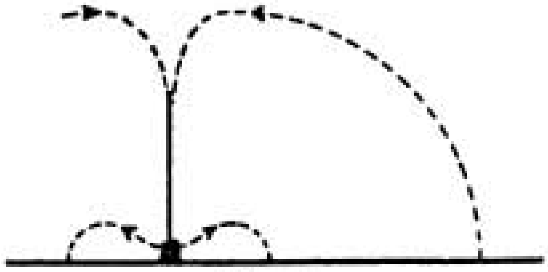


Fig. 3.

The general result is an antinode of potential at the top of the aerial, and another at or near the aerial end of the jigger secondary (in the accompanying diagrams it is supposed to be three-quarters the way up the jigger from the earthed end); and a node of potential nearer to the jigger than the free end of the aerial—in the present case the relative distances are as 3 to 4.

The aerial in the diagrams, when disconnected from the jigger secondary, is supposed to have sufficient capacity for

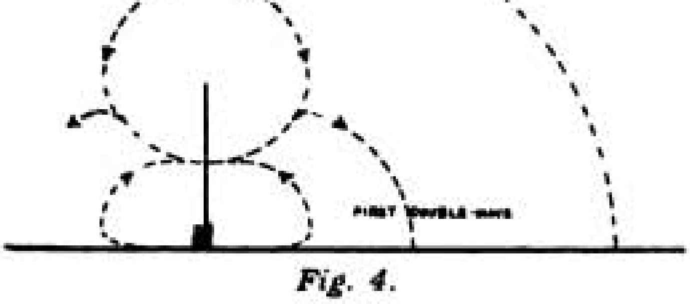


Fig. 4.

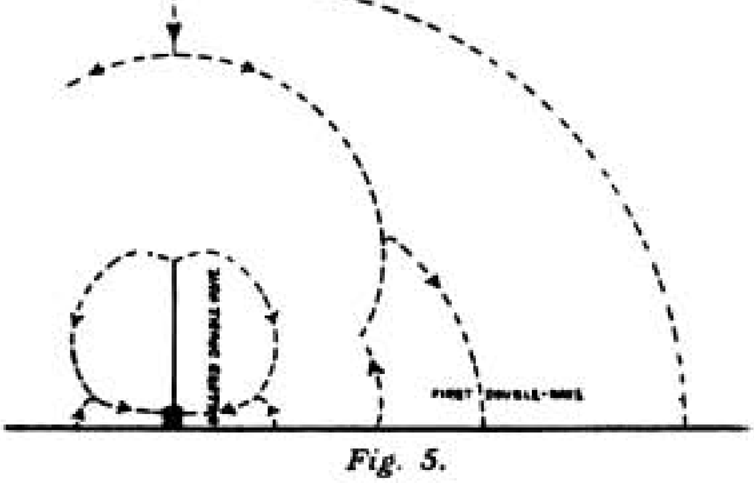


Fig. 5.

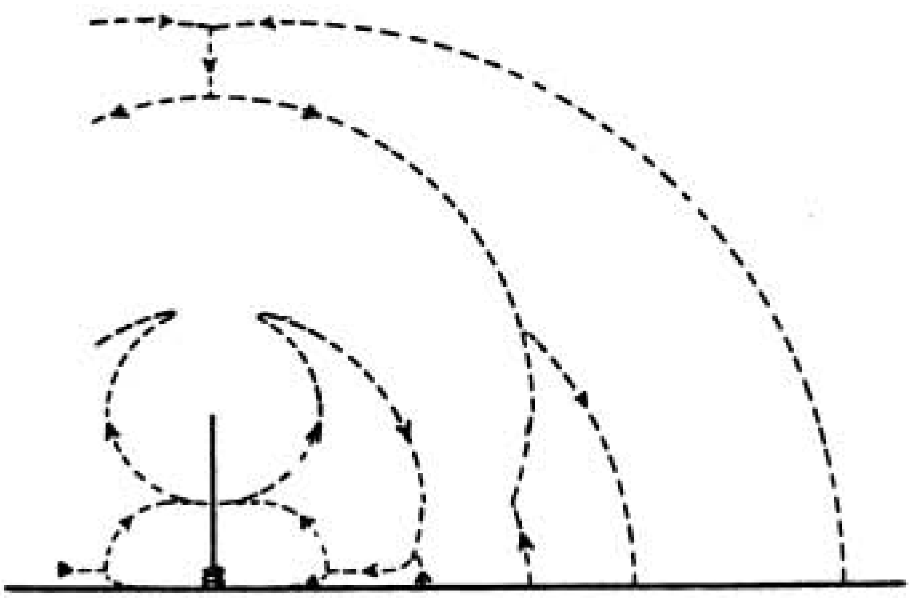


Fig. 6.

the moment the first double-wave finally severs itself from the aerial.

At the same instant reflex waves commence to grow from both nodes in the aerial jigger circuit, and in due course reach their maxima in the aerial, and join Fig. 5. The field of this second double-wave differs considerably from that of the first, shown in Fig. 3.

In Fig. 6 the second double-wave is just free of the aerial; in Fig. 7 the third double-wave is on the point of commencing to break away from the aerial.

its fundamental to be 2½ times its own length.

Figs. 2 and 3 show the growth of the field of electric strain between aerial and earth, due to the impressed oscillation from the primary circuit.

After the first ¼ period, the wave does not break away from the aerial as in fundamental wave transmission, but continues to flow up the aerial until it reaches the top, Fig. 3.

The effect of the lag of the wave when passing up the jigger is apparent in the hump of the field in the space above the aerial.

The aerial and jigger circuit now oscillated with $\frac{3}{4}\lambda$, one potential node being near the middle of the aerial and the other at the earth end of the jigger.

The flow *up* the aerial not being able to proceed further, the flow *down* commences, and simultaneously from both antinodes the double wave breaks away into space.

As the wave expands normal to its wavefront at every point, it will be seen that its top parts finally butt together in a line with the aerial and above it, so that the apex of the first wave sent off closes up. This is shown in Fig. 4, which is a diagram of the field at

Both parts of the first double-wave are earth bound, but only the lower parts of the second, third, and following double-waves are earth bound; *the top parts, at the commencement of their travel, are free waves* and their apexes are open.

A study of Figs. 7 and 8 will explain many of the phenomena peculiar to "Tune A" radiation. The essential part of a wave, the part which contains most energy, is that which gives the largest section in the direction of propagation—the direction of propagation of any part of the wave being normal to the wavefront. For want of a better word we may call the essential part the "beam" of the wave.

Then the wave is not earth-bound until its beam is on or in the earth. The contour

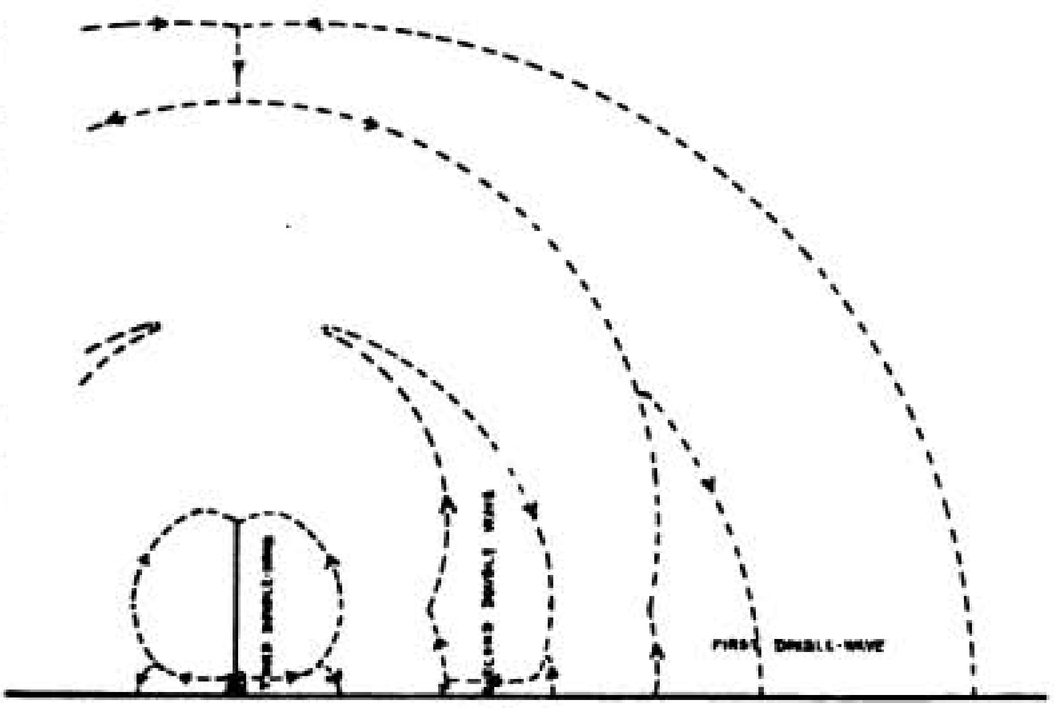


Fig. 7.

of the earth may, however, rise so that it meets the beam of the free wave; in which case this wave in its turn will become bound, but only after the bottom wave and the part of the top wave below the beam have been absorbed.

What Fig. 7 shows is this:—

The first double-wave sent off by "Tune A" is much more powerful than those which follow. It radiates well into space, and is earth-bound. Also it has a sine waveform along the earth, as the back of the first part of the wave and the front of the second part coincide.

Therefore with "Tune A" it is possible to get indications of signals with far less power than that required to maintain good communication. The first double-wave due to each spark may cause the receiver to respond, but the second and following double-waves may be too weak to do so.

Fig. 7 also shows that if the earth is a perfect conductor with no gradient, the bound wave of the second, third and following double waves can only expand in the plane of the earth; it cannot expand vertically. This will tend to conserve its intensity to a greater extent than that of the free wave above it, which can expand vertically; so that, although the bound wave is distorted and its initial loss near the aerial is great, it may under favourable conditions have considerable effect on the receiver. Such favourable conditions would be present in the communication of two ships at sea.

Suppose, however, the earth is not a good conductor. Then the bound parts of the double-wave are soon absorbed. The earthed receiving aerial is then excited by the bound first double-wave, but the following waves have degenerated into single free waves with their antinodes or peaks travelling along the earth's surface, and they are therefore likely to have little or no effect on the receiving aerial.

Obviously for best response the bottom of the aerial should now be given as much freedom to oscillate as tuning arrangements will allow. This condition is reached by inserting a small adjustable condenser in the earth wire.

The effect of the condenser is to shift the node away from the earth into the aerial, and if the right amount of inductance is also added the period of the aerial need not be altered. The aerial will then be less affected by the initial double-wave, which, because it is not sustained, is of little use for signals, and it will be more affected by the second, third, and following double-waves, which, although weaker, are of more use because they are sustained. If the earth is a good conductor, and the bound wave is not absorbed, a condenser in the earth lead

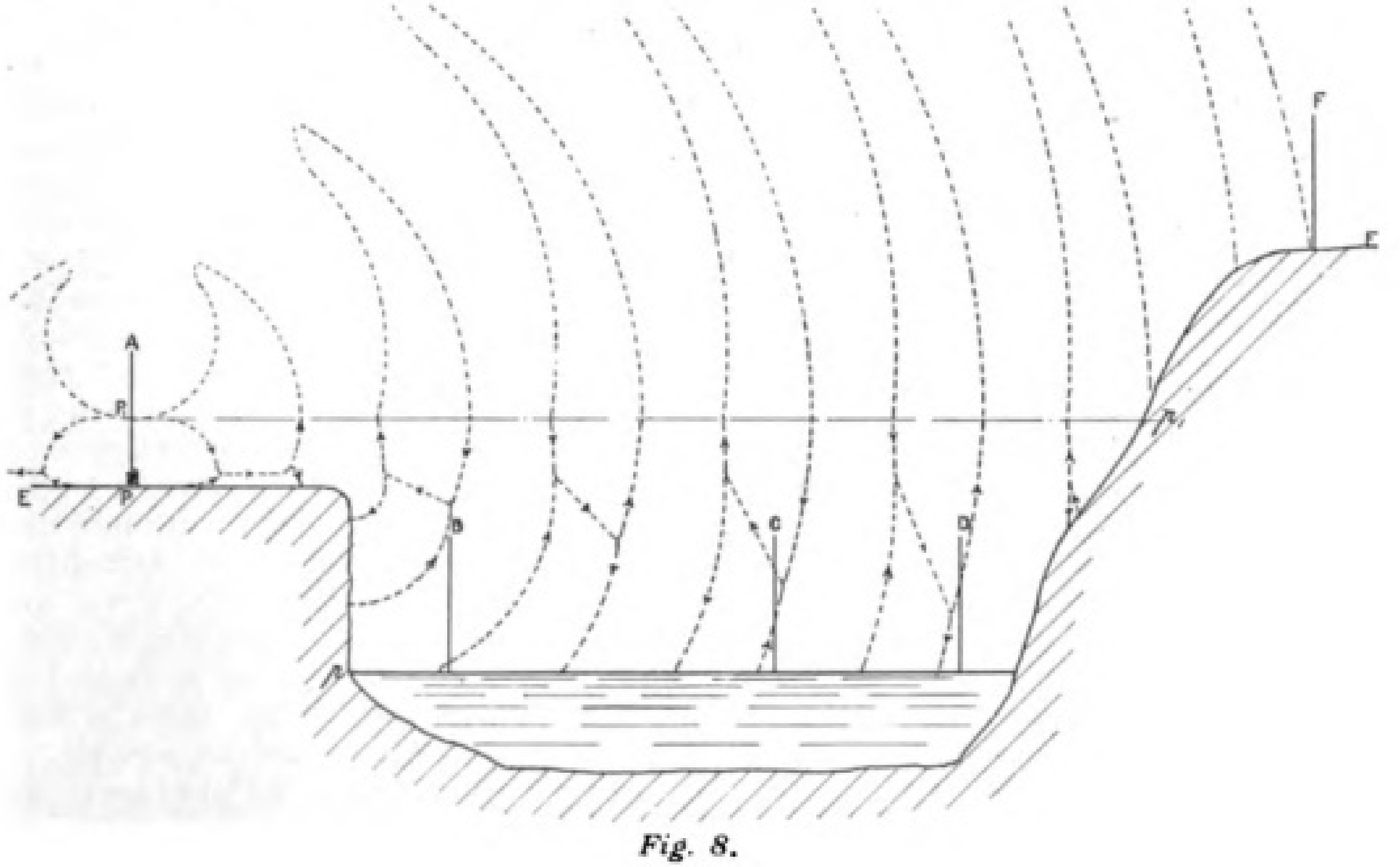


Fig. 8.

can still be used with advantage, as it assists the aerial to tap both the bound and the free parts of the double-wave.

Fig. 8 illustrates the passage of "Tune A" radiation over good conducting but broken country, and shows the semi-independence of the two parts of this radiation. The earth line EE may be taken to represent two cliff faces separated by a water channel.

We shall follow the progress of the double waves and note their effect on a receiving aerial as the distance travelled by the waves increases.

Near the aerial the front of each bound wave meets the earth at right angles; farther on, where the earth drops away, the bottom part of the bound wave bends round with the earth, still keeping at right angles to it, while the upper part continues straight on.

The bound wave therefore gets an opportunity to expand, which it would not get were the ground to remain flat and without gradient. Its intensity correspondingly decreases. *It will be seen that while the beam of the bound waves is deflected and follows the earth line Pp, the beam of the free waves P_1p_1 remains unaffected by the fall in the earth line and continues straight on.* The bottom end, however, of the free waves shows a tendency to expand downwards, which is more or less checked by the bound waves.

If a receiving aerial be placed at the position B, it will only be affected by the bound waves, and not very strongly at that. For best results it should lean *away* from the cliff face in order to lie more parallel to the advancing wavefront. This will also cause it to be less influenced by the reflected wave (not shown in the drawing) which results from the angle at which the wavefront meets the water at the position B.

The bound wave will have been considerably weakened by reflection by the time it arrives at the position C, and it will be seen that the aerial here comes partly into the field of the expanding free wave.

Due to the different paths taken by the two parts of the double wave, the bound wave now shows a lag behind the free wave.

At D these effects are intensified. By using an earthed aerial resonance can be established with the bound wave; by using an insulated aerial, or one earthed through a small condenser, resonance can be made with the free wave.

Finally, take the last case—an aerial on a headland at F. On arriving at this position the free wave has become earthbound. The original bound wave has become dissipated by reflection if the earth travelled over has been a perfect conductor, or by partial reflection and partial absorption if a semi-conductor. The lower part of the free wave up to and above the beam has suffered similar treatment, and henceforward what remains of the radiation must be directly affected by the earth

CORRESPONDENCE.

Aerials and their Radiation Waveforms.

To the Editor of THE WIRELESS WORLD.

SIR,—I should be obliged if you could give me space for a few remarks on Mr. Dowsett's article on "Aerials and their Radiation Waveforms," which appeared in the September issue of THE WIRELESS WORLD. We will start from the point on which we are in agreement. Take an infinite plane and over it an infinitely long vertical aerial; then the lines of force are quadrants of circles with their centre at the base of the aerial, and the intensity of the electric force is the same at all points at the surface of the aerial. (The solution, to make the lines accurately arcs of circles, would require that the aerial wire should be a circular cone with its vertex at the surface of the plate.) Mr. Dowsett correctly states that the intensity of the force at the surface of the plate is inversely proportional to the distance from the centre of the plate. Hence he concludes that in the case of a vertical section through the aerial the number of lines of force per centimetre (along the plate) that must be shown in the diagrams is inversely proportional to the square root of the distance from the plate centre. After some difficulty I did manage to explain this from my own point of view. Let us suppose that the whole space surrounding the aerial is divided up into a large number of unit tubes of force of as regular cross-section as possible. A vertical section containing the aerial will cut these tubes longitudinally. On the diagram of the section represent every tube so cut by a line. The density of the lines thus drawn will be inversely proportional to the linear dimensions of the cross-section of the tubes at the point considered. That is, it is inversely proportional to the square root of the cross-sectional area of the tubes at that point, and, since their cross-section at the surface of the plate is proportional to their distance from the aerial, we have finally that the density of the lines at the surface of the plate is inversely proportional to the square root of the distance from the centre, which gives us Mr. Dowsett's diagram. What the use of the diagram is I am unable to say.

There are, however, two obvious ways of considering sections of the field of force which will give rise to definite and different diagrams. The first is by taking a wedge-shaped section with its centre on the aerial,

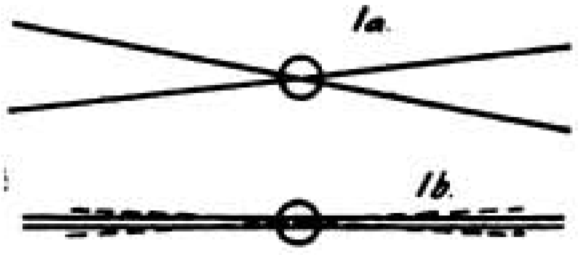


Fig 1.

as shown in plan in Fig. 1, 1*a*. The wedge must be taken of very small angle. The second way is by taking a central section of small but constant thickness, as shown in Fig. 1, 1*b*. The thickness of the section must be small compared with the thickness of the aerial. In each case the plane diagram is obtained by drawing the lines of force that would show on looking across the section, supposing it were transparent.

In case (*a*) all lines of force starting in the section would remain in it, and therefore all lines shown leaving the aerial would run right to the plate, as shown in Fig. 2, *a*. The diagrams given in text-books are of this type. In the second case lines starting in the section would gradually go out of the section as they diverged, giving a diagram like that of Mr. Dowsett's, except that in this case the density of the lines at any point would give the intensity of the electric force at that point; hence the density of the lines at the surface of the plate would be inversely proportional to the distance of the point considered from the aerial. I think case (*b*) is the more important, provided that it is clearly pointed out that the lines of force are actually continuous and that their apparent disappearance is due to the conditions under which the section is made.

Now turn to the consideration of the field of force, when the aerial is of finite length and the plate of finite extent. It is physically obvious that the field due to the potential difference between aerial and plate will, to some extent, affect the whole of space not screened by conductors. On this point Mr. Dowsett and I are again in agreement. Mr. Dowsett gives a diagram in Fig. 15 in which he shows his idea of the distribution of the lines of electric strain in the space not immediately associated with the aerial, and explains its existence as being due to aether shear. Let us see what this field involves. Take, for simplicity, a plate of infinite extent and an aerial (*ab*) of finite length (*see* Fig. 3). Then if we carry a small electric charge round the path BDEF, no work is done along BD and EF, since we cross the lines of force at right angles, and the work done along DE must equal that given back along FB. But this is exactly what would occur if the aerial were of infinite extent upward. Hence, along the line BD away to infinity we must have a line charge of exactly the same density as that on the aerial itself. What such a line charge in free aether would consist of, and what

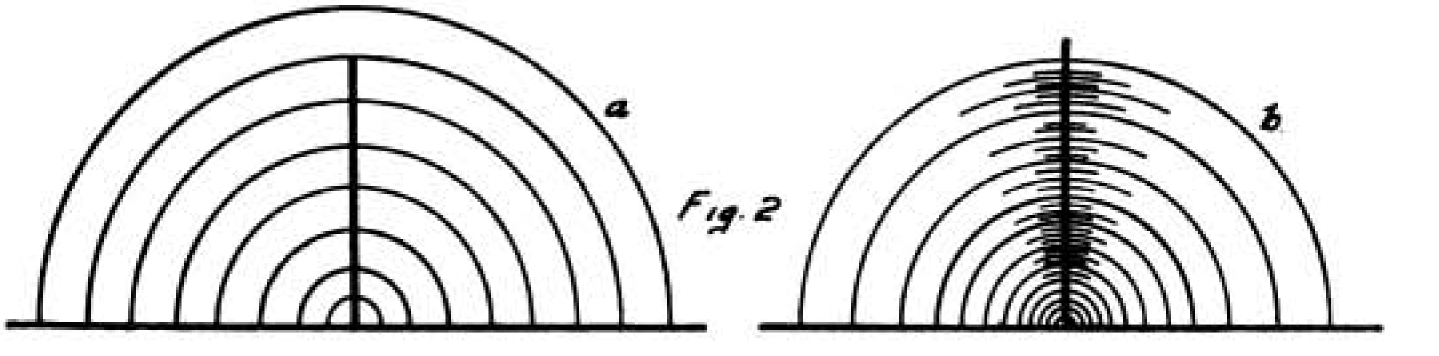


Fig. 2

would support it, I cannot say. Also, it follows that the charge on the plate is independent of the length of the aerial wire, which seems to indicate that the capacity between an aerial and an infinite plate is infinitely large.

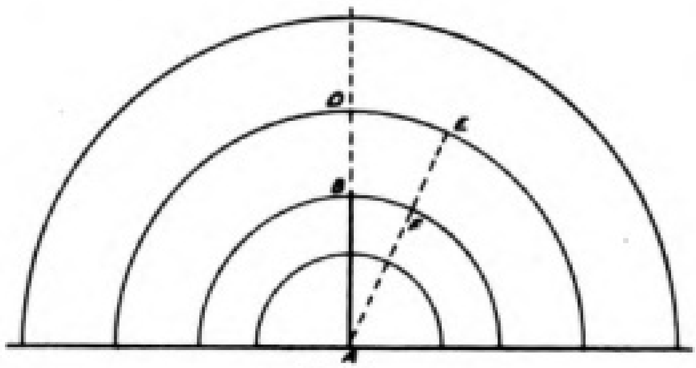


Fig 3

By far the better way of getting an idea of the field of force in such cases would be to assume a uniform density of electricity along the aerial and then make use of the known properties of lines (or tubes) of electric strain. It may be deduced mathematically from the Law of Inverse Squares (which itself rests on a firm experimental basis), that the strain lines distribute themselves in free aether as if there were a tension along the lines and an equal pressure across them. This will give rise to a distribution somewhat as shown in the Fig. 3, for which

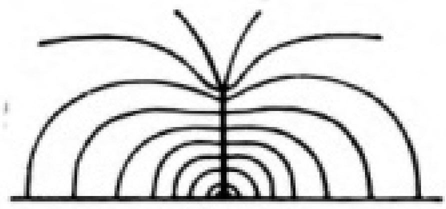


Fig. 4

no accuracy is claimed. The diagram is drawn according to case (*a*), *i.e.*, for a wedge-shaped section.—Yours, etc.,

E. GREEN.

International Commission on Wireless Telegraphy. Group of Delegates taken at Laeken, Brussels, April 6th, 1914. From left to right: MM. Marchant, Drumaux, Père Wulf, Commandant Ferrié, W. Duddell, H. Abraham, Prof. Wien, Dr. W. H. Eccles, Père Lucas, MM. Benndorf Lutze, Vollmer, Robert Goldschmidt and Braillard.

Digest of Wireless Literature

ABSTRACTS OF IMPORTANT ORIGINAL ARTICLES DEALING WITH WIRELESS TELEGRAPHY AND COMMUNICATIONS READ BEFORE SCIENTIFIC SOCIETIES.

Wireless Telephony.—A new transmitting apparatus for wireless telephony, due to Herr L Kühn, is described in the *Elektrotechnische Zeitschrift*. The microphone current is passed through a winding over a soft iron core, on which is wound a second winding connected in the antennæ circuit. The self-induction of the latter coil varies according to the fluctuations in the microphone circuit, and the oscillations in the antennæ circuit therefore also vary in frequency accordingly. By this means, it is stated, an oscillation energy of 8 kw. in the antennæ circuit has been sufficiently influenced by a microphone energy of only 8.7 watts to effect a proper transmission of speech.

Instability of Electric Circuits.—Dr. C. P. Steinmetz gives an outline of a theory and classification of instability in electric circuits in a paper which he read before the American Institute of Electrical Engineers. He divides the phenomena into three main types (1) transients of readjustment to changed circuit conditions; (2) unstable electrical equilibrium—that is, the condition in which the effect of a cause increases the cause; (3) permanent instability resulting from a combination of circuit constants which cannot co-exist.

If the constants of an electric circuit, as resistance, inductance, capacity, disruptive strength, impressed voltage, etc., have values which cannot co-exist, the circuit is unstable, and remains so as long as these constants remain unchanged. Such instability usually leads to phenomena which are more or less periodic or intermittent. The most interesting class in this group of unstable electric systems is the oscillations resulting sometimes from a change of circuit conditions (switching, change of load, etc.), which continue indefinitely with constant intensity, or which steadily increase in intensity, and may thus be called permanent and cumulative surges, hunting, etc. They may be considered as transients in which the attenuation constant is zero or negative. In the transient resulting from a change of circuit conditions, the energy which represents the difference of stored energy of the circuit before and after the change of circuit conditions is dissipated by the energy loss in the circuit. As energy losses always occur, the intensity of a true transient thus must always be a maximum at the beginning and steadily decrease to zero or to a permanent condition. An oscillation of constant intensity or of increasing intensity is thus possible only by an energy supply to the oscillation system brought about by the oscillation. If this energy supply is equal to the energy dissipation, constancy of the phenomenon results. If the energy supply is greater than the energy dissipation, the oscillation is cumulative, and steadily increases until self-destruction of the system results, or the increasing energy loss has become equal to the energy supply, and a stationary condition of oscillation results. The mechanism of this energy supply to an oscillating system from a source of energy differing in frequency from that of the oscillation is still practically unknown, and very little investigation has been directed towards clearing up the phenomenon. It is not even generally understood that the phenomenon of a permanent or cumulative line surge involves an energy supply or energy transformation of a frequency equal to that of the oscillation. Possibly the oldest and best-known instance of such cumulative oscillations is the hunting of synchronous machines. Cumulative oscillations between electromagnetic and electrostatic energy have been observed by their destructive effects in high-voltage electric circuits on transformers and other apparatus, and have been, in a number of instances where their frequency was sufficiently low, recorded by oscillograph. They, obviously, are the most dangerous phenomena in high-voltage electric circuits. Relatively little exact knowledge exists of their origin. Usually, if not always, an arc somewhere in the system is instrumental in the energy supply which maintains the oscillation. In some instances, as in wireless telegraphy, they have found industrial application.

The general nature of these permanent and cumulative oscillations and their origin by oscillating energy supply, from the transient of a change of circuit condition, is best illustrated by the instance of the hunting of synchronous machines, and this may, therefore, be investigated somewhat more in detail.

Practically all theoretical study of the hunting of synchronous machines has been limited to the calculation of the frequency of the transient oscillation of the synchronous machine at a change of load, frequency or voltage, at synchronising, etc. However, this transient oscillation is harmless, but becomes dangerous only if the oscillation ceases to be transient, but becomes permanent and cumulative; and thus the most important problem in the study of hunting is the determination of the cause which converts the transient oscillation into a cumulative one; that is, the determination of the source of energy, and the mechanism of its transfer to the oscillating system. To design synchronous machines so as to have no or very little tendency to hunting obviously requires a knowledge of those characteristics of design which are instrumental in the energy transfer to the oscillating system, and thereby cause hunting, so as to avoid them and produce the greatest possible inherent stability. If, in an induction motor running loaded at constant speed, the load is suddenly decreased, the torque of the motor being in excess of the reduced load causes an acceleration and the speed increases. As in an induction motor the torque is a function of the speed, the increase of speed decreases the torque, and thereby decreases the increase of speed until that speed is reached at which the motor torque has dropped to equality with the load, and thereupon acceleration and further increase of the speed ceases, and the motor continues in operation at the constant higher speed. That is, the induction motor reacts on a decrease of load by an increase of speed, which is gradual and steady without any oscillation.

If on a synchronous motor running loaded the load is suddenly decreased the beginning of the phenomenon is the same as in the induction motor; the excess of motor torque causes an acceleration—that is, an increase of speed. However, in the synchronous motor the torque is not a function of the speed, but in a stable condition the speed must always be the same, synchronism, and the torque is a function of the relative position of the motor to the impressed frequency. The increase of speed due to the excess torque resulting from the decreased load causes the rotor to run ahead of its previous relative position, and thereby decreases the torque until by means of increased speed the motor has run ahead from the relative position corresponding to the previous load, to the relative position corresponding to the decreased load. Then the acceleration, and with it the increase of speed, stops. But the speed is higher than in the beginning—that is, is above synchronism—and the rotor continues to run ahead, the torque continues to decrease, is now below that required by the load, and the latter thus exerts a retarding force, decreases the speed and brings it back to synchronism. But when synchronous speed is reached again the rotor is ahead of its proper position, and thus cannot carry its load, and it begins to slow down until it is brought back into its proper position. At this position, however, the speed is now below synchronism, and the rotor thus continues to drop back, and the motor torque increases beyond the load, thereby accelerates again to synchronous speed, etc., and in this manner conditions of synchronous speed, with the rotor position behind or ahead of the position corresponding to the load, alternate with conditions of proper relative position of the rotor, but below or above synchronous speed; that is, an oscillation results which usually dies down at a rate depending on the energy losses resulting from the oscillation. The characteristic of the synchronous machine is that readjustment to a change of load requires a change of relative position of the rotor with regard to the impressed frequency without any change of speed, while a change of relative position can be accomplished only by change of speed, and this results in an overreaching in position and in speed; that is, in an oscillation due to the energy losses caused by the oscillation, the successive swings decrease in amplitude, and the oscillation dies down. If, however, the torque which brings the rotor back from the position behind or ahead of its normal position corresponding to the changed load (excess or deficiency of the motor torque and the torque required by the load) is greater than the torque which opposes the deviation of the rotor from its normal position, each swing tends to exceed the preceding one in amplitude, and if the energy losses are insufficient, the oscillation thus increases in amplitude and becomes cumulative; that is, hunting.

Range of Transmission.—Mr. Marconi in 1902 published the fact that the range of transmission at night was considerably greater than in the daytime. Repetition of the experiments in 1905 showed that the lowest limiting distance at which this is observed is about 250 km. and that the ratio of energy intensities at night and in daytime was in the neighbourhood of 5 : 2. K. E. F. Schmidt reports in the *Physikalische Zeitschrift* that in 1906 he was able to determine that the received energy at night was about 20 per cent. greater than the daytime energy. In December, 1911, with improved transmitting and receiving arrangements, the following results were obtained:—December 5th, 1913, 23 per cent.; December 6th, 32 per cent.; December 7th, 19 per cent.; December 8th, 34 per cent The author believes the reason for the failure of the experiments which he made in August, 1909, can be explained by Mosler's observations, which show that in summer the ratio ε (Intensity at night)/(Intensity by day) approaches unity, while in April and December it is nearly 2.

Reception of Weak Signals.—H. Abraham publishes in the *Bulletin* of the Société Internationale Electrique some of the results obtained by him at Washington in January, 1914, when he was endeavouring to secure photographic records of the signals sent by Paris from the Eiffel Tower. During the receipt of the signals the paper strip was moved at 7 cm. per second, the signals being received by means of a Galena detector and moving coil galvanometer of short period. The coil returns to zero in about $\frac{1}{10}$ second and the sensibility of the galvanometer is 24 cm. per microamp. Most detectors, such as crystal, valve and other types, are only good rectifiers where the currents to be rectified are fairly strong. When, on the other hand, they are operated by weak wireless received currents having an e.m.f. often very much below one volt, experiment shows that the rectified current furnished by the detector is practically proportional to the square of the alternating applied voltage. The Galena detector gave the following results:—

E=voltage at terminals.	I=rectified current microamps.	$\frac{1}{1000} \cdot \frac{1}{E^2}$
0·02	2	5·0
0·08	34	5·3
0·4	777	4·8
1·0	4,290	4·3

It follows from the above that the mean galvanometer deflections are a measure of the energy of the received signals and are proportional to the square of the amplitude and not to the amplitude itself.

Atmospheric Potential.—By means of a new water-drop collector with combined pressure and suction spraying, and a Wulf String electromotor, G. Lutze (in the *Physikalische Zeitschrift*) claims to have determined the atmospheric potential within three seconds. It was found that changes are particularly rapid when the gradient itself is low; they are, moreover, often oscillatory and exhibit a high frequency, and when that is the case, they give rise to "strays" in wireless receivers. Balloon trips made with this apparatus showed a great prevalence of these rapid changes inside clouds, especially the upper and lower cloud surfaces; but they gradually decrease as the height increases.

THE BELL OF KWEI-LING

A Tale of the Far East

By Gerald Hamilton

"DING-NG-NG!"

The sharp, yet lingering, sound of a bell suddenly smote upon the stillness of the night.

It was so loud that it seemed to be almost close at hand. Its one deep, clear, decided note rang out defiantly, and the echo, though there was only one stroke, lasted many seconds. Two men who were sitting at a table reading by the light of a green-shaded lamp looked up instantly. Neither spoke for a few moments. Outside, inside, all around hung again that silence, that black silence, which the sound of the bell had so rudely broken.

The city of Mingkiang was asleep. The waters of the Yangtze lapped the deserted Bund, and the full moon shone brightly, revealing an almost empty city, though every now and then a shadowy form could be distinguished hurrying along, a doctor visiting the sick, or some unfortunate vainly searching for an opium house, or perhaps a beggar shambling towards the city gate hoping to secure a good position for the morrow. Otherwise all was silent, sleep seemed to be in the air, the very smells had gone to rest. Only the light in the window of the Catholic Mission continued to burn brightly.

One man, a tall, well set-up Englishman, put down his book.

"What was that?" he said slowly.

The other, a priest, pale over his studies, did not answer at once. It seemed as if he was waiting to hear if the bell would sound again.

"That is the bell of the Kwei-ling Monastery," said the priest in his clear, precise English. "The monastery we visited to-day up on the hill overlooking the city where you will fix your wireless station. I have never heard that bell before. It has a strange legend attached to it. If you like I will tell you the story.

Ralph Overton lit his pipe which he found had gone out, and settled himself comfortably in his chair. He was a tall, dark man of about thirty, and had not been in China more than a month or two. Ever since boyhood he had been greatly fascinated by the Chinese and their customs, folklore and history. Therefore, when this opportunity that he had been given to visit China to erect a wireless station in the neighbourhood of Mingkiang came to him he was all the more pleased by his good fortune. He had already spent some time travelling hither and thither in the interior with a view to examining possible sites for the station, and usually he put up at the Catholic Missions which are spread all over China, where he was always most hospitably received, and found in the priests, who always spoke the local dialect perfectly, most desirable companions. In their turn the priests themselves were glad to have someone fresh from Europe to talk to, and especially to practise their book-acquired English upon, for they are mostly of French, Belgian or Italian extraction; and moreover, as they are devoted to scientific studies, they eagerly devoured all Ralph had to tell them of the new world of wireless marvels.

Ralph had come down to Mingkiang from Shanghai by rail the day before, and he was beginning to find all Chinese cities very much the same. The same people, the same noises, the same smells. He felt rather bored and so was glad to hear a story, if it was at all uncommon, as this one seemed likely to be.

"You know," the priest began slowly, "that a Chinese monastery is really a kind of settlement, for the monks live there all their lives, seldom if ever leaving its precincts. We were very civilly escorted round the Kwei-ling Monastery this morning and shown what the monk considered would interest European travellers—the view from the top, the monk's quarters, the huge Buddha. You went away, no doubt, gratified that you had been able to go over such an ancient and historic monastery. You considered the site an eminently suitable one for your purpose and made a note of it in your diary. But there was something we did not see, something that no European has ever seen, or, at any rate, seen and lived to tell the tale. It is a shrine or little temple of the God Kwei-ling, from whom the monastery takes its name. Kwei-ling is essentially a Chinese deity. He is mentioned in the classics and appears to have been a human being who was deified about five centuries after his death. He was a great warrior, and the tales of his deeds of prowess and valour in driving out the barbaric hordes of Mongols that infested the country some 2,000 years before our Lord, so endeared him to the Chinese that he was eventually deified. He is supposed to have died on the site the monastery at present occupies, and the image of him in the shrine is, I believe, very wonderful and of great antiquity. But I warn you it would be the greatest insult that could ever be offered to him if they allowed one of the foreign devil's machines, which would at any rate disturb the feng-shui, or air spirits, wherever it was placed, to be erected right under his nose. He was a very popular Boxer God, during the rising in 1900, for he is essentially an anti-foreign deity and his spirit is supposed to protect his devotees from being molested at all by foreigners. You will see, therefore, how shocked he would be if one of the accursed barbarians, against whom he battled so bravely some four thousand years ago, was admitted into his august presence, now that he is a god, in order to set up an opposition deity far more powerful and mysterious. The shrine is also a sort of local Mecca. There are hundreds of wonderful tales about Europeans who have tried to gain admittance and of the dire fate that has befallen them."

Ralph had been listening intently.

"That's most interesting," he said, "but what has that to do with the bell?"

The priest watched him narrowly and continued:

"The legend is that if ever a foreigner does succeed in reaching the shrine, or offends the deity in any way, or if ever one of the deity's devotees breaks a vow made

To Mingkiang by Rail

Chinese Schoolchildren

"He walked on past timber yards."

to the god, the latter at once strikes him down dead for his wickedness and announces the event by striking the great bronze bell that is at his side. I have never heard that bell before," the priest concluded slowly.

"Jove! that's interesting," said Ralph; "but, of course, one of those johnnies strikes the bell himself and does away with the unfortunate intruder."

"Possibly," the priest smiled, "but I think you will admit that it is physically impossible for one priest, or even a crowd of them, to strike a gigantic bell weighing fifty tons and ten feet high (as this one must be) so forcibly as to be distinctly heard so far away. However, we will hear in the morning."

They went up tc bed, and Ralph entered the guest-room. It had "Monsignor" written over the door, which indicated that it was the room the Bishop of the diocese occupied when he visited Mingkiang. Inside the room was cold and bleak. Though it was November there was no fire or stove, and there was only one picture, a rather cheap reprint of the Sistine Madonna that hung in the centre of the wall over the gaunt *prie-dieu*. Ralph found sleep difficult. He seemed to hear that weird, clear bell breaking in upon his slumbers, and he would sit up and listen, to find that it was only the sighing of the wind. How he would like to enter that forbidden temple and see the great Bell itself! Could it be managed? Others had tried and failed. But that was no reason.

The next day was Sunday, and Ralph was awakened at an early hour by the crowd of Chinese school children and others who were already in the church reciting in Chinese innumerable "Our Fathers" and "Hail Marys" in loud, monotonous tones. Mass was at eight, and Ralph hurriedly dressed himself and went down into the church. The priest was at the altar, and Ralph noticed he looked paler than usual.

At breakfast he said there would be a funeral on the morrow.

"A funeral?" Ralph enquired.

"Yes, an old woman, a convert, died last night. It appears she fell dead of syncope just outside the Kwei-ling Monastery. Her relations tell me that before she became a convert she had made a vow to bring every year a certain sum and lay it before the god, a tribute of gratitude, because, so her family allege, he protected her shop from being seized by the French sailors some years ago. Yesterday was the day she should have brought the money, but, being a Catholic, I forbade her to have any further connections with a heathen god. It seems, however, that, like most Chinese, custom had great influence with her, and she went up to the monastery as she had been accustomed to do in previous years, whether to bring money or what to do I do not know. The monks brought her body to me early this morning, and told me she had fallen dead just outside the monastery. They went away chanting:

The Vengeance of the Heaven is a terrible thing,
And Kwei-ling is powerful god—great and strong.

They also said she must have died shortly after eleven o'clock. They laughed as they said it."

"The Bell?" said Ralph in a hoarse whisper.

But the priest did not answer.

"There were no marks of violence on her body," was all the priest vouchsafed when later he was pressed by Ralph.

"But can't you have the old beasts arrested? They may have killed her, and by ringing the Bell they gave the show away."

"We have no proof. It was the same when the last European who was supposed to have gone to the sacred shrine was missing. The authorities could not act in the matter, though they must have known, because no one could conclusively prove even that he went to the monastery at all. Besides, it happened some years ago."

"And nowadays you would think that they would not dare to touch a European?"

"*Che lo sa?*" said the old priest dreamily, relapsing into his native tongue. "They might or they might not."

Ralph was very restless all day. He went out for a walk late in the afternoon, and at supper announced his intention of attempting to gain an entrance into the temple of Kwei-ling on the morrow, to solve the mystery once and for all. But when the priest saw that Ralph was in earnest in his desire to penetrate into the shrine, he used every means in his power to persuade him to give up the project.

Ralph, seeing the priest's excitement, apparently yielded to entreaties and spoke no more on the matter. He had, however, decided on his plans. After lunch the next day he announced his intention of going for a walk. The priest said he would accompany him, and Ralph cordially invited him to do so. As a matter of fact he was due to officiate at the old woman's funeral, but he thought Ralph had forgotten this, and his suspicion that Ralph would go to the monastery alone was disarmed by the latter's reply. The monastery had been tabooed in their talks all day.

Ralph promised to be back in time for supper and said jokingly, "If I'm not back by seven you can certainly make inquiries for me." And the priest's mind was quite at rest.

Ralph went first to a provision shop, where he made some purchases, then placing a note and a dollar in the hands of the shopkeeper he instructed him to send it to the priest between five and six that afternoon. He walked on past timber yards and crowds of small boats, the only habitation of the swarms of river folk who lived there all the year round, and then turned to ascend the hill towards the monastery. In his walk of the day before Ralph had found out that

"He hung about the Monastery, which seemed almost deserted."

the monks of the monastery always went into the shrine of Kwei-ling for some kind of service at 6 a.m. and 6 p.m. It was a dark, gloomy place, and Ralph thought that, as it would be dark at 6 p.m., the month being November, he would somehow manage to slip in when the doors had been opened to admit the monks: with the aid of a few dollars and a revolver he hoped to succeed. At any rate he would try, and they could not harm him while he had a revolver. Also they would not dare; he knew inquiry would be set on foot, as he had written a note to the priest saying what he intended doing. He had at first thought of disguising himself as a monk and joining the throng, but he soon saw how hopeless this was, as he would at once be recognised as not belonging to the monastery. Besides, he would never without any experience be able to disguise himself successfully. A far better plan would be to trust to Providence for an opportunity to arise for him to slip in in the dark without being noticed, and then what a lot he would have to say in his diary! What a hero he already felt! It might be so simple—at any rate it was worth trying. They would not dare to do anything to him, so he had all to gain, nothing to lose.

The Shrine of Kwei-ling.

He hung about the Monastery, which seemed almost deserted, until the winter afternoon drew to a close, and shortly before six stationed himself in an angle of the wall close to the forbidden temple. Soon he saw a procession of monks coming towards the shrine. They walked in single file and they looked very solemn and stately in their long saffron robes, with their hands folded. Ralph flattened himself against the wall, and, as it was quite dark, succeeded in escaping notice. The monks marched in single file, each fifth man carrying a burning torch, but the flickering, uncertain light only illuminated the procession itself. The last monk had now gone in through the huge carved doors and Ralph saw over his head a great figure in the distance, surrounded by innumerable red candles. The draught coming in through the open door made the candles flicker, and these gave the terrible face of the god a hideous, mocking expression. Ralph noticed he had two pairs of hands, and in each hand he clasped some instrument of torture. The monks had all gone to their separate hassocks and were kowtowing before the god. The last monk had now turned to close the door. Ralph vaguely wondered why they did not guard the temple better if they wanted to keep it sacred. He had been able to see a good deal through the door, but success only increased his interest. Nothing in the world would now stop him from trying to gain an entry. He made a movement forward, intending to force the monk at the point of his revolver to let him in and he would hide in the shadows; the other monks had their backs to the door and would not notice. But as he moved forward he felt himself seized in a vice-like grip: it was so sudden and unexpected that he did not even struggle. The door was still open and the monk seemed in no hurry to shut it. The next instant he realised that he was being dragged forward into the presence of the hideous god. How the distorted features mocked him with their malignant grin!

. . . . .

The priest was walking slowly in the courtyard of the Mission, his breviary in his hand. A few moments ago he had received Ralph's note and he knew that he could do nothing now. Ralph's fate was in higher hands.

"What an old fool I am to have told him the story," he muttered. "I forgot in my old age that youth is rash and ardent."

All around the little Chinese school children were playing. It was their half hour's interval. Their merry shouts and yells seemed to clash horribly with the melancholy thoughts of the priest. A broken rubber ball fell at his feet; he stooped painfully to pick it up and restore it to its owner; and the children, quick to notice their beloved pastor's troubled expression, tried for a little to be less rowdy in their play.

The priest attempted to read his breviary, but his thoughts were elsewhere, and he constantly gazed up at the hill in front, at the top of which the monastery clustered dim and gaunt, but there were no lights and the priest could see nothing. He seemed to be vaguely expectant.

Suddenly a loud triumphant clang smote upon the air. The children stopped playing and looked at one another in terror, the priest started violently and the breviary dropped from his hands. He quickly made the sign of the Cross, and the words that came to his lips were "*Requiescat in pace.* Lord have mercy on his soul," for instinctively he knew that Ralph Overton was dead.

There was a buzzing in his ears, "ding-ng-ng-ng," the echo of the bell. With a low groan he fell forward and lay still. He was an old man and the shock was very great.

. . . . .

There is still to-day one more wireless station needed in a certain district of China: the most favourable site is said to be the hill of Kwei-ling.

THE AMATEUR'S WISH.

ALAS, Poldhu! thy blaring bugle note
Which oft at midnight pleased my list'ning ear;
And Clifden, too, thy mighty waves which float
Five miles apart, wide wafting signals clear,
For me are gone. My 'phones no longer sing
The music which was prompted by your sparks,
Nor can they tell, if still ye nightly fling
Abroad, meteorological remarks.
My watch ticks on, unchecked; I cannot fix
Its hands to Greenwich time, and set it right,
For Paris purring "tas" and "tuts" and "ticks"
Ne'er reach my ears. My aerial's gone from sight,
Gone Cleethorpes' mystic messages that thrill,
And turn my thoughts to men, and ships, and might.
Gone, too, Madrid, whose plaintive whistling shrill
I've heard, with straining ears, across the night.
My jigger lies, with coils and aerial-lead,
In tight-packed drawer; it can no longer slide
To tune, helped in its work, to let me read
Far signals, by condensers on each side.
Shall I complain? No, never! From it far,
Such hobbies now must all aside be laid
Since I have heard the "ta-te-ta-te-ta"
My country sent to call me to her aid.
And so instead I'm tuning up a gun,
And learning how to shoot, to march, and wait
With hope, to help in things which can be done
By those who turn to drilling rather late.
And if I'm called away to leave my home,
Should I, before I go, just take a peep
To see that all within my wireless room
Is right, I know this thought will on me creep.
"When peace again doth reign, and war is done,
God grant my 'phones may sing of victory
In notes that spell the words of England's tongue,
Sent out by British hands on Norddeich key."

AYLMER A. LIARDET.

Carborundum Detectors.

By H. T. WORRALL.

A VERY small proportion of those who use carborundum know how it is made, or what it is composed of. As it plays a very important part in wireless telegraphy, on account of its sensitiveness to wireless oscillations, it may well repay us to give the subject a little attention.

In the manufacture of "carbide of silicon"—for such is carborundum—ordinary "coke" is crushed and ground to a very fine powder and mixed in proper proportions with common "glass sand." "Salt" and "sawdust" of determined quantities are then added to this mixture for mechanical purposes.

The compound is then placed in an electric furnace and for thirty-six continuous hours an electric current of one thousand horse-power of energy is passed through the furnace, subjecting the contents to a heat of approximately 7,000° Fahr.

When the furnace cools down the mixture is found converted into large masses of beautifully coloured crystals of exceeding brilliant lustre and of a hardness to be compared only with that of the diamond. After several minor processes the finished article is ready for various commercial purposes.

It seems scarcely credible that certain parts of this rough crystalline matter, composed of common substances, should become an important factor in wireless telegraphy, and, as it is, a highly efficient detector of wireless oscillations. The property of carborundum which renders it a suitable detector was first discovered by General Dunwoody, of the United States Army, who found that, when placed in a suitable receiving circuit in series with a telephone, signals could be heard either with or without an E.M.F. By the application of a correct potential, however, the detector is considerably increased in sensitiveness. Subsequently carborundum detectors have been exhaustively studied by many scientists, including Prof. Pierce, of Harvard University, U.S.A., who pointed out that "suitable carborundum crystals constitute one of the most easily adjusted, reliable and sensitive forms of wireless detectors," and, we might add, one of the most robust.

To cut or chisel out the crystals—or detectors, as they are generally named—is not an easy task, and requires a great deal of patience; so that some hints from one who has had some experience may not be amiss. What is required is a suitable "Crystal Testing Set," a high-speed steel chisel, flat-faced hammer, a stout pair of trimming pliers, and 800 or 900 lb. of carborundum in rough blocks, the blocks as delivered from the makers ranging from a few ounces to as much as 10 lb. in weight.

For wireless detectors the most effective area of a block of carborundum generally extends from the amorphous or under side to approximately three-quarters of an inch upwards, and the crystals when trimmed up will be about half an inch in length; the remaining portion, which is by far the greater, carrying the sharp glass-like crystals, may be thrown on one side as useless. The selection of a piece of carborundum suitable for wireless purposes requires a great deal of care and judgment, and to illustrate this more fully I have chosen five specimen grades. These do not by any means cover all grades met with; on the contrary, there are many intermediate grades more or less good or bad, as the case may be. The five selected samples, however, have widely different characteristics, and will serve the purpose of showing the grade which is most likely to contain good rectifying crystals and the grade which is of no account.

In selecting carborundum, then, the first and most important point to consider is the amorphous formation of the various grades to be dealt with, and success or otherwise will depend to a great extent upon a knowledge of this factor. The crystal or pointed end of the detector, when cut away from the block, is not so important, as it has been found that (provided a suitable piece of carborundum is selected) the sensitivity of the detector is not impaired even though the point is broken off, for another point will usually be found giving equally good signals, the characteristics of a good piece of carborundum being fairly uniform throughout its effective area.

In the illustration I have endeavoured to show the amorphous formation of five specimen grades, numbered 1, 2, 3, 4 and 5 respectively.

Grade 1.—Colour, silvery grey; amorphous formation has a flat surface with no graphite deposit; honeycomb appearance, with irregular lightly intersected lines resembling cells; the mass is of a close and straight-grained nature; the crystals are easily chipped and require very little trimming. This grade should yield 80 per cent. at least of very efficient detectors.

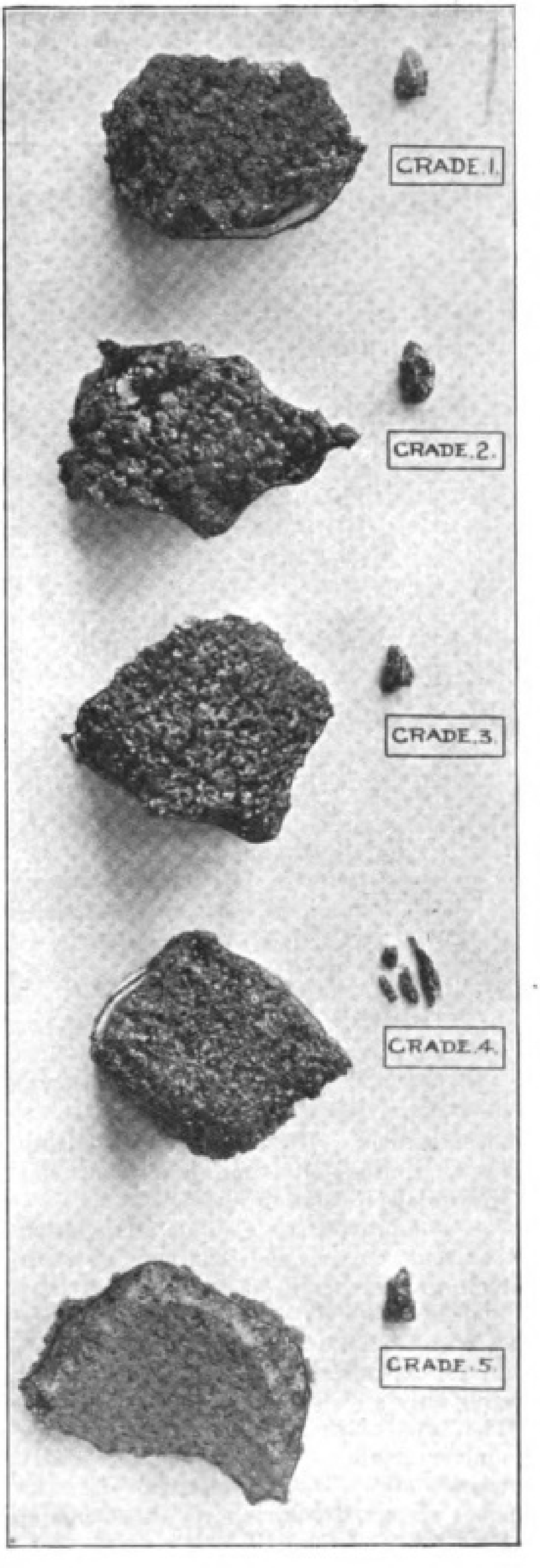
Grade 2.—Colour, grey; amorphous formation has a very irregular and rugged appearance, with fairly heavy graphite deposit; the mass is similar to Grade 1, but with deep fissures; the crystals are hard to cut and trim to required size. This grade will yield approximately 50 per cent. efficient detectors.

Grade 3.—Colour, dark grey; amorphous formation has a hard granular and fused appearance, with no graphite deposits; the mass has a similar formation to Grade 1, slightly more flaky perhaps. This grade is of no use for receivers, the crystals having no rectifying properties.

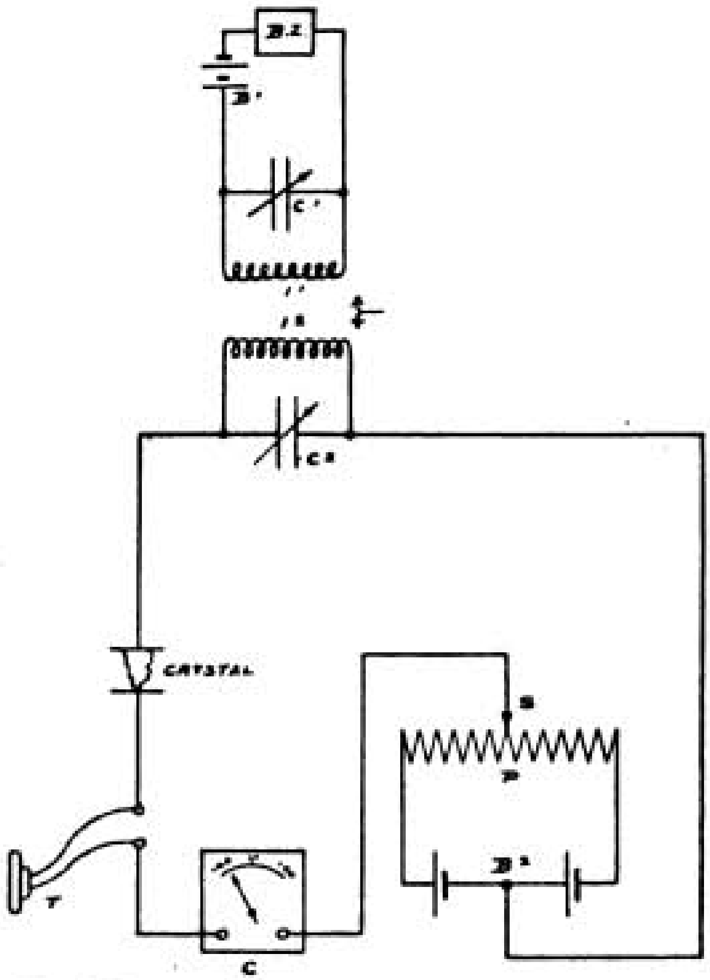
Grade 4.—Colour, motley blue; amorphous formation is composed of sharp splintery points with no graphite deposit; the splintery flakes permeate the whole of the mass; impossible to cut crystals from this grade, the mass crumbling away when struck.

Grade 5.—Colour, bluish grey; amorphous formation has a smooth flat surface with very heavy graphite deposit; the mass is of close formation, similar to Grade 1, but is much harder and more difficult to cut. Crystals from this grade are of no use for receivers, having a very low rectification of 3 to 1 approximately. These, however, might be used in conjunction with wavemeters.

What one should look for is something corresponding to Grade 1. Having chosen the grade, it is necessary to chisel out the



crystals and trim them up to some required size, care being taken not to damage the



B.z. High note shunted buzzer.
B.[1] B.[2] Batteries.
C.[1] Variable condenser from 0 to ·004 mfd.
I.[1] Inductance 25 turns No. 24 d. c. c. wound on former 6 in. diam.
I.[2] Inductance 100 turns No. 24 d. c. c. wound on former 4 in diam., 7 in long.
C[2] Variable condenser from 0 to ·0008 mfd.
T. High resistance telephone.
G. Unipivot Galvanometer, scale reading 140—0—140 Micro. Amps.
P. Potentiometer 400 w. resistance.
S. " Sliding contact.
↕ Coupling to be as loose as possible.

amorphous end. The crystal is now ready for setting into a brass cup (amorphous end downwards) previous to testing.

I do not propose to give details relating to current curves and characteristics of detectors in general, as this subject was fully dealt with in Vol. I. (Nos. 9 and 10) of THE WIRELESS WORLD. It will suffice, therefore, to explain the recognised method of testing only.

The type of carborundum detector now in universal use is one in which the steady current curve is asymmetrical—*i.e.* the current at, say, 2 volts is forty times greater in one direction than the other.

The detector is connected as shown in the diagram to a sensitive galvanometer and some source of E.M.F.; the potential is then adjusted to two volts and the steady current deflection noted in either direction. The ratio must be at least as 40 to 1.

The table below gives required current values at two volts for various types of receivers :—

For receivers having a long wave-length,
$C=10$ to 35 micro amps. $\times 10^{-6}$
For receivers having a medium wave-length,
$C=20$ to 60 micro amps. $\times 10^{-6}$
For receivers having a short wave-length,
$C=60$ to 120 micro amps. $\times 10^{-6}$
For any circuit with capacity over ·0005 mfs.,
$C=50$ to 100 micro amps. $\times 10^{-6}$

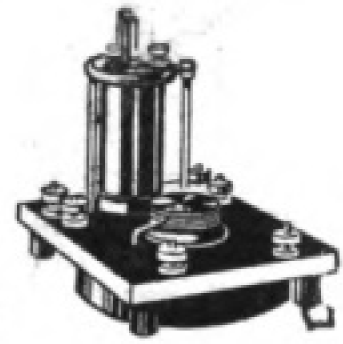
The reverse current, as previously stated, must be $\frac{1}{40}$ of above values.

A good testing set is shown in the diagram, which is of standard design, but it is expensive, and to those not in a position to afford the outlay will no doubt be looked upon as something quite beyond their reach. The galvanometer is, of course, the chief item of expense, and to reduce the outlay in this direction it has been suggested that a Reiss electric thermometer might be used (provided a serviceable second-hand instrument cannot be obtained).

In dealing with cost the question of waste must not be overlooked, and as the present market price of carborundum is nearly four shillings per lb., it is a matter of some importance, for out of every pound of carborundum operated upon one must not expect to obtain more than an ounce of good crystals; hence it is easy to understand why so much material of inferior quality is acquired by the unsuspecting buyer. A really efficient detector, after having passed the necessary tests described here, would be retailed at a high price; but the results obtained would compensate for the high price.

For the benefit of those who must purchase their detectors as they have been accustomed to before, some reliable source of supply will have to be provided. The time has come when every retailer of detectors, if only for the sake of his own reputation, must satisfy himself that his stock has passed through the eliminating processes here described.

The ENGINEERS Note Book



[Under this heading we propose to publish each month communications from our readers dealing with general engineering matters of various kinds in their application to wireless telegraphy, and we would welcome criticisms, remarks and questions relating to the matter published under this heading. We do not hold ourselves responsible for the opinions and statements of our contributors.]

INSULATING OILS.

WHATEVER the type, or size, of the transformer may be, the generation of heat is a normal working condition of all transformers, and if this heat be not sufficiently rapidly eliminated there is loss of efficiency and danger of destroying the insulation of the coils, to which may be added the risk of bringing about the "ageing" of the iron and of setting up mechanical stresses in the structure itself due to the unequal expansion and contraction of different parts of the core and windings. Generally speaking, one of four methods is employed for carrying off the excess of heat—namely, natural ventilation, oil-immersed self-cooling, oil-immersed water-cooling, or air-blast.

For small transformers natural ventilation has been found sufficient, but for the larger types some extraneous cooling medium is necessary, and oil has proved most suitable for the purpose, supplemented, if required, by water-cooling of the oil itself; in one large installation now working, at a potential of 100,000 volts, in India, where the available water supply has a mean temperature of 75° F., it is even proposed to refrigerate the cooling water, and in many of the large American installations the cooling is aided by placing the transformers out of doors, and so exposing it to the weather.

* * *

It is obvious that only the most suitable oils should be selected for use as cooling agents. And in making the selection regard should be had to the fact that not only does a transformer immersed in a suitable oil possess a good overload capacity due to the time required to heat up the large volume of oil surrounding it, but also that a properly prepared oil has insulating properties of the highest value, and thus incidentally serves to minimise any bad effects which may be caused by small defects in the solid dielectric by static discharges.

The earliest makers of transformers, realising that the heat conduction between metal and oil was very much greater than between metal and air, naturally adopted oil as the best medium for cooling purposes. But their efforts to solve what is now known as the "sludging" problem were scarcely successful.

* * *

A writer in the *Electrician* states that as the result of several years' experiments an important company have ascertained that the Russian hydro-carbon oils are better suited for the purpose than are the American oils, as they can be refined on a commercial scale to a very much greater extent.

This process entirely deprives the oil of any tendency to oxidise and prevents injurious action on either the metal or insulating materials of a transformer. In the absence of a standard test for determining the non-sludging qualities of an oil, the following physical characteristics are recorded in the *Electrician* :—

They are free from acids and moisture, and perfectly neutral. They are also free from all impurities, such as sulphur compounds, and colourless when examined in an ordinary test tube. Their flash point is above 160° C. by the Pensky Marten close test, with a fire test of not under 190° C., while at the other extreme they remain fluid to a temperature of —29° C.

As stated, these oils are singularly free from oxidisable or tarry matters likely to precipitate sludge, and to ascertain their behaviour in the presence of bare copper, a quantity, 100 cubic cm., of the oil, in which metallic copper foil of 28·559 cm. area was immersed, was maintained at a temperature of 150° C. for 45 hours. After a current of air had been passed through the oil for the time stated, the temperature being maintained, no appreciable separation of solid matter could be traced.

A comparable, and equally favourable, result was obtained by passing a current of ozonised air through the oil at a temperature of 138° C. (280° F.) for 14 hours. The ozonised air was produced by an electric discharge, and was passed between copper gauze electrodes through the oil at the rate of 37·75 cubic decimeter (1·3 cubic ft.) per hour for 14 hours.

For all practical purposes it is desirable to state in specifications dealing with the copper test for non-sludging oils that the limit of solid matter separated from the oil during the process of testing should not exceed, say, 0·05 per cent. when using air, or 0·07 per cent. when using ozonised air. The specification should also contain detailed particulars as to the quantity, quality and shape of the copper employed, together with the quantity of the air and the exact speed, pressure, temperature and hygroscopic condition at which it should be passed through the oil.

* * *

CHAINS.

The three main varieties of chain are: (1) short link or crane chain; (2) long link or cable chain; (3) studded chain. Of the first-named variety, which is weaker than either of the others, each link of short-link chain has a length equal to five times the diameter of the iron used for the links, and studded chain has a length of six times this diameter. Any chain over five diameters in length and not studded is called long-link chain. Both short-link and studded chain have a width of three and three and a half times the diameter of the iron. The length of the chain issued varies according to the work to be done, and is measured in fathoms. The smaller sizes of short-link chain are usually galvanised; studded chain is usually ungalvanised.

According to Government specifications, the weight of chain, from which a variety of 5 per cent. is allowed, is approximately given by the following rough rule:—

Short-link chain ...	$64d^2$ lb. per fathom.
Studded chain ...	$59d^2$ " "

where d is the diameter of the iron in inches. Government specifications for ascertaining the strength of chain provide for a short piece of each chain to be tested with a load that may be taken as the equivalent of the breaking stress. The amount of this load is given by the following rules:—

Short-link chain	$24d^2$ tons.
Studded chain	$27d^2$ "

In the case of short-link chain this is equivalent to a stress of about 15·3 tons per square inch, whereas the iron from which the chain is made is specified to have a tensile strength of 23 tons per square inch. The difference is due to the way in which chain fails—namely, by the links distorting and pulling out. This also accounts for the greater strength of studded chain, although it is lighter, as it is helped against this distortion by the studs.

In addition to the test load, the whole chain is subjected to a proof load, which is half the test load for a short-link chain and two-thirds the test load for studded chain, namely:—

Short-link chain	$12d^2$ tons.
Studded chain	$18d^2$ "

On an emergency new chain may be used up to the proof stress, but for ordinary use half this amount should not be exceeded. Even this, in the case of studded chain, does not give a very large factor of safety.

Long-linked chain is only about five-sixths of the strength of short-link chain made from the same iron—that is, its test strength would be about $20d^2$ tons.

* * *

For use in the field the following rules give the safe working load:—

Short-link chain	$6d^2$ tons.
Studded chain	$7d^2$ "
Long-link chain	$5d^2$ "

When chain has been subjected to violent use, such as loads coming on suddenly, the iron of the links becomes crystalline and brittle. Chains used for such purposes should be annealed periodically, to restore the iron to its fibrous condition. This may be done by heating it to a very dull red heat and then allowing it to cool slowly.

Maritime Wireless Telegraphy

WE take the following from the *Arlanza* edition of the *Wireless Mail*, the daily news bulletin published on board the vessels of the Royal Mail Steam Packet Company. It is dated August 18th :—

"This issue of our *Wireless Mail* will, we feel sure, be a 'welcome' souvenir to some of our passengers; welcome, perhaps is hardly the word, as the experience we have gone through since our last issue is one few of us will ever want to undergo again, and while it lasted and grave doubts hung in the balance, the emotion and feelings we felt can be better imagined than described. A short account of our 'happy escape' is as follows :—

"On August 16th at 12.50 p.m. we sighted on our starboard beam a four-funnelled steamer, apparently steaming about S.E.; shortly after we saw her she altered her course and came direct for us. On getting within signalling distance we made her out to be the German armed merchant cruiser *Kaiser Wilhelm der Grosse*. She at once hoisted the German ensign and signalled us to 'Heave to, or I will fire.' This signal we need hardly say was at once acknowledged and acted on, as what can an unarmed passenger steamer do in such a case with the lives of 1,600 or 1,700 people at stake? The following signalling then took place :—

"1. 'Lower away and heave overboard all your wireless telegraph installation.'

"2. 'Have you any women on board?'

"3. 'Dismiss, on account of your having women and children on board.'

"4. 'Lower away and heave overboard all your wireless telegraph installation.' (Repeated.)

"5. 'I have no further commands to your captain.'

"During this signalling the cruiser remained within 200 or 300 yards of us, and after she had seen our wireless aerials, etc., thrown overboard she steamed away in a southerly direction, much to the relief, we are sure, of all who witnessed it. We needed no second bidding, and our good ship *Arlanza* was at once put on her course for Las Palmas.

"A short description of our 'enemy' will be of interest.

"The *Kaiser Wilhelm der Grosse* was built in 1897 at Stettin. She is 14,349 tons gross, 626 ft. in length, 66 ft. beam, 39 ft. depth, and has a speed of 22½ knots, and belongs to the North German Lloyd Company. As far as we could make out, she appeared to be armed with nine 12-pounders, so we think you will agree with us that we should stand a very poor chance against such an enemy.

"Las Palmas was reached at 7 a.m. on August 17th, and here our commander at once landed and reported the occurrence to H.B.M. Consul; by 9 a.m. the report was telegraphed to the Admiralty at London, also to the R.M.S.P. Company, and at 3 p.m., after leaving Las Palmas, we had the satisfaction of knowing that our report had been received. At noon we left the Canaries, and meeting the British cruiser *Cornwall* outside, the affair was reported to her captain by semaphore. And as soon as this was finished and we started on our homeward run, a loud burst of cheering for the captain and crew of the *Cornwall* came from the hearts of all our passengers, and we cannot help thinking that all on board must have felt a great deal of satisfaction and safety, knowing that a British man-of-war was within hail and always ready to uphold her place as Mistress of the Seas. We must mention that by 9 p.m., or say seven hours after the wireless telegraph was thrown overboard, a complete new set was in place and in working order."

A thrilling narrative has been told of the stopping of the Union-Castle liner *Galician*, homeward bound from Cape Town, off the Canary Islands by a German cruiser, which subsequently turned out to be the *Kaiser Wilhelm der Grosse*.

At 2.45 p.m. on August 17th, in latitude 27° 30′ N., longitude 18° 0′ W., a black, ugly-looking four-funnelled steamer came alongside flying the German flag, and signalled to the *Galician* to stop at once and not to use its wireless apparatus. The wireless operator, however, quickly sent out the "S.O.S." signal, and had already sent the first three letters of the ship's name—"Gal"—when a second message came from the German ship: "Stop your wireless. We blow up the bridge if another letter leaves." Presently a third vessel appeared in the distance. She signalled that she was a German liner disguised in the colours of the Union-Castle line. The German cruiser was not satisfied, but after the newcomer had hoisted the German mercantile flag and given her name she was allowed to proceed.

The cruiser then ordered the aerial of the *Galician* to be lowered and the vessel ordered to follow at full speed. At 3.15 p.m. the order to stop was given. What followed may be described in the words of a *Morning Post* correspondent :—

"The merchantman (*i.e.* the *Kaiser Wilhelm der Grosse*) then sent a boat manned by two officers and men, who destroyed the wireless, then inspected ship's papers, mustered and inspected passengers and crew. At 5.30 p.m. Germans left ship, taking with them Lieutenant Deane, first-class passenger, and Gunner C. Shearman, third-class passenger, and ship's papers and documents, etc. At 5.40 p.m. we were ordered to precede merchantman at full speed and to steer S. 25. Mag.; at 6 p.m. we received orders to keep all lights extinguished and to have all effects belonging to passengers and crew ready on deck and to provision all boats, and to have everything in readiness for leaving the ship at daylight. At 8.30 p.m. we were ordered to alter the course to S. 17 E. Mag.; on which course we continued until 3.40 a.m., August 16th, when we received orders to steer S. 455 W. Mag. Merchantman throughout following closely in our wake. At 5 a.m. the merchantman sent the following message to Captain Day: 'I will not destroy your ship on account of the women and children on board. You are dismissed. Good-bye.' To which the following reply was sent: 'To German Captain,—Most grateful thanks from passengers and crew. Good-bye.' Lat. 25.35 N., Long. (?) 17.20 W., the merchantman then left us at full speed and we turned ship and shaped a course for Teneriffe.—Note: The German officers were most courteous throughout."

* * *

The wireless apparatus recently installed on the Great Western Railway Company's Irish steamers served a useful purpose. A passenger travelling on the Night Boat Express from Paddington left a purse containing £7 in a sleeping compartment. At Fishguard he boarded the steamer *Saint Patrick*, and when in mid-channel discovered his loss. The chief steward suggested that a wireless message should be sent to Fishguard, which was done. On arrival at Rosslare the passenger found that the station master there had received an advice that the purse had been found.

* * *

On July 11th the *Invermore*, belonging to the Reid Newfoundland Company, went ashore near Brigg Harbour, Labrador, and is likely to become a total wreck. Her cargo included supplies for the Canadian Marconi Company's stations along the coast, and salvage operations are now in progress. A part of the supplies have been landed, and it is anticipated that the vessel's $1\frac{1}{2}$ kilowatt wireless installation will also be saved.

* * *

When the *Royal George* was in the Gulf of St. Lawrence bound for Montreal a "SOS" call was received from the French steamer *Sacha* on July 22nd. Her position being ascertained, the captain of the *Royal George* at once ordered full steam ahead for the point given, which was just off St. Pierre, Newfoundland. After proceeding for half an hour, the *Sacha* signalled that she was out of danger and that assistance was not required. It transpired later that there had been a serious fire on board, which, however, the crew had been able to extinguish.

* * *

The following call letters have been allotted by the Canadian Government:—*Bellona*, VEP; *Bessie Dollar*, VFO.

* * *

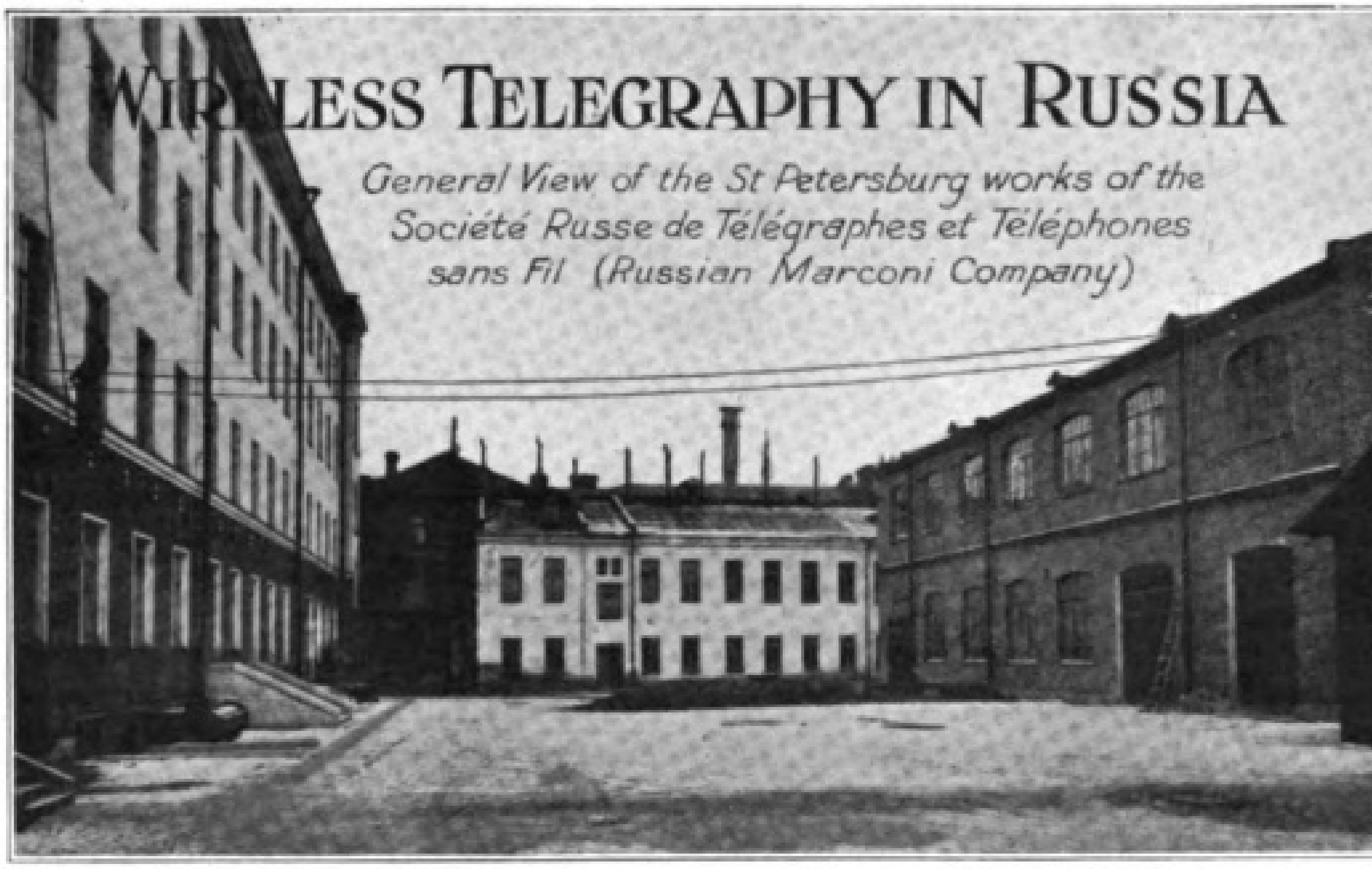
The *Christopher*, formerly owned by the Booth Line, has been renamed *Obuasi*, and sold to Elder Dempster & Co. The call letters (MDD) will remain the same.

* * *

The *Leopoldville*, formerly owned by Cie. Belge Maritime du Congo, has been renamed *Abinsi*, and sold to Elder Dempster & Co. The call letters have been changed to MVP.

* * *

The wireless apparatus on the *Eagle* (Bowring Bros. & Co., Ld.) is now operated and controlled by the Marconi Wireless Telegraph Company of Canada.



The main building is on the left of the illustration with a new wing in which is located a 100 k.w. station on the right. The wood working shops are seen in the centre.

ONE of the most promising countries for the development of wireless enterprise is Russia, where progress is being watched with considerable interest. Since the year 1900, when, thanks to the encouragement and support accorded by the present Minister of War, General Soukomlinoff, wireless telegraphy obtained a footing in the country, the general progress has been steadily maintained.

During the past year the operations of the Russian Company of Wireless Telegraphs and Telephones, which has developed from the early enterprise that was started fourteen years ago, has shown substantially increased revenue and profits. The company's premises have been considerably enlarged to accommodate the increasing number of employees in order to be able to deal with the growing business.

Special attention has been paid by the Russian Company to the installation of high-power wireless telegraph stations for commercial purposes. Information regarding these stations has already been published in THE WIRELESS WORLD, and there is at the present moment little to add.

Instruments have been designed for the automatic transmission as well as the automatic recording of messages, thus enabling stations to increase to a large extent their working capacity. Apart from the installation of stations of high power, it is significant to note that in the company's laboratories work is being continued in connection with the construction of special types of military and marine stations.

A great deal of attention has been paid to the design of special types suitable for the requirements of the mercantile marine, and in the near future a large field should be opened up in this direction, for a new law is under consideration to make it compulsory for all passenger-carrying vessels to be equipped with wireless telegraphy. It is not difficult to foresee that wireless telegraphy will become an important line, and it is interesting to note that in Russia this particular development has received the attention which it ought to receive, so that before very long the possibility of adopting wireless telephony for military, naval and commercial purposes should become an accomplished fact.

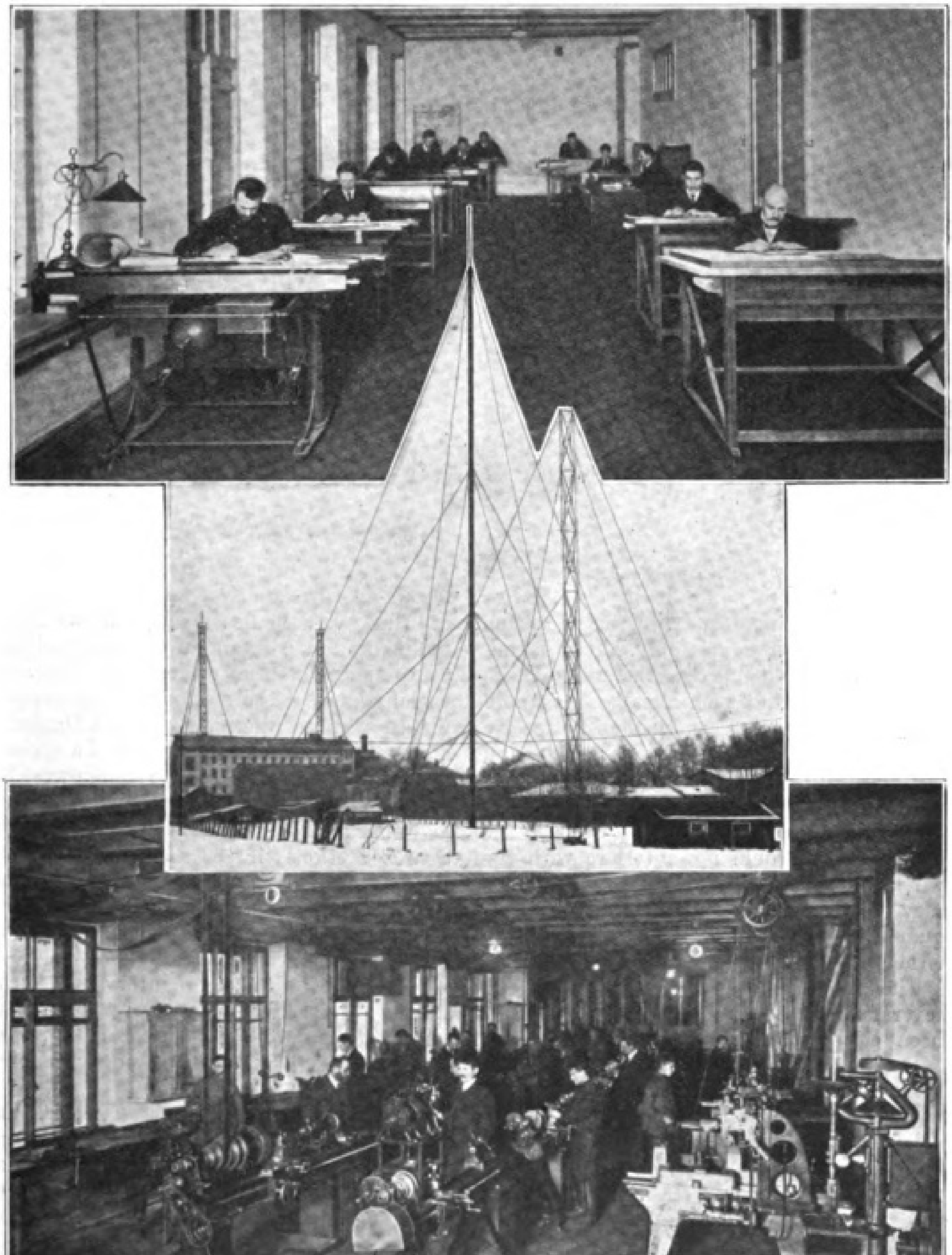
The Russian Wireless Company has for some years now made substantial progress, and the results of its operations last year supplement the favourable results in 1912.

In that year it will be remembered the Government placed large and important orders with the company, both for the erection of shore stations and the equipment of the Russian marine. Thirty-six naval ship stations were converted by the company, and among other developments in 1912 was the introduction of a special type of light portable station for cavalry use.

The company's works, of which we are able to publish some photographs in this issue, are situated in one of the most beautiful parts of St. Petersburg—on the Camero Ostrov—about 2½ miles from the centre of the city. They are designed on broad hygienic lines, and are magnificently equipped. The outlook in Russia generally is a most promising one; she takes an honourable place among the countries who have adopted wireless telegraphy and have contributed definitely to its advancement. Up-to-date as she is, she intends to be still more admirably equipped in the near future, and a scheme of internal communication has been under consideration by which the central parts of the Empire will be connected by wireless communication with remote and sparsely inhabited regions.

Indeed, Russia presents favourable conditions for the development of international radio-telegraphy. Her situation between Western Europe and the newly developing countries of Asia along the shores of the Pacific and Indian Oceans makes the opening up of a wireless service a paramount necessity, as by this means alone will it be possible to connect the two great wireless systems of the Atlantic and the Pacific. Furthermore, Russia, by being included in the chainwork of communications, will derive not only commercial prestige, but a considerable revenue from transit rates.

The Russian War Minister, General Soukomlinoff, inspecting parts of apparatus in one of the shops of the Russian Company. On his left is Mr. Balinski, and on his right Admiral Bostrom, Mr. Eisenstein and Mr. Adrian Simpson, Directors of the Company.



The Drawing Office is seen at the top of this page. Below is the Automatic Lathe Shop. Inset is a general view of the works showing the masts supporting aerials.

Administrative Notes

China.

THE Minister of Communications, Pekin, informed the Berne bureau on July 7th that the Government of the Republic of China had under consideration a scheme for the establishment of wireless telegraph stations along the coast of China for public service and for communication with ships of all nations. Several stations, he said, had already been erected in the interior of the country, and three important coast stations, at Canton, Foochow and Woosung, would be in operation in the near future.

* * *

Great Britain.

CERTAIN owners of British steamships asked for permission to equip their vessels with apparatus for the reception of signals only. It was considered by the Post Office that such installations would be useful in enabling commanders to receive time signals and meteorological reports, and the authorities therefore advised the Berne Bureau of their intention to license such stations for receiving purposes only. As such stations would not interfere with the wireless telegraph service, it was not necessary to require them to be in charge of duly qualified operators, and it was not intended either to allot call signals to them.

The motor-driven lifeboats carried by several large British passenger vessels have been equipped with wireless installations. In addition to being used as lifeboats, these vessels will be employed in foggy weather as pilot boats for the liners to which they belong and with which they will be in wireless communication. In view of the limited range of these lifeboat stations, particulars will not be published in the *Nomenclature Officielle*, which will simply state the number of lifeboats so equipped carried by each liner. The call letters will be the call letter of the main installation followed by a numeral. Thus in the case of the *Aquitania*, which carries two lifeboats fitted with wireless, the call letters of the lifeboat equipment will be MSU1 and MSU2.

Greece.

As a result of the annexation of the island of Crete by Greece, the administration of ports and telegraphs of Crete ceases to be an independent administration, and the services are now directed from Athens.

The station on board the cruiser *Helli* has been allotted the call letters SZA.

* * *

Madagascar.

A SERVICE giving warning of the passage of cyclones has been organised, as an experiment, on the east, north-west and west coasts of Madagascar. The warning telegram, originating at the Observatory at Antananarivo, will be sent out at the even hours (except between 12 midnight and 6 a.m.) during the probable continuance of the cyclone in the zone within range of the stations. The warning will be sent out alternately by the Dzaoudzi and Majunga stations in the case of a cyclone affecting the region to the north-west of Madagascar or the Mozambique Channel, and alternately by the Dzaoudzi and Diégo-Suarez stations in the case of a cyclone affecting the regions to the north-east and east of Madagascar.

This telegram will be preceded and followed by the warning signal — — — — - - — — — — repeated at short intervals. If the warning signal only is sent out it will indicate, in the absence of precise information, that there is reason to expect the passage of a cyclone.

During the whole of this service, the Dzaoudzi, Majunga, and Diégo-Suarez stations will remain on the watch, after the regular hours of working, during the first quarter of each hour, except between 12.15 a.m. and 6 a.m.

* * *

The hours of attendance at Flinders Island Radio station are now from 9 a.m. to 6 p.m., with no service on Sundays.

* * *

The station at Quai du Rhin, Antwerp (call letters OQR) will no longer maintain a permanent watch, but will be open principally for the exchange of service messages with incoming and outgoing Red Star Line and Canadian Pacific steamers.

* * *

The wireless station at Grand Island, La., has been dismantled.

* * *

Mexico.

THE Mexican Government have signified their adhesion to the International Radiotelegraph Convention, London, 1912, subject to the condition that Mexican stations shall transmit wireless telegrams originating on board ship or in inland towns only when those towns to which telegrams are addressed, or in which they originate, are connected by telegraph or telephone with the coast stations; or when wireless telegrams sent to or from ships through the coast station and addressed to or originating from places abroad are carried overland by the Mexican Federal lines. The Government further reserves the right to refuse for the time being wireless telegrams for express delivery.

* * *

Land Stations Open and Closed.

Argentine Republic.—Faro Recalada (LID) closed until further notice. *Spain.*—Vigo (EAV) reopened for general public service. *France* (*West Africa*).—Tabou (FTA), on the Ivory Coast, temporarily interrupted. *France.* — Ajaccio T.S.F. (FFA), Boulogne-sur-Mer T.S.F. (FFB), Brest-Kerlaer (FFK), Cherbourg T.S.F. (FFC), Cros-de-Cagnes (FFG), Dunkirk T.S.F. (FFD), Lorient T.S.F. (FFL), Rochefort T.S.F. (FFR), and Ushant closed to public correspondence. *Austria.*—Trieste (OHT), Sebenico (OHB), Castelnuovo (OHC) will not communicate private wireless telegrams until further notice (July 27th). *Spain.*—Soller coast station temporarily interrupted owing to fire.

* * *

Brazil.

ON October 23rd there will come into operation a new wireless law in Brazil which provides that all Brazilian ocean-going passenger vessels over 300 tons (or 500 tons in the case of river vessels) shall be equipped with wireless telegraph installations. Cargo vessels having on board 30 or more persons, including members of the crew, must be similarly equipped. The wireless telegraph installations must be fitted by October 23rd, after which date the harbour masters have received instructions to withhold clearance papers from vessels not so equipped.

* * *

British North Borneo.

THE fourth wireless telegraph station in British North Borneo will be at Kudat, which stands on the shore of Marudu Bay, instead of Lahad Datu. The call signal, VQD, originally allotted to the latter has been assigned to Kudat.

Disaster all but overtook the Anchor liner *California*, when travelling recently from New York to Glasgow. A dense fog was the chief factor of the mishap. Without any warning the vessel found herself on the rocks at Tory Island, off the Donegal coast, and any who are acquainted with the nature of the coast line will appreciate the peril of her position. Moreover, her passengers numbered some thousand, and her crew was considerable. Immediately she sent out wireless messages for assistance, which were picked up by the wireless station at Malin Head, H.M.S. *Hecla*, and the torpedo-boat destroyers patrolling the Ulster coast. These rushed to the rescue, as well as the Donaldson liner *Cassandra*. Some difficulty was experienced in finding the *California* owing to the fog. But the torpedo-boat destroyer *Lynx* was first on the scene, and by her searchlight was able to locate the wrecked vessel and to give assistance to the *Cassandra* to approach her. Fortunately the sea was calm, but there is always a certain amount of risk in the transhipment of passengers from one ship to another. In this case the *Cassandra* lowered baskets, and took the passengers up in them, and only in one instance did mishap occur. An illustration of the confidence which a wireless installation affords to the passengers when they find themselves in such perilous plights is afforded by an account given of the accident by one of the passengers. In it he says: "After the first shock of the collision everybody came on deck, while the captain gave the order for the boats to be swung out. This was followed shortly afterwards by the announcement, 'It will not be necessary to lower the boats, vessels are coming to take off the passengers."

NOTES OF THE MONTH

THE *Electrical World* of New York has an article entitled "A New Marconi Transatlantic Service" in its issue for August 29th. This article is based upon the account of the proposed additional transatlantic service and the description of the Welsh stations which appeared in the July number of THE WIRELESS WORLD. In commenting editorially upon the proposed service, our contemporary draws attention to some of the troubles experienced in the early days of long-distance wireless telegraphy, but we think it does less than justice to the achievements since 1908, and underrates the permanent commercial value of the results which have rewarded the patience, courage, and foresight of Mr. Marconi and his Company. The *Electrical World* speaks of the present transatlantic wireless telegraph service as the "first regular *night-time* wireless between the United States and Great Britain." The words which we have italicised entirely misrepresent the character of the service which, as the whole world knows, has for years past carried on regular commercial day and night wireless communication between the United Kingdom and North America. This service has had a potent influence upon transatlantic telegraph rates, and its success forms the justification for the larger service which would have been in commercial operation by this time had not the European war intervened. So glaring, indeed, is this misstatement that it discounts the further "striking fact" which our contemporary discloses—namely, that eight years after the establishment of the service "no commercial day and night service has been opened in competition with the Atlantic cables." If that is so, it would be interesting to know why Atlantic cable rates have been reduced from time to time in the endeavour to bring them within reach of the transatlantic wireless rate.

* * *

A chance commentary in a colonial journal on progress in the last century has prompted Mr. Lovat Fraser to enumerate some of the marvels which he has himself witnessed in the last twenty years. His conclusions are sufficient to make any man who has reached forty pause and appreciate the age in which he lives, for he will find that in, say, the twenty years of his public life he has *lived* longer than his father and at least twice as long as his grandfather. Here are a few of the triumphs civilisation has achieved during that period: The invention of tramway-cars, the evolution of the bicycle, motor-cars, the first experiments in gliding, the invention of wireless telegraphy, the invention of the dirigible, monoplane, biplane, and waterplane, the introduction of taxicabs and motor-omnibuses in our streets, the invention of the submarine and waterboats, radio-photography, colour-photography, the kinematograph, the gramophone, the telephone, the opening of the Panama Canal, one of the greatest engineering feats of the world, and last, but by no means least, the inauguration of a great trans-oceanic wireless service.

Mr. Lovat Fraser recalls the coming of Mr. Marconi to England in 1896, and a few years later the stir that arose when the public began to realise that it was possible to talk through space. Now those that first of all made bold to scoff have been compelled to acknowledge the potency of this great world-force, which to-day rules over the wind, the waves, the hubbub of commerce, and the noise of battle.

The Press in New Zealand has heartily welcomed the new regulations which require that all vessels licensed to carry 50 or more passengers shall be equipped with wireless apparatus; but in many circles the opinion prevails that something should have been done with regard to the safety of cargo vessels and that some sort of provision should have been made for the installation of wireless on these ships, which at the same time as they carry valuable cargoes to and from the markets of the world carry also a crew whose lives are valuable to the Commonwealth, for these men are brave and trusted citizens who, even from the strictly commercial view, are possessed of valuable knowledge of seamanship and cannot be easily replaced, and who, furthermore, have wives and children or other relatives dependent upon them. Their lives are exposed to constant risk, whereas such is not the case with the occasional passenger. It is generally believed that steps will be taken to remedy this omission, and there is every reason to hope that before long a Bill will be passed which will ensure that all vessels, whether passenger or cargo, above a certain capacity shall be fitted with this important safeguard.

* * *

The American Consul at Hong Kong has drawn up an extremely interesting and exhaustive report on the proposed telegraph and telephone construction work in China, which outlines the government's plans for a comprehensive system of wireless telegraph stations. According to this report, stations of various degrees of power have already been established at points in the north along the coast, and in the south particularly at Peking, Tientsin, Hankow, Shanghai, Canton and Hoihaw. In Canton the main station has been made the centre of a series of twelve sub-stations in Kwangtung province, and a school for the instruction of operators has been established at Canton. In Western China various stations have been established under the Board of War. Plans for much more comprehensive and powerful stations along the coast, including Peking, Hankow, Shanghai, Swatow and Canton have been prepared. The proposed system, it is said, will have a radius of 1,500 miles, and will include stations at Kalgan, near the Siberian border, and on the Pratus Island shoals, about 600 miles south of Hong Kong, where a station is required for meteorological purposes and the protection of shipping.

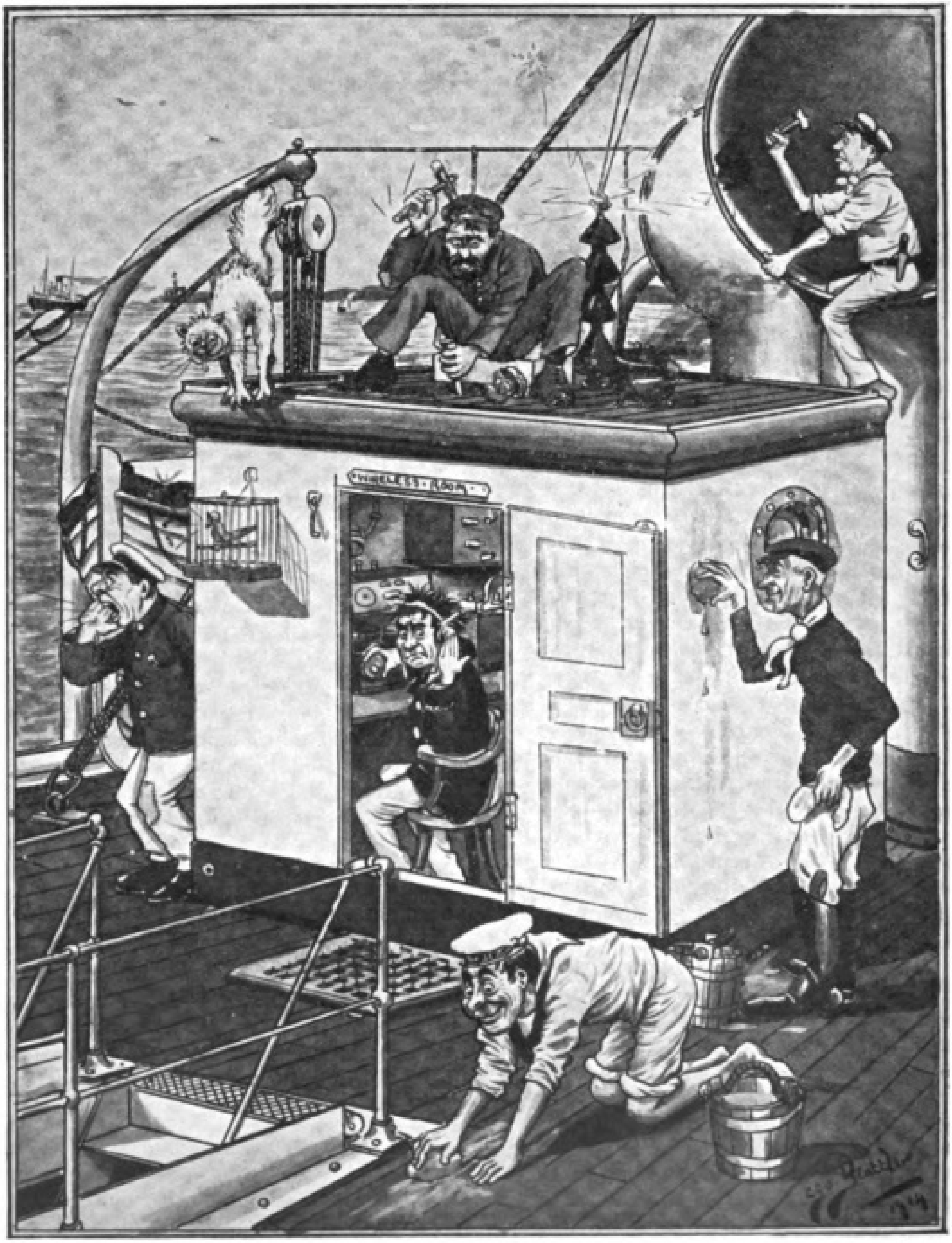
* * *

An interesting piece of scientific work of considerable practical importance was recently undertaken in Australia—namely, the correct determination of the longitude of Port Augusta. The operations were carried out in co-operation with the Postal and Telegraphic Department, a direct telegraphic communication being made between the temporary wireless station at Port Augusta and the Adelaide, Melbourne and Sydney Observatories. According to the plans arranged, signals were to be interchanged along this line every day of the week ending July 25th last, each station in turn sending a series of clock ticks, which were to be received and recorded on the chronographs of each of the other three stations. In addition, for the first time in Australia, an attempt was to be made to obtain the difference in longitude by means of wireless signals. The Government Astronomer of Melbourne promised to issue from his clock at the Melbourne Observatory a series of signals lasting from 9.15 to 9.30 every evening, and these were to be received at Sydney, Port Augusta, and, if possible, Adelaide. The principle it was proposed to adopt was that known as the time vernier, which is in operation at the Eiffel Tower in Paris. The transmitting clock is to be rated so as to gain about one second in each minute, and the receiving stations note the time of coincidence of the beats of this clock with those of their own. By this means a series of comparisons can be obtained, the error of each comparison not exceeding one-fiftieth of a second of time. If these signals are successful, it is probable that this method will become the universally adopted one for future geodetic operations in Australia.

* * *

It is only two months ago that we published in these pages the Admiralty's regulations relating to the enrolment of wireless telegraph operators in the Royal Naval Reserve. The response has been a fine one, for as we were about to close for press the announcement was made that no more wireless operators could be enrolled.

CARTOON OF THE MONTH



Wireless Worries

The little difficulties in Reading.

Wireless Telegraphy and the War

Though all we made depart
The Old Commandments stand!
"In patience keep your heart,
In strength lift up your hand."

RUDYARD KIPLING.

OF the part which wireless telegraphy is playing in the great world-war now being waged it is too early to speak. Official reports from the field of operations are silent concerning this new arm of warfare, and it is perhaps better that we follow this example of official reticence and pass over for the time being the military and strategic aspects of wireless telegraphy. Previous campaigns have already demonstrated the importance of wireless as a factor in warfare on land and sea, and, even in the case of aerial warfare, we can safely assert that the adoption of wireless telegraphy has reached a standard hitherto undreamt of. The thrilling despatches of Sir John French, with their glowing tributes to the work of the aviators, prompt us to point out that information can be signalled from aeroplanes by wireless telegraphy, and to what extent this means has been adopted will be disclosed later.

* * *

Other aspects of the use of wireless telegraphy in the present war may be touched upon without that feeling of restraint which is natural in considering the military aspect. One of these relates to the censoring of wireless telegrams, and the action of the United States Government in this connection raises a new point in international law. On the report that the German-owned stations in the United States had been sending information and instructions to German ships at sea, President Wilson laid down a new principle in the duty of neutrals. The rule seems to have been understood hitherto as prohibiting the use of the wireless on neutral territory by one of the belligerents, but it has not been extended to the operations of private companies, which have stood on the same footing as cable companies and land telegraph lines.

Two protests were raised against the sweeping censorship of wireless messages proposed by President Wilson, one by the American Marconi Co. and the other by the German Chargé d'Affaires at Washington. The German case in the censorship controversy was not strengthened by the discovery that the Tuckerton Wireless Station, from which the Germans hoped to get the censorship removed, had not even got a licence, and orders were therefore given for the station to be closed. The Marconi protest was in the following terms:—

> The Marconi Wireless Telegraph Co. of America respectfully represents to the Secretary of the Navy that it is receiving messages to be sent by wireless to foreign countries; that the censor of the Navy Department assumes the right to forbid the sending of certain of such messages; that this company is under the ordinary duty of a forwarder of communications when paid for; that we are aware of no statute of the United States or of any treaty or rule of international law which justifies the intervention of a Government censor or the stoppage of this company in sending messages in the ordinary way.
>
> We ask, therefore, to be referred to the legal authority under which your department assumes such right of censorship. We wish to respect the policy of our own Government, but when our corporate rights and duty and the rights of the public are involved, we must respect only the law which governs the case.
>
> Respectfully,
> (Signed) JOHN W. GRIGGS,
> President.

The outcome was that on September 3rd Mr. W. J. Bryan, the Secretary of State, announced that an agreement had been reached whereby belligerent nations might send and receive wireless messages. They might use code or cipher, but the American censor must be furnished with any code used. Great Britain and Germany acquiesced in the agreement.

* * *

In view of the controversy that has arisen, we publish below an extract from The Hague Convention, 1907, which sets out the position in respect of belligerents and neutral wireless stations in land warfare :—

ARTICLE 3.—Belligerents are also forbidden :—

(a) To instal on the territory of a neutral Power a wireless telegraphy station or any apparatus intended to serve as a means of communication with belligerent forces on land or sea.

(b) To make use of any installation of this kind established by them before the war on the territory of the neutral Power with an exclusively military object and not already opened for the service of public messages.

ARTICLE 8.—A neutral Power is not bound to forbid or restrict the employment on behalf of belligerents of telegraph or telephone cables or of wireless telegraphy apparatus, whether belonging to it or to companies or to individuals.

ARTICLE 9.—Every restrictive or prohibitive measure taken by a neutral Power with regard to the matters referred to in Articles 7 and 8 must be applied impartially to the belligerents. The neutral Power shall ensure that the same obligations are respected by companies or individuals owning telegraph or telephone cables or wireless telegraphy apparatus.

The following extract from The Hague Convention, 1907, respecting the Rights and Duties of Neutral Powers in Maritime War is also of interest :—

ARTICLE 5.—Belligerents are forbidden to use neutral ports and waters as a base of naval operations against their adversaries, and especially to instal their wireless telegraphy stations or other apparatus intended to serve as a means of communication with belligerent forces on land or sea.

With so many countries engaged in the war, it is but natural that international telegraphic arrangements should be considerably modified, and recent advices from Berne indicate how far-reaching has been the effect of the war upon radio-telegraphic communication.

On August 1st the British postal authorities advised Berne that wireless telegraphy on board vessels in the territorial waters round the British Isles would be suspended, except, of course, in so far as concerned British warships. Two days later notification was made of the suspension of telegraphic communication to and from the United Kingdom and British Possessions and Protectorates, except in the case of Government telegrams or Government wireless telegrams; but on August 5th a further order was issued permitting the transmission of public telegrams or wireless telegrams in plain language at sender's risk and subject to censorship—only on condition, however, that such communications were worded either in English or in French. The use of abbreviated telegraphic addresses was not allowed.

Changes in many respects similar to those mentioned above were notified to Berne by the Government of the Union of South Africa (August 4th and August 7th) and the Government of the Commonwealth of Australia (August 4th).

The French Government adopted like measures (according to their notifications dated August 3rd and August 5th), and they undertook to accept for transmission over their lines telegrams and wireless telegrams for places in France, Algeria, French Colonies and Protectorates.

By advice dated August 8th the Italian Government admitted only in Italy and its colonies private telegrams and wireless telegrams worded exclusively in plain language in Italian, German, English, and French. Abbreviated or code address were not allowed to be employed. Code or cypher was permitted only in the case of official telegrams or wireless telegrams exchanged between diplomatic or consular representatives and their Governments, or between themselves.

On August 9th the Turkish Government informed Berne that all telegrams to or from Turkey had to be written in plain language in Turkish, Arabic, or French.

Greece, on August 12th, reported the suspension of wireless telegraphy on vessels in Greek territorial waters.

The Swedish Government also issued an

order prohibiting the use of wireless telegraphy on board vessels of belligerent Powers within the radius of Swedish harbour areas.

On September 11th it was announced that the Cuban Government wireless telegraph installation at Havana had been placed under a censorship similar to that enforced in stations in the United States.

The Canadian Government Naval Department ordered all wireless stations in Canada not operated by the Government to be at once completely dismantled.

* * *

Sensational stories, many of them either baseless or exaggerations, have been current regarding the activities of German spies in this country and France, and needless to say wireless has figured prominently in them. One of the stories which went the round of the daily Press was that the German proprietor of a Paris hotel had been found communicating with the enemy by means of a wireless plant on the roof of the hotel, and that he, along with his staff of German waiters, had been promptly shot. The facts, as told in the French newspapers, are that the manager of the Hotel Astoria was denounced as a spy, but that the wireless plant was merely a toy, constructed by a youth who was staying in the hotel. The hotel manager was tried by court-martial, and acquitted of the charge.

* * *

A case of alleged misuse of wireless was investigated in the Dublin Court on September 17th, when Albert E. Archer, a young man, 19 years of age, was charged with a breach of the Wireless Telegraph Act, 1904, by establishing at his father's house, at Stillorgan, County Dublin, a wireless station without having been granted a licence, and with having worked the apparatus between August 3rd and September 7th. It appeared defendant applied for a licence some time ago, but was refused. The wireless apparatus was nevertheless erected by him, and he discarded a warning from the Post Office in London to dismantle the station. The officials who ultimately removed the apparatus found a book in the defendant's room which contained a record of a large number of messages received. The defence was that Archer was simply learning wireless telegraphy, and the military authorities stating they were satisfied that there was no guilt on his part, he was discharged.

* * *

The possible use of indoor aerials has been agitating several newspapers recently, and found expression in a question in the House of Commons on September 17th to the Home Secretary, who was asked "whether, in view of the fact that with sufficiently long horizontal wires placed quite close to the ground wireless communication was quite practicable, and masts could be dispensed with, he would consider the advisability of causing instructions to be given to the skilled person whose duty it was to discover and deal with wireless installations to search for horizontal wireless installations in this country." Mr. McKenna replied that the matter was in the hands of skilled persons, who were well aware of the system.

* * *

In capturing Herbertshohe the Australian Naval Reserve performed a smart piece of work which will be particularly valuable, as it deprives the Germans of the use of another wireless telegraph station. It was after 18 hours' fighting that the station fell, and then it was found that the enemy had damaged it sufficiently to put it out of action for some time.

* * *

Among the extracts from letters published in the Press from those serving in the Navy and Army are two from wireless operators. In one of these Mr. T. Marsden, wireless operator aboard his Majesty's ship *Gloucester*, writing to his mother at West Hartlepool, gives an interesting account of a chase by that vessel of the German warships *Goeben* and *Breslau*.

The *Gloucester*, he says, opened fire upon the *Breslau*, but her first shot fell short. The *Breslau* replied with thirty shots, of which only two took effect, two of the *Gloucester's* boats being smashed on their davits. "After the first shot our lads were quite happy," adds Mr. Marsden, "and they kept firing as quickly as possible. One chap nearly swallowed his chew of baccy when the first shot fell short. The next one he spat on for luck, and it took half the *Breslau's* funnel away. He repeated the operation with the next shot, which cleared the *Breslau's* quarter-deck and put her aft gun out of action. Then he began to smile."

A Weybridge operator, describing his experiences on board one of His Majesty's vessels, in a letter to his parents which was reproduced in the *Surrey Herald*, said the instrument room, although small, was fitted up to date, and everything was "O.K." His ship had been chiefly used in chasing Germans and convoying transports across to France, but there had been nothing particularly exciting. For the past few days he had been transferred to the training ship to await another boat, and after the work he had had he was not sorry for the change, although he was desirous of doing his share.

* * *

After being in hiding since a date before the war began, the German cruiser *Emden* has just emerged from her retreat and is now threatening the trade routes of the Indian Ocean. Already she has captured and sunk seven merchantmen, but now that her whereabouts are known British cruisers are in hot pursuit, and there is no doubt that before long her wings will be clipped. The wonder is: How did she come by the information necessary for her to carry out this successful coup? The Naval Correspondent of the *Times* suggests that she was able to receive instructions from some central authority, adding :—

"This is not improbable, for the sweep of the wireless messages from Nauen is wide. It reaches the east coast of America, and therefore very likely touches at points within a semi-circle which includes the West Indies, the north coast of Brazil, the West Coast of Africa as far south as Walfish Bay, and the east coast to Lorenzo Marquez, and right across the Indian Ocean to Rangoon. If this assumption is correct, it would account for the way in which the German raiders now appear to be seeking this area from other parts of the world. It would be natural for them to do this if their communications outside this radius had failed owing to the destruction of wireless stations beyond the Fatherland.

"The notion of the people in Berlin being able to direct operations at such a distance is almost uncanny. If they do so, no more striking exhibition of the use of wireless in naval war could well be imagined. We may picture Von Tirpitz in his office in Berlin. He receives news of the situation in the Bay of Bengal and realises the opportunity for a little *coup*. There is a cruiser a few miles away which has been carefully hidden until some such chance presented itself. He calls her up and gives information and orders. The raider does the rest."

But if Germany is in a position thus to make use of her wireless, England is yet better equipped for the purpose. She can send her message over every sea and to the farthest corners of the earth. If Admiral von Tirpitz can accomplish this from Berlin our Admiralty can do the same from Whitehall. Wireless can give the enemy no unique advantage, though its innovation has revolutionised the tactics of naval belligerents.

War Sidelights.

The Germans made an aerial raid on Antwerp, when they attempted, without success, to destroy the wireless telegraph station.

* * *

Before leaving Brussels the Belgians blew up the wireless station at Laeken.

* * *

When a thousand miles south of Cape Leeuwin the *Matatua* picked up signals made in code by a German warship to several German merchantmen. The latter afterwards declined to answer the *Matatua's* calls.

* * *

The Board of Trade has been informed that a very bright electric light is exhibited nightly from the German wireless station at Monrovia, the capital of Liberia, West Africa. It is considered dangerous for ships, as it may be taken for the light at Cape Mesurado.

* * *

The mobilisation of the Swiss army has had the effect of considerably depleting the staff of the Berne Bureau, and in consequence all publications other than those of extreme urgency have been temporarily suspended. The *Journal Télégraphique* will not appear until the resumption of more normal conditions, and the preparation and printing of the Nomenclature of Radiotelegraph Stations and the map of such stations has been held up. In other respects, every effort is being made to carry on the duties of the Bureau.

AN ATLANTIC LIFEBOAT.

MARINE enterprise has already been responsible for the equipment of ships' lifeboats with wireless, but now a young naval architect of America, Einar Sivard, Superintendent of the Welin Marine Equipment Company, has devised a vessel which he claims is practically unsinkable and incapable of capsizing and unbreakable.

In order to test this vessel, which is called the "Lundin Power Lifeboat," he intends to make a voyage across the Atlantic. The present condition of navigation, owing to the European war, will in all probability cause him to postpone his venture, but his plan is to go by way of Boston and Halifax to St. John's, Newfoundland. Thence to cross to Queenstown and proceed along the English coast to London. It is anticipated that the total trip will occupy something over a month, and the open sea will be navigated within seventeen days. The crew will consist of five persons: Mr. Sivard himself, who will captain the undertaking; his wife, Mrs. Signe Holm Sivard, acting in capacity as cook; a navigator, a wireless operator, one engineer and one sailor.

This is the smallest of all craft to be fitted with a wireless installation. It carries a ½-kw. Marconi set, specially designed for this particular use. All the units are mounted on one panel, so arranged as to facilitate the work of installation and operating. One extra break system type hand key is supplied for table mounting. The transformer consists of a 120 cycle, 220 volt motor generator. A volt transformer with a maximum power of 8,000 volts, condenser, oscillation transformer, aerial tuning inductance, break system hand key with reactance, aerial switch, 5-point wave-length switch, change-over switch, break system aerial switch, switches for direct current and alternating current lines, generating field and blowers, generator field rheostat, automatic starter, direct and alternating current voltmeter, alternating current watt meter, radiation ammeter. This equipment is similar to that supplied by the Marconi Company for the United States submarine and torpedo boats owing to the limited available the "Lundin Lifeboat," the transmitting radius of between 50 and 100 miles.

A Lundin Motor Lifeboat.

The craft is unique in form and design. It has a length of 36, and a beam of 12 feet. It is built of galvanised steel with a water-tight deck 6 inches above the waterline. The space between the deck and bottom is divided into numerous watertight compartments, several of which may become filled without placing the vessel in any danger of capsizing. A steel house, with water-tight portholes, doors and ventilators encloses all but a small part of the boat fore and aft, where short decks are provided for the helmsman and outlook.

It has been proved that, with this type of house, the boat is practically self-baling and self-righting. Along the sides are fitted massive fenders (bulwarks) of Balsa wood, the lightest wood in existence, added with a view to making the boat practically unbreakable when lowered from a ship.

For power the vessel is equipped with a 32 horse-power four-cylinder standard engine, and gasoline tanks with sufficient supply capacity to enable her to remain for many days at sea.

Telegram

TTE.*

...ferred to in that "msg," ... is intended, the ... wishes to know— ... han you want ... though.

So I watched this passenger write his "telegraphic dispatch." First he asked the operator:

"What day of the month is this?"

There was nothing unusual in that. All men ask that. It is the opening line in the regular formula of sending a "msg." You may know what date it is before entering the office, you may even have it impressed on your mind by having a note fall due on that day, but the moment you poise your pencil over the blank, the date flies from your mind like the toothache from a dentist's stairway. So when the man asked, "What day of the month is this?" I was not surprised. I courteously answered him as a cover to approaching his position, but he did not believe me. He repeated his question, and made the operator answer. Then I knew he was very new at it.

He was a tall man, with long hair and a thin neck. He had a nervous way of licking his lips and then smacking them as though the ghost of a good breakfast still lingered about them. His pantaloons were just about as much too short as his hair was too long, and he wore a shawl. That settled him. He spoiled three blanks before he got a "telegraphic dispatch" written to suit him. But even that is not very uncommon. A man always uses stationery more extravagantly in another man's office than he does at home. Then he wrote every word in the body of the dispatch carefully and distinctly, but scrambled hurriedly over the address as if everybody knew that as well as he did, and dashed off his own signature in a blind letter style as though his name was as familiar to the operator as it was to his own family.

But even this is not uncommon. A man will write "Cunningham" so that no

... for ... warm, sending a few telegrams and badgering the poor station agent with questions.

My business was soon transacted. I sent the committee the cheering words that told them nothing short of a miracle could get me to Bosshaven in time to lecture that night, and then I ceased to worry, and resigned myself to grim Fate and the grimmer cigar which the train boy sold me. A veritable wrecker is the train boy. An accident that lays the train out for half a day is his fortune, because by some inscrutable law of disaster a wreck never takes place in a pleasant centre, and trains never collide at a dining station. Here is something for our great thinkers to ponder upon.

While I puffed tranquilly away at the alleged cigar, I amused myself by watching my fellow passengers. Presently one man reached a long arm over the little crowd clustered at the operator's window and asked for a "blank telegraphic form," explaining that he wished "to send a telegraphic dispatch" to his family.

Now, when a man speaks of a "telegraphic dispatch" I always wake up and look at him, because the cumbersome title is all at utter variance with the spirit of the telegraph. It's too long. The use of it betrays the man who has little use for the telegraph. The more he uses the wire, the shorter his terms. The more nearly he can come to saying "msg" the more content he is. And he doesn't call for a "telegraphic form," he asks for a blank, black or red, as the case may be. And he never telegraphs anybody. He wires them. He doesn't explain to the operator what he wants to do with the blank. Presumably he wants to write a message. And as for

* Reprinted from the *Sunset Magazine*.

expert under the skies will tell whether it was Covington, or Carrington, or Cummagen, or Carrenton, and when the operator points to it and asks, "What is this?" the writer will stare at him in blank amazement for a moment, and then answer, "Why, that's my name!"

"Well, yes, I know that," the operator will say, "but what is your name?"

Then the man will gasp for breath and catch hold of the desk to keep himself from falling, and finally shout, "Why, Cunningham, of course!" and look pityingly upon the operator, and then glance about the room with a pained, shocked expression, as one who would say:

"Gentlemen, you may not believe it, and I do not blame you, but heaven is my witness—here is a man who does not know that my name is Cunningham!"

Well, my tall man with the thin neck got along a little better than that, when he handed the operator the following explicit message:

Mrs. Sarah A. Follinsbee, Dallas Centre, Iowa:

MY DEAR WIFE,—I left the city early this morning after eating breakfast with Professor Morton, a live man in the temperance cause. I expected to eat dinner with you at home. But we were delayed by a terrible railroad accident on the railroad, and I narrowly escaped being killed; one passenger was terribly mangled, and has since died, but I am alive. The conductor says I cannot make connection so as to come to Dallas Centre this morning, but I can get there by eight o'clock this evening. I hate to disappoint you, but cannot help it. With love to mother and the children, I am your loving husband,

ROGER K. FOLLINSBEE.

The operator read it, smiled, and said:

"You can save considerable expense and tell all that is really necessary, I presume, by shortening this message down to ten words. We have no wire directly into Dallas, and will have to send this message part of the way over another line, which adds largely to the cost of transmission. Shall I shorten this for you?"

"No; oh, no," the man with the shawl replied. "I'll fix it myself. Ten words, you say?"

"Yes, sir."

The tall man with the short pantaloons went back to the desk with his message. It was a stunner, for a fact, and the man heaved a despairing sigh as he prepared to boil his letter down to ten words. He scratched and sighed, and read the dispatch over and over again. Occasionally he would hold it from him at arm's length after making an erasure, to get at the general effect. At last he came to the window and said:

"Here is the telegraphic dispatch to my wife. I have not been able to condense it into ten words, and do not see how it can be done without garbling the sense of the dispatch, but if you can do it, you will oblige me greatly, as I do not wish to incur any really unnecessary expense."

And with that he handed the operator the following expunged edition of his original message:

Mrs. Sarah A. Follinsbee:

MY DEAR WIFE,—I left the city—this morning after eating—Prof. Morton alive—cause I expected to eat—you at home. But we were delayed by a terrible railroad accident on the railroad I—being killed—terribly mangle and since died; but I am—the conductor—I cannot—come to Dallas Centre—but I can—I hate—mother and the children.

Your loving husband,

ROGER K. FOLLINSBEE.

The operator smiled once more, and made a few quick dashes with his pencil, and without adding or changing a letter in the original message, cut it down to its very sinews, as follows:

Sarah A. Follinsbee, Dallas Centre, Iowa:

Left city smorning; delayed by accident; all right; home sevening.

"There, that is all right," he said in the cheery magnetic way these operators have. "Fifty cents, sir—saves you several dollars, sir. That's right, thank you."

And the man with the thin neck and long hair stared at the operator. Then as he went away, I heard him whispering softly to himself:

"S'follnbee —clish'n smorning — d'layed baxident — mall right — home safternoon. Rog."

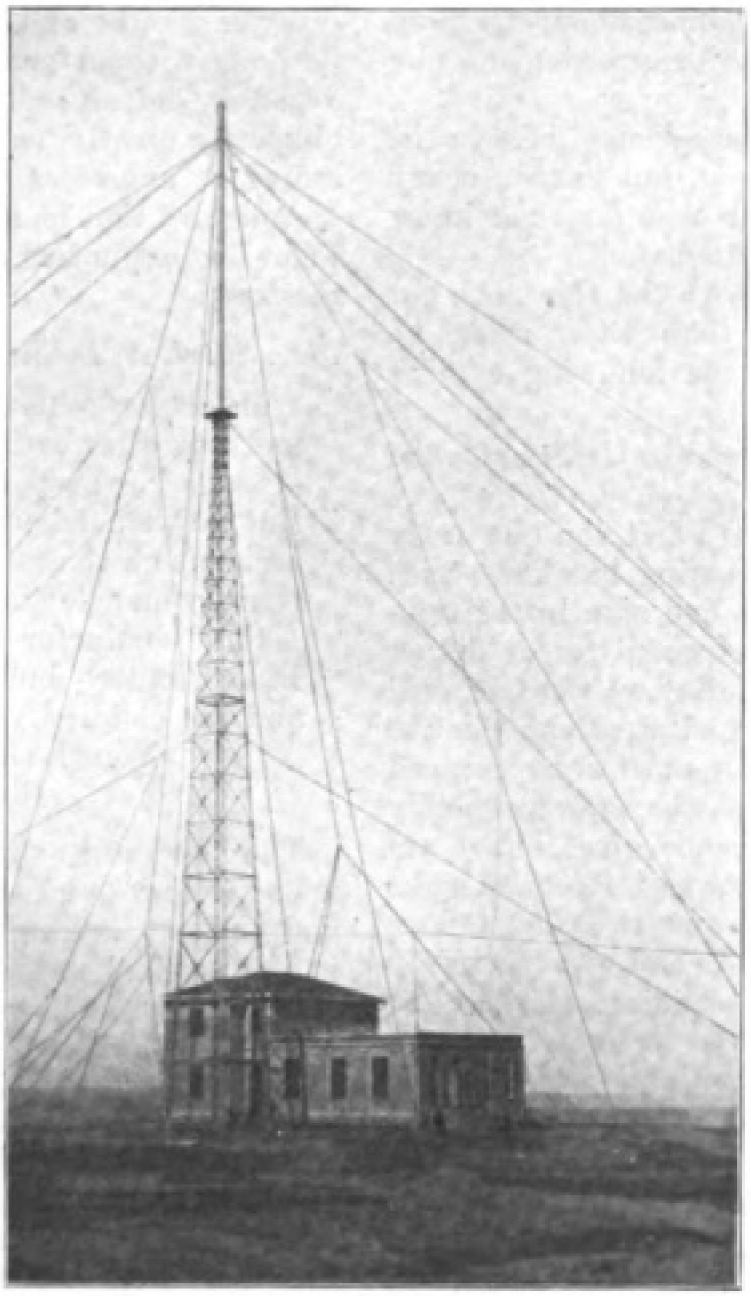
And I knew that he was practising his lesson, and had "caught on."

Wireless Telegraphy in Turkey

The Ok Meidan Station

IT is appropriate to recall, at this moment, when the thoughts of war are uppermost in men's minds, and the part played by wireless telegraphy is not without interest, the notable achievements of a station during the late Balkan war. The station to which we refer is the well-known Ok Meidan wireless telegraph station near the capital of the Ottoman Empire. We have already recorded in these columns how a portable 1½ k.w. Marconi station shut up in Adrianople with the beleagured garrison, effectively maintained communication with Ok Meidan station and thus foiled the enemy's attempts to destroy communication between the gallant troops in the invested city and Government at the capital. So full of interest is the centre in which the station has been erected that a brief reference to it will afford a clearer understanding of the character and importance of the equipment described here.

For all intents and purposes Constantinople is now a collection of towns and villages situated on both sides of the Golden Horn and along the shores of the Bosphorus, including Scutari and Kadikeui. But the principal parts of this great agglomeration are Stamboul, the name specially applied to the portion south of the Golden Horn of the city, Galata and Pera. Galata is the chief business centre of the city, the seat of banks, post offices, steamship offices, etc. Pera is the principal residential quarter of the European communities settled in Constantinople, where the foreign Embassies congregate, and the fashionable shops and hotels are found. The city is styled Constantinople to perpetuate the name of its founder—Constantine the Great—and in respect of influence over the course of human affairs it has very few rivals.



Constantinople Wireless Station. View showing central mast 250 ft. high. Engine room gear in small building on right. Receiving room and operators' quarters on left.

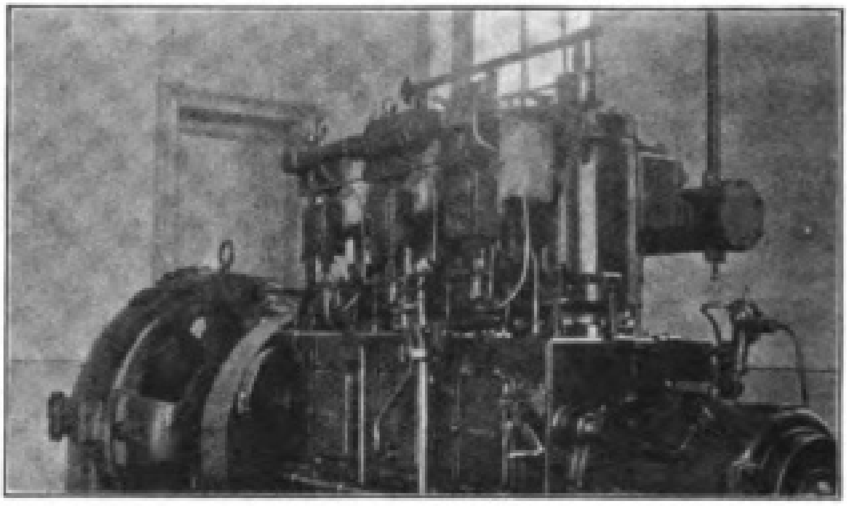
The wireless station is at Ok Meidan, which stands upon a high hill at the far end of the Golden Horn, about two miles in a direct line from the city. Translated literally, Ok Meidan means "Arrow Field," and it is said to derive its name from a former Sultan of Turkey who used it as a ground for the practice of his favourite pastime—archery. Approaching Constantinople from the wireless station the sight forms an indelible impression upon the memory, for in this city, which, with its suburbs, boasts of a population estimated at three-quarters of a million, every type of human kind may be seen, every type of human tongue be heard. Eastern and Western architecture blend in a wonderful blaze of colour, and the mosques springing up here and there—with their needle minarets—add to the picturesqueness of the scene. Nor are the inhabitants less interesting. The total population of the city and district is estimated at three quarters of a million, and practically every nationality is represented in this cosmopolitan centre.

The majority of the inhabitants are excellent linguists, and it is a common thing to come across people who are equally proficient in Turkish, Greek, French and, perhaps, German, Italian or English. Most of the children of the English colony are in charge of Greek nurses, and it is customary to hear these children converse as fluently in Greek as in the native tongue of their parents. A pleasing trait in the character of the Turk is his hospitality, and visitors to Galata Tower are invariably entertained by the officials to some "Turkish delight" and a cigarette. Even in business houses it is common to regale callers with a cup of coffee and a cigarette, so that the traveller who makes a number of calls in the course of the day has been well supplied with this favourite Turkish beverage.

The Switchboard at Ok Meidan Station.

The wireless station at Constantinople is a powerful one, and could get in touch with a station as far distant as Cairo. It was built by the Marconi Company in 1911 for the Turkish Government, and it is operated by the Turkish Navy. The station has a working range of 1,000 kilometers over land and water with vessels of the Turkish Navy, and the installation is arranged to tune in transmission to any wave between 600 and 2,000 meters. The aerial is supported by a main mast of 250 ft. in height. The prime mover consists of a 55 h.p. oil machine driving direct a 42 k.w. continuous current dynamo. This set supplies the electrical energy required for running the motor generators, charging the accumulators, or lighting. The motor generator set drives a disc discharger which is mounted on the same bed. The accumulator battery consists of 60 cells of 900 amp. capacity at three-hour rate. In conjunction with the transformer is a suitable air-cooled iron core, primary inductance, which is protected against injurious induced effects from high frequency by air-core protecting chokes.

The manipulating gear consists of a Morse key actuating a high-tension relay key. A magnetic detector multiple tuner and valve receiver are provided for the reception of all waves between 100 and 2,500 meters. A tuner permits of the instrument being set at any pre-arranged wave-length to be received, and is, moreover, provided with a change switch to permit of the instantaneous change of the circuit from a highly-syntonised tuned condition to an untuned condition for standing by. By reason of its robust nature the magnetic detector can be permanently connected to the transmitting aerial. There is also a valve receiver. In addition to the 20 k.w. land station, the Marconi Company have fitted various war vessels of the Turkish Navy with 3 k.w. sets. These are designed for a working range of 600 kilometers over water, with the land station and to transmit 300, 600 and 900 meters, and in reception to all waves between 100 and 2,500 meters. The motor-generator combination comprises a continuous current motor mounted on a bed, and direct coupled to an alternating current generator. The motor takes its power from the continuous current supply, and furnishes mechanical power to the alternator sufficient for an output of 3 k.w. at 300 volts, 300 cycles. The combination is coupled to a synchronous disc discharger mounted on the same bed. The discharger produces a musical note, enabling the transmitting signals to be distinguished from atmospheric disturbances when received in the telephone at the corresponding station.



The high-speed vertical oil engine coupled to 42 k.w. dynamo.

A group of Turkish Officers.

Another type of vessel equipped with Marconi apparatus for the Turkish Navy are destroyers, on which 1½ k.w. sets are used. These installations provide for a working range of 200 kilometers, and tuned in transmission to waves of 300, 450 and 600 meters, and in reception to waves between 100 and 2,500 meters.

A view of the Transmitting Room showing the high-tension gear.

Practical Hints for Amateurs.

A Lakeland Station.

By W. K. ALFORD.

THE station illustrated on p. 460 has been at work for two years, and the results obtained are excellent.

Instead of describing minutely each piece of apparatus used, I propose to delineate broadly each factor which I think contributes to the success of the station.

The aerial is triangular in plan, supported at the corners by a 20-ft. pole on a house, a 50-ft. pole, and a tree respectively. The main section, which is 140 feet in length, is of the 4-wire cage type, the wires (3/19 phosphor bronze) being kept apart by 4-ft. hoops. This type of aerial is found extremely steady in high winds.

Three large strain insulators are used at each corner, but I suspect that even these leak slightly when wet. Curiously, insulation seems the last thing many amateurs think of when erecting an aerial, which is shown by the large number of aerials one sees bearing microscopic bobbin insulators.

Another very important point about aerials is the spacing of the wires. I have found that the efficiency when the wires are 3 feet apart is quite 30 per cent. more than when they are 1 foot or less. This point has been clearly discussed in the instruction columns of THE WIRELESS WORLD.

With regard to the transmitting apparatus, the prime mover is a 1 h.p. gas engine driving a 35 volt 12 amp. dynamo, charging a set of 14 cells, which are used for lighting as well as supplying power to a 10 in. Apps coil used for transmission.

A mercury turbine break is employed, which is driven at a high speed by a Pelton wheel from the water supply. This gives a spark-frequency of about 200.

A set of 9 leyden jars are used as a condenser battery, and are quite successful. The inductance is of the spider-web type, and the spark-gap is of the "twin" type, which keeps very cool under continuous working. It may be of value to some who are troubled with the fumes of the discharge to know that oil of turpentine readily absorbs the ozone, and a small piece of newspaper moistened with it will soon set matters right. Communication is daily established with the station of Mr. J. W. Shepherd at Sedbergh, 11 miles distant.

The waves of both stations are sharply tuned to about 23 o.m.

The receiving apparatus has become rather involved owing to the number of change-over switches, etc., used for bringing in different pieces of apparatus, but broadly it consists of the following: Three jiggers for waves, 0–600, 600–3,000, 3,000–9,000 métres. The secondaries are wound to suit each range of wave-lengths respectively.

The detectors used are zincite-bornite and zincite-tellurium, both with battery and potentiometer.

A valve is used as a stand-by, but its sensitiveness is inferior to either of the above mentioned.

During transmission the top crystal of the detector is slightly raised in a vertical plane by a pivot arrangement, and when it is desired to receive it is allowed to fall back gently, when precisely the same parts of each crystal are brought into contact again. This is the best way of preserving the sensitiveness of a crystal detector I have found yet.

The farthest station heard is Glace Bay, always after 10 p.m.

Next is Ingö Radio in Norway, which is over 2,000 miles distant. Most of the larger coast stations of Europe come in very well.

HOW TO MAKE A VARIABLE CONDENSER.

By J. H. R. HANNING.

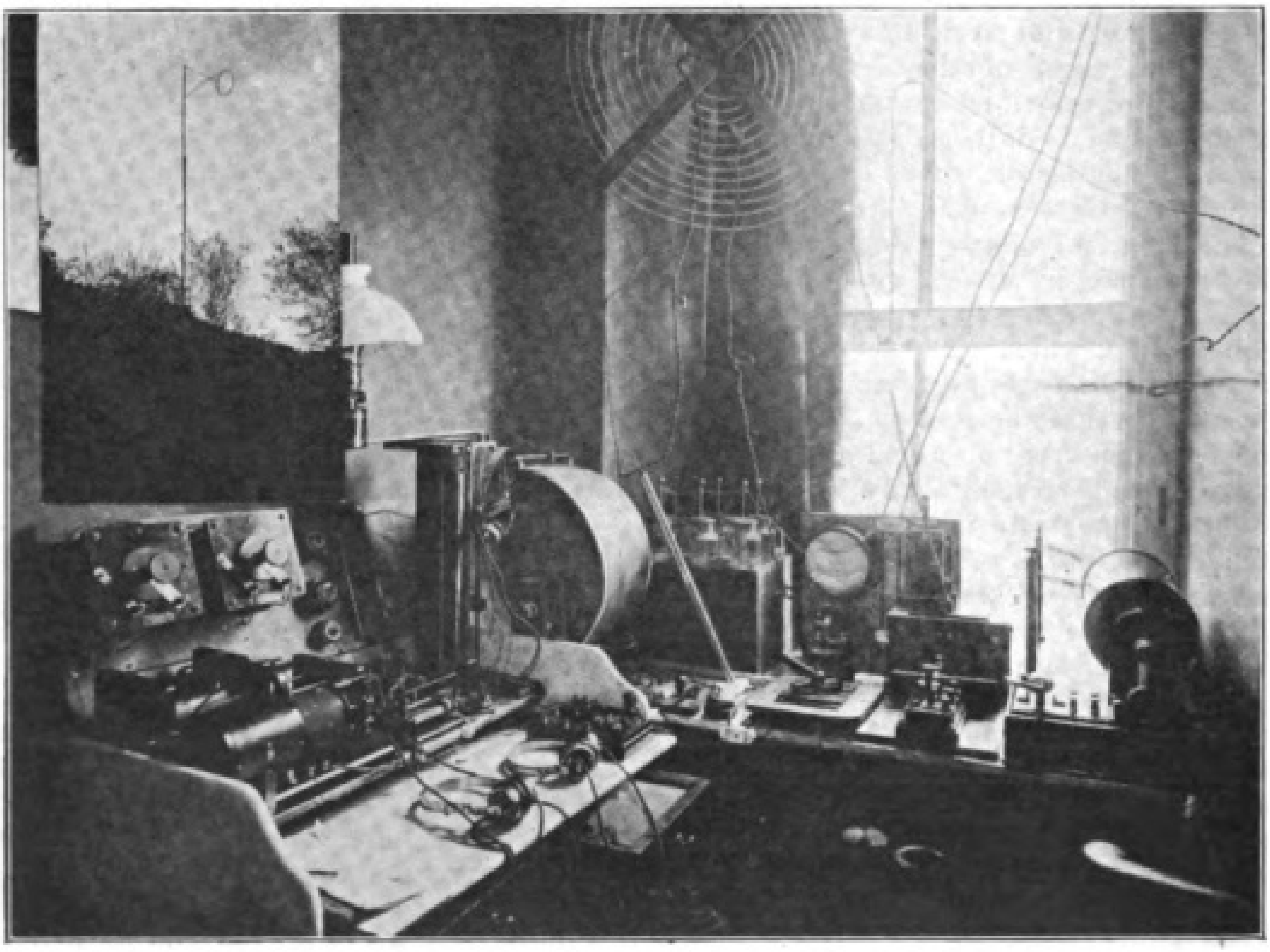
TAKE two strips of brass curtain rod, one being of about 1 inch inside diameter and the other about $\frac{1}{2}$ inch or $\frac{5}{8}$ inch. It will be noticed that these curtain rods are not solid brass, but iron covered with thin brass sheet; but this will not alter the value of the condenser. Then make a strong wooden base at least $1\frac{1}{2}$ inches thick and 5 inches square. Into this fix the larger of the two rods (A) by making a hole about $\frac{1}{2}$ inch deep to fit the rod, and secure it with sealing wax (O), which will help to insulate it. In order to make the insulation of this rod (A) more perfect, the instrument should be placed on a piece of glass.

Next, take the smaller rod (B) and paste round it several thicknesses of paraffin-waxed paper from top to bottom, so as to prevent any contact between the two rods. Then drill two holes in the top of (B) and make a wire loop to pass through these holes for the purpose of hanging the rod.

All that remains now is the sliding up and down of (B) into (A), which can be quite easily arranged. A piece of string is attached to the wire loop and carried up to the ceiling, over a pulley, and brought down again to a weight (W) to support (B) when in mid-air. To get the best effects it will be found advisable to put an insulator between the loop of (B) and the pulley—a piece of india-rubber, for instance The next thing to do is to solder a terminal (T_2) to the top of (A) and another (T_1) to the top of (B), from which terminals the wires may be led off to the instruments.

Curtain rod strips and the pulley, etc., may be purchased at any ironmonger's at little cost.

I have found one of these condensers a very efficient instrument, and, although roughly made, it serves its purpose well.

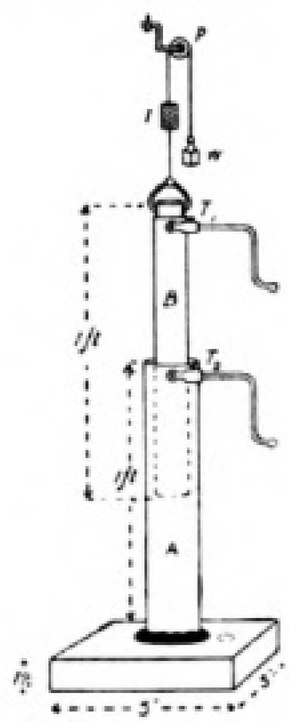


Mr. Alford's Station.

AN AMATEUR RECEIVING STATION.

By W. ISON.

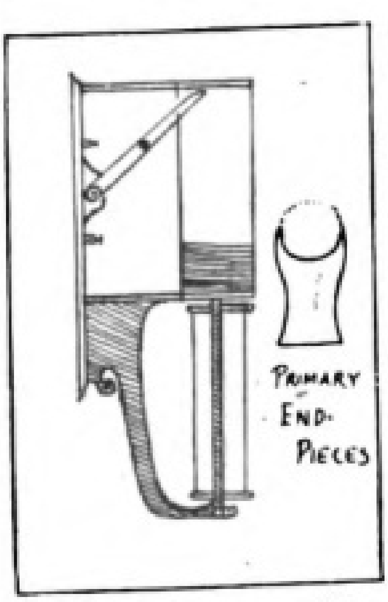
THE receiving station shown in the photograph has recently been erected at my house in Watford. I have at present no transmitting apparatus as I have



Design for Variable Condenser (p. 460).

so far devoted all my spare time to experimenting with the receiving apparatus.

I have tried several forms of aerial, but I find my present one quite good. It is of the "T" form, and consists of two No. 18 hard-drawn, bare copper wire, 72 feet long and 7 feet apart, suspended between a pole 43 feet high and a chimney about 40 feet high, and, of course, insulated. I lead down one wire from the centre of each and join them at the window of my receiving room



See article on p. 460.

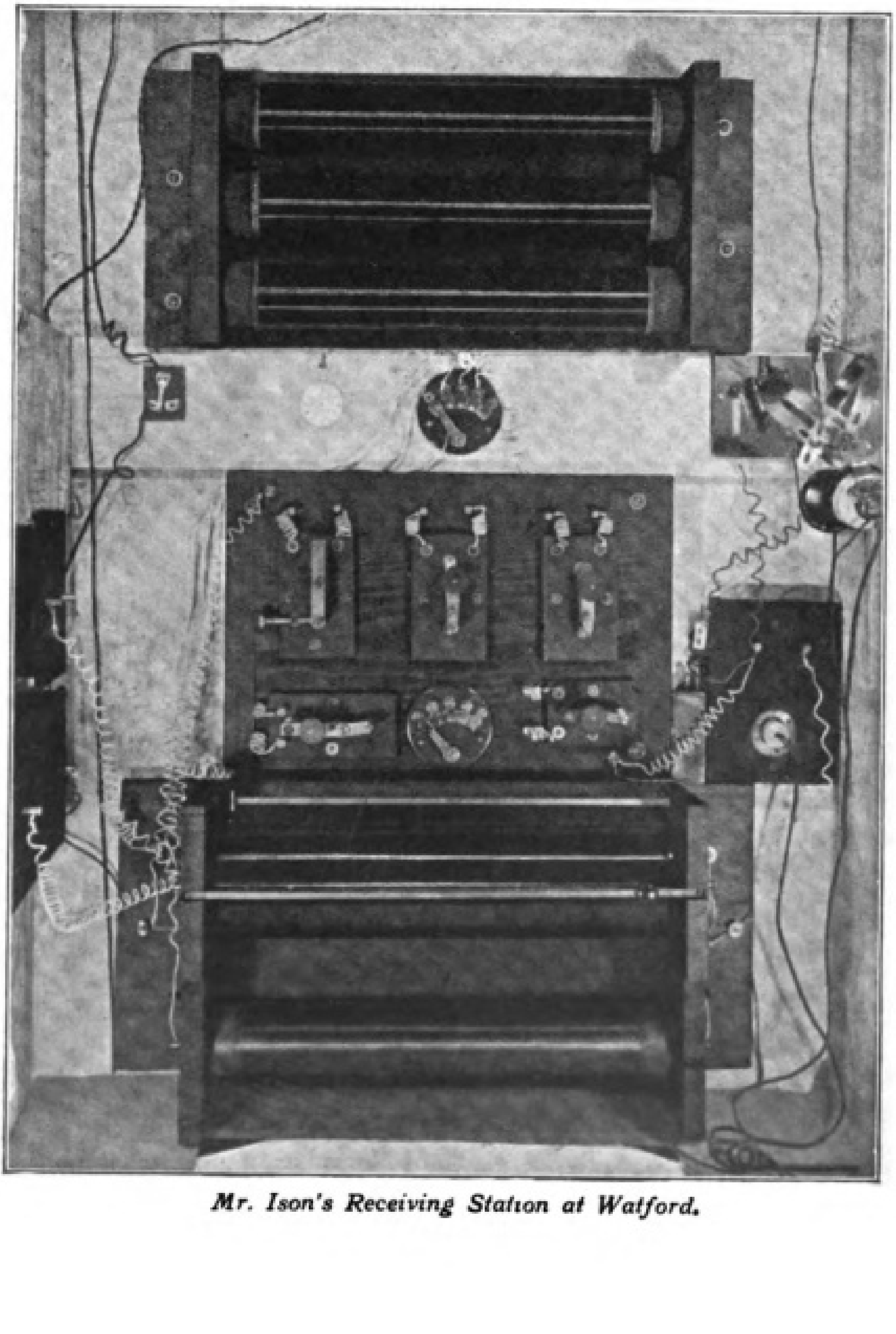
on the first floor to a length of insulated electrolier wire, and thence to the instruments. Between the leading-in wire and the instruments I have fixed a lightning arrester, which is of two plates of sheet brass, one serrated to make a spark gap and earthed.

The three coils shown at the top in the accompanying illustration and the bottom coil are switched in front of the main inductance as required by means of the upper 5-way switch. They are wound with No. 28 enamelled copper wire, three of them, on 2½-inch wooden cylinders, the bottom one on a hollow cardboard tube. The inductance is wound with similar wire, being 18 inches long by 4 inches in diameter. It has two sliders, but I am now fitting a third. I also use a blocking and a variable condenser. These are made up of half-plate negatives interleaved with tinfoil, the variable plates being of brassfoil and fitted up in neat boxes of 3-ply wood. The centre board holds five detectors, two silicon and gold, two silicon and brass, and one zincite and bornite. I am constantly changing these to other crystals by way of experiment, keeping a number of cups for the purpose. They are controlled by a five-point bell switch.

The telephones with head-gear are wound to 1,000 ohms each. I use two plugs, one for one set of headgear and the other with an adaptable plug for two sets for visitors' use. I find practically no difference whether the separate sets of 'phones are used in series or parallel, and such is the power of the signals that I have had as many as three sets of double head-gear in use at one time. By the side of the instrument is a bell push connecting with a buzzer buried in a box in the roof. This I use for testing the detectors, and find it exceedingly useful. It gives a note exactly like Eiffel. I have also fitted a Morse key to the same circuit and use it for teaching myself Morse. I may say that by using the loading coils and variable condenser I can cut out practically any station. The signals generally are very strong, some being so strong that I tone them down. I am able to get all the principal stations, though I confess that my knowledge of Morse is at present so limited that I have to rely upon my more expert friends to identify some of them for me. Of course, such stations as Paris, Norddeich, Madrid, Poldhu, etc., are easily identified, but I get numerous other stations of all wave-lengths and notes that I cannot place, and it may be that my range is considerably greater than I imagine.

I have experienced great interference from the buzzing of the alternators at the town power station, and sometimes, particularly on Sundays, when they are working on a light load, it is almost impossible to hear some of the signals. I found it possible to tone them down by cutting out my blocking condenser and holding my hand on the brass rod slider. I have now, however, found that by putting off the main switch in my lighting circuit I can cut them out altogether. Unfortunately this also puts me in darkness, so that the remedy is as bad as the disease.

My earth wire is carried round the skirting board in my workshop to the water pipe supplying my photographic developing sink.



Mr. Ison's Receiving Station at Watford.

THE AMATEUR HANDYMAN.

Instrument Design.

By HARRY TRUSSELL.

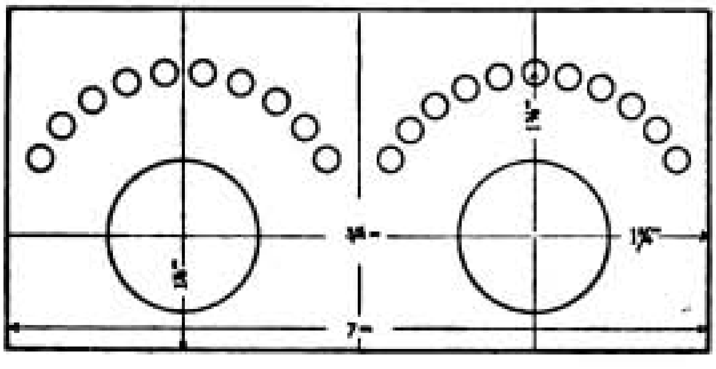
IN too many cases, I fear, amateurs are prepared to sacrifice efficiency in their instruments for the sake of appearance. In making an inductance for my station I have attempted to avoid this error and the result is an instrument which works efficiently without being ungainly in appearance.

Both primary and secondary are wound on cardboard tubes, the primary wire being 24 gauge enamelled, and the secondary 36 D.C.C. A radial type contact is provided on the primary and a brass strip slider on the secondary. The primary winding reaches within $\frac{3}{16}$ in. of each end of the tube, and over this $\frac{3}{16}$ in. space are tightly drawn two aluminium bands, which hold the coil in its "cradle." The curved piece holding the outside end of secondary slider rod is cut from $\frac{3}{16}$ in. teak, likewise the end-pieces for primary. The secondary slider rod is $\frac{1}{2}$ in. by $\frac{3}{8}$ in. oak slotted to drop over the curved arm on the outer end; at the other end a single screw passes through the end of the primary tube. This tube, by the way, is an old dry cell case, first covered with a scarlet cloth, similar to American cloth. All raw cardboard edges and margins are covered with the same material.

Constructing a Loose Coupler.

By A. L. MEGSON.

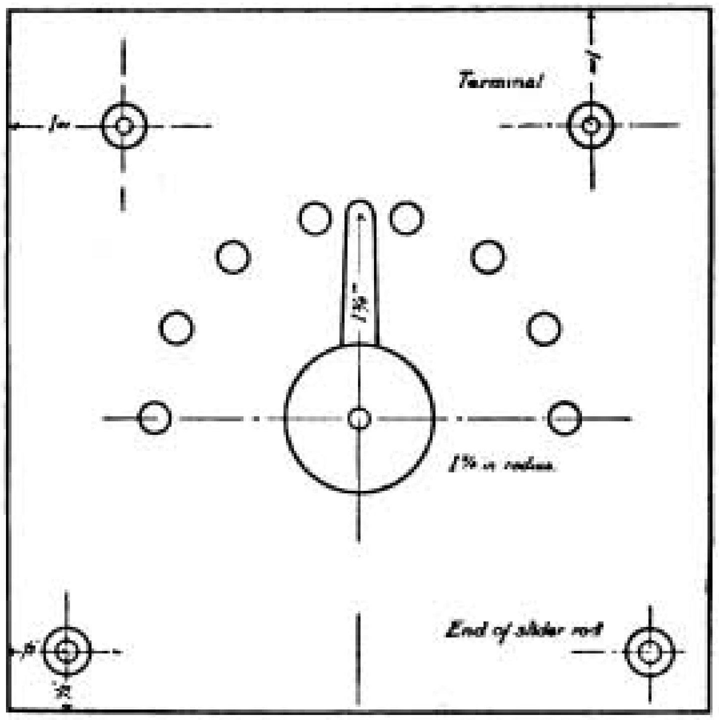
THE loose coupler described was designed to take up a minimum of space on the wireless table without sacrificing any of its efficiency. Most instruments of this class have long base boards principally used for supporting the sliding rods of the secondary and taking up a lot of extra space.



Sketch showing studs and switches.

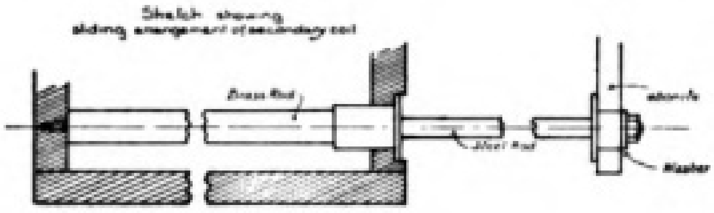
The woodwork is baywood; the base measures $10\frac{1}{4}$ in. by $7\frac{3}{4}$ in. by $\frac{3}{4}$ in. thick, the side pieces 9 in. by 6 in. by $\frac{3}{8}$ in. thick, the end pieces 6 in. by 6 in. by $\frac{3}{8}$ in., and the top, $9\frac{1}{2}$ in. by $7\frac{1}{4}$ in. In the front piece a circular hole is cut slightly larger than the diameter of the secondary tube. All the woodwork is either french polished or stained and varnished. The primary tube is mounted by glueing a round piece of wood into the back end; the wood is then screwed to end piece of casing.

No sliding contacts are used, these being unsatisfactory owing to bad contacts, lack of quick adjustment, etc.



The primary has 220 turns of 24-gauge enamelled copper wire wound on a card-board drum 8 in. long and $5\frac{1}{2}$ in. diameter on the units and tenths system, as follows:—Measure off $1\frac{3}{8}$ in. from left hand end of tube and insert a small round head brass screw, to which fasten the wire for winding the coil; then take two turns of wire round the drum and insert a small nail part way into tube close up against the turn of wire. Take one turn of wire round the nail, then withdraw the nail. This leaves a loop which should be bent up at right angles to tube, continue winding in this way until there are ten loops, one to every other turn of wire. The loops should not be exactly in line, as it would be too difficult to solder the wires on, leading to the studs. Now wind 20 turns of wire and make another loop, and so on to end of winding; these latter can be all in line. On the side of the casing a piece of ebonite 7 in. by 3⅜ in. is screwed, and on this the studs and switches are mounted. The studs are made from $\frac{3}{16}$ in. cheese head brass screws with the slots turned out. Ten studs for the tenths and eleven studs for the units. The shanks are slit part way up with a fine saw.

A wire is now fastened to the small screw at beginning of winding and taken to the



first stud of the left hand set. After the enamel has been scraped off the wire is pushed in the slit in shank of stud, which is then pinched tight together; the last loop of the first section is lead to the first stud of the right hand set, and the remaining loops to the other studs of the right hand set.

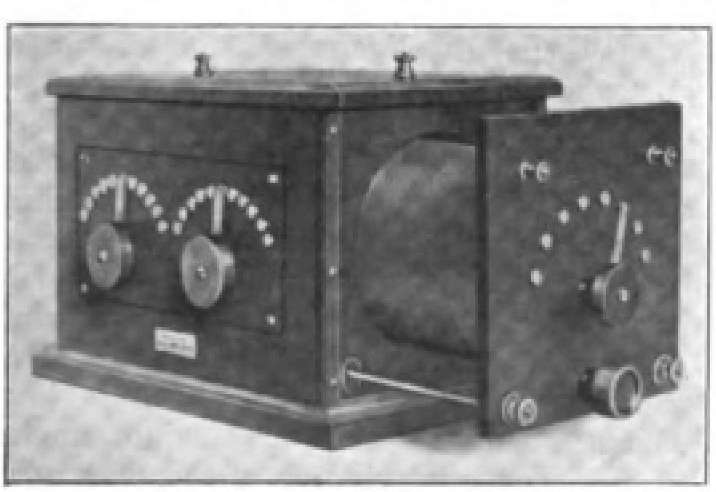
A wire is taken from the left hand switch to a terminal on the top of the coil for connection to aerial, and a wire from the right hand switch is taken to another terminal for earth connection.

The tube for the secondary coil measures 7½ in. by 4¼ in., and at the front end is attached a piece of ebonite, 6 in. by 6 in. by ¼ in. thick, and on this a switch is mounted for the secondary tappings.

The tube is wound for a length of seven inches with 29-gauge single silk covered wire and a tapping taken every inch. After winding an inch prick a small hole through the tube, then make a loop about an inch long by twisting the wire, and pass it through the hole. Continue this method to end of coil, then take wires from the end of each stud and pass them through each of the loops which project inside the tube, and after pulling tight they should be soldered. A wire should be attached to the back of each stud before the secondary tube is attached to the ebonite front.

The method used for sliding the secondary in and out of primary tube ensures a very sweet movement and is as follows:—Two brass tubes, $\frac{9}{16}$ in. inside diameter and 8 in. long are fixed in the case, as shown in sketch, turned brass flanges being fitted at one end of each and a wood screw soldered in the other end. These tubes are lined with felt or box cloth in the following way. A strip of felt is cut about three times as wide as inside diameter of tube and, say, two inches longer; one end of this strip should be cut to a point, then after glueing one side of the felt a wire is passed through the tube and hooked on to the pointed end of the felt. On drawing the wire in the felt follows and will be found to coil round the inside of tube perfectly. Two silver steel rods $\frac{7}{32}$ in. diameter have soldered on their ends two brass flanges as shown in sketch, leaving about ¾ in. projecting, this part being tapped $\frac{3}{16}$ in. These rods will be found to fit the felt-lined brass rods perfectly, being fairly tight and yet easy to adjust, especially if they are first rubbed with a little french chalk. The rods are then bolted on to the corners of the ebonite on front of secondary tube.

A handle is fixed on ebonite front of secondary coil, as shown in the photograph, for moving the coil in or out. If all the metal parts are nickel-plated it gives the coil a very good appearance.



The wireless station at Nauru has been destroyed.

[Nauru is a German island in the Pacific, and the wireless station now destroyed is believed to have been Germany's last, outside Europe.]

Among the Wireless Societies

In normal times, all the amateur wireless societies would be in full swing. From inquiries made among the societies we learn that many of them will continue to hold their meetings as usual, while with regard to others the only change is that the meetings will be less frequent than they would have been but for the war. A summary of the forthcoming arrangements appears below.

Barnsley.—Morse code practice is among the chief features of the meetings of the Barnsley Amateur Wireless Association, which will continue as usual. At the October meeting the programme for the ensuing session will be arranged and the Hon. Sec., Mr. G. W. Wigglesworth, will give a short paper entitled "Various Combinations of Crystals."

* * *

Birmingham.—The next meeting of the Birmingham Wireless Association, which has now been amalgamated with the Scientific Society of the Midland Institute, will be held on Wednesday, October 7th, when Mr. H. W. H. Darlaston will deliver his Presidential Address. To this meeting all members, and particularly intending members, are invited.

* * *

Derby.—The meetings of the Derby Wireless Club will be held every Wednesday evening as usual in the Mechanics' Institution. The club intends to direct its attention mainly to scientific and electrical subjects, although, of course, wireless will not be lost sight of. No programme of meetings is being issued, but a notice will be posted up in the club room each week, advising members of the subject under discussion at each meeting.

* * *

Dublin.—A meeting of the Dublin Wireless Club was held on September 2nd, when it was decided to suspend for the time being the meetings of the club, owing to the war. Occasional gatherings will be held from time to time, however, so that the members may keep in touch with one another. It has been agreed to abandon the club's county wireless station at St. Pancras, Terenure.

* * *

Halifax.—An interesting programme of weekly meetings had been arranged for the Halifax and District Amateur Wireless Association, but a change has since been made, and the meetings will be held monthly. Among the subjects of papers are "Elementary Wireless Telegraphy," "Induction," "Aerials," "Condensers and Capacity," etc. Buzzer practice, which has hitherto found so much favour with the members, will be continued. It is also proposed to hold a series of competitions.

* * *

Liverpool.—The war has naturally imposed some restriction upon the activities of the Liverpool and District Amateur Wireless Association, and instead of the usual weekly meetings there will be fortnightly gatherings on alternate Thursdays. A "progressive" series of wireless studies "from the beginning," as Mr. Frith, the energetic Hon. Sec., informs us, has been arranged, and this, with Morse code practice, will comprise the programme. There will also be special lectures on the construction of wireless apparatus. McGhee's Creamery Café, 56 Whitechapel, Liverpool, is the meeting place.

* * *

London.—Up to the moment of going to press we had been unable to obtain definite information regarding the sessional arrangements of the Wireless Society of London. We were advised that a special meeting of the committee would be held during the last week in September or the first week in October to consider this question. The original intention was to open the 1914-1915 session with a meeting at the Institution of Electrical Engineers on Tuesday, October 27th, but whether or not this will now be held remains for the decision of the committee.

* * *

Newcastle-on-Tyne.—Mr. N. M. Drysdale gave an interesting lecture on "Detectors" before the Newcastle-on-Tyne Wireless Association on September 3rd. He put forward several novel ideas with which he had been experimenting for some time. It has been arranged to hold meetings of the association on the first Thursday in each month.

* * *

North Middlesex.—The September meeting of the North Middlesex Wireless Club was devoted to Morse code practice, with Mr. Midworth's silent practice set. Meetings of the club are now being held monthly, but it is possible that in the near future the fortnightly meetings will be resumed.

* * *

Nottingham.—No definite programme has yet been arranged for the Nottingham and District Wireless Society, but the committee hope to be able to hold monthly meetings for the discussion of matters of interest.

Diary of Meetings.

THURSDAY, OCTOBER 1ST.

Liverpool and District Wireless Association.—Meeting at McGhee's Café, 56 Whitechapel, 8 p.m.

Newcastle-on-Tyne Wireless Association.—Meeting, 29 Ridley Place.

FRIDAY, OCTOBER 2ND.

Barnsley Amateur Wireless Association.—Mr. G. W. Wigglesworth on "Various Combinations of Crystals," at Shaw Lane Cricket Ground, 7.30 p.m.

MONDAY, OCTOBER 5TH.

North Middlesex Wireless Club.—Meeting Shaftesbury Hall, Bowes Park, London, N.

WEDNESDAY, OCTOBER 7TH.

Birmingham Wireless Association.—Mr. H. W. Darlaston, "Presidential Address," at the Midland Institute, 8 p.m.

Derby Wireless Club.—Meeting, Mechanics' Institution, 8 p.m.

THURSDAY, OCTOBER 8TH.

Newcastle-on-Tyne Wireless Association.—29 Ridley Place.

WEDNESDAY, OCTOBER 14TH.

Derby Wireless Club.—Mechanics' Institution, 8 p.m.

THURSDAY, OCTOBER 15TH.

Liverpool and District Wireless Association.—Meeting at McGhee's Café, 56 Whitechapel, 8 p.m.

WEDNESDAY, OCTOBER 21ST.

Derby Wireless Club.—Mechanics' Institution, 8 p.m.

THURSDAY, OCTOBER 22ND.

Newcastle-on-Tyne Wireless Association.—29 Ridley Place.

WEDNESDAY, OCTOBER 28TH.

Derby Wireless Club.—Mechanics' Institution, 8 p.m.

THURSDAY, OCTOBER 29TH.

Liverpool and District Wireless Association.—Meeting at McGhee's Café, 56 Whitechapel, 8 p.m.

Newcastle-on-Tyne Wireless Association.—29 Ridley Place.

THE following letter in response to an inquiry by the secretary of the Birmingham Wireless Association regarding possible assistance by wireless amateurs in the war will be read with interest by our readers :—

BROMPTON BARRACKS,
CHATHAM.
September 7th, 1914.

SIR,—With reference to your letter of August 21st, 1914, in which you ask for suggestions as to methods by which the knowledge and experience of wireless gained by owners of stations may be put to serve some useful purpose, I have to inform you that there are five wireless signal companies in the Territorial Force detailed in columns 839 to 846 of the Army List for August, 1914, with headquarters at Palmer Street, Westminster, S.W.; Leeds: 21 Jardine Street; Glasgow: The Barracks, Great Brook Street; Birmingham; and 38 Mason Street, Edge Hill, Liverpool.

2. No doubt if vacancies exist in these companies you and your friends might join one or other of these units, or if you wished only to learn the correct handling of military messages, and also semaphore signalling, there are 14 Divisional Signal Companies in the Territorial Force open to you if vacancies exist.

3. Should any of you desire now, or at some future time, to join the Regular Forces, it is open to you to enlist as Pioneers in the Royal Engineers in the ordinary way. This means that you may enlist either for the Old Army, the terms of service in which are six years' colour service and six years' Reserve service; or for the New Army, the terms of service in which are three years or duration of the war.

4. Should any of you desire to obtain commissions in the Royal Engineers of the New Army, you should apply by letter—stating qualifications—to the President of the Institution of Civil Engineers, Great George Street, Westminster, S.W.

Yours faithfully,
(Signed) B. R. WARD.
Colonel, R.E.

STEERED BY WIRELESS.

IN *McClure's Magazine* recently there was a well-written and good account of the work achieved by Mr. John H. Hammond, jun., who was one of the United States delegates at the International Radiotelegraphic Congress in 1912. It appears that as a schoolboy he predicted that he would some day be able to control a moving body at a distance by the sound of his voice, and in this article an account is given of the boat *Radio*, which fulfils this prediction. It can be directed by the voice, but practically its evolutions are controlled by working an ordinary telegraph key, and it is asserted that it will be a prelude to a new kind of torpedo, so sure and so deadly that it will revolutionise war-making.

His early attempts, the early difficulties that arose, and how he overcame them, one by one, are described. A measure of success was soon obtained, but the old form of Marconi coherer which he used was found to be unreliable, and after consulting the greatest authorities on the subject and visiting Europe, Mr. Hammond was unable to find a substitute for this coherer. He apparently nearly gave up, but before doing so he had an interview with General Weaver, the chief of the United States Coast Artillery. The conversation is reported as follows :—

"Would it interest you, General," the young man asked, "if I could show you a boat running thirty miles an hour that I could steer from shore without any physical connection and ——"

"*Did* you say thirty miles an hour ?" interrupted General Weaver.

"Yes, sir. And make her do whatever I wanted, turn her against a battleship or—or anything. Would that interest you, sir ?"

The General smiled good-naturedly, and assured his anxious visitor that if he could do what he said, or half as much, he would have accomplished something of real value in the military world.

"And if I go away now, sir, and work hard at this, and after a while get something ready to show you, will you come up and see it ?"

"I certainly will," promised the General. "I'll be glad to come."

With renewed energy he went to work again and devised a detector which has been found to be absolutely reliable, and is one of the jealously guarded secrets. A new boat was built called the *Radio*, and fitted with 180 horse-power engines, and having a guaranteed speed of 30 miles per hour. Finally, he was able to give a demonstration with this boat to General Weaver, who was accompanied by Colonel R. P. Davis.

The following abstract from the article fully explains the situation :—

General Weaver himself told me how, as he watched this wonderful boat, his sensations changed from scepticism to awakened interest, then to surprise, and finally to absolute amazement.

"Hold on !" he said. "I must understand this. Can you make her go to the right—now, when I say the word ?"

"Certainly," said Hammond, and immediately the boat swung sharply to the right.

"Now make her go to the left."

"Left it is," said Hammond, touching the control key, and the boat obeyed.

"Make her cross the bow of that schooner."

"There, sir." As he spoke the boat darted swiftly around the fishing vessel, while the General stared.

Then Colonel Davis took a hand. "Now stop her," he said. "Now make her circle around in the opposite direction." And so on, while the boat obeyed each time.

In general terms the arrangement is as follows : There is an aerial separated by two masts 360 feet high, which sends out electro-magnetic waves generated by the powerful wireless station, and by means of a key any one of a number of contacts can be made on board the boat. Each contact closes the local circuit of some particular motor and effects a different operation. Thus one motor starts the main engines, another stops them ; another turns the rudder to the left, another to the right. The boat when working at night is followed by a powerful searchlight, which enables her to be seen seven miles out to sea (in clear weather).

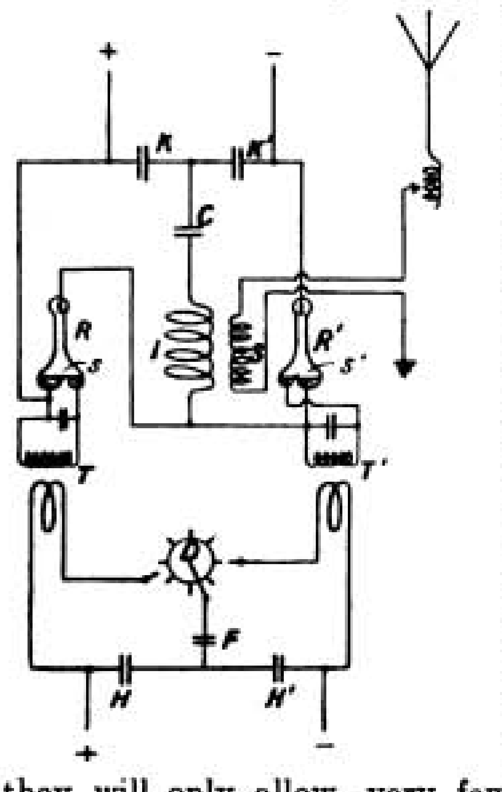
It is stated that the matter has been taken up by the United States authorities, and that very shortly this invention will stand on a very solid engineering basis.

[*The above article may be taken as a pendant to the article on* "*Distant Control by Wireless*" *in the June number of* THE WIRELESS WORLD, *which gave the first authoritative account of the great progress in this work realised by the Marconi Company.*]

PATENT INTELLIGENCE.

A Wireless Transmitter.

No. 7610/13. (Mr. G. Marconi and Mr. C. S. Franklin).—Specification No. 4593, of 1907, describes an arrangement in which a working condenser connected to the middle of a split condenser is charged alternately in opposite directions by means of a rapidly rotating toothed disc. The object of this invention is to provide a transmitter for use in wireless telegraphy and telephony in which the same broad principles shall be utilised without the necessity of the whole power employed passing through the disc, and which shall, therefore, be more suitable for use with the very high powers required for long-distance work. It has before been proposed to employ for actuating the aerial a condenser circuit which is connected to the main power supply, and comprises spark gaps of such a type that they will only allow very few oscillations to take place during either charging or discharging, and also will only allow current to pass in one direction. The main current is normally unable to pass these gaps, and the current is enabled to pass at regular intervals by means of a discharge produced in or near the spark gaps by an auxiliary circuit, which is traversed by a current of small power. According to this invention, such an auxiliary circuit is employed to cause discharges of the main condenser in such a direction and at such times that the impulses imparted to the aerial are in phase with the oscillations produced in it by the previous impulses, which are thereby maintained and rendered continuous. The main power supply is connected to a split condenser K K_1, the middle point of which is connected to one plate of a working condenser C, while the outer plates are connected through mercury rectifiers R and R_1, and an inductance I to the other plate of the condenser C, the rectifiers being oppositely arranged as regards this latter condenser. The inductance I acts as the primary of a transformer, of which the secondary S is the aerial circuit. The circuits comprising C, I, R, K and C, I, R_1, K_1, should both be tuned to the natural time period of the aerial circuit. The auxiliary spark gaps *s* s_1 in the rectifiers R R_1 are connected across the secondaries of transformers T T_1, the primaries of which are connected in the auxiliary circuit which comprises a toothed disc D, a working condenser F, and a split condenser H H_1, connected to an auxiliary supply. As the disc D rotates, sparks are produced alternately and regularly at the spark gaps *s* s_1, thus allowing the main current to pass the rectifiers R R_1, and to charge the condenser C in opposite directions alternately, at a frequency which is determined by the speed and number of teeth on the disc, and is so adjusted that the aerial receives impulses in such a direction and at such times as to increase or maintain the oscillations produced in it by the previous impulses.



PATENT RECORD.

17246. July 21st. Giuseppe Mussi. Transmission of electrical impulses over circuits of high electrostatic capacity. (*Complete.*)

17416. July 22nd. Marconi's Wireless Telegraph Co., Ltd., and Henry J. Round. Apparatus for receiving electric signals. (*Provisional.*)

17487. July 23rd. George Owen Squier. Receiving system for radio-telegraphy and telephony. (*Complete.*)

18009. July 30th. Victor Bouchardon. Sender for Hertzian waves with polyphase generators. (*Convention date, August 1st,* 1913, *Germany.*) (*Complete.*)

18203. August 1st. Marconi's Wireless Telegraph Co., Ltd., and Emilio Ichino. Wireless telegraph direction finders. (*Provisional.*)

18408. August 7th. John Hays Hammond, junior. Radio-dynamic control of gyroscopes. (*Convention date, August* 14*th*, 1913, *United States.*) (*Complete.*)

18511. Aug. 10th. Giuseppe Mussi. Transmission of electrical impulses over circuits of high electrostatic capacity. (*Complete.*) (*Addition to No.* 17246.)

18711. Aug. 15th. Wm. Claude Woodland. Wireless Telegraphy. (*Complete.*)

18751. Aug. 17th. British Thomson-Houston Co., Ltd. (*General Electric Co., U.S.A.*) Coherers. (*Provisional.*)

19054. Aug. 25th. Alban J. Roberts. Receivers for Wireless systems. (*Convention date,* 25*th August,* 1913, *Australia.*) (*Complete.*)

19433. Sept. 4th. Alfred Henry Cohen. Means for producing oscillatory currents of high frequency. (*Complete.*)

Among the Operators

In the following sketch are set out some of the essentials that go to make a good operator and other points that an operator should bear in mind.

He is a man's man, is Operator A1. There is nothing of the narrow-chested, feeble-kneed weakling about him He is well knit and muscular, of a good average height, smart in appearance, his well-proportioned head is set squarely on broad shoulders, his hands are strong but not ungainly, and the way he moves his fingers shows him to be capable of using them both for hard work and for the manipulation of delicate machinery. He walks briskly, he looks intelligent and straightforward. A man of few words, he is nevertheless always able to hold his own in argument, to give reasons for his actions and to find time for courtesy. Above all he obeys promptly.

Operator A1 is not the sport of chance ; good luck has never been his guiding star, he has gained the position of trust which he now holds entirely on his own merits, that is to say, his proficiency as a wireless operator is the outcome of much hard work and many months of patient endeavour, but with nothing much to show as actual result. As soon as he had made up his mind to become a wireless operator he set himself to study, attended the usual routine of classes, but always managed to do a little more than was expected of him by his master. "*The little more*, and *how much* it is!" Yet Operator A1 was never a prig, he never set himself to be the "good boy of his class," it was only that he worked when he was supposed to work and took good care to avoid the group who were interested in anything except the question in hand. But my friend was always top-hole at sport: when quite a little nipper he was elected captain of his school eleven and could always lob a ball with the best of them. In his den at home are to be seen several trophies of his prowess. The finest is the silver challenge cup which he won in an inter-collegiate swimming contest. Later he found his skill of immense benefit when he was able to save a passenger's life on one of his trans-Atlantic voyages, and his own when he barely escaped the jaws of a shark in the Indian Ocean. But this is a sidelight on his career. The work which earns him his livelihood is his skill as a wireless operator. He can sit down at any time and receive at the rate of from 2,000 to 2,400 an hour plain English and in his copy every letter is unmistakably legible. He can use a typewriter equally well, and, in fact, has got so accustomed to the machine that he can work it practically mechanically as he is receiving. This is something to be proud of, for there is a great deal to learn about a typewriter, in order to handle the machine properly and it requires intelligent study to get the best out of it. But personally I am more inclined to admire his penmanship, which is in every way excellent, for it is bold and legible and at the same time free from the cramped inferiority of the unintelligent clerk. He has told me that it was a severe tax on his patience when he was trying to combine legibility with swiftness, but he was determined to persevere, for, as he said, "The recipient of a telegram should not be taxed with the duty of deciphering poor handwriting. It is not fair to the patron and reflects unfavourably on the company employing such poor writers."

Sometimes over a pipe Operator A1 has discussed with me the qualifications which are necessary to bring success in the service. Physical fitness he more than once has propounded as being absolutely essential—general health good, sight and hearing good, the hands capable of quick action, steady nerves, self-confidence, a good memory, and some degree of precision and rapidity of general movements. He lays great stress on the necessity of a complete mastery of rules and fours, skill in reading from poor manuscript, and much general knowledge of business, names, customs, geography, etc. In addition an operator should be able to transmit correctly at a rapid rate with one hand while timing with the other the messages sent, he should know how to adjust instruments to every variation in the current, particularly is this necessary in bad weather or on faulty apparatus. In sending he has often found it necessary to exercise considerable judgment in gauging the speed of transmission to the ability of the receiving operator and in his conversations he has referred frequently to the need of a peculiar telegraphic sense which prompts him to instantly detect an error, even in a cipher message ; and it is an axiom of his never to break, except when in doubt as to the correctness of a word, and then *always* to break. He has always some pungent remarks to make with regard to courtesy on the line, and he thinks there is much opportunity for general improvement, though this can only be effected by the individual efforts of each operator. He is very strong on this point for, as he rightly remarks, "courtesy is the only effective social grease which can oil the wheels of the business world." Lastly, Operator A1 contends that every wireless operator should make it his business to acquire as much knowledge as he can of the science on which this work is based, not merely a superficial knowledge, but a thorough grasp of electro-technics and the principles of radio-telegraphy.

Mr. C. Peters, who recently resigned his position with the Marconi International Marine Communication Co., Ltd., has been appointed officer-in-charge of the Chilian Naval Station at Coquimbo.

United States operators will be interested to know that the Department of Commerce have amended the third paragraph of General Letter No. 69, of April 10th last, under the heading "Radio Operator's Licence, Commercial Extra, First Grade." Applicants for the Commercial Extra First Grade Licence must now pass a special examination. To be eligible for this examination they must hold commercial first grade licences, and their certificates of skill in radio communication, issued under the Act of June 24th, 1910, or licences under the Act of August 13th, 1912, must record eighteen months' satisfactory commercial service at sea or at land stations either or both." (The remainder of the paragraph is unchanged.)


A. C. Brown (Operator, SS. "Galician.")

This amendment permits wireless operators who hold the Department's certificates of skill and first grade commercial licences, and who have had eighteen months' operating experience, either on land or sea, or both, to take the examination for the Commercial Extra First Grade Licence. Applicants presenting themselves at the Radio Inspector's office for examination should see that the service recorded on the back of their First Grade Licences, or certificates of skill, or both, is filled in and signed by the master, manager, or superintendent, under whose direction they have worked, covering a period of at least eighteen months' service. All operators should prepare themselves and endeavour to obtain this higher grade licence. The possession of this licence will doubtless influence the American Marconi Co. in determining the fitness of their operators for promotion.

When a ship is within range of the wireless stations of two different countries, the operator is sometimes in a difficulty as to which station he should pass through the traffic, although, if he follows his instructions, his difficulties soon disappear. A difficulty of this kind which operators in the Pacific have sometimes experienced is made clear by the instructions recently issued by the Amalgamated Wireless (of Australasia), Limited. According to these instructions, no traffic is to be accepted for transmission through New Zealand stations when the ships are nearer to Suva than to New Zealand. In cases where a sender particularly specifies that his message is to be forwarded *via* New Zealand stations and refuses to have it sent *via* Suva, the message may be accepted at sender's risk, and if possible transmitted to New Zealand after Suva Radio is clear of traffic and closed for the night, or it may be relayed through another vessel. Operators must not communicate with New Zealand stations for any purpose during the working hours of Suva Radio when their ships are nearer to Suva than to New Zealand.


L. J. G. Smith (Operator, R.M.S.P. "Arlanza.")

Roll of Honour.

We record with regret the deaths of the following operators:—

VIVIAN ARTHUR WALTERS, Leeds, lost his life in the *Pathfinder* disaster. He was 26 years of age, and was a wireless operator, the official description being "leading signalman." He received his education at the Leeds Central High School, and at the age of 14 joined the training ship *Ganges* at Chatham. Last Easter he paid a visit to his parents, just after he had been transferred from H.M.S. *Hawk* to the *Pathfinder*. He had much natural ability, and one of his diversions was the sketching and painting of other war vessels from the deck of his own.

JOHN R. CHARLTON, aged 19, also one of the wireless telegraph operators on board the *Pathfinder*, was interred at Bridlington, on September 10th, with naval honours. The Rev. Conrad Balmer, at the funeral service, said that after the ship went down Charlton had swam for over an hour with a mate. The two young men agreed, shortly before Charlton sank, that the survivor should take a message to the other's parents that he had died as a true Briton should. That noble message had been delivered.

GEORGE THACHER was the wireless operator on board the armed merchant cruiser *Oceanic*, which was wrecked off the north coast of Scotland. Fortunately no lives were lost in that disaster.

The International Correspondence Schools of Kingsway have displayed a splendid and practical patriotism in the present national crisis. They have more young men of military age on their register than any other institution in the country; and they are represented in the Forces by a vast number of "old boys." As far as can be computed at present, there are 1,200 I.C.S. students in the British Navy; and the first to have his name inscribed on the Roll of Honour was Chief Telegraphist W. C. Mair, who perished in the *Amphion* disaster. Thirteen hundred students are enrolled in the Regular Army and about 7,500 more have been called to the colours with the Territorial and Reserve Forces. The I.C.S. authorities have established a war relief fund in the interest of the families of students who are killed and wounded, and they have taken into their care all the families of the married men on their staff who have joined the colours.

Furthermore, they have placed their buildings and the beautiful grounds at Hendon at the disposal of the Government, who are utilising them for a home for the children of Belgian refugees.

They invite all who can to take up a course of study in sound technical training, and if necessary devote their spare time to this purpose, for they point out—and with justice—that England requires technical proficiency if her trade is to gain ultimate benefit from the war.

A Telegraphic Code in the Making

How the great inventor, Samuel Morse, worked out his telegraphic system of dots and dashes which is to-day universally known as the Morse Code.

CONSIDERING the position that Morse holds in the invention of the telegraph, it is surprising to find how little is generally known about the great inventor. You would think that the ubiquitous penman would have found in his life excellent material for a biographical sketch which would appeal to the readers, not of one continent alone, but of the whole world. Instead of that, the diligent searcher after truth will find his attempts at research rewarded with only a series of monographs and journalistic articles and one single biography written by Samuel Irenaeus Prime, and published in New York in 1872, a year after the great inventor's death.

THE WIRELESS WORLD is not the place to attempt an authoritative or elaborate history of this great career, but there are one or two details which will no doubt interest our readers.

The most surprising fact about the life of Samuel F. Breese Morse is that he started life as an artist and was by no means a young man when he took up the study of telegraphy. That was in 1832, when he had reached his 39th year. He was on board the packet boat *Sully*, travelling from France to the United States, when he conceived the idea of electro-magnetic telegraphy which should consist of the following parts, viz., a single circuit of conductors from some suitable generator of electricity; a system of signs consisting of dots or points and spaces to represent numerals; a method of causing the electricity to mark or imprint these signs upon a strip or ribbon of paper by the mechanical action of an electro-magnet operating upon the paper by means of a lever arm at one end with a pen or pencil; and a method of moving the paper ribbon at a uniform rate by means of clockwork to receive the characters. These processes, as well as the mathematically calculated signs devised for producing a permanent record, were drawn by Morse in his sketch book while he was still on board the vessel. For some two years and a half afterwards various circumstances combined to prevent him from making any attempt to embody his apparatus in practical form. But in the autumn of 1835 he constructed the first rude working model of the invention.

His apparatus was simple in the extreme. The electro-magnet was formed of a bent iron rod procured from a blacksmith. The helices were a few yards of copper wire insulated by hand with cotton thread, wound upon it. The support upon which the various portions of the machinery were arranged consisted of an artist's stretching frame such as is used for the canvas of oil paintings. This was nailed against the edge of an ordinary table.

But perhaps the most difficult part of the inventor's scheme was the elaboration of a system, in dots and dashes, to represent the aphabetic code.

Morse took as a unit of space or length the shortest available length of line, technically termed a dot. His alphabet was then made up of signs, forty-five in number, formed from three elements: the dot, the space and the dash, arranged in various combinations, representing the following relative values:—

The dot...	One unit
The space or break between the elements of a letter... ...	One unit
The space, employed in the "Spaced Letters"	Two units
The space, separating the letters of a word	Three units
The space, separating words ...	Six units
The short dash...	Three units
The long dash	Six units

Morse, in considering the mechanical means at command for producing at a distance any permanent mark, perceived that by means of the electro-magnet the motion of a lever, up and down, could be easily and surely commanded; and if a pencil at one extremity of it were made to strike upon a piece of paper, a dot would be made whenever the magnet was charged and quickly discharged. This action, however, without a further device, would be unavailing to produce variety, since the lever motion is limited to the simple movement of up and down. Hence the idea of moving the paper at a regular rate beneath the pencil. Thus a dot could be made on the moving ribbon of paper, which, passing onward, the paper was ready to receive (after an interval more or less extended) another dot, or series of dots. Thus, the ability to produce dots in groups at pleasure was demonstrated, and, consequently, groups of dots expressive of various numerals were devised. In pursuing the experiments with the numerals whose elements were a simple dot and space, it was perceived that, by means of the moving paper, not merely a dot could be produced at pleasure, but if the magnet was kept charged while the paper was in movement, the pencil produced a line long in proportion to the time in which the magnet was charged. This fact introduced a third element for combination, to obtain variety in the groups, indicating letters, as well as numerals—to wit, the line or dash—so that dots, spaces and lines in any variety of combination were at command for forming a code of signs. Hence originated what is now universally recognised as the Morse code.

In the arrangement of the alphabet it was desired that no letter should occupy more than five dots, or nine units in length; and none of them, with the single exception of the letter J, exceeds that number. Another principle was specially observed, viz., that the letters occurring most frequently in the English language were to be composed of the fewest and shortest elements. The letter E is thus represented by a single dot; the I and T within the space of two dots or three units, and so on. The numerals were comprised within the value of six dots or eleven units, to distinguish them more readily from the letters.

There are six letters or signs in the American Morse alphabet—viz., C, O, R, Y, Z, and ampersand—&—termed space letters, because they are distinguished by a space in the body of the code which is equal to two units. These space letters were very early found to possess a practical inconvenience by being liable to be confounded with other letters or combinations of letters unless very carefully used. The most common fault made in transmitting such signs is to make the space-letter exactly equal to that between the letters themselves instead of one-third less, as it should be. Nevertheless, the actual number of words which are liable to be mistaken for each other, when transmitted in this way, is very small. As example of two such words is found in "poison" and "person," which are impossible to distinguish except by reference to the text. Morse worked hard to eliminate these minor deficiencies, and when the system was introduced into Europe his improvements were adopted. But by that time American operators had become used to the earlier system, and it was not thought advisable to revolutionise their code merely for the sake of a few minor deficiencies.

The history of the adoption of the Morse code in Europe is interesting. In the spring of 1838 Morse himself visited Europe, taking with him a set of his telegraphic apparatus for the purpose of obtaining patents in England and France, and to make arrangements for its practical introduction abroad. But in these matters he was not successful, for as yet no definite results had been accomplished even in his own country. Therefore, he determined to let matters be for a while and devoted himself to placing his invention on a permanent basis in his native land. In this he was successful, and in 1844 the first working telegraph line was opened up between Baltimore and Washington.

The next year, Mr. C. J. Fleischmann exhibited the Morse apparatus to the Emperor of Austria at Vienna and it was soon officially adopted by the Austrian Government. Three years later two Americans, Robinson and Chapin, constructed a line from Hamburg to Cuxhaven, a distance of ninety miles, which was operated upon the American plan with Morse's apparatus and was used for reporting marine intelligence.

Some years previously to this, however, a Professor Steinheil had worked out a system of telegraphy, and his apparatus had been adopted by the Bavarian Government, though little had been done towards putting it into actual operation beyond the construction of a short line between Munich and Augsburg. England also produced a competitor in Fardley, who had succeeded in introducing the Whetstone Dial apparatus, to a limited extent, on several railways in North Germany. But none of these systems had proved a conspicuous success, and by many—we might say the majority—the idea of telegraphy was considered to be little more than the pet hobby of irresponsible scientists.

But their mistake was soon to be proved. In 1849 Robinson and Chapin undertook the equipment of a line between Berlin and Vienna. In the meantime, however, Steinheil had been commissioned by the Bavarian Government to travel through Germany and examine the different systems of telegraphy then in operation. On his return home he received an appointment in the Austrian Ministry of Commerce for the purpose of permanently organising the telegraph system of that country. In 1851 a Convention of Delegates from Austria, Prussia, Bavaria, Wurtemburg, and Saxony met at Vienna with a view to establishing, if possible, a common uniform telegraphic system, under the name of the German and Austrian Telegraphy Union. Steinheil, who, it will be remembered, had himself invented a system of telegraphy, was one of the warmest supporters of Morse and his code. His generous acknowledgment of his rival stands to his lasting honour, and it was mainly through him that the Convention decided, with great unanimity, that the Morse system was practically far superior to all others, and was accordingly adopted. It was at this stage that the Vienna Convention adopted Morse's new and uniform international aphabetic code, which has since become universal, except, as was mentioned before, in the case of the American Morse Code.

The only letters which differ from the Morse code are C, F, J, L, O, P, Q, R, X, Y, Z; the additional letters peculiar to foreign languages are ä, ö, ü, ch, é, ñ. The figures are all different except the figure 4, but in all cases letters and figures are made by dots and lines, the same as in American Morse, and only differ in their relative position. A few of the code signals of punctuation and expression may perhaps be here reproduced, as being less well known than the alphabet itself :-

Period (.)	. . . . . .
Comma (,)	.-.-.-
Query (?)	. . — . .
Exclamation (!)	— — . . — —
Apostrophe	. - - - - .
Hyphen	- . . . . -
Fresh paragraph	. - . - . .
Inverted commas	. - . . - .
Parenthesis	- . - - . -
Understand	. . . - .
I don't understand	. . - - . . . . - - . .
Wait	. - . . .
Erase	. . . .
Call signal	- . - . - . -
End of message	. - . - . - .
Cleared out all right	. - . . - . . - .

It is interesting to note that in the case of the period and the erasure the signs are generally written in pairs, thus :—

Period	. . . . . .
Erasure	. . . .

as the mind more easily grasps groups of three than of six or other composite numbers.

The work of constructing the semi-high-power Alaska service stations is well under way. The station at Ketchikan will be 25 k.w. The aerials will be supported by four steel towers, in a position which will place the aerial directional toward Astoria, where the United States terminal station of the Alaska service will be located. The site for the Astoria station has been purchased and plans completed.

F

QUESTIONS AND ANSWERS

Directly and indirectly the war has interfered with every branch of correspondence, and the "Questions and Answers" section is no exception to the rule. Many of our most enthusiastic correspondents are at the front, and Mr. Dobell is himself so overwhelmed with important work that he has found it impossible to devote all the attention he would like to answering the questions which have been sent to him. For this reason several answers have been held over till a later issue. All, however, will receive full attention in due course, and readers are still invited to send questions on technical and general problems that arise in the course of their work or in their study to Mr. H. Dobell, 21 Maltese Road, Chelmsford. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered.

C. W. B.—On page 4 of Fleming's *Principles of Electric Wave Telegraphy and Telephony*, he gives the expression for a damped oscillation as

$$i = I\epsilon^{-at} \sin pt.$$

He then says that i has the first maximum value (I_1) when $t = \frac{\phi}{\pi} \cdot \frac{T}{2}$ and the second maximum, in the opposite direction, (I_2), when $t = \frac{\phi}{\pi} \cdot \frac{T}{2} + \frac{T}{2}$ Hence by substitution

$$\frac{I_1}{I_2} = \epsilon^{a\frac{T}{2}}$$

Will you kindly explain the intermediate steps by which he arrives at this formula.

Answer.—ϕ is, by agreement, the angle made by the radius-vector when the first maximum, I_1, is reached. T/2 is the half-period, at the end of which the angle made by the radius-vector is π; therefore the time t to reach the angle ϕ is evidently $\frac{\phi}{\pi}$ of T/2; that is, i has the value I_1, when $t = \frac{\phi}{\pi} \cdot \frac{T}{2}$.

The next maximum (I_2) is half a period later; that is i has the value I_2, when $t = \frac{\phi}{\pi} \cdot \frac{T}{2} + \frac{T}{2}$ So, by putting these values for i in the equation,

$$i = I\epsilon^{-at} \sin pt$$

we have:—

$$I_1 = I\epsilon^{-a\left(\frac{\phi}{\pi} \cdot \frac{T}{2}\right)} \times \text{Sin } p\left(\frac{\phi}{\pi} \cdot \frac{T}{2}\right)$$

and

$$I_2 = I\epsilon^{-a\left(\frac{\phi}{\pi} \cdot \frac{T}{2} + \frac{T}{2}\right)} \times \text{Sin } p\left(\frac{\phi}{\pi} \cdot \frac{T}{2} + \frac{T}{2}\right)$$

and dividing out:—

$$\frac{I_1}{I} = \epsilon^{\frac{-a\,\phi\,T}{2\,\pi} + a\left(\frac{\phi\,T}{2\,\pi} + \frac{T}{2}\right)} \times \frac{\text{Sin } p\left(\frac{\phi}{\pi} \cdot \frac{T}{2}\right)}{\text{Sin } p\left(\frac{\phi}{\pi} \cdot \frac{T}{2} + \frac{T}{2}\right)}$$

$$= \epsilon^{\frac{aT}{2}} \times -1.$$

since the angles at top and bottom of fraction only differ by 180°, and Sin (180° + θ) = − Sin θ. Fleming, it is true, leaves out the minus sign, the meaning of which, of course, is that the two maxima I_1 and I_2 are on opposite sides of the axis of time.

R. C. W. (Darwen).—(1) What connections are used to cut out atmospherics? (2) What gauge of wire is used in the manufacture of a Marconi multiple tuner?

Answers.—(1) Most of the special connections for cutting out or reducing atmospherics are too complex for amateur use; their adjustment, quite apart from their design, requiring great familiarity with every part of the apparatus and—to get the best results—a thorough understanding of the processes going on. If you are one of the amateurs who have such an understanding, it will be worth your while to consult Fleming's "Principles" (2nd Ed.). Also you might look up the "Electrician" of April 26th, 1912. The subject is briefly touched on in Bangay's "Elementary Principles," but all details are omitted as beyond the scope of the book. The "intermediate circuit" of a three-circuit receiver like the Marconi multiple tuner has a certain amount of good effect in reducing atmospherics, if the circuits are sharply tuned and the coupling weakened considerably. This is probably the best line for the amateur to go on, for the usual amateur "single-circuit" receiver is very bad for atmospherics. The whole problem, however, is one of great difficulty, and presents a very interesting field for research, amateur and otherwise. See also our reply to V.H.K. in this number. (2) We make a rule never to give constructional details of patented apparatus in these columns. A simplified diagram of connections is given in the "Elementary Principles," and a more complete one in Fleming's book mentioned above. See also answer to B.G.P. in our last number.

C. B. (North Finchley) has made an oscillation transformer for receiving. The primary is 11 inches long and 10½ inches in circumference, wound with No. 18 dcc wire and tapped out into four equal sections. The secondary is also 11 inches long, but 9¼ inches in circumference, wound with No. 22 dcc wire, and tapped out into five equal sections. For stations such as Norddeich, and stations with still longer wave-lengths, he uses an aerial inductance in series with the primary of the oscillation transformer, but his trouble is this: when receiving any wave, no matter of what length, he has never to vary his secondary inductance, as he obtains the best results with the full amount of secondary inductance in his closed circuit, whether he is receiving a ship wave (600 metres) or the Poldhu wave, or any other wave. He never loosens the coupling, which is always as tight as it is possible to be, otherwise the signals would fade away entirely, even if the coupling were only slightly loosened. A small capacity variable condenser across the secondary winding fails to give any benefit. The secondary is not shorted in any way, and he asks for a reason. He is about to make another oscillation transformer to enable him to receive up to 3,500 metre waves on the primary alone, without using an extra aerial inductance, and he asks what we would suggest.

Answers.—If a slight weakening of your coupling makes signals die right away, you can be sure that your two circuits are not properly in tune, and that the only way you are getting signals at all is by the primary forcing them on to the secondary through the very tight coupling. After all, we might well expect your tuning to be rather bad, since you are trying to use the same jigger for waves as short as 600 metres and as long as 2,700 metres. If you read the "Elementary Principles" you will see why. If you really mean that your coils are 10½ inches and 9¼ inches in circumference, as you say they are, your secondary cannot be anything like long enough for Poldhu, without any condenser across it. We do not understand why the variable condenser you tried did not improve signals: perhaps it was of quite the wrong value. Your best plan is to get some quantitative knowledge of your circuits, calculate the approximate inductance of your coils by some formula (such as that given in the "Year Book" or the simpler one mentioned in the May 1914 number) and see how you stand. Several recent answers will assist you. As to your getting interruptions from stations on other wave-lengths, you will certainly get this unless your circuits are so well tuned as to allow of a loose coupling; and even so, if the jamming stations are near and strong enough they are bound to come through.

N. A. (Bishop's Waltham).—(1) My aerial is an inverted L, two wires 6 ft. apart, horizontal length 47 ft., vertical length 43 ft. to leading in tube, total length of each wire 90 ft. Shall I be right in taking the capacity as twice, and the inductance as one-half that of a single wire 90 ft. long? Also, if I add two more wires at right angles to these making a four-wire aerial, would the capacity be four times and the inductance one-quarter that of the single wire? If this is not so, I shall be glad to know how the capacity and inductance are calculated each separately for such aerials.

(2) Now that my aerial is down I should like to know if I should gain any advantage in receiving signals by thus converting my aerial into a four-wire hoop aerial.

3. What do you understand by a "thick" secondary winding for induction coils? An ordinary coil has, say, 16 S.W.G. for the primary, and 36 S.W.G. for the secondary winding. What size should the secondary be to be a "thick" winding?

Answers.—(1) No, not exactly. The presence of the other wire close at hand makes the resultant capacity less than twice that of the single wire and the resultant inductance slightly more than half that of the single wire. The result is that the natural wave-length is not greatly different from that of the single wire: but it *is* different, which would not be the case if the second wire exactly doubled the capacity and halved the inductance. The calculation of the inductance and capacity of composite aerials is a matter of great complication, and certainly cannot be dealt with here. Some idea as to its complication you may gather from the articles by Prof. Howe in the current numbers of the "Electrician."

(2) Yes, you will gain a certain advantage, especially for receiving long waves, which require a great deal of tuning-inductance added to the aerial. If you read former answers you will see that increased aerial capacity and decreased inductance means that a given amount of added inductance produces a greater increase of wave-length.

(3) For a coil whose primary is No. 16 S.W.G., we should call No. 36 S.W.G. a fairly thick secondary-winding. For a coil of this size, No. 34 would certainly be a "thick" secondary-winding.

INSULATOR (Guildford).—(1) Why is it usual for receiving transformers of the type where the secondary slides inside the primary, to be so arranged that the secondary coil is withdrawn from that end of the primary where inductance is increased? If the primary is designed for long as well as short waves, when turned to short waves it means that a great portion of the secondary is surrounded by the dead end of the primary coil. Whereas if the secondary were withdrawn from the opposite end, this would not be so.

(2) I recently made a receiving transformer with both cheek ends of the primary open, so that the secondary coil could pass in and out at *both* ends. I found when using this coupler, that if the secondary were pushed to the extreme right, signals from low wave stations (200 and less), such as London amateurs, etc., were very much louder than when moved the corresponding distance to the left. But I did not notice the difference with stations above 300. Do you think it possible that moving the secondary to the right would allow of a low wave being impressed on an aerial already fundamentally longer than the sending station? My aerial is fairly large in capacity. I am not sure of the exact wave-length, but it is somewhere in the neighbourhood of 200, and may be over. I cannot get these stations as loud if I put a condenser in series with the aerial, and therefore conclude that my aerial is not longer than these stations, which I hear better when the secondary is moved to the right. I ought to mention that my primary can be plugged out in sections, so that there is no question of dead end surrounding the high potential end of the secondary, although there would, I suppose, be some effect of mutual inductance.

(3) Where a variable secondary coil is used, which would be the correct circuit, 1 or 2? (1 shows the fixed end of the secondary close to the primary, and the slider—going to the crystal—farther away, so that the unused part of the secondary is pointing away from the primary; 2 shows the fixed end of the secondary as far as possible from the primary, so that any unused part is close to, or inside, the primary). The reason I ask this last question is because of your remarks re the crystal being always at the end "farthest away from the earthed primary." A recent illustration in the "Engineer" of a Telefunken set showed the circuit arranged as per No. 2, but I must say I cannot get on with it, and prefer No. 1.

Answers.—(1) We cannot explain the idiosyncrasies of "outside" manufacturers. We consider the design you mention entirely wrong.

(2) You say "than when moved the corresponding distance to the left," but we cannot quite tell what you mean by this. Do you mean *with regard to the cheeks of the primary* or with regard to the actual turns of the primary which are in use? For short waves, you probably have most of the left-hand end of the primary out of circuit—since here are the groups of 10 turns—and have only the single turns in circuit. Since these are at the right-hand end of primary, the secondary would have to be moved a long way to the right before its coupling with these turns was weakened; while a small movement to the left would weaken the coupling considerably. With waves over 300 metres, probably some of the 10 groups would be in use, and the more of these in circuit the more symmetrical does the apparatus become. You cannot conclude that your aerial (with a certain amount of primary) is not longer than those short waves, simply from the fact that signals are weaker with a condenser in series, *unless your condenser is a variable one of the proper range.* If the condenser is suitable, and the aerial-cum-primary is longer than the incoming waves, you ought, on adjusting your condenser, to get signals increasing up to a certain point on the condenser and then decreasing again.

(3) Of the two connections shown, we prefer No. 1, where the dead end of the secondary is away from the rest of the apparatus. But we do not quite approve of either: we should prefer the aerial and earth to be reversed on the primary, so that the earthed end is as far as possible from the secondary.

Educational Notes.

The University of London announces that a course of twelve lectures on the Theory and Practice of Radio-telegraphy by Professor J. A. Fleming, M.A., D.Sc., F.R.S., will be held at University College, on Wednesdays, at 5 p.m., beginning on October 28th.

The course will be in two parts, six lectures before Christmas and six between Christmas and Easter.

It is open to both members and non-members of the University, and is intended for telegraphic engineers and electrical students who have already some elementary knowledge of the subject, and it will presume an elementary acquaintance with the differential calculus, and with the properties of Vector quantities. The object of the course is to impart a more advanced knowledge of the theory and practice of wireless telegraphy in its modern form.

A prospectus giving a full syllabus of the subjects to be dealt with in the various lectures, together with the fees for admission, can be obtained from the Secretary, Mr. Walter W. Seton, University College, Gower Street, London, W.C.

The syllabus of the Northampton Polytechnic Institute, of St. John's Street, Clerkenwell, is quite an imposing volume of some three hundred octavo pages. This admirable institution aims at providing thorough education in technological and trade subjects. The educational courses fall into two distinct sections—the engineering and other day courses for students who are willing to give the whole of their time for one, two, or more years, to a thorough systematic training in any of the technological subjects dealt with, and the evening courses or classes, which are provided for the needs of those who are unable to devote the whole of their time to attendance at day classes.

Division II. (page 171) of this syllabus deals with all the classes and courses of lectures on telegraphy and telephony which will be held during the coming session. Two special courses—the one for elementary, the other for advanced radio-telegraphy—have also been arranged, and all particulars appear on pages 194–196. The fees for these courses are merely nominal, so that it is within the reach of any who are at all ambitious to avail themselves of the advantages offered by this excellent institution.

But particularly we would draw our readers' attention to the concluding paragraph of this section of the Syllabus. It runs—"The above courses must not be regarded as completing the whole of the training which can be given in this subject. Owing to limitations of time and opportunity, there are necessarily developments, especially in the direction of mathematics and calculations, which cannot be carried to the final stage. If, therefore, a sufficient number of students who have already been through the classes desire to carry the subject further in exercise work and in the laboratory, the governing body will be prepared to consider favourably suggestions for such an extension of the work."

The managers of the Royal Technical College, Glasgow, find that the demand for instruction in wireless telegraphy has increased to such an extent that it cannot be met by the present arrangements at their School of Navigation. The demand is coming largely from students of navigation who cannot remain on shore for a time sufficiently long to enable them to complete the courses. In these circumstances the managers of a number of local lines of steamers have intimated that they will make special arrangements for giving the apprentices who sail on their ships every possible opportunity of attending the classes. They are of the opinion that, while all ships fitted with an installation must have one wireless operator, the manipulation of the apparatus, on cargo ships at any rate, might be entrusted to a junior officer, and that on long-distance passenger ships one exclusive operator might be carried, and there might also be, for relieving purposes, one qualified member of the crew.

Personal.

His Excellency M. Tokitoshi Taketomi has been appointed Minister of Communications in Japan in place of M. Hajime Motoda, who retired on April 16th. His Excellency M. Hirokichi Nakaya has been promoted from the post of Director-General of the Electrical Department of the Ministry of Communication to Vice Minister of Communication, in which office he has succeeded M. Katsutaro Inuzuka.

The Department of Posts and the Department of Telegraphs of British India have now been combined into one department under the directorship of the Hon. W. Maxwell, C.I.E., M.V.O.

The *London Gazette* records the following appointments in the Royal Engineers (T.F.):

London Wireless Signal Co.—R. E. Priestley to be Second Lieutenant.

Scottish Wireless Signal Co.—Second Lieutenant D. F. Fulton to be Lieutenant; C. S. Wright and Hy. Thirkill to be Second Lieutenants.

Southern Wireless Signal Co.—Kenneth E. Shellshear to be Second Lieutenant.

Western Wireless Signal Co.—Wm. Rathbone to be Lieutenant.