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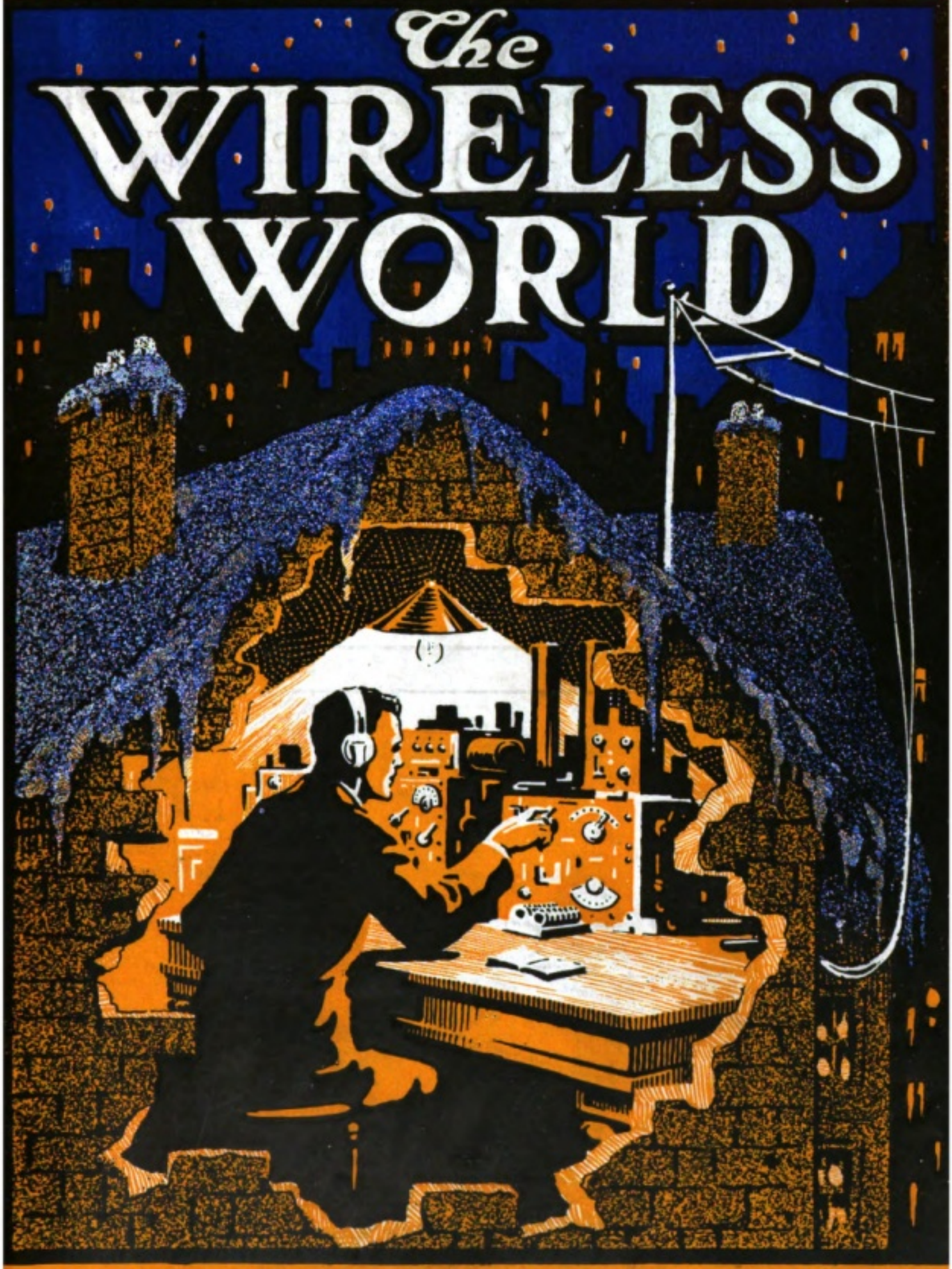
# The WIRELESS WORLD



THE
WIRELESS WORLD

No. 81
Vol. VII

DECEMBER,
1919

# The Kamina Wireless Station

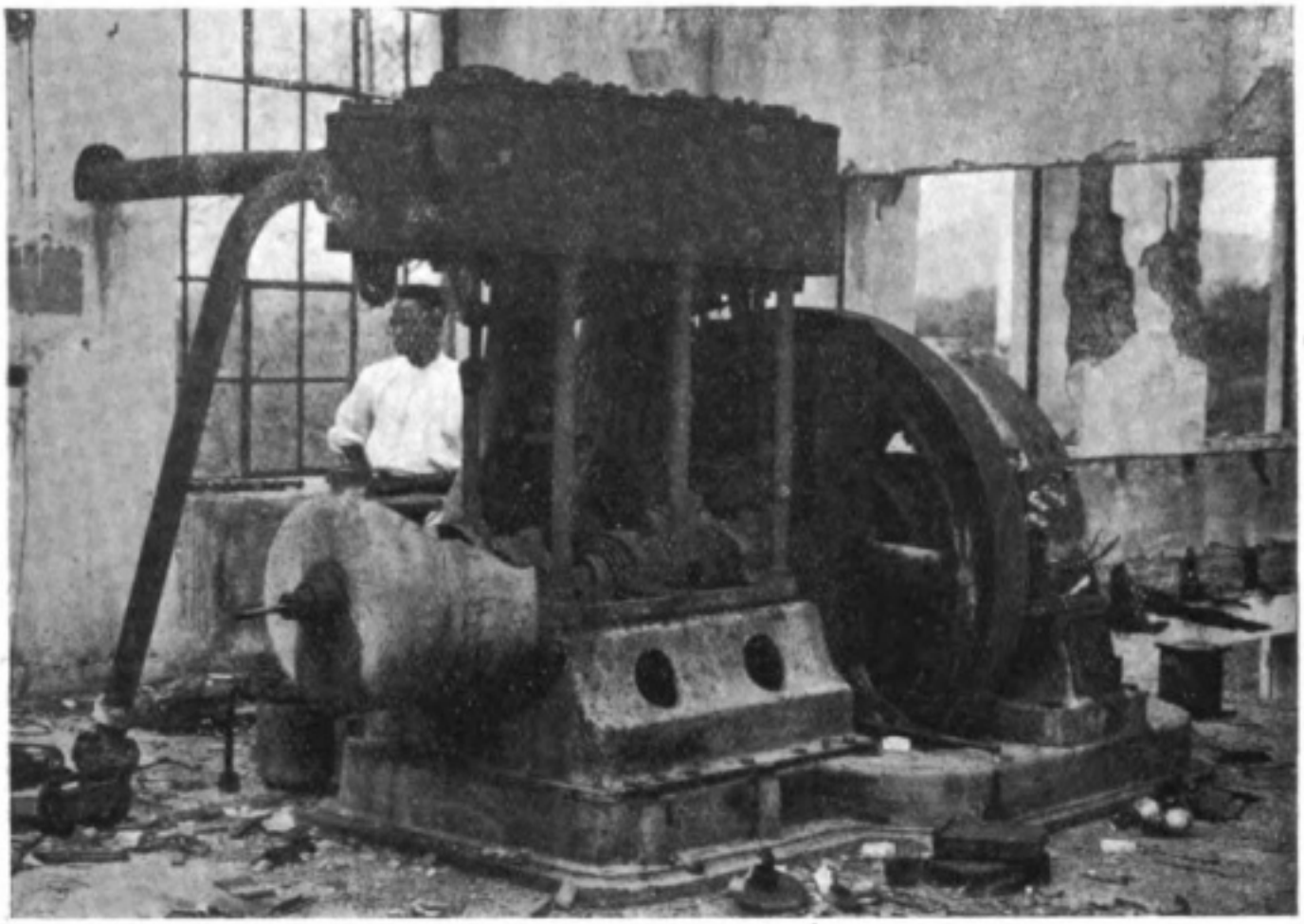
## ITS CONSTRUCTION AND DESTRUCTION

AMONGST the numerous events of the Great War which have almost escaped public notice the Togoland campaign is particularly interesting as it was in the Kamina Wireless Station that the surrender of the Colony was effected.

Lome, the Government town, situated on the seashore and quite close to the British frontier, was occupied by British troops in the first days of the war, whilst the French troops were advancing westwards on the littoral. As a result of these operations the German Colonial Government, as well as German troops and business people were obliged to retire towards the hinterland to the Kamina high power wireless station. Here they installed themselves, resolved to defend it energetically, and started digging trenches.

The British and French columns on this side were each closing in upon them. The British were following the railroad line to Atakpame, the bridges of which the Germans had blown up, whilst the French were advancing by an unfinished road, which starting at Anecho, was intended when finished to meet the railroad at about half way from Atakpame. It was a little further on, near the village of Chra, that the Franco-British vanguards came into contact with the German rear-guards, and after a short fight the latter were forced to fall back on Kamina. Von Doering, Acting Governor of Togo, judging then that resistance would be impossible, decided to surrender after having destroyed the wireless station.

For this purpose the Germans placed two large drums of petrol in a room where they had prepared several wood fires. They then went outside and fired at the barrels from a distance, flooding the whole place with petrol and immediately setting on fire the whole building. During that time other parties of Germans were destroying the aerials and lattice masts. There were ten masts having the shape of a prism, each resting



*A good example of how the Germans destroyed with hammers what had escaped the fire.*

*Franco-British occupation of Kamina Station. The main switchboard after its "morning hate."*

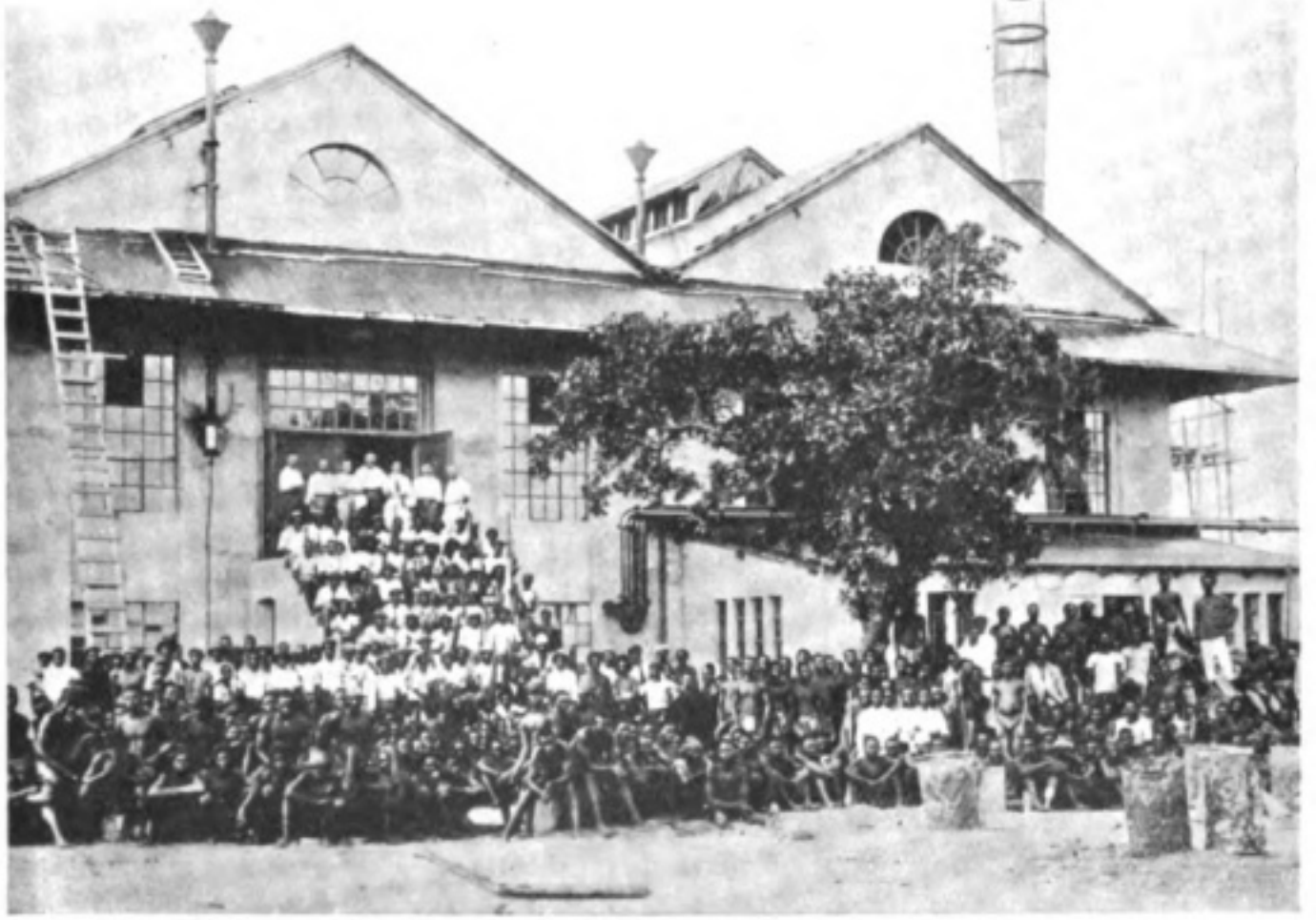
on a point on a cast steel base insulated by lenticular glass insulators. These masts being held in a vertical position by means of stays, it was sufficient to unscrew the stays from their anchorage on one side of the mast in order to bring down the whole mast with a crash to the ground on the opposite side.

When, therefore, the British and French troops arrived at Kamina nothing remained of that powerful wireless station but smouldering ruins, upon which the Germans still vented their fury by breaking up with sledge hammers whatever had been spared by the flames.

The photographs which we are so fortunate as to be able to reproduce show very well this side of the Teuton's thoroughness. Such utter destruction of good machinery as to its smallest parts must be inexplicable to true engineers, who would content themselves by doing some vital damage sufficient to render the station beyond repair, and would not smash the unessentials. On looking at these pictures one is tempted to think of our late enemies as naughty, screaming children breaking their toys.

The Kamina station had an effective power of 250 kw. It was really 325 kw. if we add the supplementary 75 kw. of D.C. which were necessary for the general service of the station, such as accumulators, light, blowers, water pumps, servo motors, workshop gear, etc.

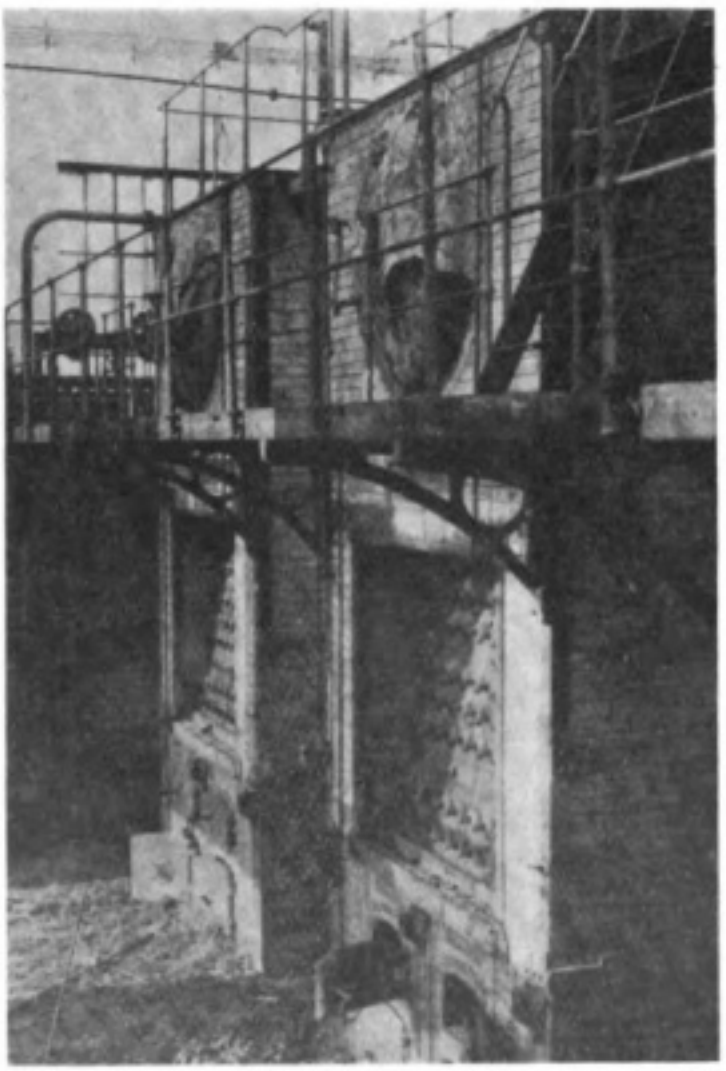
The transmitting system already installed was of the normal Telefunken type with sparks divided and blown



*The German staff at Kamina. The kultured part of it forms the top row*

off by means of powerful blowers, the object of which was also to cool the multiple plates of the spark discharger. The necessary alternating current was supplied by a group of Curtiss—A.E.G. turbo-alternators of 250 kw. The continuous current was produced by a group consisting of dynamo and steam engine of the vertical marine type coupled on the same shaft. *Every machine was duplicated.*

The transmitting aerial was of the flat top type made of twenty wires, ten each side with a wide free space in the middle, and was supported by four lattice masts, each 120 metres in height. Each wire was straightened by extension wires fixed at the top of twenty small masts and could be kept always at the same tension by means of counter-weights. The receiving aerial consisted of a single big bronze cable about 3,800 metres in length supported by five masts of 120 metres, and three 75-metre masts; the construction of two more 75-metre masts was planned, and their foundations already started upon.



*Another view of the gutted station.*

The Kamina wireless station was supposed to work as a relay station between Nauen and the Windhuk station, in German West Africa and also Dar es Salaam in German East Africa. In the meantime Kamina was a connection between the Metropolis and the German colonies of Togo and the Cameroons, possessing respectively the two 25 kw. wireless stations of Togblekhove and Duala. The latter was completely destroyed by the Germans, but at Togblekhove station they only had time to destroy the lattice mast and to take away the receiving set and the spark discharger.

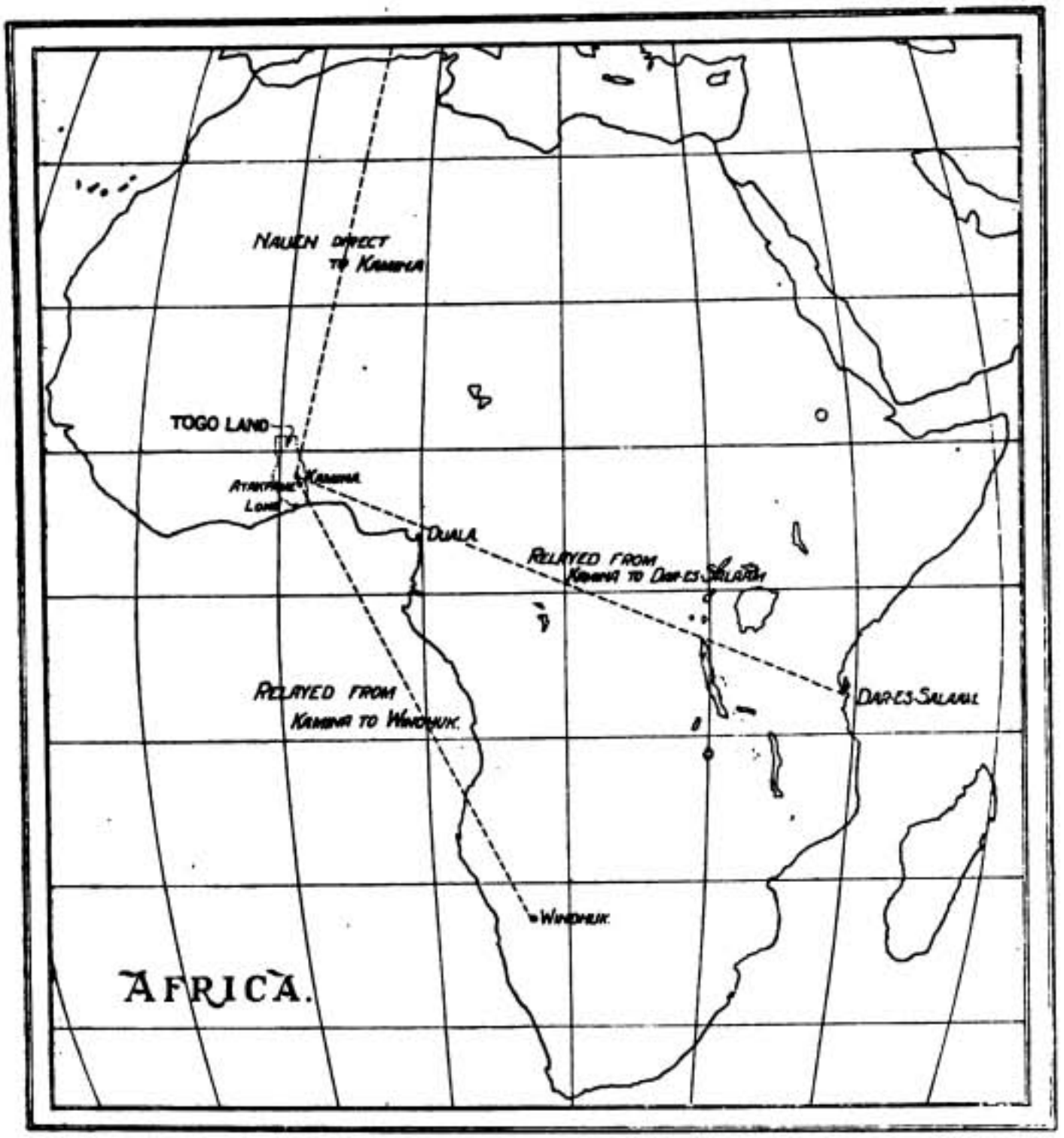
The building of the Kamina station was started in 1912 under the supervision of Baron Codelli, and it was fitted with the latest improvements.

The construction was not quite finished in August, 1914, and the war began during the first trials between Kamina and Windhuk and Dar es Salaam.

This station presents an example of the better side of German colonial methods, although there is no doubt but that it was primarily intended as a mere outpost of the Wilhelmstrasse. Yet one is struck by the enormous pains which were taken over the technical details, and the lavish outpouring of money. It would be interesting to know how many other high-power wireless stations in the colonies or remote footholds of other countries are provided with a complete duplication of plant.

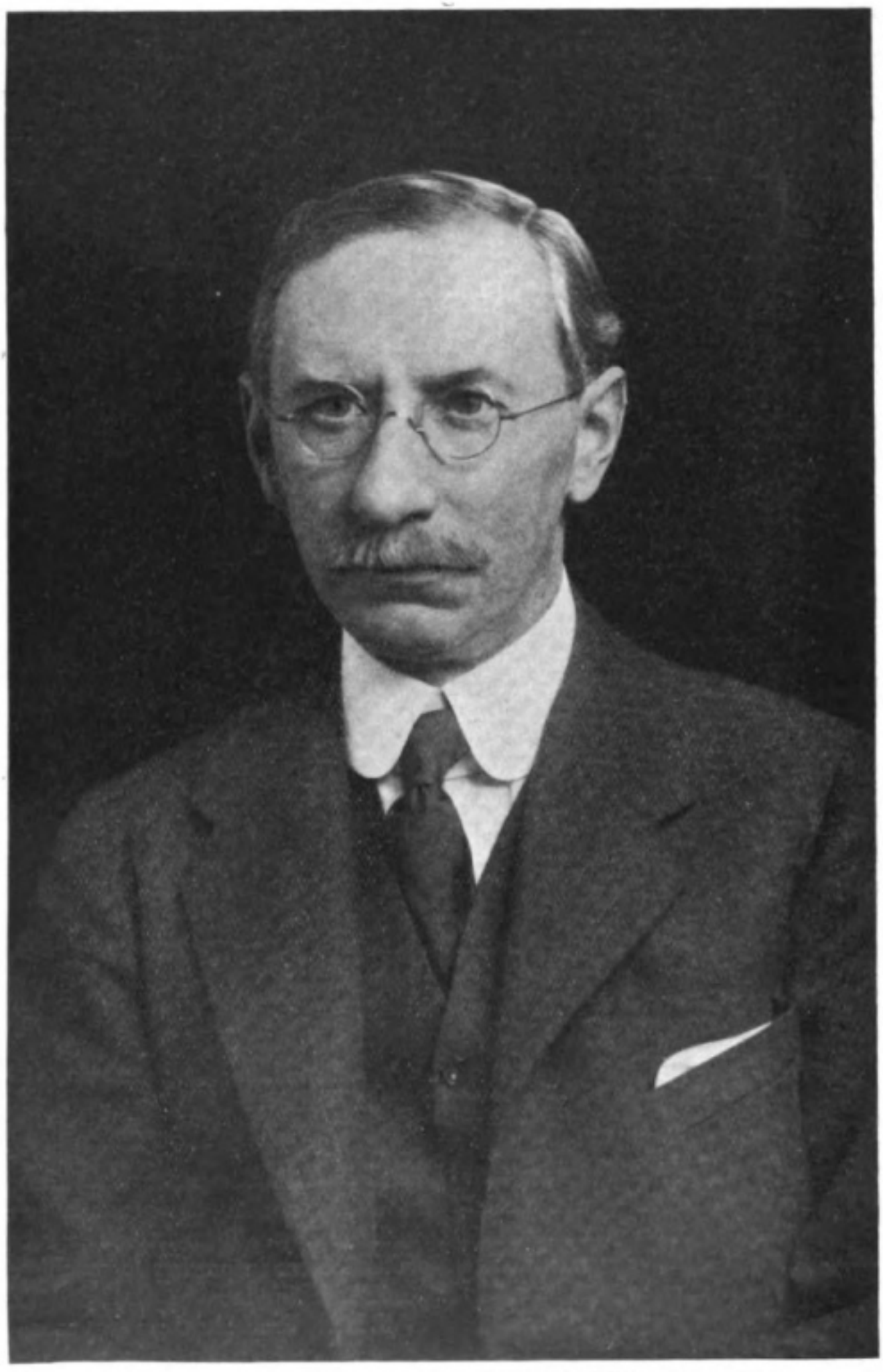
The accompanying photograph of the

## KAMINA WIRELESS STATION.




*This map illustrates part of the great German plan of wireless "penetration." This particular strategic system worked very well till the relay station was captured.*

German wireless staff is unique. Our contributor who supplied it and the interesting notes detailed above, states that but one print was obtained from the negative when the latter was destroyed by a native in German pay. It furnishes a curious sidelight on the German temperament, because anyone with experience of even larger stations than Kamina knows that nothing like such a large unskilled staff would be required, and the precise object in putting so much "coloured" padding into the group is difficult to divine. Probably there was some intricate piece of propaganda at the back of the idea.



*MR. A. A. CAMPBELL SWINTON, F.R.S.*

# Personalities in the Wireless World

MR. A. A. CAMPBELL SWINTON, F.R.S., was born in Scotland in 1863, and at the age of nineteen was apprenticed to Lord (then Sir William) Armstrong and began his engineering career in the Elswick Works at Newcastle. In 1887 he came to London, where, since then, he has practised as a consulting engineer.

Like so many other eminent men, Mr. Campbell Swinton's activities and interests extend far beyond the immediate claims of his own business. Besides being a member of the Institutions of Electrical, Mechanical, and Civil Engineers, he is Chairman of the Council and Vice-President of the Royal Society of Arts, a member of the Executive Committee of the British Science Guild, and from 1912 to 1915 was a Manager of the Royal Institution of Great Britain. He is a Past-President of the Röntgen Society, and in connection with this it is of interest to note that he took the first X-ray photographs ever produced in this country. These photographs hang in his office in Victoria Street in company with others which illustrate the radiographic art as applied to the hands of various celebrities.

He is a devotee of photography, having engaged in it since the age of ten years That he is also a master of it is evident from the portrait—taken by himself—which is reproduced on the opposite page.

At the present time, when hundreds of our readers are so deeply interested in amateur wireless work, the subject of our biographical notes retains for us a special interest because he is the President of the Wireless Society of London. Mr. Campbell Swinton has for a long time been an enthusiastic private experimenter in wireless, and it is quite certain that the subject lies near to his heart—for he makes his own apparatus; an example of his workmanship is shown on another page of this number. Now that the Wireless Society has resumed its work we feel sure that under the wise Presidency of Mr. Campbell Swinton it will, through its able Committee, accomplish a most useful work for science and for the fraternity of amateur wireless men.

# Stray Waves

### The Amateur Position.

ALTHOUGH no public announcement has been made by the authorities regarding the granting of licences for wireless transmission by amateurs, we understand that the Post Office is now prepared to consider applications for informal permission to do such work. It need scarcely be said that at the present stage of Dora's lingering demise these applications will be dealt with fairly severely and the needful permission only given in cases where the applicant is considered to be highly-skilled in the use of his apparatus and is desirous of prosecuting serious experimental work not likely to interfere with commercial or official stations. (See p. 535.)

So far as reception is concerned, little difficulty should be met by any amateur in securing permission to work, and this aspect of the situation may thus be considered to be cleared up, though we would respectfully urge the Post Office to be more generous with regard to the dimensions of the amateur's aerial. If a person intends to use crystals, then we can think of no reason why he should not be allowed to erect as large an aerial as he likes.

• • •

## RADIOGONIOMETER AND TRIANGULAR DIRECTIVE AERIAL PATENTS.

There has been an action brought by Professor Artom against Mr. Bellini and others before the County Court, Court of Appeal, and Court of Cassation of Turin on the ground that the invention forming the object of Artom's Italian Patent No. 88,766, and other corresponding foreign patents in his or other's name, commonly known under the name "Radiogoniometer," or "Direction Finder," had been in some publications attributed to Bellini and Tosi, and the invention protected by the Italian patent 88,765, and corresponding foreign patents in Artom's or other's name, commonly known under the name of "Dirigible Triangular Aerials" had been attributed to other persons.

The Court of Appeal of Turin by the judgment dated July 18-24th, 1914, confirmed by the Court of Cassation on June 26th, 1915, decided that said publications were an infringement of Prof. Artom's rights, as it could not be contested, even in print, that said inventions belonged to Prof. Artom's intellectual patrimony, this having been admitted by Mr. Bellini himself in his declaration before Mr. Rolando, Public Notary, dated April 5th, 1912, whereby he bound himself to withhold from any opposition.

• • •

## LORD FISHER ON WIRELESS.

We take the following extract from Lord Fisher's interesting "Memories," published in *The Times* of October 17th:— . . . . . ." An intercepted German naval letter at the time gave me personally great delight, for it truly divined that wireless was the weapon of the strong Navy. For the development of the wireless has been such that now you can get the direction of one who speaks and go for him; so the German daren't open his mouth. But

if he does, of course, the message is in cipher; and it's the elucidation of that cipher which is one of the crowning glories of the Admiralty work in the late war. In my time they never failed once in that elucidation."

* * *

## THE HYDROCARBON IN ARC CHAMBERS.

From an extremely interesting article entitled "Development of Arc Radio Transmitters," contributed by Messrs. A. L. Anderson and H. F. Elliott to the *Electrical World* (August 30th, 1919), we extract the following:—"The magnetic field strength is a function of the power, frequency, and kind of hydrocarbon used." "Alcohol is the hydrocarbon generally used with the smaller arcs. Kerosene is used where considerable power is required on short wavelengths. It will increase the antenna current when the magnet field is weak, but produces soot in the chamber, which makes an occasional cleaning necessary. Illuminating gas is used when available."

# Speaking Across the Atlantic by Wireless Telephony

*A Report of the Public Lecture Delivered by Professor J. A. Fleming, M.A., D.Sc., F.R.S., on Wednesday, October 22nd, at University College, Gower Street.*

THE lecturer opened his entertaining discourse with a brief description of wave motion in general and in particular of the mechanism of sound transmission through air. He pointed out that different sounds have different wave characteristics, and described an instrument that had been developed in the Research Laboratories at University College in the course of certain experiments made during the war, for the purpose of delineating the wave form of various types of sound. This instrument he termed a "Phonoscope" or "Phonodeik." The general construction of this apparatus was shown by means of lantern slides. By its use it is possible to delineate on a photographic strip the wave form of various speech sounds. A number of lantern slides were shown illustrating the different types of vowel sounds. The lecturer showed by the addition of a number of curves of different wave-lengths the manner in which a complex shaped wave form is built up of a number of sine wave harmonics, and explained the reverse process, known as Fourier's analysis, by means of which a complex wave form may be analysed into its constituent harmonics. A number of films were on view showing the wave form of various speeches—such as Hamlet's "To be, or not to be," etc.

To further the explanation of Radio-

telephony the elements of simple line telephone apparatus were described by the aid of lantern slides. Sections were shown of the transmitting and receiving instruments and diagrams of their mode of connection together. The great disadvantage of wire telephony, as compared with radiotelephony, is the distortion that occurs with the former when speaking over long distances. More particularly is this distortion felt when speaking through cables. A diagram was shown of the wave form of the "oo" sound such as in "moon," at the beginning and at the end of a long cable. All the irregularities in the original sound were smoothed out by the action of the cable, so that the resultant wave form at the receiving end was practically only a smooth sound curve. This means that all the vocal character of that sound would be lost at the receiver, and it would be impossible to distinguish what word had been spoken.

The action of the cable in producing this distortion takes the effect of damping out all the higher harmonics in the wave form. The lecturer compared this action to that of a race in which both men and boys take part. The energetic boys rush forward at the beginning but are soon worn out, whereas the men would sustain their pace throughout the whole race.

The general principles of radio transmission were explained at length by the help of slides and the essential need for high frequency oscillations in the transmitting aerial was pointed out. There are three chief sources of such oscillations of the type required for radiotelephony: High Frequency Alternators, Poulsen Arcs, and Vacuum Valves. The principle by which an alternator may be constructed to set up high frequency currents was explained by diagrams and also by photographs of parts of Alexanderson's High Frequency Alternators. These machines although suitable for use in fairly large units are far too costly for small experimental work.

The Duddell Oscillating Arc was next dealt with and the mechanism by which its falling characteristic is used to set up oscillations in a shunt condenser circuit was lucidly explained.

A few brief remarks about the constitution of atoms and electrons preceded a description of the Fleming Oscillation Valve. It was pointed out that all hot bodies, lamp filaments, a hot poker, the sun, etc., are all emitting torrents of electrons from their surfaces. This electron emission is ordinarily hindered by the pressure of the surrounding air, the molecules of which are, comparatively speaking, crowded together round the surface of the hot body, but in a vacuum such thermionic emission, as it is called, can take place quite freely. Since these electrons are negatively charged they are attracted by a positive charge. This phenomenon was made use of by Dr. Fleming in 1904 in his application of the Edison effect to the construction of his oscillation valve. Such a valve in its simple form is only available for use as a rectifying detector, but it was subsequently modified by De Forest in America into what is now known as the Three-Electrode Valve, so called because it has three essential component parts, the hot filament, the anode or plate electrode, and a grid between these two. The action of the grid in bringing about the amplification of a small potential applied to it was explained and various circuit arrangements of the three-electrode valves used as detectors were shown. One of the well-known French valves and a larger transmitting valve were on view after the lecture.

The great importance of the Three-Electrode Valve, as compared with the Two-Electrode, or Fleming Valve, is

that a number of such valves can be connected up in cascade, that is to say, the received impulse can be amplified by the first valve, the resultant amplified current used to affect a second valve through a transformer and so on. A Marconi Seven-Valve Amplifier with the valves connected in cascade in this manner was shown.

In addition to acting as a detector, the Three-Electrode Valve may be employed to set up high-frequency oscillations. An analogy was given of the singing telephone and microphone placed near to each other and connected together to explain the means by which the valve can sustain oscillations in a closed circuit. These valves may in this manner be used for transmission purposes, but it is necessary to have a high voltage battery to supply the energy to the plate circuit of the valve. In practical working a small alternator is frequently used to supply this voltage, and the resultant high voltage is rectified by one or more Fleming Valves before being used with the main oscillation valves. The circuit diagram of the arrangements used by the Marconi Company for this purpose was shown, as well as the means by which the local transmitting microphone may be used to modulate these oscillations in accordance with the speech to be transmitted.

Valves of this type were used in recent experiments in radiotelephony across the Atlantic. These tests were carried out from the Ballybunion Station of the Marconi Company with the object of determining the minimum power required for practical day-time working. They were, therefore, not merely a costly experimental feat like the Arlington to Eiffel Tower Radio Telephony tests in 1915. Particulars of the Ballybunion experiments were quoted by the Lecturer from a recent article in the WIRELESS WORLD.

Radiotelephony is now also available for use in aircraft and in fact it is being regularly so used on the London-Paris Air Service. The machines engaged in this service are not out of radiotelephone touch with English, or French, Stations during the whole of the journey. The apparatus may also be used for speaking between aeroplanes, as well as from aeroplanes to the ground.

At the present time it is not absolutely essential that large elevated aerials should be employed, as it is now possible to use only a few turns of wire wound on a small frame in order to receive radiotelephone messages over considerable distances. For this purpose one of the multi-valve amplifiers, such as the instrument that was on view are necessary to amplify up the received signals. Such a loop transmits best in its own plane, and very little energy is radiated in a plane at right angles. Conversely such a loop will receive best from a station in its own plane. Loop aerials of this type may, therefore, be used for direction-finding purposes, such as for locating a distant aeroplane. During the war loop aerials of this type were used by our airmen for locating Zeppelins. Once a Zeppelin made use of its wireless its position could very quickly be determined by our men, who were then able to interview it.

Dr. Fleming confidently looked forward to a regular Trans-Atlantic Radiotelephone Service in the near future, when it would be as easy to speak from London to New York as at present it is to speak to Glasgow, or Edinburgh, with the additional advantage that with the Radiotelephone there is no distortion and the received speech is remarkably clear, since all waves travel at the same speed through the æther.

# Digest of Wireless Literature

## ON THE PROPAGATION OF ELECTROMAGNETIC WAVES ROUND THE EARTH.

By Balth van der Pol, Jun., D.Sc. (Utrecht).

*Philosophical Magazine*, Vol 38, p. 365, Sept. 1919.

The theoretical problem of the bending, by diffraction, of electromagnetic waves round the earth has been attacked by various writers. This work is largely mathematical and for convenience of calculation the earth is imagined to be a conducting sphere, the circumference of which is large compared with the wave-length of the radiation, and the atmosphere surrounding the earth is regarded as a perfect insulator. However, when the amplitudes of the waves received at various stations from a fixed sending station are compared with the calculated values obtained from the mathematical solution, discrepancies are found. It is thus obvious that effects other than those of pure diffraction must be taken into account. That signals from a distant station are as a rule stronger during the night than during the day, undoubtedly indicates that the electrical conditions of the atmosphere have a pronounced influence on the wave amplitude. An annual variation of signal strength in overland transmission has further been found: also the intensities of the signals received during the night show further appreciable fluctuations while the day-time intensities are usually more steady. This last fact suggests that the day-time values of received wave-amplitudes may be regarded as " normal." The object of this paper is to compare these observed " normal " values with the magnitudes to be expected according to the diffraction theory.

Solutions of the mathematical problem suggested above have been obtained by Nicholson, Macdonald, Love, and Watson. All these solutions at first sight appear different, but more detailed examination shows that they are in close agreement within the limits of their validity. The investigations of Macdonald, Love, and Watson show that a finite conductivity of the order of $\sigma = 10^{-11}$ such as sea water actually possesses, has only a small influence on the wave amplitude increasing it a few per cent. in comparison with the case of infinite conductivity. The same result is found by Watson allowing for the conductivity of the earth. Therefore where discrepancies arise between experimental values of wave amplitude and theoretical formulæ the cause is not to be sought in the finite conductivity of the earth's crust.

If we consider the case of a simple Hertzian oscillating doublet and confine our attention to intensities along a great circle of the conducting sphere the formula giving the ratio of the received antenna current $I_R$ to the sending antenna current $I_s$ for the assumption of a perfectly insulating atmosphere and a perfectly conducting earth is as follows.

$$\frac{I_R}{I_S} = 0{\cdot}5368 \cdot \frac{1}{\sqrt{\sin\theta}} \cdot \frac{a_1 h_1 \times a_2 h_2}{\lambda^{7/6} R_2} \cdot e^{-0{\cdot}00376\, d/\lambda^{1/3}}$$

where $R_2$ is the total equivalent resistance of the receiving antenna in ohms,
$h_1$, the actual height of the transmitting station,
$h_2$, the actual height of the receiving station,
$\alpha_1$, the form factor of the sending station,
$\alpha_2$, the form factor of the receiving station,
$d$, the distance in kilometres between the two stations,
$\lambda$, the wave length in kilometres, and
$\theta$, the angular distance between the stations measured in radians.

The quantity $\alpha$ has been defined by Zenneck as the ratio of the mean current amplitude divided by the product of the antenna height and the maximum current which is usually found at the bottom of a transmitting aerial. A comparison of the above formula with experimental observations must now decide whether actual wireless communication is established by diffraction alone, the atmosphere being regarded as a perfect insulator.

Experimental data on this subject are very few in number. Practically all the work has been carried out by Austin, who measured the signals in a telephone receiver by shunting the latter down to such an extent that dots and dashes could just be discriminated, the value of the shunt giving an indication of the amplitude of the waves at the receiving station. Now the numerical relations entering into the action of crystal and thermionic detectors are not yet completely known and no definite quantitative theory of their action has been advanced. What was therefore actually determined in Austin's experiments is the strength of the sound in the telephone receiver representing a quantity of energy which was initially drawn from the energy of the incident radiation. Unfortunately Austin is not very clear in the description of his experiments and it is difficult to decide whether certain values or constants were obtained experimentally by him or were calculated or estimated. The smallest amount of energy in the receiving antenna producing a barely audible sound is given by Austin as $1{\cdot}225 \times 10^{-15}$ watt.

It is obvious that the measurement of these amazingly small alternating energies is a matter of considerable difficulty and that variations in the observations of a few hundred per cent. are to be regarded as relatively small, especially in view of the atmospheric disturbances which occasionally prevent the observations altogether. When the value given above is accepted as the limit of measurable energy an estimation of the oscillating electric field near the receiver antenna can be made on the basis of a total antenna resistance of about 25 ohms and an effective receiving antenna height of 146 metres which are the figures given for the receiving system at Darien where a part of Austin's measurements were carried out.

From this it can be calculated that the least amplitude of alternating potential gradient measurable in this way is of the order of $10^{-11}$ per cm., being about $10^{-11}$ of the normal static atmospheric potential gradient; and it is therefore not surprising that proportionally small variations in the latter field (in the form of strays or atmospherics) occasionally prevent or disturb the measurements of the minute

alternating field superimposed upon it. If we accept Austin's observations as giving the true antenuation of wave amplitude with distance, it is at once evident that the pure diffraction theory cannot explain the experimental data.

As a single instance we may take the measurements at Darien of the waves sent out by the Nauen station. In this case Austin gives,

$I = 150$ amp. $\lambda = 9{\cdot}4$ kilometres $\alpha_1 h_1 = 120$ metres
$\alpha_2 h_2 = 146$ metres $R_2 = 29$ ohms $d = 9{,}400$ kilometres.

This is the largest distance up to the present over which received antenna currents have been measured. The audibility factor in this case was 200 corresponding to a received antenna current of $I_R = 1{\cdot}3 \times 10^{-6}$ amperes, while the theoretical diffraction formula above would yield $I_R = 6 \times 10^{-13}$ amperes. In this case therefore the actual value of the wave amplitude according to Austin's measurements is about two million times bigger than the calculated value. Even if we allow for experimental errors of a few hundred per cent. the disagreement is still enormous.

As several theoretical investigations have undoubtedly proved that the finite conductivity of the earth's crust cannot increase the wave amplitude to such an enormous extent and as the conductivity of sea water is the same for high and low frequencies, the cause of the discrepancy cannot be due to the earth. It must be due to the atmospheric conditions.

It is almost certain that a good deal of the action can be explained by the theory of ionic refraction due to Dr. Eccles who suggested a possible increase of phase velocity of long electromagnetic waves when propagated through an ionized gas which would cause the wave-front to follow more or less the earth's curvature.

Recently Professor Watson has investigated the case, assuming that in the upper atmosphere there is a spherical shell of finite conductivity, concentric with, and surrounding, the earth. With the assumption of a sharp inner boundary of this shell and for a certain conductivity of the latter, values of the field can be obtained of the order of magnitude of the experimental observations. But it is doubtful whether this sharp inner boundary actually exists in Nature.

## THE MEASUREMENT OF ALTERNATING WAVES WITH THE BRAUN TUBE.

By E. Lubke.

*Electrician*, Vol. 83, p. 270. September, 1919.

This paper, which also appeared in the *Jahrbuch der Drahtlosen Telegraphie*, describes a novel application of the Braun Cathode-ray tube to the delineation of alternating current waves. Instead of the usual method in which the curve of the waveform is directly delineated upon the fluorescent screen of the tube, the cathode-ray beam is employed to ionise the space between the plates of a small condenser mounted on the end of the usual tube. The beam is caused to rotate in a conical path, by electromagnetic deflection, so that the instant of ionisation with respect to the position in the cycle can be controlled at will by rotating the deflecting coils around the tube. The condenser plates take the place of the contact-maker in the delineation of the waveform by the "Joubert" contact, point-by-point method. Examples of curves are given in the paper. A modified method is also described, and is suitable for frequencies up to several million per second.

# Notes on the Design and Construction of Valve Amplifiers

By John Scott-Taggart. M.S Belge E., A.M.I.Radio E.

## II.—DETECTOR-AMPLIFIERS

A VERY useful 4-valve amplifier suitable for general use on a modern wireless station is represented by Fig. 7. It possesses the usual features, but, of course, is more sensitive than the previous examples. Each valve is capable of a magnification of about 5 times, and so with such an amplifier signals would be increased at least 600 times their normal strength.

With regard to the mounting of these circuits on a base board, care should be taken to insulate all parts very carefully, and to keep the different connecting wires and transformers away from each other. In early experiments with amplifiers considerable difficulty was experienced on account of induction and capacity effects between the different component parts. It will also be convenient to provide two "in-put" terminals Y and Z, two terminals to which the four-volt filament-heating accumulator may be connected, and two for use with an external plate battery.

In the preceding notes we considered the simple low-frequency amplifier. Such an instrument is the most useful for ordinary work. There are cases, however, where a complete detector-amplifier is desirable. Such an amplifier may be connected across any oscillatory circuit without the need of a separate rectifying vacuum tube.

Detector-amplifiers may be roughly divided into two classes:—

(1) Arrangements of valves in cascade in which the first valve acts as a detector, the subsequent vacuum tubes acting as low-frequency amplifiers.

(2) Arrangements of valves in cascade in which the first vacuum tubes act as amplifiers of the oscillations and the last one as a detector. This second class is by far the most desirable, but the circuits are usually more difficult to operate and do not function equally well over a wide range of wave-lengths. Neither of these defects are experienced in the first class of detector-amplifiers.

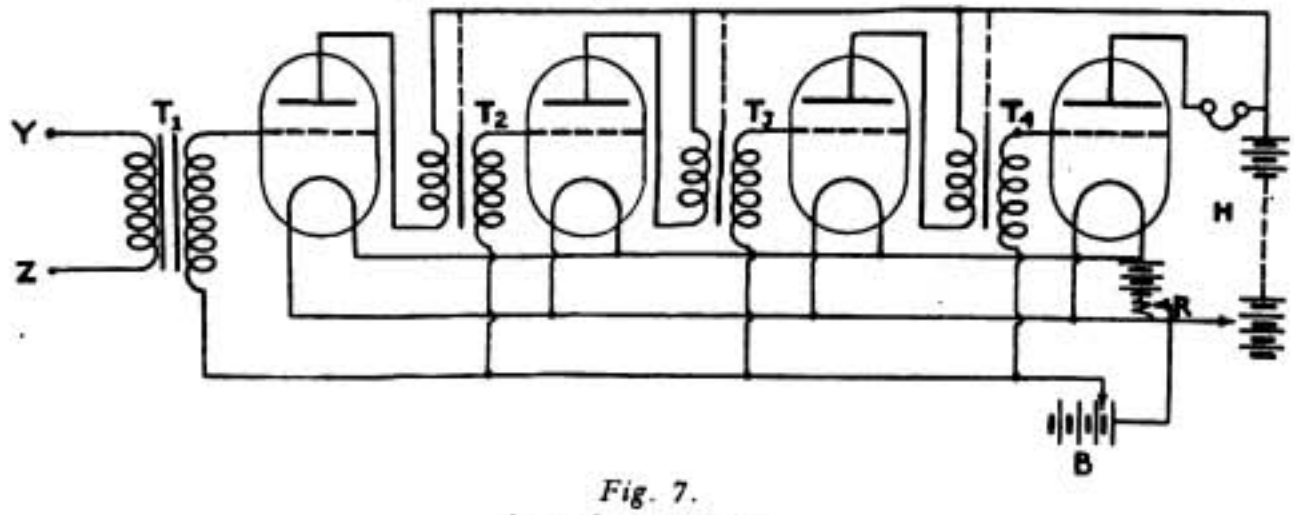



*Fig. 7.*
*A 4-valve Amplifier.*

A simple arrangement is shown in Fig. 8 which shows a typical 4-stage receiver. The input terminals Y, Z of the detector-amplifier are shown connected across the closed oscillatory circuit $L_2$ $C_2$ as an example of the use of such an amplifier. The first valve rectifies on the cumulative leaky grid condenser principle, a condenser $C_3$ of ·0003 mfd. and a resistance $R_1$ of 3 megohms being provided. A simple resistance may be made by cutting two or three grooves about 2 inches long on a piece of ebonite with the point of a knife, and filling these grooves with graphite by rubbing the point of a pencil across them until the required resistance is obtained. Suitable terminal connections are made at the ends of the grooves.

In order to facilitate the adjustment of the first valve to act as a rectifier, a separate filament current rheostat $R_2$ of about 5 ohms maximum resistance is provided.

Three intermediary step-up transformers $T_1$, $T_2$, and $T_3$ are arranged in a manner similar to that adopted in the low-frequency amplifiers already described A condenser $C_4$ is connected as shown in order that the high-frequency component of the plate current of the first valve will be by-passed. The practice of connecting a condenser of about ·0008 mfd. across any impedance in the plate circuit of a rectifying valve is widely adopted. It prevents arcing in the transformer $T_1$ and also assists in obtaining a certain retroactive effect. It also stores and "flattens out" the rectified current.

A step-down telephone transformer is shown and also a battery $B_2$ for impressing on the grids of the amplifying tubes a slight negative potential.

Fig. 9 shows a very useful amplifier for general wireless work. It is of the three-stage type largely developed by the French during the war. The special feature is that the arrangement can be used as a low-frequency amplifier or as a detector-amplifier, thus combining two instruments in one. Three terminals, D, L and C are provided. The terminals D and C are used if the amplifier is to be applied directly to an oscillatory circuit. In this case the switch S is moved over to the top stud so that the leaky grid condenser $C_1$ is brought into use, the input transformer $T_1$ $T_2$ being isolated. If the amplifier is to be used for magnifying low-frequency cur-

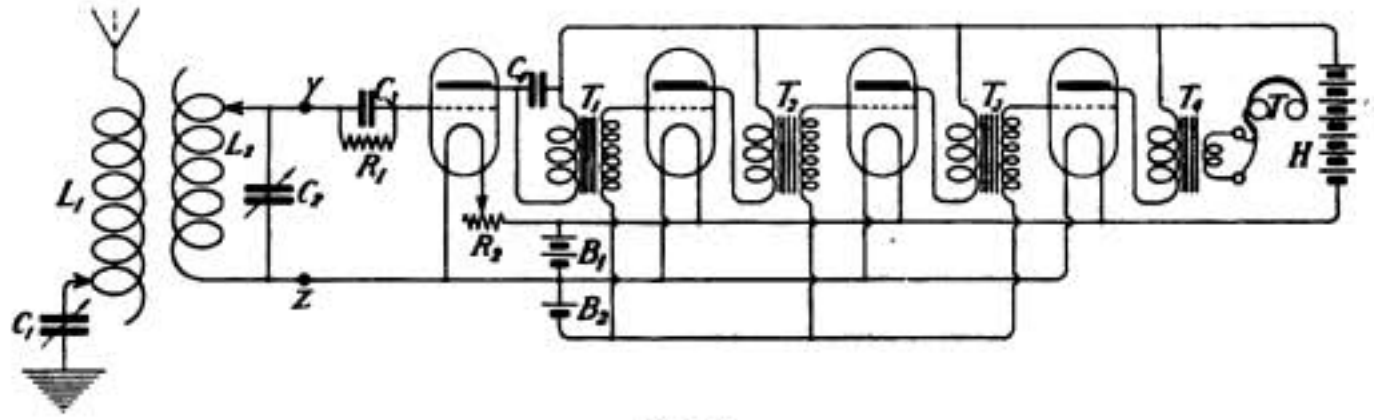



*Fig. 8.*
*A Typical 4-stage Detector-Amplifier.*

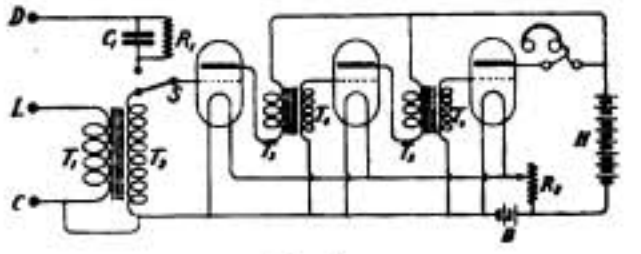



*Fig. 9.*
*Three valves arranged in cascade to act as a Detector-Amplifier or Low-Frequency Amplifier.*

rents such as rectified pulses, the currents are passed through the transformer primary $T_1$, connection being made to the terminals L and C, and the switch S being moved on to the bottom contact. The values of the transformer windings and other details may be made the same as in the case of other amplifiers described

Coming now to the problem of amplifying our oscillations before rectifying them, we have several methods open to us. We can use inter-valve oscillatory circuits which may be of the tuned or aperiodic variety, and of either the auto-transformer or ordinary air-core transformer type.

latory circuit will possess a certain natural wave-length which should invariably be made smaller than the length of the shortest waves to be received. To prevent the plate battery H giving the grids of the 2nd, 3rd and 4th valves an excessively high positive potential, insulating fixed condensers $C_2$, $C_3$ and $C_4$ are arranged as shown. Although acting as insulators to the steady voltage of H, yet they will allow the high-frequency potential variations at the feet of $L_2$, $L_3$ and $L_4$ to be impressed on the grids of the 2nd, 3rd and 4th valves. The capacity of each of the fixed condensers may be .0003 mfd. To prevent the excessive accumulation of electrons on the

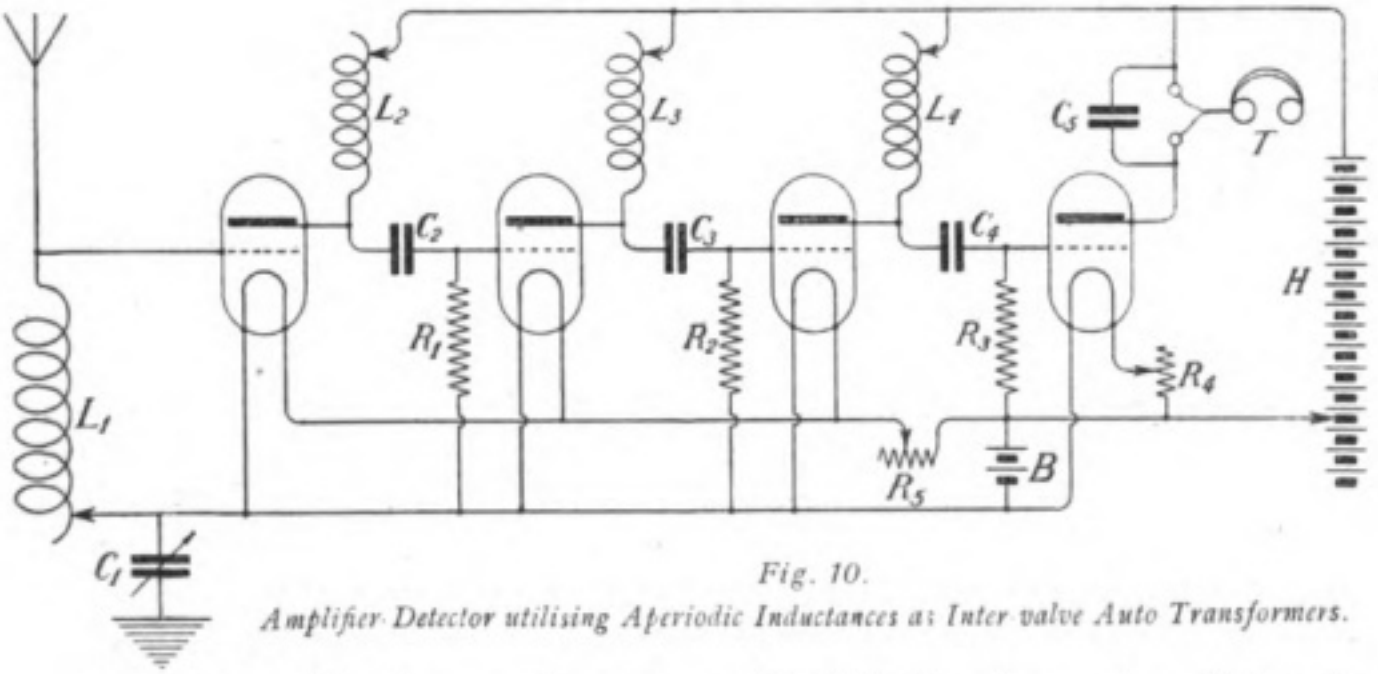



*Fig. 10.*

*Amplifier-Detector utilising Aperiodic Inductances as Inter-valve Auto Transformers.*

A 4-valve amplifier detector is reproduced in Fig. 10. The intermediary oscillatory circuits are of the auto-transformer type. Inductances $L_2$, $L_3$ and $L_4$ are arranged in the plate circuits of their respective vacuum tubes and serve to apply the amplified high-frequency E.M.F.'s to the grid or input circuit of the succeeding valve. In the figure the inductances are shown aperiodic. They will consequently respond over a wide range of wave-lengths without requiring anything more than a rough adjustment. It is to be noted that each oscil-

grids of the last three valves, high resistances $R_1$, $R_2$ and $R_3$ are arranged as leaks and may conveniently have a valve of about 4 megohms. It is probable that each valve acts to a certain extent as a cumulative rectifier, although the last valve is intended to rectify the high-frequency current amplified by the preceding valves. To assist in obtaining the best rectifying conditions, a filament current rheostat $R_4$ is provided.

The amplifier of Fig. 10 may be modified by tuning the intermediate circuits. Variable condensers are then shunted

across the inductances $L_2$, $L_3$ and $L_4$, each plate oscillatory circuit being tuned to the incoming wave-length. This necessitates a considerable amount of adjustment, which may be lessened by arranging that the condensers are all varied simultaneously.

Another variation consists in having two variable contacts on each of the inductances $L_2$, $L_3$ and $L_4$. For example, the connecting lead from each plate may be taken to a variable tapping on the inductance instead of to the foot of the inductance. By this auto-transformer arrangement, a certain amount of "stepping-up" is obtainable and rather finer tuning is possible.

amplifying tube through the intermediary of the air-core transformer $L_2$ $L_3$. Each of these windings is aperiodic and will respond to a wide range of wave-lengths, differing sometimes by as much as 2,000 metres. Each coil will have a natural frequency which can be calculated by a simple formula which is of utmost value to the designer of wireless circuits. This formula is:—

$$\lambda = 2\,f\,l,$$

where

$\lambda$ = wave-length of coil,
$l$ = length of wire on coil,
$f$ = a factor which is given in the following table drawn up by P. Drude:—

| $g/d$. | 6·0 | 4·0 | 3·0 | 2·0 | 1·0 | 0·8 | 0·7 | 0·3 | 0·1 = h/2r. |
|---|---|---|---|---|---|---|---|---|---|
| 1·09 | 0·68 | 0·76 | 0·84 | 1·00 | 1·33 | 1·47 | 1·56 | 2·08 | 2·79 |
| 1·24 | 0·67 | 0·75 | 0·83 | 0·97 | 1·27 | 1·39 | 1·46 | 1·91 | 2·57 |
| 2·40 | 0·66 | 0·74 | 0·81 | 0·96 | 1·225 | 1·34 | 1·41 | 1·79 | 2·28 |

The next type of amplifier which comes under discussion possesses loosely-coupled intermediary circuits. These, if desired, may be aperiodic as shown in Fig. 11, which illustrates a convenient three-stage receiver. The magnified

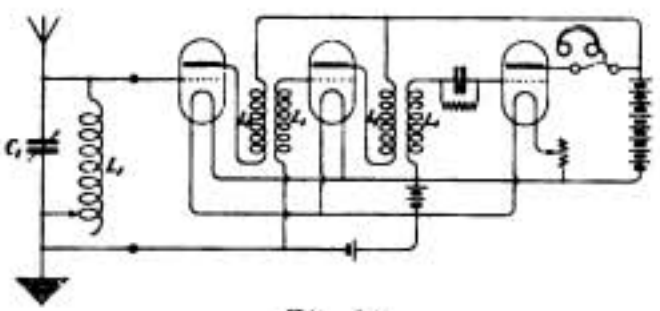


*Fig. 11.*
*A 3-stage Receiver with Inter-valve Aperiodic Oscillation Transformers.*

oscillations appearing in the output circuit of the first vacuum tube are passed on to the input grid circuit of the second

The factor $f$ depends slightly on the ratio between the pitch $g$ of the turns and the diameter $d$ of the bare wire used, but chiefly on the ratio between the length $h$ of the coil and its mean diameter $2r$.

The quantities $h$ and $l$ may be found from the formulæ:—

$$h = (m - 1)\,g$$
$$l = 2\pi\,r\,m,$$

where $m$ is the total number of turns and $r$ the radius of the coil.

The wave-length of the aperiodic coils should be less than the lowest wave-length to be received. The two coils of each transformer may be wound directly over each other, although some may prefer to have a variable coupling between primary and secondary.

*(To be continued.)*

# A Roll of Honour of Italian Mercantile Wireless Operators

IT is unfortunate that the British people are not better informed as to the nature and extent of Italy's efforts and sacrifices during the Great War. We believe that the average Briton has but the vaguest conception of the well-nigh incredible performances of the Italian soldiery in the terrible fighting which took place amongst the mountains of the Italian frontiers. If the reader will acquaint himself with the geographical and geological nature of the country, noting the heights of the peaks upon which King Victor's men planted their country's flag and the frozen inhospitable crags, bristling with long-prepared Austrian batteries against which they unsparingly flung themselves, he will be able to realise somewhat of the stark, stout valour which animates our freedom-loving Allies.

The maritime achievements of the Italians lag behind their military deeds only in extent, not in quality. For Italy it was mainly a land war, yet the Adriatic Sea has been the scene of many a stirring exploit on the part of the Italian Navy. Those dare-devil dashes into the great harbour of Pola alone suffice to stamp our Allies as intrepid sailors, though history bears ample witness as to that. Yet it should not be thought that the Italian is sustained and impelled only by the Latin fire of his blood. He has shown that he knows how to keep a cool head in the face of sudden peril, and to "stick it" to the end. He has written with immortal hand that he can stay at the post of duty and, if need be, die there.

We have hitherto done honour to the memory of those heroic youths, British wireless operators, who bore with their mates of the Mercantile Marine the full

*G. Pinto.* *L. Saglietto.* *C. Garcia.*

brunt of the infamous U-boat campaign and died through enemy action, and now that a certain amount of information and some photographs have come into our possession we feel that we can do no less than publish the following details of the sacrifices made by the countrymen of the great inventor who originated their profession.

*G. Rossi.* *V. Cuniberti.* *F. Cuzzani.*

## ROLL OF HONOUR.

Names of Operators who lost their lives during the War in the Merchant or Military Transport Service, as a result of their ships being torpedoed:—

| | | |
|---|---|---|
| Licinio Caso, | S/S. Minas | February, 1917. |
| Federico Cuzzani, | „ F. Confalonieri | April, 1917. |
| Vicenso Cuniberti, | „ Catania | April, 1917. |
| Luigi Saglietto, | „ Catania | April, 1917. |
| Guido Rossi, | „ Ascaro | May, 1917. |
| Filippo Welby, | „ Carmen | Dec., 1917. |
| Carlo Garcia,* | „ Tripoli | March, 1919. |

* This operator was posthumously awarded a silver medal for his good behaviour during the sinking of his ship.

| | | |
|---|---|---|
| Giovanni Bonino, | S/S. Soperga | Sept., 1917. |
| Giuseppe Pinto, | „ Deipara | May, 1918. |
| Arrigo Salsa, | „ Gen. Salsa | August, 1918. |
| Umberto Riggi, | „ Giuseppe G. | Sept., 1918. |
| Camillo Marcone, | „ Manin | October, 1918. |

## ITALIAN ROLL OF HONOUR.

### OPERATORS DECORATED FOR GOOD BEHAVIOUR DURING THE SINKING OF THEIR SHIPS.

| | | |
|---|---|---|
| Luigi Galli, | S/S. Tito Speri | Awarded Italian Crown Cross. |
| Ugo Coen, | „ Re Umberto | Awarded Bronze Medal. |
| Carlo Malgaroli, | „ Prometeo | „ |
| Salvatore Longardi, | „ Verona | Awarded War Cross. |
| Giuseppe Laezza, | „ Vicenza | „ |

### OPERATORS WHO DIED OF INFLUENZA CONTRACTED ON BOARD.

| | | |
|---|---|---|
| Italo Biotto | S/S. Elba | March, 1918. |
| Virgilio Jovine | „ Catania | August, 1918. |
| Ruggero Moro | „ Procida | Nov., 1918. |

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Pietro Scanarotti, received letter of praise for rescuing passengers from the wreck of S/S. Piero Maroncelli.

Giovanni Jelmini, S/S. Luigi, taken prisoner of war off Gold Coast on March 7th, 1918.

N. Pasqua, awarded Bronze War Cross for courageous conduct during two submarine attacks on his ship.

*L. Caso.* *F. Welby.* *G. Bonino.*

# Aircraft Wireless Section

Edited by J. J. Honan (late Lieutenant and Instructor, R.A.F.).

*These articles are intended primarily to offer, as simply as possible, some useful information to those to whom wireless sets are but auxiliary "gadgets" in a wider sphere of activity. It is hoped, however, that they may also prove of interest to the wireless worker generally, as illustrating types of instruments that have been specially evolved to meet the specific needs of the Aviator.*

## AIRCRAFT WIRELESS SETS.

### Spark Transmitters.

### THE 54A.

A PHOTOGRAPH of the actual set is shown in Fig. 21, whilst a schematic diagram of the circuits is given in Fig. 22. The characteristic feature is the use of a motor-driven rotary interrupter to replace the make-and-break. When the motor-starting switch S is closed, current from a battery of 28 volts is fed to the brushes B and drives the motor M, at a speed of 3,000 revolutions per minute. A rotary interrupter I of the commutator disc type is mounted on the opposite end of the armature shaft to that carrying the brushes. Altogether there are 12 segments on the interrupter so that in combination with the motor speed of 50 revolutions per second the arrangement gives a "break" frequency of 600. This of course will be the pitch of the telephone note heard at the receiving end.

With the motor running, i.e., the circuit S,O,T,B,M, Battery closed, the ammeter A should give a reading of 1 amp. On load, with the transmitting key K depressed, the reading should be 7.5 amps and 1.5 in the hot-wire ammeter.

### ACTION OF THE SET.

This is best seen from the skeleton diagram, Fig. 23, which includes the interrupter, but not the motor circuit. When the transmitting key K is closed, current flows through the coil QR in the direction of the full-line arrow, and, in addition, the condenser C is charged to the full Battery potential.

The Interrupter *break* then occurs, and the condenser discharges through the series inductances RQ, QP, P′P″ setting the closed circuit into oscillation. The natural frequency of this circuit is designed to synchronize with the frequency of the interrupter.

Consequently the following *make* of the primary circuit occurs when the return current surge in the closed circuit is in the direction shown by the dotted-line arrow. As the interrupter circuit is then closed, the discharge surge passes through the Battery which offers a path of less impedance than the coil QR.

This discharge supplements the normal output of the battery and causes a very heavy momentary current surge in the circuit comprising the Battery, C, and inductances P′P″, PQ. A correspondingly high value of e.m.f. is

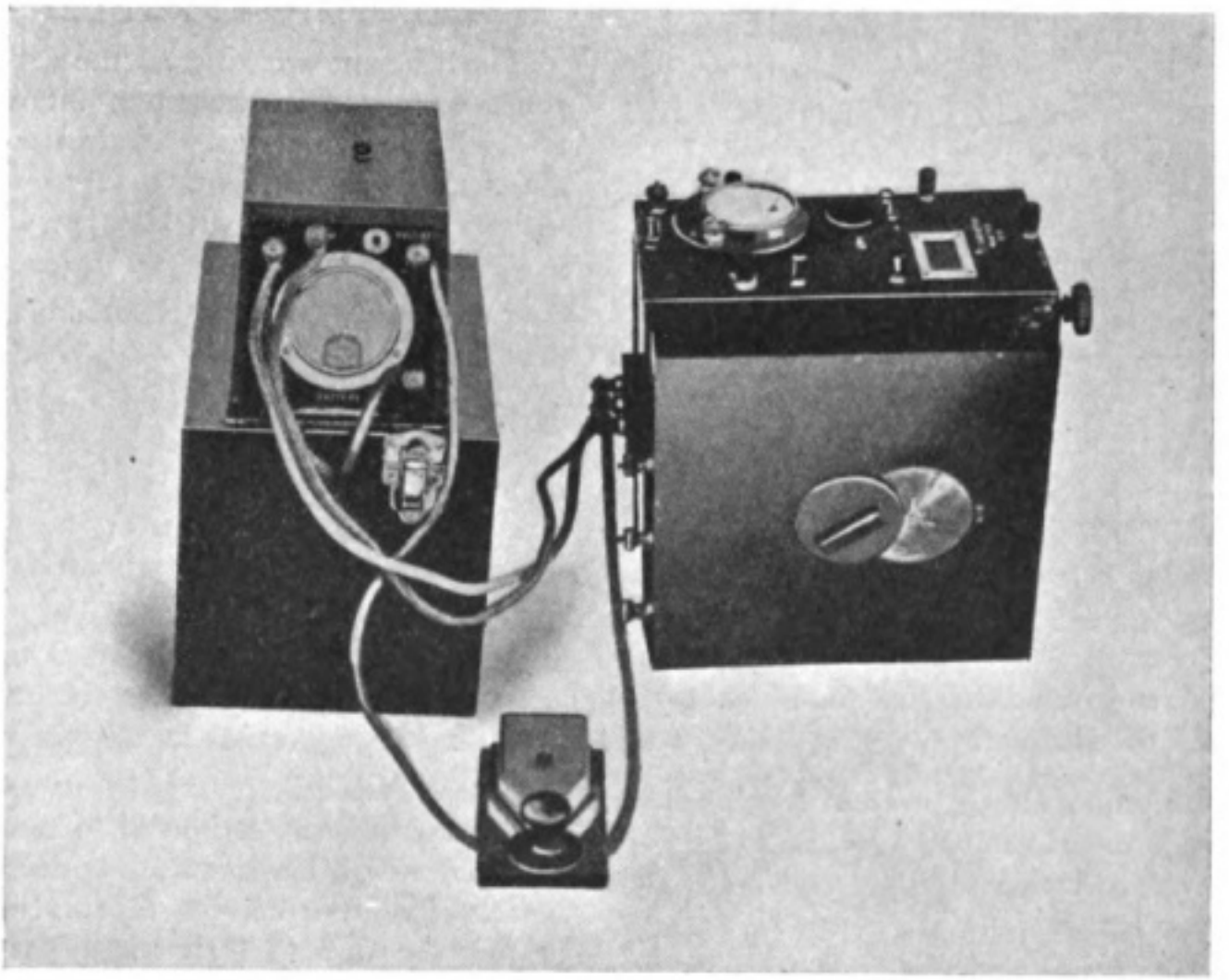


Fig. 21.

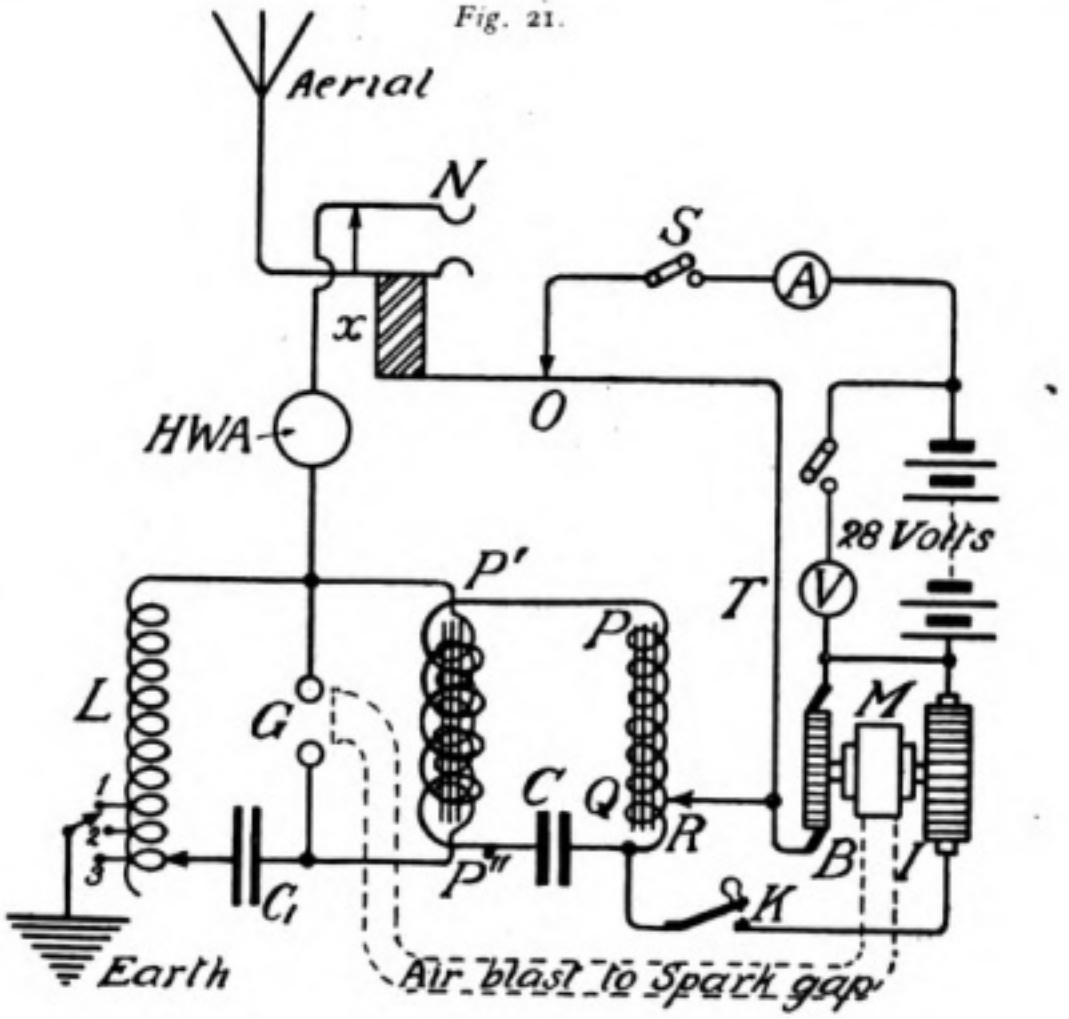



Fig. 22.

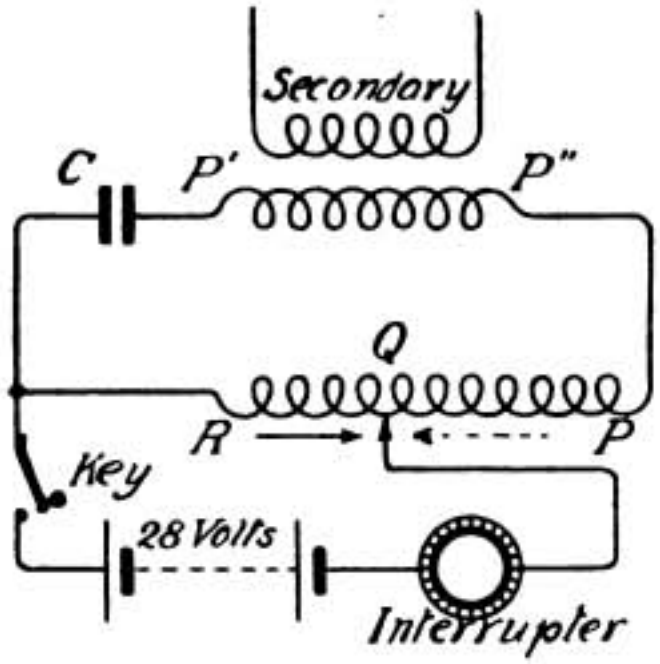



*Fig. 23.*

thereby induced across the secondary of the transformer.

Simultaneously, current is again being built up in the coil QR, and when the ensuing break occurs the whole cycle is repeated.

The high efficiency of the set is due to the boosting effect of the oscillatory surge upon the Battery current, owing to the synchronism of the closed circuit frequency with that of the rotary interrupter, combined with the shortening of the time period during this part of the cycle caused by the momentary cutting-out of the coil QR.

The voltage across the secondary of the step-up transformer reaches a value of 15,000—20,000 volts which when applied to the condenser $C_1$, Fig. 22, is sufficient to break down the spark-gap G and energise the closed oscillatory circuit $C_1$ G, L, which is auto-coupled to the aerial or open circuit.

The spark-gap distance should be between 4 and 5 millimetres. The gap may be ventilated by means of an air blast, created by a rotary "scoop" on the motor and conveyed by a $\frac{1}{4}$-inch tube, as shown in dotted lines.

## MOTOR INTERRUPTER.

The efficient working of the set depends largely upon the motor interrupter, which requires careful treatment, and accurate adjustment.

The bearings are plain, and should be lubricated with thin oil. The contact disc must be kept clean and free from grease.

It is most important that the interrupter brushes should be securely bedded on the contact disc. The angle between the brush and the tangent at the point of contact should be approximately 30°.

In fitting the set in the bus, care should be taken to see that it is easily accessible, as it may be necessary to adjust the brushes whilst in the air.

There should be practically no sparking at the brushes. It is well to remember that a high current reading does not necessarily mean correct adjustment, as it may be due to "shorting" at the brushes.

## OTHER DETAILS.

A socket N is provided to enable the aerial to be connected to a receiving set. When the plug of the receiver is inserted, an insulating block X automatically stops the motor by breaking the circuit at O.

The weight of the transmitter is 17½ lbs., and that of the rotary interrupter 8 lbs. The battery is contained in a box, both together weighing about 22 lbs.

The range is upwards of 50 miles with efficient crystal reception. The capacity of the battery is sufficient to run the transmitter under constant signalling for about one hour.

The set is designed to transmit at 200-335 and 500-600 metres and tappings marked 1, 2, 3, are taken from the inductance L and give the correct couplings for these values.

# Aviation Notes

## OUR BIGGEST AIRSHIP BOUGHT BY THE AMERICANS.

IT has been decided that our latest and biggest rigid-type airship—the R.38—is to be handed over to the United States Navy as soon as she has been completed by Messrs. Vickers. The finishing stages are being accelerated, and before long she will be in the hands of her new owners.

The trans-ocean trip home is, however, to be delayed until such time as suitable accommodation for housing the vessel is ready on the other side.

She is to be handed over to the American crew here, and they will have the task of navigating her across the Atlantic. The R.A.F. have undertaken to train the new personnel free of charge, except pay and rations.

The ship is to be sold at cost price, which is understood to be half a million sterling. It appears to be a somewhat one-sided bargain, to say nothing of the natural regret with which one is bound to regard the loss of so striking a symbol of our national prestige in the new dominion of the air.

But whilst so fierce a gale of economy is raging, there seems to be no alternative but to bend our backs to the breeze with what complacency we can muster.

• • •

## PRIZE MONEY FOR AVIATORS.

Although the opportunities for making money in a steady way of business by flying are somewhat restricted at present, there is no lack of inducement offered to the individual pioneer pilot or designer. In addition to the many big money prizes already awarded for various circuit flights and the transatlantic voyage, which will be fresh in the minds of most, the following list shows some of the cash awards still open to competitors.

£64,000 offered by the British Government for the best design of aircraft (aeroplane or seaplane) which combines maximum safety in flight with the advantage of landing and "taking off" in the minimum ground space.

£20,000 offered for the trans-America flight by the Aerial League of America.

£12,000 by the *Echo de Paris* for a 2,500 mile circuit race.

£10,000 to the first Australian pilot who makes the trip from Great Britain to Australia.

£10,000 offered by the *Daily Express* for aeroplane demonstrations establishing aerial communication on a commercial basis with India and South Africa, the machines entered being required to carry at least one ton of cargo.

£10,000 offered by Mr. Thomas H. Ince for a trans-Pacific flight.

£5,000 offered by Raymond Orteig for the first flight from New York to Paris.

In addition a sum of £80,000 has been given by M. H. Deutsch de la Meurthe to the Aero Club of Paris, for the purpose of forming a prize fund for the general development and encouragement of aeronautical achievement. Whilst no less a sum than £360,000 has been earmarked for the same objects by the French Government and is to be spent on Premium Prize competitions between January and July next.

• • •

## OUR COMMERCIAL AIRWAYS.

The Blackpool-Southport-Manchester daily flying service was terminated for

the season at the end of October after a continuous "run" of some five months. The route was opened by the Avro Company towards the end of last May, and has proved a most successful enterprise commercially.

Each day at noon, one or more machines left Blackpool for Manchester, calling at Southport on the way. The total journey took 45 minutes, the machine returning from Manchester at 2 p.m. The price charged was 5 guineas single, and 9 guineas return, but in spite of these high rates in comparison with railway fares, the Aero service more than paid its way. No interruption of the daily trip occurred until towards the end of September, when unusually bad weather led the Company to cancel the flight on several occasions in accordance with their policy of taking no avoidable risk.

The Airco Company completed the first seven weeks of their London-Paris daily service with a record of only three flights less than their scheduled timetable. In one case a fierce hurricane made the Company play for safety; whilst in the second the cause was engine trouble. On the third occasion, the pilot lost his way in a thick fog and made a forced landing in the Channel alongside a passing steamer, who took aboard the pilot, passenger and mails. Unfortunately the plane itself could not be salved, owing to the heavy sea. This seems to be a case where a D.F. wireless installation would have proved a real friend in need.

Up to the end of October the Handley Page Company had transported 219 passengers and over 6,000lbs. of freight between London and Paris.

* * *

## DEATH OF THE DESIGNER OF THE "FELIXSTOWE FURY."

Lieut.-Colonel J. C. Porte (late R.A.F.), died last month at his home in Brighton at the early age of 38.

Aviation in general and the flying-boat type of craft in particular owe much to the genius and labours of this gifted designer. He was an Irishman, being born at Brandon, Co. Cork, and secured his pilot's certificate in France as early as 1911 on a Deperdussin monoplane.

The outbreak of war found him in America, but he at once returned home and joined the R.N.A.S. For some time he commanded the depot at Hendon, being subsequently transferred to Felixstowe where his energies were mainly devoted to the completion of the famous but unfortunate "Felixstowe Fury," then probably the largest aircraft in existence. It is a pathetic coincidence that Col. Porte did not long survive the destruction of his mammoth flying-boat.

Photo by Photopress

*Late Lieut.-Colonel J. C. Porte.*

# The Wireless Society of London

*Report of the General Meeting held in the Lecture Hall of the Institution of Civil Engineers, Westminster, on Tuesday, October 28th**

THE President, Mr. A. A. Campbell Swinton, F.R.S., took the chair at 6 p.m., and the Secretary read the Minutes of the last General Meeting of the Society which was held on December 29th, 1915. These were duly confirmed by the meeting.

THE PRESIDENT then delivered a short address dealing at some length with the resumption of activity of the Society after four years of stagnation during the war. There seemed, he said, every indication of a possibility of the Society resuming useful work among the wireless experimenters of the country. This meeting was to be purely a formal one to confirm the election of the Committee and Executive Officers of the Society. The Committee of the Society that had been elected in 1915 had on their own authority met together with a view to resuscitating the activities of the Society, and this had been done without any authority from the general members, since the rules of the Society stated that the Committee and Officers may only remain in office for one year unless they are re-elected. It had therefore been found necessary to call this meeting, and he would subsequently ask them to pass a resolution confirming the election of the present Committee for the remainder of this year.

The President discoursed upon some of the effects of the war. Its influence had been most felt in aviation and in wireless, both of which experienced considerable development, and it was now felt that the time had come when much useful discussion could take place amongst the members of the Society on some of the latest developments.

The President deplored the loss that the Society had incurred by the deaths of some of its members. In particular he mentioned Sir William Crookes, who had been an Hon. Member, Professor Silvanus P. Thompson and Mr. E. Russell Clarke, who were both Vice-Presidents. Mr. Russell Clarke had been an active member of the Society, and had read them a very interesting paper before the war. He had relinquished his barrister's career to take up wireless work for the Government, and it was largely due to this that he met his early death. In addition to the above, mention was also made of the loss of Mr. William Duddell, well known for his researches on the oscillating arc and for his many inventions of instruments for high frequency measurements, without which a very large number of such measurements could not be made. Sir John Grant had also been one of their esteemed members.

The Committee were at present occupied on the compilation of a list of members who had been engaged in wireless work during the war, and he asked that all members who had any information that might be of use for such a list to communicate it to the Secretary as soon as possible.

Mr. R. H. Klein, who was one of the founders of the Society, and had been its Hon. Secretary, had resigned this

* Readers will be interested to learn that THE WIRELESS WORLD has been appointed the official organ of the Wireless Society of London.

*Mr. R. H. Klein, Vice-President.*
*(One of the Founders of the Society.)*

position owing to pressure of work, and he had been elected by the Committee to be an Acting Vice-President. The Hon. Secretaryship had been taken over by Mr. H. Leslie McMichael, who has resigned his position of Vice-Chairman, which he previously held. Mr. McMichael had been interested in the Society since its inception, and he would be pleased to hear from anyone contemplating membership. The President referred to the honour they had recently received by numbering amongst their Vice-Presidents, Admiral of the Fleet, Sir Henry Jackson, G.C.B., etc., who is taking an active interest in the welfare of the Society and in the work of its Committee. Admiral Jackson, as is well known, was one of the very earliest of experimenters in the science of wireless telegraphy and the Society was fortunate in acquiring his co-operation.

Dr. Knight had been elected to fill the vacancy on the Committee caused by the death of Mr. Russell Clarke.

The Resolution was then put to the meeting that the present Officers and Committee of the Society remain in office for the remainder of 1919.

A MEMBER then proposed an amendment to the effect that the resolution be extended to cover their retention in office for the following year, 1920, as it hardly seemed fitting that after their useful work in keeping the Society alive during the war they should merely remain in office for a matter of two months. This amendment was endorsed by other members present and the above resolution was therefore amended to read that the present Officers and Committee remain in office for the remainder of 1919 and for the year 1920. This was carried unanimously by the meeting.

Mr. F. HOPE-JONES (the Chairman of the Society), then read a list of names of members whose addresses had been lost during the war, and asked members who were present who had not received

*Mr. F. Hope-Jones*
*(Chairman.)*

notices, to communicate with him in order that the list of membership might be completed.

Photo by Lafayette.

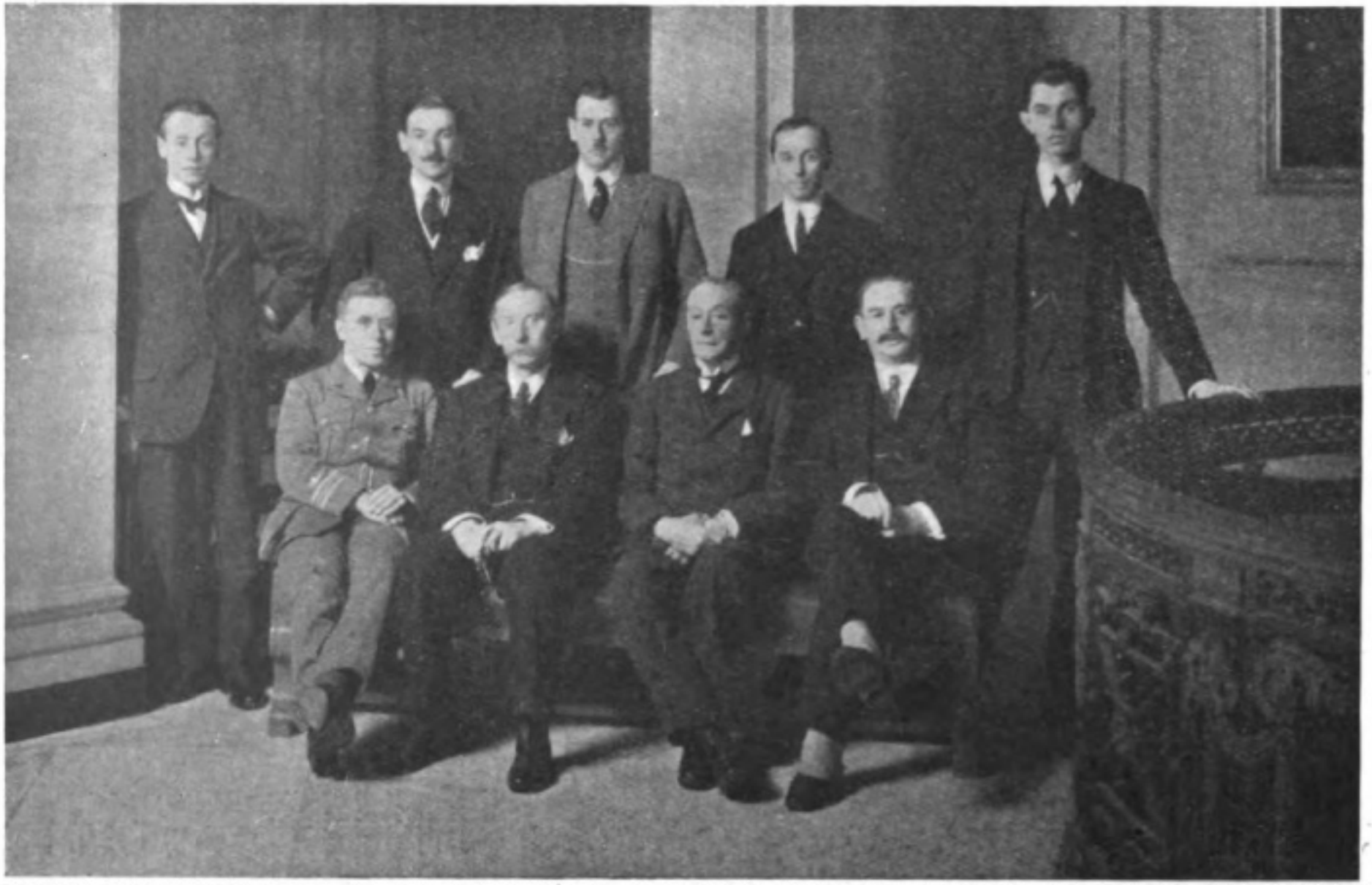
*Mr. H. L. McMichael*
*(Hon. Sec.)*

THE PRESIDENT then spoke relative to the arrangements in hand with the Post Office regarding licences for wireless experimental work. The Committee of the Society had been in communication with the Post Office on this matter, and he read the last letter, dated August 30th, received from the Secretary of the Post Office. This letter stated that the Postmaster-General authorised the Advisory Committee of the Wireless Society to recommend suitable applicants for transmitting licences when the latter are being issued. At the present time temporary permissions were being granted for receiving purposes. It was stated that very few obstacles were being put in the way of the granting of such permissions, provided that the applicants were able to assure the Post Office that they were of British nationality and were capable of utilising the gear in a proper manner. Permissions for the use of valves for reception purposes were also being given to those who could show that they were able to operate them in a proper manner. Applications for transmitting licences were at present only being considered for commercial purposes and for very special cases of definite scientific research. The President added that the Society had written again to the Post Office with a view to expediting the granting of such licences, but that up to the present no further reply had been received.

THE PRESIDENT then called on Mr. Hope-Jones to make a few remarks relative to the affiliation of other wireless societies in the country.

Mr. F. HOPE-JONES spoke at some length on this matter, and emphasised the importance of such affiliation. It was proposed that, if possible, all provincial and suburban wireless clubs and societies should be affiliated to the Wireless Society of London. The whole subject was at present rather nebulous, but one or two of the societies had already written mentioning the matter of affiliation, and he thought that if a proper scheme and basis could be worked out it might be arranged for in the future. The general rules of the Wireless Society were equally applicable to all the other societies, and if such affiliation could be carried into effect, it would give them as a whole a very much greater force in the country towards securing the desired licences, and also in connection with any regulations that might subsequently be made by the Authorities concerning transmitting work. Mr. Hope-Jones looked forward to the time when club rooms would again be available for the use of members of the Society, and this, of course, would be one of the points

## OFFICERS AND COMMITTEE OF THE WIRELESS SOCIETY OF LONDON AT THE INSTITUTION OF CIVIL ENGINEERS, ON OCTOBER 28th, 1919.



*Back Row (left to right) Mr. L. F. Fogarty, A.M.I.E.E. (Hon. Treasurer), Mr. R. H. Klein, L.S.C. (Vice-President), Mr. H. L. McMichael (Hon. Sec.), Mr. M. Child, Mr. E. W. Kitchen, A.M.I.C.E.*

*Front Row (left to right) Dr. J. Erskine-Murray, M.I.E.E. (Vice-President), Mr. Alan A. Campbell Swinton, F.R.S. (President), Admiral Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S. (Vice-President), Mr. F. Hope-Jones, M.I.E.E.*

in the affiliation scheme, namely, that the members of all branch societies when visiting London would have the use of the club rooms of the Wireless Society, and he hoped that they would be able to feel that they had the right to enter such club rooms and to make themselves at home there. The current electrical periodicals would be available at such premises for their use, and they would also have facilities to consult the Society's library and to make use of the apparatus that would be installed. It was also hoped that the Wireless Society would be able to offer for distribution by the Secretaries of all the Branch Societies reprints of all the Meetings held in London. This, of course, would be a valuable feature and would serve to bring the affiliated societies into closer touch with one another.

THE PRESIDENT said a few words relative to the provision of club rooms for the Society. Before the war they had had the use of some premises owned by Messrs. Gamage, but these were not now available, and he sincerely hoped that suitable accommodation would soon be found. The matter was a very difficult one at the present time in London as all suitable premises were extremely scarce. The Committee, however, had the matter well in hand and it was hoped that some arrangements would very shortly be made. If permanent club premises could not be secured at the present time, he trusted that they would be able to get some temporary accommodation and expressed the hope that in the near future they would be able to have some really good club rooms in a central part of London.

The list of new members for election to the Society was then read and a scrutineer appointed to collect the ballot papers. It was subsequently announced that these new applications for membership, to the number of about thirty, had been duly elected.

Mr. J. SAYERS made a few remarks relative to the proposed affiliation of the wireless societies of the country. He was, he said, a very great believer in unity, and he thought that it would be very advantageous if the membership of the Society could know as soon as possible what steps had been taken towards affiliation. He also referred to a proposal of which he had heard, namely, that the American Institute of Radio Engineers intended to found a Branch Society over here and he would be glad if the President could inform the meeting whether any action had been taken in this respect as he was sure that no one present would wish to see the existing Wireless Society of London become merely a branch of the New York Institute.

THE PRESIDENT, in reply, said that as far as he was aware the idea of the Institute of Radio Engineers Branch Society in London had been entirely dropped. He also pointed out that the Wireless Society of London was primarily intended to fill up the gap for those radio workers who are not professional electrical engineers, and therefore were not in a position to join the membership of the Institution of Electrical Engineers, or to avail themselves of the wireless section of that Institution. The Wireless Society of London was not therefore running in opposition to the Wireless Section of the I.E.E., but should be an important adjunct to it.

The meeting was well attended, and upwards of two hundred members and visitors were present. In many cases members had come long distances such as from Plymouth, Derby, Bristol, Peterborough and Winchester to attend the meeting, and the Society may congratulate themselves on the success of their first general meeting since the war.

The formal business closed with a vote of thanks to the President and

Officers for the work they had done and for their offer to carry on in future.

An exhibition had been arranged of some apparatus sent by members of the Society, and the President called on the various exhibitors to give a short description of their apparatus.

MAJOR J. ERSKINE-MURRAY, R.A.F., made a few remarks on the subject of the use of wireless in aircraft. All such apparatus must of necessity be very small and very light and must have as great a power and range as possible. A two-valve C.W. Transmitting apparatus for working on 700 to 2,500 metres wavelength on aircraft was shown. This set has a range of several hundred miles and is fed from a small direct current generator weighing only 10lbs. The receiver for use with the above is a three-valve one, having one detecting and two low-frequency-amplifying valves. This receiver is now standard for use on aircraft. The usual range of wavelength that can be picked up with this apparatus is from 500 to 3,000 metres, but in the set shown special windings were included to enable this range to be extended to 4,500 metres. These sets were usually employed for wireless telegraph purposes, but by the addition of the transmitting microphones they could also be employed for radiotelephony.

A wireless telephone set was also exhibited. (Fig. 1.) This usually operates on a 450 metres wave. The receiver, on the right of the photograph, has three valves, one high-frequency-amplifying, one detecting, and one low-frequency-amplifying. An important feature of this set is that the tuning arrangements and filament control regulator are made up separate from the instruments to which the valves are attached. This is necessary on account of the restricted space in some aircraft, since, of course, the operator need have access only to the tuning gear and to the filament regulator, while the valves themselves can be mounted in a less accessible position. In the illustration these separate control portions can be seen below the valves, and connected thereto by flexible leads. All the parts of this gear

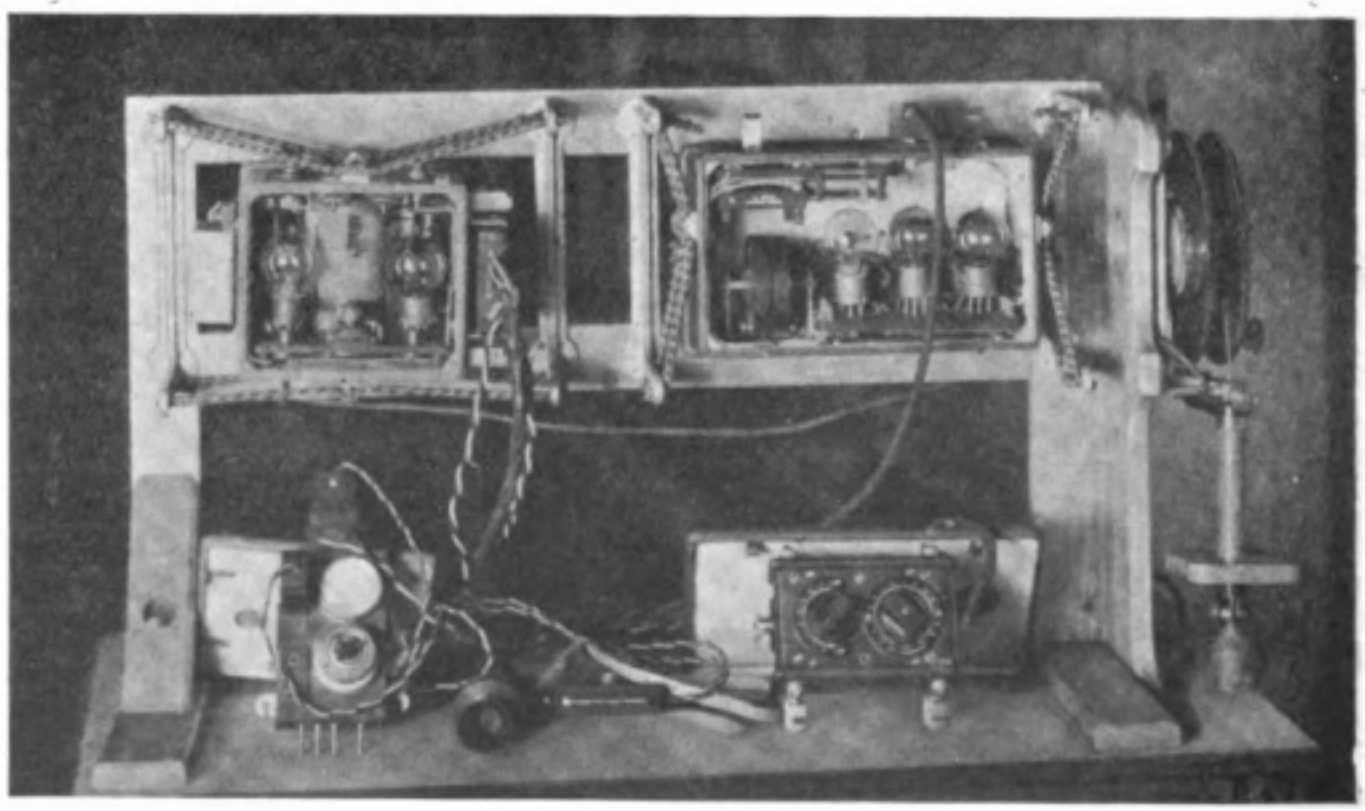


*Fig. 1.—R.A.F. Wireless Telephone Set.*

were suspended by rubber in order to minimise damage from shocks and vibration. "French" type valves were employed. In the transmitting part (on the left) two valves were used, one the power valve for generating the oscillations, and one the control valve for impressing the speech current on the emitted waves. The photograph also shows the reel for the aerial wire, and the plummet at the end of that wire.

Direction-finding apparatus for use on aircraft was also shown. The Bellini-Tosi or Artom method of direction-finding with a radiogoniometer was not much use for aircraft as the direction of the waves is given on that apparatus by the position for minimum sound in the telephones. Owing to the proximity of the engines it is extremely difficult to determine accurately this position of minimum sound and a special arrangement was therefore devised by the R.A.F. to overcome this defect. This comprises the two-frame method which was shown. It consists of two frame aerials mounted at right angles to one another. One of these is used to pick up the signals in the ordinary way and is adjusted by rotation until its plane is in line with the transmitting station, when maximum sound is heard in the telephones. The other frame at right angles is then joined in series with the reversing switch and a fine adjustment of the position of both frames is then made until on throwing over the reversing switch there is no change in sound in the tele-

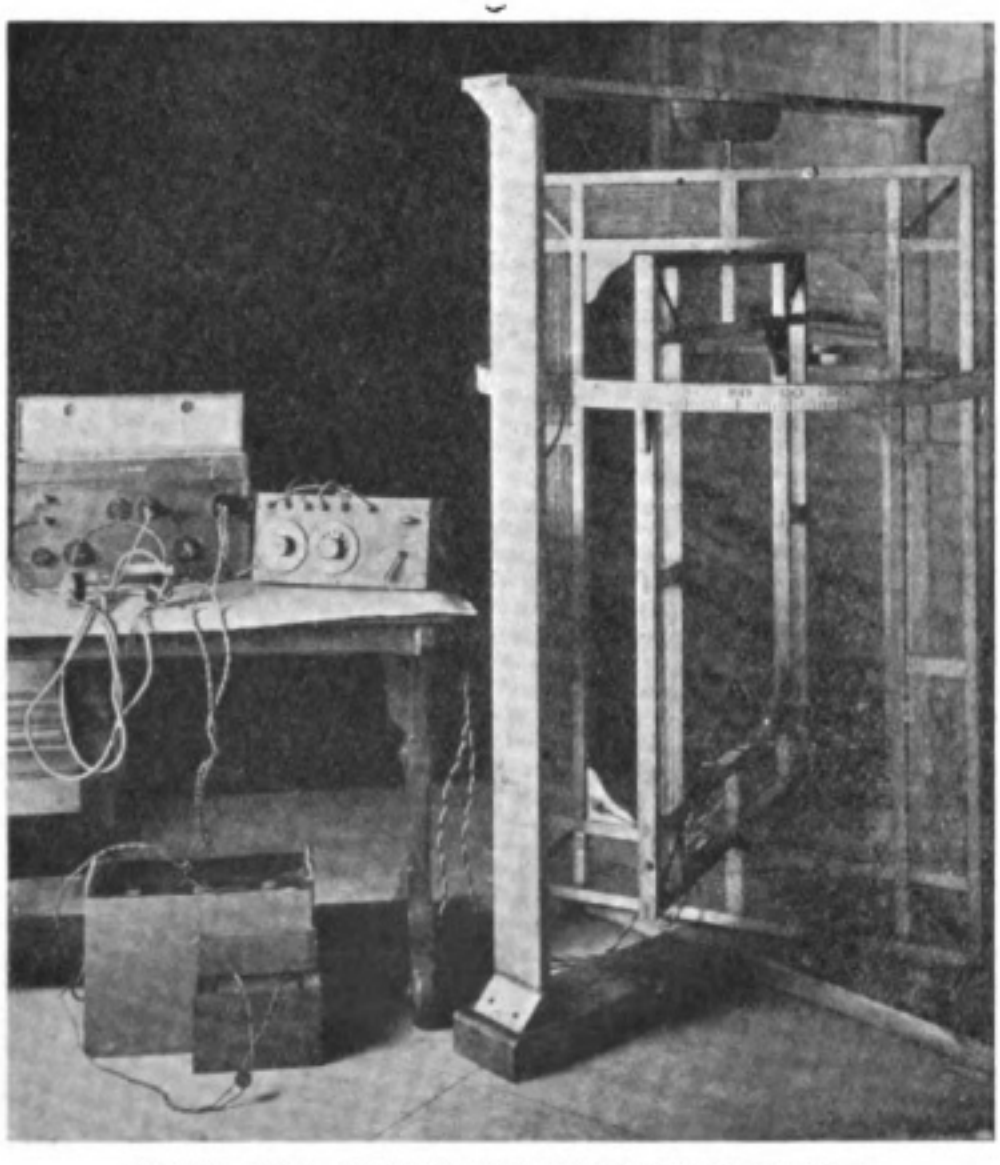


*Fig. 2.—D.F. Apparatus with Amplifier used by R.A.F.*

phones. When this is the case the plane of the main receiving coil is then accurately in line with the transmitting station. This arrangement was said to give a very accurate result with aircraft and had been extensively used in long flights. Instances were mentioned in which flights had been made between this country and France in fogs and above clouds, in which the navigation was effected entirely by means of direction determined on the D.F. apparatus. A view of this frame aerial arrangement is shown in Fig. 2. The crossed aerials are seen on the right hand side of this photograph, and the necessary amplifying arrangements on the table on the left with their filament and high-tension batteries on the floor.

Mr. J. SCOTT-TAGGART described the exhibit of the Edison Swan Electric Company, consisting of 15 different types of valves all made by this Company. Amongst these were included a number of service valves, Marconi Company's valves, and other special valves suitable for both transmission and reception purposes.

An extensive exhibit was also arranged showing in detail the construction of an " R " type valve based on the design of the " French " valve. All the parts of the valve were shown, starting from the sheet nickel used for the anode, with the molybdenum wire used for the grid, and the plain glass bulb as received from the glass factory. The grid wire is wound on a special steel rod former having a thread of the proper pitch cut in its surface. After winding the former is removed, the resulting spiral grid straightened out and stiffened by a wire along its length. The sheet nickel used for the anode is 0·008 inch thick. It is cut to the proper size and shape, a tag is stamped out on one side and the piece then shaped into the cylindrical form. The glass stem for supporting the electrodes of the valve has four wires fused through it, and after the electrodes are mounted the completed stem is mounted in the bulb. For this purpose the glass bulb first has a tube fused into one end for the exhaustion process, and the neck of the bulb opened out to fit the assembled stem. These two portions are then sealed together, and the complete valve exhausted. After exhaustion all the valves are subjected to an ageing process, details of which were not, however, given. This process makes the charac-


*Fig. 3.—The Scott-Taggart-Ediswan Full-wave Rectifier (small power type).*

teristics of the valve much more uniform and also considerably improves the vacuum. All valves after completion are subjected to rigid tests before they are passed on to the department where the brass collars and caps are attached to them.

Mr. SCOTT-TAGGART also exhibited some special valves designed by himself and for which provisional patents have been taken out. Photographs of two of these valves are shown in Figs. 3 and 4. These included a special double anode "full wave" rectifying valve (Fig. 3). This valve contains two separate anodes surrounding one filament, so that both half waves of an A.C. supply can be rectified in the one valve instead of using two valves as has hitherto been necessary. By the use of this valve it is claimed that more efficient and more economical results are available. Furthermore, it is much cheaper to construct than two separate valves, while the vacuum is identical for both anodes. It is claimed further that almost the full electronic emission from the filament passes to each anode in turn, whereas when two valves are used the filament current of one of them is wasted during alternate half-cycles. High-

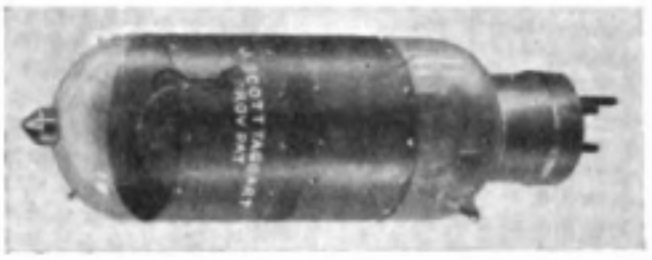


*Fig. 4.—Scott-Taggart Continuous-wave Transmitting Tube.*

power tubes of this type have been made and have yielded very satisfactory operation.

The special valve shown in Fig. 4 also has a double anode similar to the preceding one, but in addition is provided with a grid electrode. This tube may be used to generate continuous-waves by the application of an alternating current supply directly to the anodes, no separate rectifiers being necessary, since the double anode enables both half waves to be utilised as in the preceding case. This valve when in operation yields a slightly pulsating continuous oscillation, and is therefore suitable for "tonic-train" transmission.

The third type of valve that was exhibited was claimed to be suitable for passing heavy currents at a comparatively low voltage. It was designed for

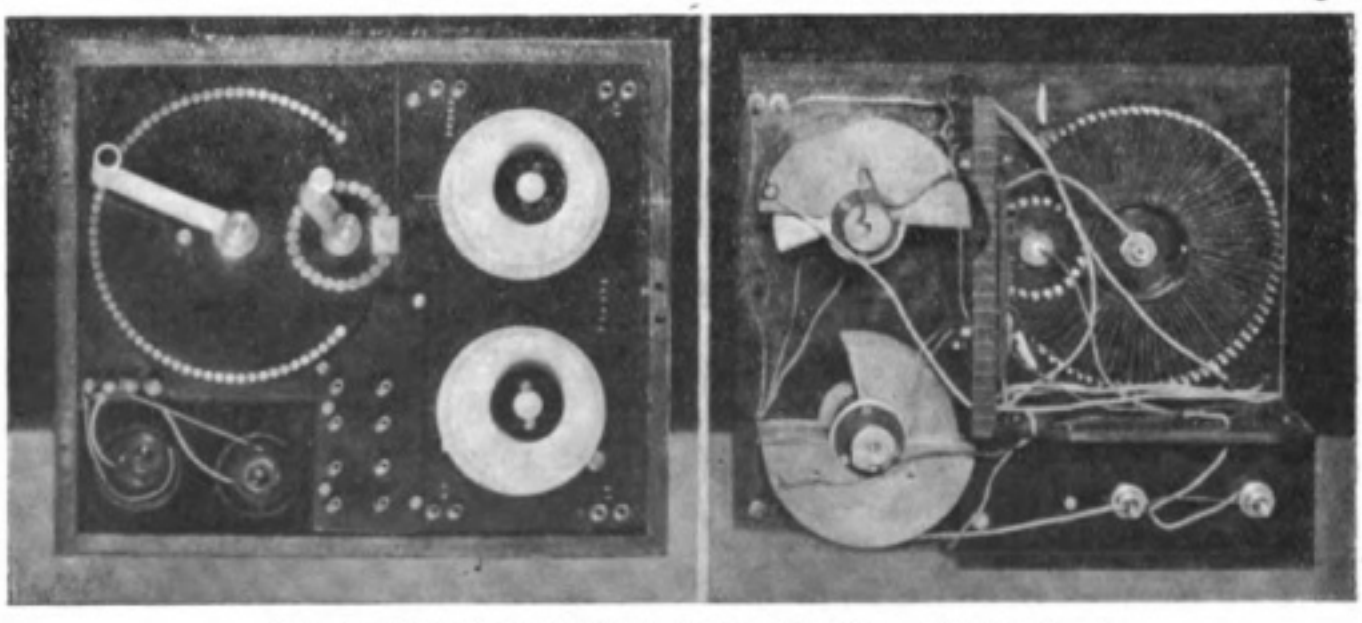


*Fig. 5.—Two-valve High Frequency Amplifier. (H. Burbury) Front and back view.*

high-power work, and can handle approximately twice as much energy as any bulb of the ordinary type of the same size and at the same anode voltage.

Mr. H. BURBURY exhibited several instruments made by himself. These comprised (1) a two-valve tuned high-frequency amplifier; (2) a three-valve low-frequency amplifier, having one detecting and two amplifying valves; (3) a valve relay constructed on the lines recently described by Capt. Turner before the Institution of Electrical Engineers, and (4) an ordinary type of heterodyne wavemeter.

The two-valve high-frequency amplifier is shown in Fig. 5, which also gives a photograph of the inside of the same instrument. The rotary variable air condensers can be seen in this photograph, and in particular the special construction of the potentiometer, consisting of a number of radial wires joined between adjacent studs.

The front view of the three-valve amplifier is given in Fig. 6.

The valve relay is particularly interesting. The principle of operation of this relay as described by Capt. Turner,* lies in the adjustment of a three-electrode valve, so that it is *just not* oscillating, and in the arrangement of the connections so that a small e.m.f. impressed on the grid of the valve will cause the oscillations to commence. When this occurs there is a sudden change in the plate current of the valve; this plate current is passed through a sensitive relay which can be seen at the bottom right-hand corner of the front view of the instrument in Fig. 7. At the left-hand top corner of the front of the instrument is the reaction coupling. Further details of this can be seen in the back view,

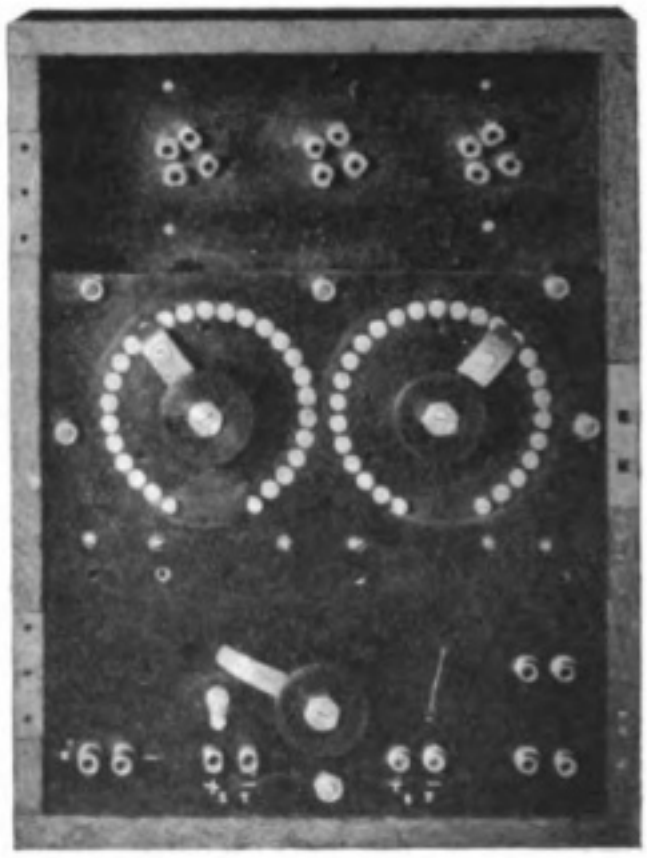


*Fig. 6.—Three-valve low-frequency Amplifier. (H. Burbury.)*

on the right-hand side. This coupling consists of two cylindrical coils between and inside of which a small spherical coil is mounted and mechanically connected to the adjusting handle on the face of the instrument. A very essential part of this apparatus is the means employed for the accurate adjustment of the potential of the grid of the valve. This adjustment is rather critical as its value determines the magnitude of the additional e.m.f. which must be supplied by the incoming signal in order to start the valve oscillating. The potentiometer used for this purpose must therefore be a finely-divided one and capable of accurate and suitable adjustment. The type used in this instrument of Mr. Burbury's is similar in construction to that described above, and may be seen in the centre of the left-hand side of the back view of the instrument, Fig. 7. The potentiometer wires are threaded through holes in an ebonite annulus mounted concentrically with the contact studs. Mr. Burbury stated that

* Read before Institution of Electrical Engineers, June 30th, 1919. See *Electrician*, July 4th, p. 4.

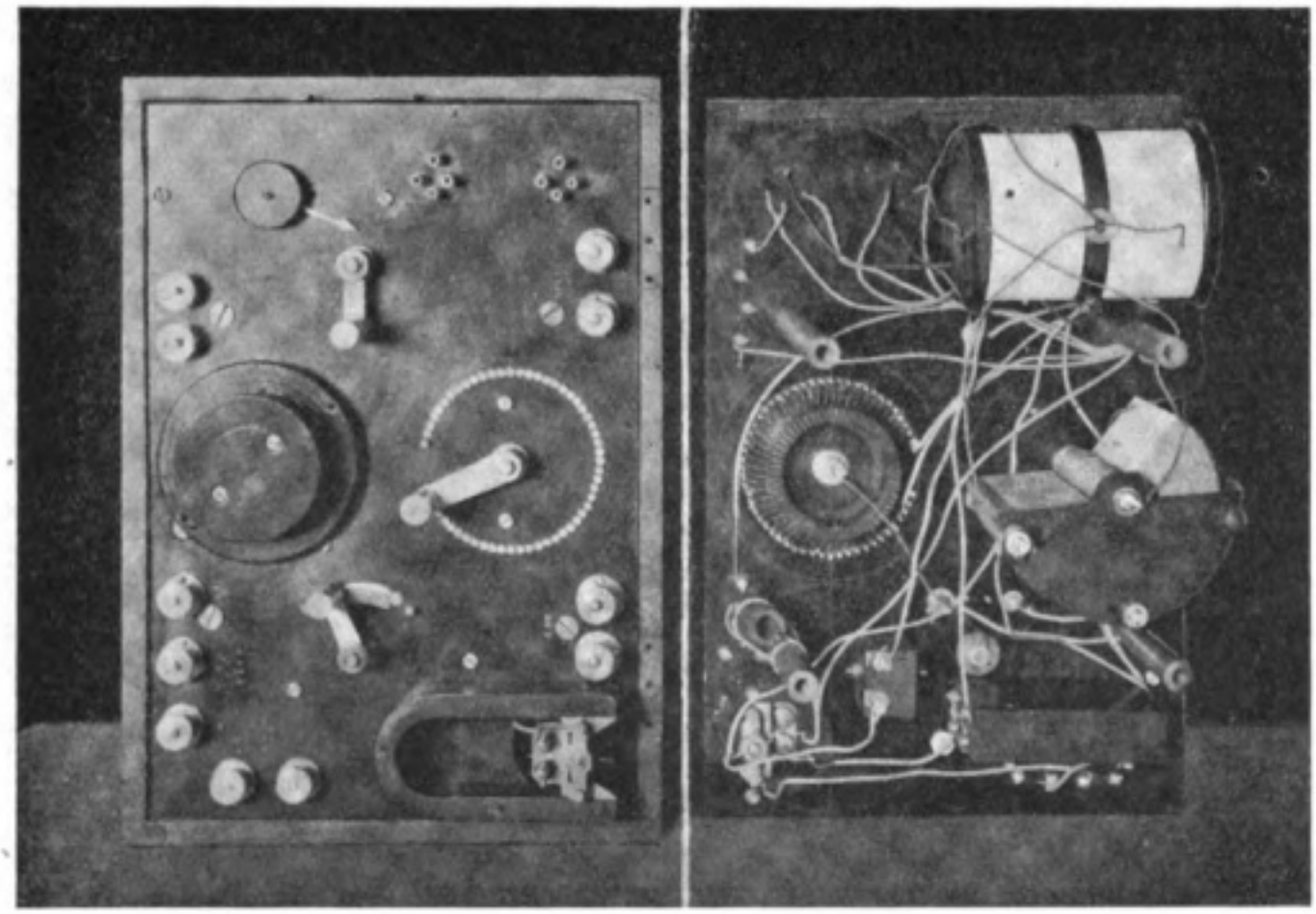


*Fig. 7.—Valve Relay (H. Burbury). Front and back view.*

this instrument will operate an ordinary Morse inker very successfully, and in fact he had recorded a number of Paris press messages in this manner without any mistake at all. One disadvantage of the instrument was said to be its extreme sensitiveness to C.W. signals, so that when receiving from a spark transmitter a much weaker C.W. signal was liable to cause considerable interference.

Mr. R. KEEN described some exhibits shown by the Marconi Company, comprising a number of small instruments such as "billi-condensers" and similar adjuncts for receiving purposes. One of the ½ k.w. 3-electrode transmitting valves used for the wireless telephone transmitters was also shown. One of the recent "Type 55" seven-valve amplifiers was exhibited. This instrument has a receiving range of from 600 to 5,000 metres wavelength, but gives a maximum amplification between 300 and 800 metres. The amplification obtainable on 2,000 metres wavelength is approximately half that obtainable when working on the optimum wavelength. The central feature of this exhibit was the latest form of radiogoniometer constructed especially for direction-finding

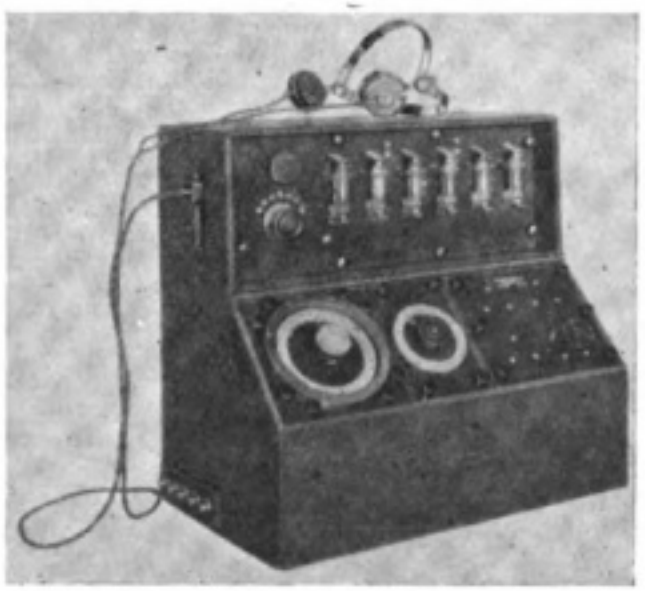


*Fig. 8. New Marconi D.F. Apparatus for Ships.*

aboard ships (Fig. 8). This instrument is arranged to be as nearly foolproof as possible and is suitable for use with any ordinary ship's D.F. aerials. The instrument has three separate ranges covering wavelengths between 300 and 5,000 metres. For ship work, direction-finding is of especial utility in navigating intricate passages at the entrance to harbours, etc., and especially for foggy weather. The apparatus has an additional sphere of utility for handling ordinary traffic in crowded waters where there is often considerable jamming, since it may then be used to cut out entirely the signals from an interfering station.

Mr. M. CHILD exhibited a machine captured from the Germans. It has been used for generating the energy for trench "spark" wireless sets. It was a self-contained and self-excited high-frequency alternator of the inductor type yielding a current at 500 cycles. Its normal speed was 4,000 r.p.m. and it was driven by a chain from a tandem bicycle frame. The exhibit was shown especially as an example of a very small and extremely well-constructed generator.

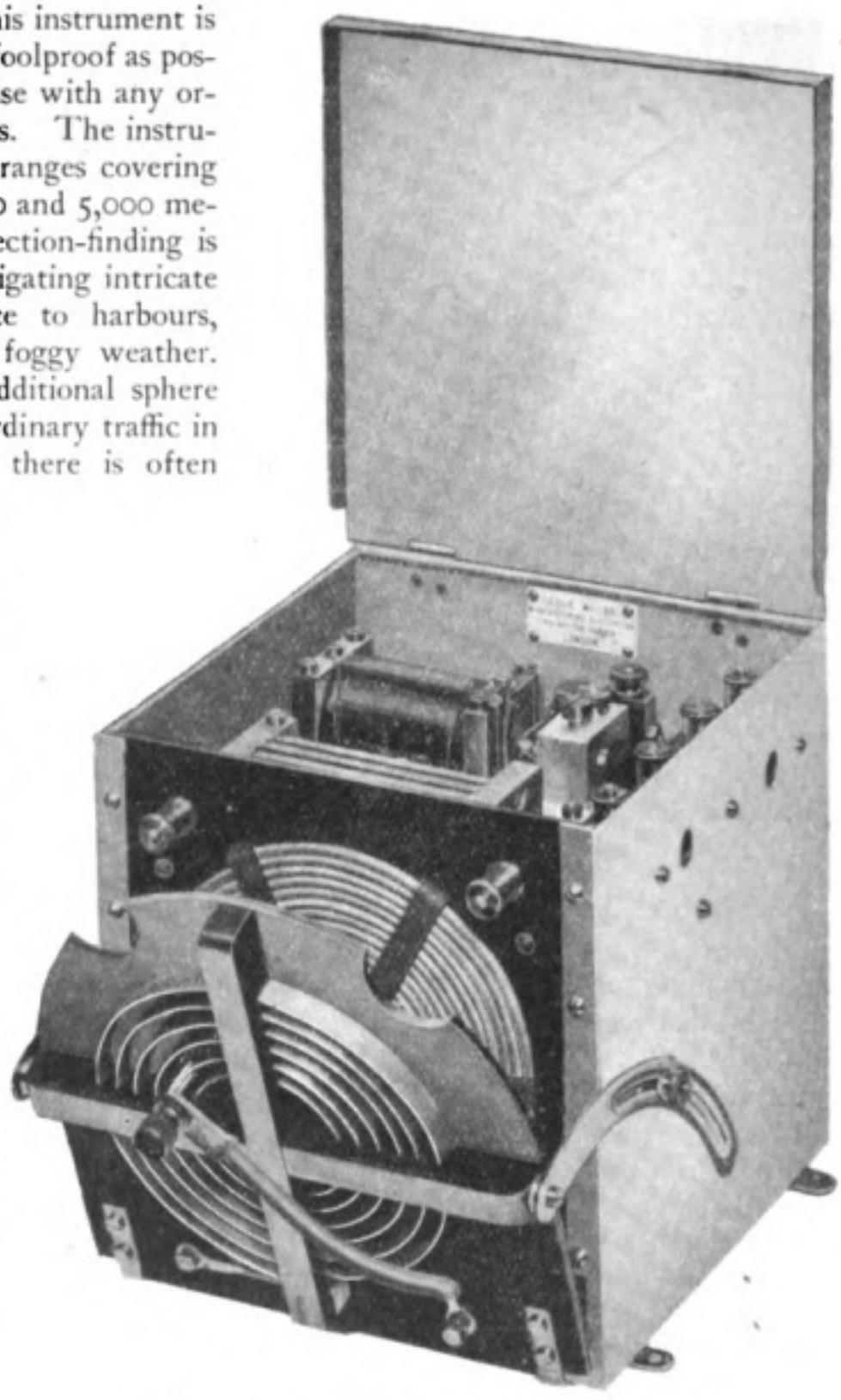


*Fig. 9.—Portable Quenched Spark Transmitter.*
*(Leslie Miller.)*

Mr. R. C. CLINKER described some valves exhibited by the British Thompson-Houston Company. Amongst these were:—(1) a 300-watt transmitting valve constructed by the General Electric Company of America for use with a plate voltage of 2,500. (2) A captured German receiving valve of rather low vacuum. (3) A small American transmitting valve having a very small anode to enable it to be operated with the six volt anode circuit battery as used for illuminating the filament. (4) A small "French" valve constructed with

specially high vacuum for transmitting purposes. This valve of the same size as an ordinary "French" receiving valve could yield 30 watts of high-frequency energy with 1,500 volts in the plate circuit. (5) An American receiving valve.

A special variable condenser was also shown constructed particularly for use in C.W. receivers. It has a separate single plate moveable vane in addition to the ordinary ones, and is suitable for obtaining an extremely fine adjustment such as is advantageous in heterodyne work. A particular feature was the arrangement of the single handle to control both adjustments.

Mr. LESLIE MILLER showed two small portable transmitters, one suitable for use on a 200-volt D.C. supply, and the other on a much lower voltage. Both these sets are furnished with quenched spark gaps. The high voltage set operates on the principle of utilising a condenser discharge to furnish medium-frequency alternating current from the D.C. supply, through the medium of a vibrating contact maker. This principle has been utilised in a number of similar portable wireless sets, and its successful operation depends on the tuning of the speed of vibration of the contact maker to the natural electrical oscillation frequency of the circuit. This frequency may be made round about 500 to 1,000 per second, thus getting a musical note at the quenched spark gap. A photograph of one of these sets is given in Fig. 9.

CAPT. DONNISTHORPE, R.E., exhibited a Selenium cell, a captured German valve, and a U-type rectifying valve, but these exhibits were not described in detail.

THE PRESIDENT, Mr. A. A. CAMPBELL SWINTON, exhibited some receiving apparatus constructed entirely in his own laboratory and pointed them out especially as examples of what could be done with very limited appliances and very few tools. The group of apparatus is shown in Fig. 10. It comprises an octagonal frame aerial mounted on a small base with a compass card, and capable of rotation in order to determine the direction of the incoming waves. On the right-hand side of the picture a seven-valve amplifier can be seen constructed for use with this frame. "French" type valves are employed and an ordinary type of resistance-capacity coupling

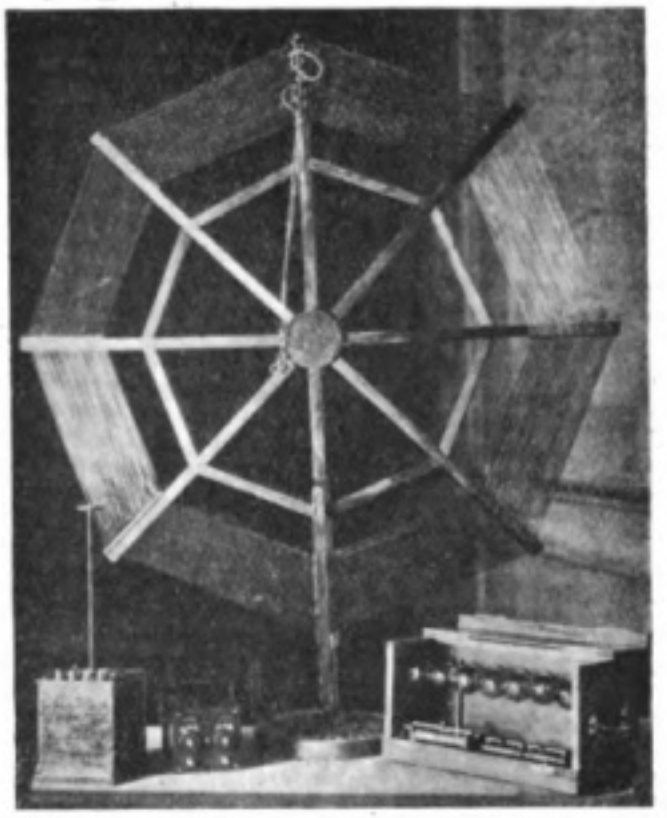


*Fig. 10.—Small frame Aerial and Seven-valve Amplifier (A. A. Campbell Swinton).*

is used between the valves. With a four-volt battery for the filaments and an 80 to 100-volt battery for the plate circuits of this amplifier, and with the addition of a variable condenser for tuning the frame, almost any large European Station can be picked up with this arrangement, while in many cases the signals are so loud that they can be heard all over the house. On the left hand side of the picture there is a small coupling coil for use with heterodyne receivers, the special feature being a long

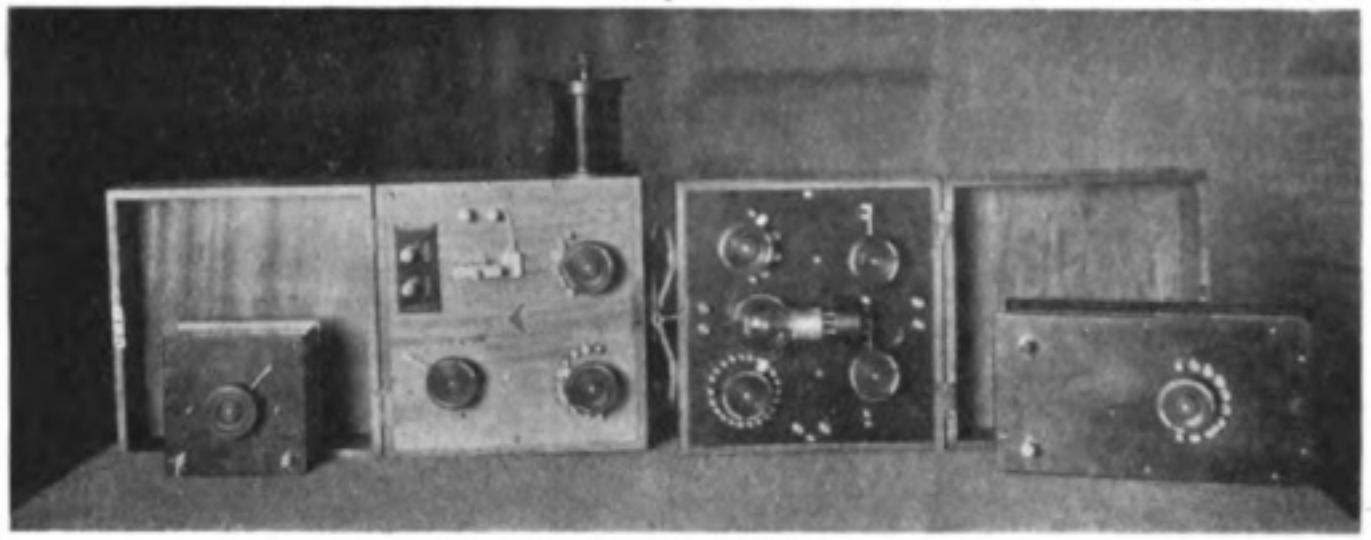


*Fig. 11.—Crystal and Valve Receivers.*
*(F. Reed.*

handle to avoid disturbance of the tuning by the hand of the operator.

A set of receiving apparatus was exhibited by Mr. F. REED. This is illustrated in Fig. 11. The instrument on the left is a complete crystal receiver with loose coupling—the coupling handle can be seen pulled out at the top. The small box standing at the extreme left is a variable condenser for tuning the aerial circuit of these instruments. On the right-hand side is a special single valve receiver. It was claimed that this particular receiver would give results as good as almost any three-valve amplifier of the ordinary pattern. A single "French" type valve is used. The scheme of connections used with this receiver is given in Fig. 12, from which it will be noted that the receiver connections are joined between the grid and anode of the valve, instead of between the grid and filament as in the usual arrangements. The condenser $C_2$ is an ordinary grid condenser of very small capacity, while $C_3$ is a special variable condenser joined between the grid and the filament. This condenser serves partially to control the wavelength of reception, but more especially to determine the frequency of the local oscillations when using the instrument for C.W. reception. Either spark or C.W. signals can be picked up with this gear by proper adjustment of this condenser. The telephones T are joined in series with the plate battery $B_2$ in the usual manner, while $C_1$ $L_1$ is an ordinary receiving tuner. The aerial tuning coil L and secondary $L_1$ are external to the instrument shown in Fig. 11. The small box at the extreme right of the photograph (Fig. 11) is the high-tension battery with its selector switch for use with this valve receiver.

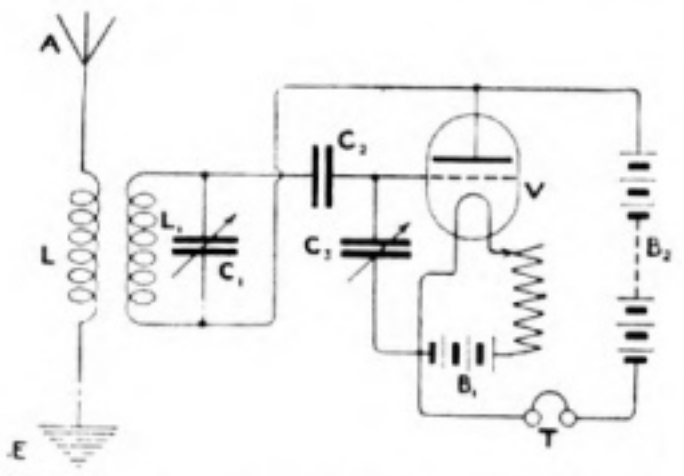



*Fig. 12.—Connections of Reed's Valve Receiver.*

The proceedings of the meeting closed with a hearty vote of thanks to the exhibitors, both for bringing up their apparatus and for describing it. The various exhibits were closely examined by the members present at the close of the proceedings.

# Notes of the Month

## TWO NEW COMPANIES.

THE Marconi - Osram Valve Company, Limited (private company), was registered on October 20th with a capital of £100,000 in £1 shares. The objects are to carry on the business of manufacturers of, and dealers in, electrical valves and other articles, instruments, apparatus and things used in connection with wireless telegraphy, and to carry on the business of electrical and general engineers, manufacturers of telegraphic works and appliances of all kinds. The number of directors is to be either two or four, half to be appointed by Marconi's Wireless Telegraph Co., Ltd., and half by the General Electric Co., Ltd. Registered Office: Osram Works, Brook Green, Hammersmith, W.

Marconi's Wireless Telegraph Co., Ltd., have sold to the General Electric Co., Ltd., of New York, U.S.A., the whole of their shareholding in the American Marconi Company at an advantageous price, subject to resolutions to be submitted to the shareholders of the American Marconi Co. on November 20th being approved. A new Company, the Radio Corporation of America, has been formed, which it is proposed will buy the assets of the American Marconi Co. An agreement has been entered into by Marconi's Wireless Telegraph Co., Ltd., with the General Electric Co., and the Radio Corporation, which provides that the English Marconi Co., secures the sole rights for the whole of the British Empire and a licence for other parts of the world other than the United States of all radio patents and inventions of the General Electric Co. and the Radio Corporation, past, present, and future until the end of 1945, which include the Alexanderson High Frequency Alternator.

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## NEW WIRELESS STATIONS.

A wireless station for exclusive military use is to be built this year at Kamishi, a town in the Ishikawa prefecture, facing the Sea of Japan.

The Portuguese government is considering purchasing from the British Navy the wireless installation now at Madeira. The apparatus would be transferred to Porto Santo and a more powerful station erected in Madeira.

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## RETIREMENT OF THE "ELECTRICIAN" EDITOR.

On October 31, Mr. W. R. Cooper, M.A., B.Sc., M.I.E.E., A.M.I.C.E., was presented by his colleagues of Benn Brothers with a silver rose bowl and Weston portable milli-ammeter, upon his retiring from the editorial chair of the *Electrician* after a period of 13 years. Mr. Cooper has decided to devote the whole of his time to his consulting practice, the growth of which renders it impossible for him to continue his editorial duties at the same time. Mr. Cooper was appointed Editor of the *Electrician* in 1906, and under his editorship the journal has made considerable progress. His place will be taken by Mr. F. H. Masters, O.B.E., A.M.I.E.E., who was chief assistant editor at the outbreak of war in 1914. Mr. Masters received his technical training at King's College, London, and Finsbury Technical College, under the late Prof. S. P. Thompson. During the war he was engaged on coast defence

electric lighting work and on search-lights used against enemy aircraft. Mr. Masters was twice mentioned in despatches.

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## LECTURES ON WIRELESS TELEGRAPHY.

Amongst the series of lectures projected to be delivered during the coming winter at the Merchant Venturers' Technical College, Bristol, is one about Wireless Telegraphy, by Professor Marchant, of Liverpool University.

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## THE GREAT WIRELESS SILENCE.

On November 11th, the anniversary of Armistice Day, all the wireless stations of Marconi's Wireless Telegraph Co. and of the Associated Companies within the Empire ceased work for two minutes at 11 a.m. as a tribute to the Empire's glorious dead.

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## NEW MARCONI DIRECTOR.

The Rt. Hon. Lord Herschell, K.C.V.O., has been elected a Director of Marconi's Wireless Telegraph Co., Ltd., and The Marconi International Marine Communication Co., Ltd.

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## WIRELESS TELEGRAPHY IN PORT.

With reference to the notice which appeared in the WIRELESS WORLD (November) relating to the arrangements made for inter-communication by wireless telegraphy between ships while in ports of the United Kingdom, the Ministry of Shipping announces that the special circumstances which gave rise to these arrangements no longer exist, and that the previous regulations under which the use of wireless telegraphy by ships in harbour is prohibited except with the written permission of the Postmaster-General are again in force.

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## LECTURES ON VALVES.

On Wednesday, October 29th, Prof. J. A. Fleming, F.R.S., delivered the first of a series of six lectures on Thermionic Detectors, Oscillators and Amplifiers in Telegraphy and Telephony.

The lecture was chiefly devoted to an exposition of the electron theory and dealt with the emission of electrons from heated filaments composed of various substances.

On November 5th, the second lecture dealt with the Fleming two-electrode valve and the methods used for producing high vacua.

The same subject was dealt with in the third lecture on November 12th. Dr. Fleming went on to describe the use of the Fleming valve for the rectification of A.C., two experiments being given to illustrate this. The three-electrode valve was then considered and a detailed explanation was given of the control of plate current by grid potential.

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## WIRELESS MEN DECORATED.

*Order of the British Empire. C.B.E.—(Military Division.)*

Hon. Lt.-Col. H. Airey, R.M.—For valuable services in connection with wireless telegraphy.

*O.B.E.—(Naval Division.)*

Lt. W. G. Bishop, R.N.—For valuable services in connection with wireless telegraphy.

Lt.-Comm. G. Key, R.N.—For valuable services in connection with wireless telegraphy.

Comm. E. J. Prendergast, R.N.—For valuable services in connection with wireless telegraphy.

*O.B.E.*—(*To be Member of the Military Division of the said most Excellent Order.*)

Lt. W. A. Appleton, R.N.V.R.—For valuable services in connection with wireless telegraphy.

Actg.-Wt.-Armr. G. P. Pitt, R.N.—For valuable services in connection with wireless telegraphy.

## WIRELESS CLUB NOTES.

### The Wireless Society of London.

Application for Membership should be addressed to the Hon. Sec., Mr. H. Leslie McMichael, 32, Quex Road, West Hampstead, N.W.6.

Mr. J. Scott-Taggart will read a paper before this Society on November 26th.

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### Stoke-on-Trent Wireless Club.

Will anyone interested in or intending to join this Club kindy communicate with the Acting-Secretary, Mr. F. Shaw, 55, Alexandra Rd., Longport, Staffs.

* * *

### The Wireless and Experimental Association.

The past has been a month of great expectations and interest for the members of the Experimental and Wireless Association meeting every Wednesday at 16, Peckham Road, for many members have by now obtained permission to receive or endeavour to receive signals on the small amount of aerial allowed by the Authorities.

The old licencees' apparatus, too, is slowly and deliberately filtering back out of P.O. custody, generally in none too good a condition for immediate use, but good signals have been obtained.

Captain Owen, of the R.A.F., has for two meetings interested, instructed and delighted the members with his thorough and interesting lectures on receiving on small sets, the necessity for studying which was forced upon him by the exigencies of space on an aeroplane.

New members are still coming in, but still there is room for more.

A programme based on "making the most of a little" is planned for the immediate future.—Hon. Sec., Mr. F. H. Gribble, 48, Surrey Square, S.E.17.

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### Three Towns Wireless Club.

*October 4th*—Mr. J. Jerritt presided. Mr. Lock lectured on the working and construction of Induction Coils. A letter from the Milwaukee Amateurs' Radio Club, U.S.A., was read by the Hon. Sec. It stated: "We are glad to see that the radio amateurs in England are organising. We are very interested in your Secretary's question of leaguing all the Radio Clubs together, and we do not see why this cannot be international as well as national. We would like to see co-operation among the radio amateurs of all countries, and a great international association formed for the exchange of ideas, etc." The Hon. Sec. stated that as the Wireless Clubs of Great Britain were organising it would be a great thing if all joined up internationally.

*October 10th.*—Mr. Jerritt presided, and an interesting lecture was given by Mr. Voss on Alternators. Diagrams were drawn and the construction of several types were shown, such as those built for lighting, etc.; also High-Frequency Alternators as used in wireless telegraphy. The Marconi and the Goldschmidt machines were ably explained. Mr. Voss was complimented by the members on the clearness of his lecture.

*October 17th.*—The Chairman was Mr. J. Jerritt. The lecture was by Mr. Lemin, late R.F.C., of Saltash, on the Lucas Bros. Signalling Lamp. This

lamp was shown in pieces, also intact, and all parts were ably explained. It is lit by electricity and is carried by one man, and has been read with a telescope at 74 miles under good conditions.

*October 22nd* was spent in Morse practice, and arrangements were made for a Social on November 5th.

*October 29th.*—A discussion of the leaguing of all the Radio Clubs took place, and a letter was read stating that a scheme has been started in America by a Radio Club at Omaha, U.S.A., and that it is called the International Society of Radioists. The Three Towns Wireless Club has been appointed the headquarters for Great Britain, and a Relay is being proposed from America to this country. Rules and particulars of membership are being forwarded to all clubs in due course. Apply for membership to Mr. W. Rose, Hon. Secretary, 7, Brandreth Road, Compton, Plymouth.

*Some members of the Three Towns Wireless Club enjoying a field day.*

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### Sheffield & District Wireless Society.

The Opening Meeting of the Session was held in the Mappin Hall, Sheffield University, on October 2nd, when the President, Mr. H. E. Yerbury gave the Presidential Address to an appreciative audience of members and friends.

In response to the wishes of those present, it was decided to print the Address and distribute copies to all the members.

A very interesting exhibition of component parts of wireless receiving apparatus, kindly loaned for the occasion, was afterwards held, and proved a source of great interest to the members.

The weekly meetings of the Society are being held temporarily at the Sheffield Municipal Officers' Club, and the first meeting took place on October 10th when buzzer practice was commenced.

A series of 14 fortnightly papers given by members has been arranged, the subjects covering the various phases of wireless work. The first of the series, on "The Principles of Wireless Transmission," was given on October 17th by Mr. C. H. Hainsworth, who dealt with the subject in a very lucid manner, illustrating his lecture with numerous diagrams and experiments.

The Hon. Secretary invites applications for membership, which should be addressed to 156, Meadow Head, Norton Woodseats, Sheffield.

* * *

### The Manchester Wireless Club.

It has been decided to form a Wireless Club in Manchester. Will all those interested kindly communicate with the Hon. Secretary, Mr. J. C. A. Reid, 16, Hawthorne Avenue, Monton, Eccles, Lancs.

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### North Middlesex Wireless Club.

A meeting of the Club was held on

November 4th at Shaftesbury Hall, Bowes Park, at 8.30 p.m. The chair having been taken by Mr. Reed, he called on Mr. D. J. Stone to give his promised lecture entitled "Five Years at Sea as a Marconi Operator." Mr. Stone commenced by telling his audience how he had first become attracted towards wireless operating while on a voyage to Genoa on a holiday, and as he was already a keen amateur, on joining the Marconi School it was not long before he obtained his P.M.G. certificate, and was sent to sea. A few months afterwards the War broke out, and Mr. Stone had a number of thrilling adventures. It was clear that, on the whole, Mr. Stone's life at sea had been an enjoyable experience, and one on which he was able to look back with pleasure.

It has been arranged to form a library in connection with the Club, and members who have any technical books that they would be prepared to present or lend to the Club, should get in touch with the President, Mr. A. G. Arthur, 45, Westbury Road, Bowes Park, N.22.

Full particulars of the Club may be obtained from the Hon. Secretary, Mr. E. M. Savage, Nithsdale, Eversley Park Road, Winchmore Hill, N.21.

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NOTICE TO HON. SECS. OF WIRELESS CLUBS.

A Wireless Club is being formed at Burton-on-Trent. All interested please apply to the Hon. Sec., Mr. Rose, 214, Belvedere Road, Burton-on-Trent.

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We shall be pleased to publish notices and reports of your meetings, free of charge. Kindly endeavour to submit these not later than the 1st of each month.

# WIRELESS TRANSMISSION FOR AMATEURS

*The following are the eagerly-awaited official rulings regarding transmission. A new Wireless Telegraphy Bill will be introduced into Parliament, and when this is passed the various forms of licences will be revised.*

## EXPERIMENTS IN WIRELESS TELEGRAPHY.
## AUTHORITY FOR SENDING.
## SUMMARY OF CONDITIONS OF ISSUE.

(*Note:—All Sending Stations must also be equipped for reception.*)

(1) Applicants must produce evidence of British nationality and two written references from persons of British birth and of standing, not related to them.

(2) Installation to be approved by Postmaster-General.

(3) Secrecy of correspondence to be observed.

(4) Applicants must satisfy the Postmaster-General that they have in view some definite object of scientific value or general public utility. If scientific research is intended they should be certified as competent investigators by a Government Department or some recognised scientific body.

(5) Applicants will normally be required to show that they have attained:—

(a) A sufficient knowledge of the adjustment and operation of the apparatus which they wish to work;

(b) A knowledge of the regulations of the International Convention in so far as they relate to the prevention of interference and impose certain duties on all wireless operators (these are contained in Section V of the Postmaster-General's Hand-Book for Wireless Operators which is sold by the Stationery Office);

(c) An operating speed of at least 12 words (Morse) a minute, sending and receiving.

A fee of 5s. will be charged in connexion with this arrangement.

A licensee may be allowed, exceptionally, to employ a certificated operator, whose name should be furnished.

(6) It is proposed to charge small fees to cover clerical expenses and expenses of inspection, etc.

(7) Communication will be authorised only with specified stations not exceeding five in number.

(8) *Aerials.*

(Same dimensions as for receiving.)

(9) *Portable Stations.*

General conditions same as for fixed stations.

Power of portable sending stations will usually be limited to 10 watts.

Use will ordinarily be authorised only within 10 miles of a fixed point.

# The Design and Construction of an Amateur Receiving Station

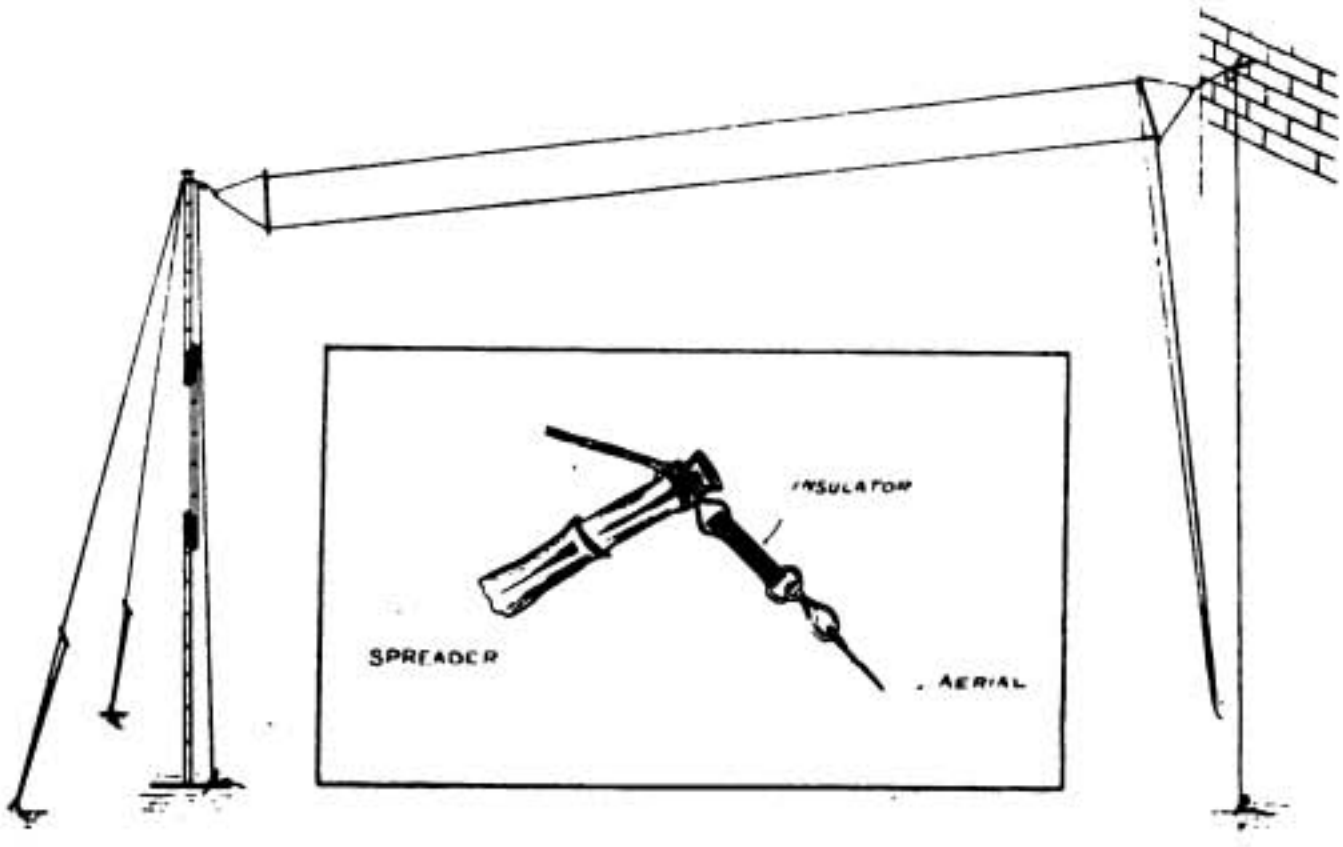
By A. D. Kent.

NOW that the ban on Amateur Wireless has been partially lifted, we can go ahead with work of a practical nature. In many previous articles the principles underlying the reception of wireless signals have been fully dealt with, and it is now proposed to give our readers as much help as possible with the design and construction of apparatus suitable for amateur work.

The present article outlines the construction of a simple form of Crystal Receiver which will be inexpensive and yet do useful work. Its wavelength range will be such as to receive signals from ships, Time signals and Press from the Eiffel Tower, Poldhu and any other "Spark" stations working on wavelengths up to 3,000 metres or thereabouts.

## THE AERIAL.

Take the case of the average amateur who has to use the wall of the house as a fixture for one end of his aerial and a light mast at the end of the garden for the other end. Most gardens will allow a 50 or 60 foot span and the wires should be placed as high above the ground as possible,—as the range of a transmitting or receiving station is directly proportional to the height of the aerial with small power sets. It is usually most convenient to rig the aerial up at one end to a window at the top of the house, and use, say, three or four stout




*Figs. 1 and 2.*

bamboo poles lashed together at the other end; this pole must be suitably guyed to take the strain of the aerial. This arrangement would give the Aerial an average height of about 20 feet from the ground. (See Fig. 1.) As better results will be obtained with a twin wire aerial, it is necessary to have two 3-foot bamboo poles to act as "spreaders." The Aerial wires should not be attached directly to the spreaders, they should be insulated from them; therefore four small porcelain, ebonite, or fibre insulators must be obtained. The ends of the two wires should have "eyes" fitted to clip on to dog snaps on the insulators (Fig. 2). The two lengths of wire should be sufficiently long to act as down-leads and should not be joined except at the leading-in wire, and they should not be connected together at the far end. The most suitable wire to use is 7/19 S.W.G. bare, stranded, phosphor bronze, or silicon-bronze wire, as this will allow the Aerial to be lowered when necessary without the wires curling up into a tangle. If this wire cannot be obtained, ordinary hard-drawn bare copper wire of not less than No. 18 S.W.G. may be used. The "lead-in" may be of ordinary rubber-covered cable; this may be joined to the Aerial wires by means of an ordinary cable connector or a well-twisted, soldered joint.

## THE EARTH.

With most amateur stations it is not very convenient to bury large earth plates in the ground so recourse is made to the water pipes of the house. A good "earth" can be made in this way if the connection is made as near as possible to the ground. A length of wire netting, 15 inches wide and 15 feet long, also is very useful, especially if covered with slightly moist soil.

We now come to the RECEIVER (Fig. 3). From the diagram it will be seen that we are using a "plain" aerial

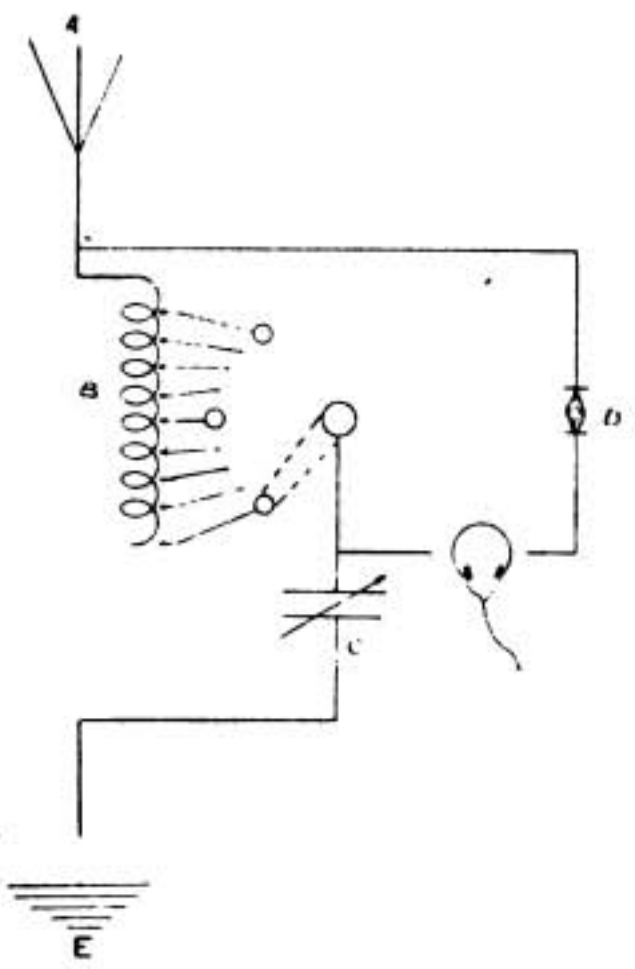



*Fig. 3.*

circuit, having a variable inductance and a variable condenser in series, with a crystal rectifier and telephones connected across the inductance. To make the INDUCTANCE FORMER which should have a winding diameter of $6\frac{1}{2}$ inches, obtain two hard dry wood discs, 7 inches diameter and $\frac{1}{2}$ inch thick, and eight pieces $\frac{1}{2}$ inch square or $\frac{1}{2}$ inch round and mount them as shown in sketch, Fig. 4. The length of these pieces will vary according to gauge of wire used (see table). Before mounting, cut a 3-inch diameter hole in one disc to bring the tappings through to the switch. Mount two terminals on this disc. Obtain another wooden disc, 4 inches diameter and $\frac{1}{4}$ inch thick, for a switch base, and on this mount, say, ten contacts—using metal-threaded screws and nuts—the nuts underneath and the screw-heads filed down to act as contacts. Mount a small brass switch arm in the centre of the contact circle and just suf-

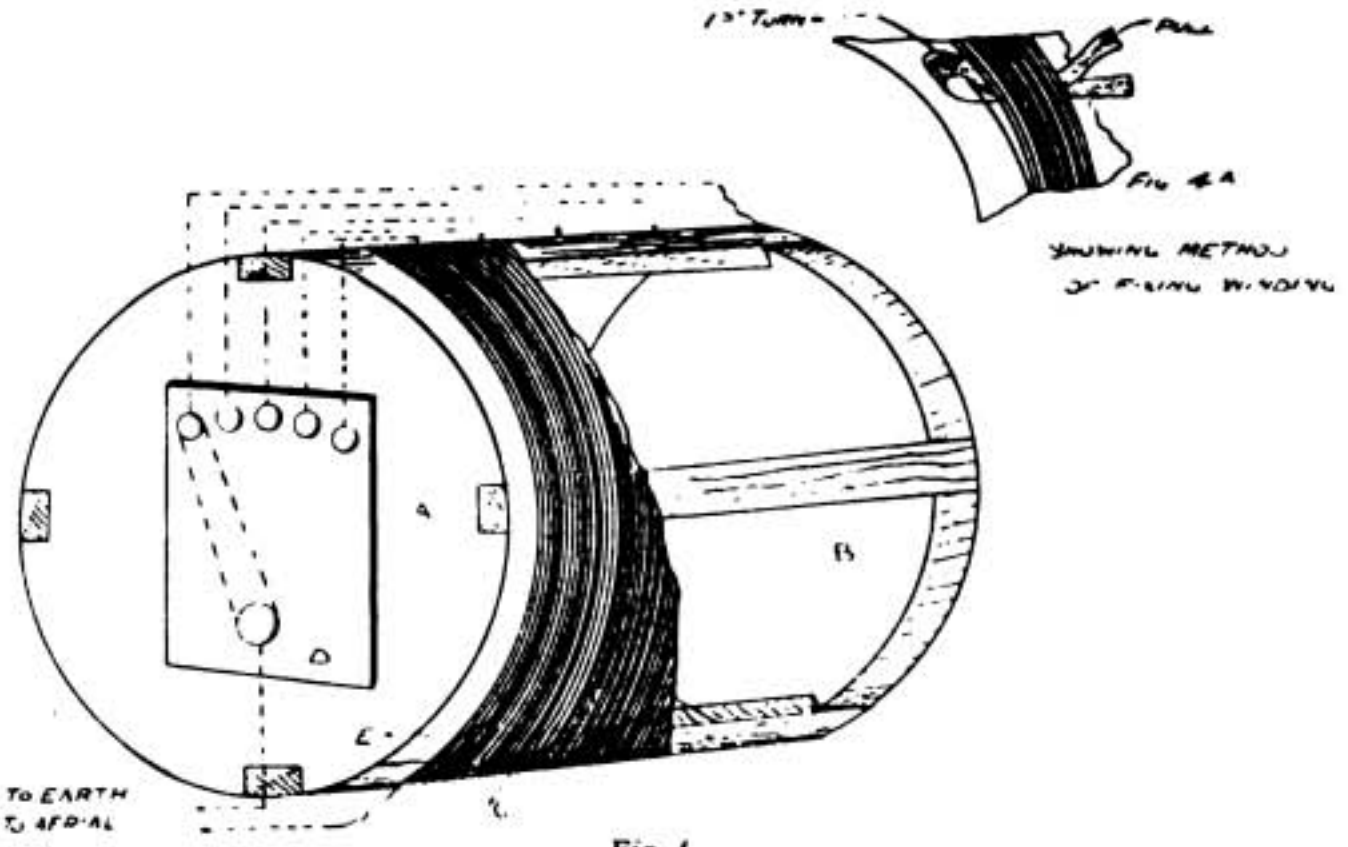



Fig. 4.

ficiently wide to make contact on one stud at a time.

Now for the WINDING. Assuming the capacity of the two wire aerial to be approximately 0·0003 mfd., an inductance of 8,500 microhenries will be necessary to tune it to 3,000 metres. The number of turns necessary are given in the table below for three gauges of copper wire. Commence winding at the end of the former nearest the switch and wind as tight and close as possible. Make nine evenly spaced tapping points. These may either be made by slipping a small piece of ebonite $\frac{1}{8}$ inch thick under the turn to be tapped and then soldering a connecting wire on, or by leaving a long loop at the tapping point giving the loop a twist and then continuing to wind. If the tappings are made by means of loops, these can be pushed inside the former, and afterwards brought up through the end of the former to the switch contacts. If tappings are made by slipping ebonite blocks under the turns, the connections to the switch must be made on the outside of the former and not through the centre. If carefully done the looping method is the best. The tappings should be connected to the switch contacts in order—the first tapping to first contact and the end of the winding to the last contact. The beginning of the winding should be connected to one terminal and the contact arm of the switch to the other. Commence winding $\frac{1}{4}$ inch from the end cheek, and make the winding secure at both ends by slipping a doubled-over piece of tape under the first few turns (Fig. 4a), putting the first turn through the loop in the tape, and then when the tape is almost covered pulling it tight so that the tape is holding the first turn and is held down itself by the other turns.

WINDING TABLE.

| | TURNS | LENGTH OF FORMER |
|---|---|---|
| No. 22 D.W.S. | 320 | 10¾ inches |
| No. 24 D.W.S. | 285 | 8 inches |
| No. 26 D.W.S. | 260 | 6½ inches |

Amount of wire, ¾lb. either gauge. The wire should be double silk covered.

THE AERIAL TUNING CONDENSER is provided to tune to wavelengths between those given by the tappings on the tuning inductance. The maximum capacity of the condenser should be approximately 0·001 mfd. A variable circular vane condenser is not very easy to make up and should preferably be purchased complete. A useful condenser might be constructed as shown in Fig. 5. Two pieces of ebonite are grooved to take metal plates which may be of copper or brass, 1/32 inch thick and about 3 inches square of actual working surface. There should be about 30 plates spaced 3/32 to $\frac{1}{8}$ inch apart. The grooves in the ebonite should be of sufficient depth to hold the plates rigid. A box must be made sufficiently large to take the condenser when mounted and a false bottom of ebonite provided for the plates to bed down on. The plates should be mounted as shown in the diagram with the shaped ends of alternate plates reversed. Alternate plates should be connected by a soldered wire, making two sets each of 15 plates. One set should be free to move smoothly in the grooves. The condenser is now complete, and providing it is kept clean and free from dust, will be quite an efficient receiving condenser. If preferred, the false bottom may be of metal; the condenser can then be short-circuited if desired, without an extra switch.

THE CRYSTAL. — Carborundum is the best all-round crystal, but its one disadvantage is that it requires a potentiometer and battery to apply a small potential to the crystal. In order to avoid using a potentiometer, we use as a rectifier a combination such as Zincite-Bornite, which will give good signals, but will not stand so much rough usage as carborundum. A small piece of each should be mounted in small brass cups with solder, or Wood's metal if possible, as this has a low melting point and consequently the crystal is not heated so much when melting occurs. The cups must have brass stems fitting into two brass supports with fairly weak tension springs as shown in Fig. 6.

TELEPHONES.—It will be very convenient for the amateur to use high resistance telephones directly in the crystal circuit. There is not a great difference in the cost between high resistance telephones and low resistance ones with a transformer; also, unless the transformer is well-designed and wound, there will be a big drop in the efficiency of the set. Present-day high resistance telephones are the order of 2,500 ohms

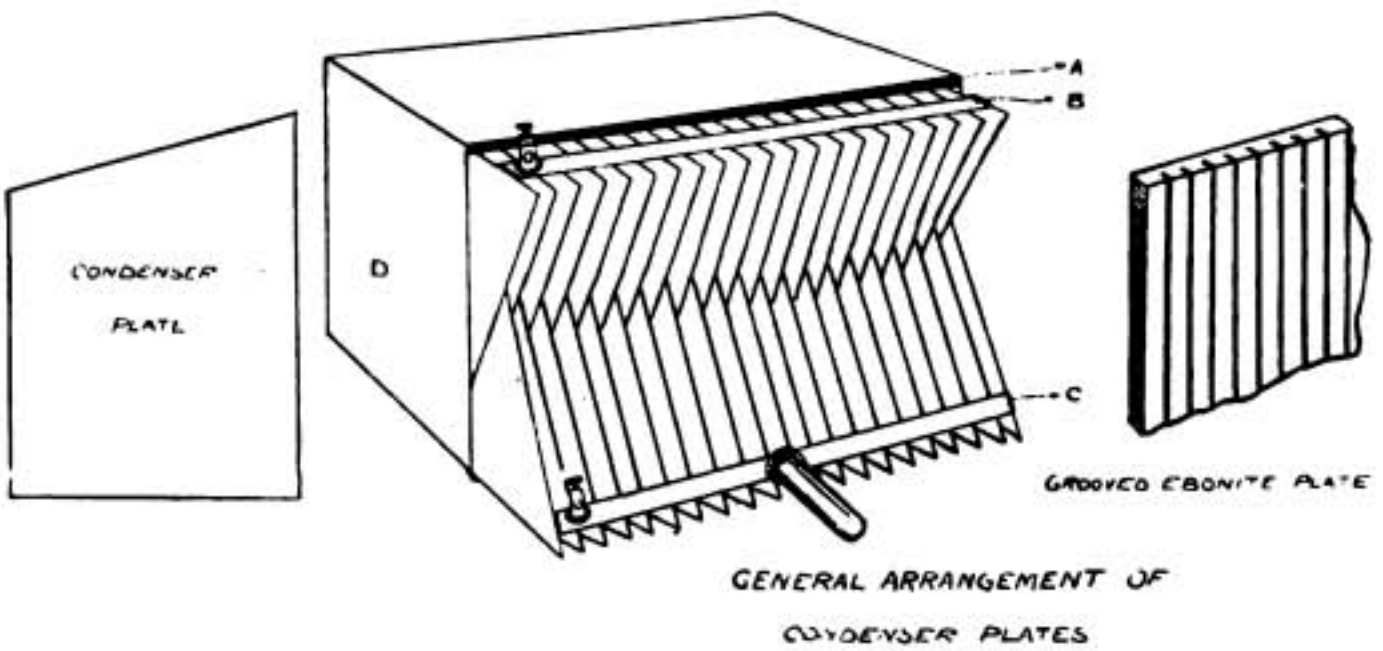
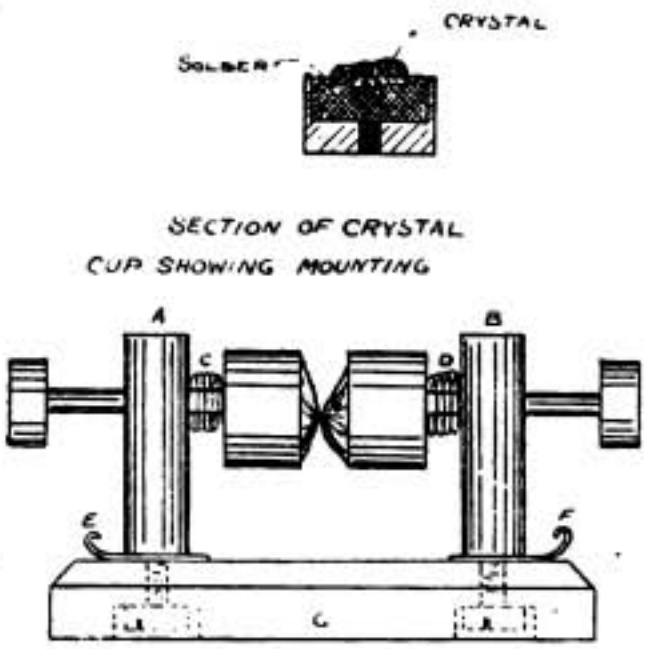



*Fig. 5.*




COMPLETE CRYSTAL CLIP
Fig. 6.

per head piece, 5,000 ohms in series. To put the receiver into operation, connect up the circuit as shown in Fig. 3, and see that all connections are well made. It is a good plan to have the first test of the set one afternoon, commencing at 3 p.m., Greenwich mean time, when Eiffel Tower (FL) sends press for twenty to thirty minutes each day on 3,200 metres. Short-circuit the Aerial condenser, and put all the inductance in the circuit, which will then be approximately in tune to 3,200 metres. Then carefully adjust the crystal until signals are heard. Get the best crystal adjustment and adjust the aerial inductance and condenser for best signals. The tuning point for the ship wavelength of 600 metres will be approximately between the second and third tappings.

## HOW AMATEURS CAN COMBINE BUSINESS WITH PLEASURE.

We feel that the time is now ripe to devote more space to practical matters of direct interest to the private experimenter. Although we by no means intend to neglect the theoretical aspect of wireless work, and shall continue to keep our readers in touch with its latest developments by means of technical articles by competent writers, we shall also provide that class of matter which appeals so strongly to amateurs who like to make their own apparatus. We have already made a start along these lines, by publishing our series entitled "The Construction of Amateur Wireless Apparatus," and the present number contains still further evidence of our intention to serve the needs of practical amateurs.

There must be many of our readers who have evolved in their workshops ingenious contrivances of "wireless" interest or have designed some special form of apparatus for special purposes, but who have never thought of publishing a description of them for the benefit of their fellow-amateurs. We therefore invite them to write to us about them, giving all necessary dimensions and connections for the construction of the apparatus they describe. Payment for all such articles published in the WIRELESS WORLD will be made at our standard rate. Photographs and descriptions of complete amateur stations will also be welcomed. If you are not an expert draughtsman do not let that fact deter you; we will work up your rough sketches and diagrams. A few articles accepted and published by us means more spare cash for you to spend on valves and H.T. batteries.

# THE AMATEUR'S GUIDE TO THE AETHER.

*Below we give a list of certain long wave Shore Stations in which Amateurs in Great Britain are most likely to be interested, together with data whereby they may be identified. Except in the cases of Time and Weather signals (see Year Book of Wireless Telegraphy and Telephony, 1919), the times of transmission are very liable to vary.*

| Station. | Call Letters. | λ | System. | Remarks. (All times G.M.T.) |
|---|---|---|---|---|
| Arlington ... ... | NAA ... | 6000 m. ... | C.W. ... ... | |
| Berlin ... ... | LP ... | 5500 m. ... | Spark ... ... | Transmits at 7 p.m. |
| Carnarvon (Wales) | MUU ... | 14000 m. ... | C.W. ... ... | Works irregularly to EAA. Press at 7.0 a.m., 9.0 a.m., 4.30 p.m, and 6.0 p.m. |
| Clifden (Ireland) ... | MFT ... | 3500 m. ... | Spark ... ... | Works irregularly throughout day and night. |
| Coltano ... ... | ICI ... | 6500 m. . | Spark ... ... | Works at 4.0 a.m. and sends programmes at various times during afternoon and evening. |
| | | 2400 m. ... | Spark ... ... | Astronomical Time Sigs. 11.29 p.m. |
| | | 2600 m. ... | Spark ... ... | Weather Reports. 9.45 a.m., 4.0 p.m. |
| Eiffel Tower ... | FL ... | | | Time Sigs. 9.56 a.m., 10.2 a.m., 10.44 a.m. and 11.44 p.m. |
| | | 3200 m. ... | Spark ... ... | Press. 3.0 p.m. |
| | | 8000 m. ... | C.W. .. .. | Press. 1.0 a.m., 4.30 a.m. and 6.0 p.m. |
| Eilvese (Hanover) | OUI ... | 15000 m. ... | C.W. ... ... | Works irregularly to EAA in early morning. |
| Gibraltar ... ... | BWW | 2750 m. (C.W.) / 4600 m. (Spk.) | Spark and C.W. | |
| Glace Bay ... | GB ... | 7500 m. ... | Spark ... ... | Works to MFT irregularly throughout 24 hours. |
| Horsea ... ... | BYC ... | 4500 m. ... | C.W. ... ... | Works every *even* hour. Press at 10 p.m. |
| Lyons ... ... | YN ... | 14000 m. ... | C.W. ... ... | Works most of night from about 1.0 a.m. |
| Nantes ... ... | UA ... | 11000 m. ... | C.W. .. ... | 7.0 a.m., 11.44 a.m., 4.30 p.m., 6.15 p.m. |
| Nauen ... ... | POZ ... | 5500 m. ... | Spark ... ... | Spark. 7.0 a.m., 9.45 a.m., 11.56 a.m. (Time Sigs.) 3.0 p.m., 5.30 p.m. and 7.0 p.m. |
| | | 12600 m. ... | C.W. ... ... | |
| Poldhu ... ... | MPD ... | 2800 m. ... | Spark ... ... | Press at 10.30 p.m. |
| Rome ... ... | IDO ... | 11000 m. ... | C.W. ... ... | |
| Moscow ... ... | MSK ... | 5000 m. ... | Spark ... ... | Works at 11.0 a.m., 1.0 p.m., 5.0 p.m. and 10.0 p.m. |

# The Library Table

## TELEPHONY WITHOUT WIRES.

By P. R. Coursey, B.Sc., A.M.I.E.E.

London: The Wireless Press, Ltd.

(Pp. xix. + 414, price 15s. net.)

THE author of this volume does not state in his preface that his work is designed to satisfy a "long-felt want." Nevertheless, the work really fills a gap in our Radio and our Telephonic Literature. The problem of transmission of human speech by "wireless" methods is here dealt with in an interesting and exhaustive manner. As the title would lead one to suppose, Radiotelephony is not the only subject dealt with. The first three chapters deal with the simple methods of speech communication using induction or earth induction and light wave transmission, including an interesting account of photophones and thermophones. It is well to note that although these methods have to a great extent been superseded in these days of Atlantic Radiotelephony, the exigencies of war-time conditions have provided ample opportunities for their revival. The British Military Authorities were not lacking in discrimination when they placed the trench "listening sets" under the control of the "wire-less" branches of the service.

Fully twenty chapters of the book are devoted to the problems of Radiotelephony. The discussion of the problem of speech transmission (e.g., limits of audibility and modulation of the transmitted wave) is followed by a classification of all the different oscillation generators. The latter are then described in detail. The discussion of "spark" generators deals first with practical forms of the quenched gap followed by an exhaustive account of the methods of obtaining continuous oscillations by these and other spark gaps. This section of the work ends with a chapter on multiphase spark transmission.

Three chapters are devoted to the Arc oscillation generator, the Braun tube oscillographic work of Simon and Yagi on "dynamic characteristics," being fully described. One of the longest chapters of the book is that on vacuum oscillation generators, and to many readers this will prove the most interesting part of the book. All types of valves are described, but a reader might wish for a little more detailed information on modern high-power valves. It is also a pity that the salient points of Fortescue's recent paper (published presumably after this work was in the press) on the design of high-voltage thermionic rectifiers could not have been included.

The subjects of high-frequency alternators and frequency raisers are accorded two chapters, which are extraordinarily clearly written. Students working at this subject for the first time often find the usual arguments relating to the frequencies generated by these various machines rather unconvincing. To such these two chapters can be confidently recommended.

Four chapters are devoted to the subject of microphonic control, every type of microphone of any importance being described, while the remainder of the book deals with the receiving apparatus of Radiotelephony, including, of course, a thorough discussion of telephone relays, ionic valve receivers, and the subject of heterodyne reception.

A very pleasing feature of the book is the list of nearly seven hundred references to original papers on the subject of Radiotelephony. In the cases of articles reprinted or abstracted in *The Electrician*, *Science Abstracts*, or *The Wireless World*, both the original and abstract references are given. It is impossible to insist too much on the importance of such a reference list in a work of this kind, and the author is to be congratulated on the exhaustive nature of these references and also on the very helpful classification of these under the chapter headings. We are certain that the book will meet with a cordial reception in radio and scientific circles generally. E. V. APPLETON.

## ALTERNATING CURRENT WORK.

### AN OUTLINE FOR STUDENTS OF WIRELESS TELEGRAPHY.

By A. SHORE, A.M.I.E.E.

London: The Wireless Press, Ltd., IX + 163 pp 3/6 net.

Here is a work admirably suited to the needs of the student of radiotelegraphy, whether he be an amateur or a person intending to make wireless his profession. The wireless man simply must know a certain amount about A.C., but it is by no means imperative that this knowledge should be profound. This book provides an excellent primer for all students who are likely to have dealings with alternating currents. We venture to suggest that if it were adopted as a school text-book for senior science students, together with a companion treatise on D.C. work, and another on technical chemical analysis, there would be registered a landmark in the history of elementary education in this country.

The first three chapters deal with the production of Alternating Current, including sections on current curves, R.M.S. values, and form and amplitude factors; with A. C. generators and rotary converters. Chapter IV. is devoted to the question of Power, and explains the phase relationships between current and voltage in a simple manner. Then follow two chapters on Inductance and Capacity, well illustrated and with worked examples. Chapters on Resonance Transformers and High-frequency Resistance follow, and the text closes with two excellent ones descriptive of electrical measuring instruments. Appended are tables of the squares and reciprocals of numbers from 1 to 10,000, tangents, sines and logarithms.

To attempt an outline of Alternating Current work in less than 200 pages is courageous; to accomplish it in such style as is revealed by the book under review is at once skilful and noteworthy.

The book is well printed, the diagrams are good and the reader has the advantage of the author's practical experience as a wireless engineer.

## GUIDE TO THE STUDY OF THE IONIC VALVE,

### SHOWING ITS DEVELOPMENT AND APPLICATION TO WIRELESS TELEGRAPHY AND TELEPHONY.

By W. D. OWEN, A.M.I.E.E.

London: Sir Isaac Pitman and Sons, Ltd., pp. VII + 59, 2s. 6d. net.

This is a small collection of short notes which, though not without interest, are of no special value to the serious student of wireless, who nowadays has a number of first-class text-books on the valve at his service, to which, so far as we can see, he has no need to go *via* a "guide."

The volume is well printed and well bound, the only facts which warrant its somewhat high price of two shillings and sixpence for 59 small pages.

# The Construction of Amateur Wireless Apparatus

*This series of articles, the first of which was published in our April number, was originally designed to give practical instruction in the manufacture of amateur installations and apparatus, and arrangements had been made with Marconi's Wireless Telegraph Co., Ltd., to supply complete apparatus to the designs it was intended to detail. The restrictions on amateur work, however, remained in force, and the author was compelled to proceed on general lines only. A further series will be published giving the class of information originally intended.*

*Article Nine.*—THE HIGH VOLTAGE BATTERY.

IN using the three-electrode valve, one of the most serious difficulties which at once confronts the amateur experimenter is the question of how he is to obtain the necessary voltage for the plate circuit of his valves. Much will naturally depend on the type of valve used, and whether for transmitting or receiving work. Different types of receiving valves require widely differing plate voltages for best results, the optimum voltage being mainly a question of the mesh of the grid. If the grid is of very open mesh or a simple spiral of metal wire, a fairly low voltage should be used; a close mesh grid means that a high plate voltage will be found best. Commercial three-electrode valves vary in this respect and the plate voltages required may be anything from twenty to two hundred volts or more. For use in the simple receiving circuits we have already illustrated, the amateur will find that he will get the best results by employing a valve which requires a fairly high plate voltage.

In commercial wireless stations the high voltage batteries consist of banks of either dry cells or accumulators, a sufficient number of cells being connected in series to give the E.M.F. required. Since the current required is very small—being only 100-150 micro-amperes in the case of a valve requiring a plate voltage of 200—the cells need only be of small size. Such a battery of dry cells can be very conveniently made up from the small 4-volt batteries used for pocket flash lamps of the flat type. But even if these small cells are used the expense is heavy. The chief disadvantage of dry cells lies in the fact that they deteriorate almost as quickly whether used or not. So that if the amateur constructs such a battery it will only last a certain time and since the initial cost of the battery is high (fifty units being required) it renders valve receiving circuits expensive to run. Accumulator batteries to give a voltage of two hundred can be ruled out of court for the average amateur as the initial cost is very heavy. Also, accumulators are not an unmixed blessing, as at the very slow rate of discharge involved they tend to sulphate rapidly unless carefully watched.

A solution of the difficulty can be found if the amateur has a supply of direct current at about the right voltage in his house. In general, a valve designed for 150 volts plate pressure will

operate quite well on either 110 or 220 volts, though the magnification may not be the very highest that can be obtained. The suitability of the supply for the amateur's work will have to be determined by experiment. It is necessary that the voltage should be steady—or at any rate not subject to fluctuations sufficiently rapid to cause noises in the telephones loud enough to drown out the received signals. The currents delivered by different generators vary very much in this respect. Some machines are perfectly quiet—others are so noisy that work is quite impossible. *It is absolutely necessary that the amateur should make up a protection board such as we describe below before he attempts to use his house supply for valve work.* This protection board is to ensure that no harm is done should the high voltage supply be accidentally short-circuited. The effects of a short-circuit on the supply may be very serious indeed if the protection board is not used—the apparatus may be badly damaged and the operator burned.

The protection we recommend consists of a small gauge fuse and a low candle power lamp in *each* lead of the supply. This arrangement is illustrated diagramatically in Fig. 1. Here A and

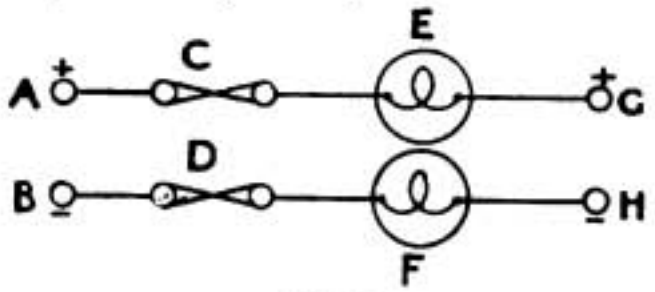



*Fig.* 1.

B are the positive and negative terminals of the supply, C and D are two fine fuse wires, E and F are two, four- or eight-candle power carbon filament lamps and G and H are the terminals which are used to supply the plate voltage for the receiving circuits. It is clear that should G and H be accidentally short-circuited nothing will happen except that the lamps E and F will partly light up. The lamps E and F should each be the correct type for use on the full supply voltage. There is one other matter on which we would give the amateur warning—never under any circumstances make any alterations in the connections of a valve circuit with the high voltage supply on. Very nasty shocks can be received by ignoring this point. It is an excellent rule in practice *never* to touch two parts of a circuit at the same time with both hands. Use only one hand for making adjustments—in fact it is an excellent plan to form a habit of keeping one hand always in the pocket when adjusting a "live" valve circuit.

*Smoothing Out Apparatus.*

The practicability of utilising the house supply for valve receiving circuits depends, as we have pointed out, upon the absence of secondary ripples in the D.C. voltage. The ripples may be caused by sparking at the commutator of the generator or by slight irregularities in the armature winding. It should be noted that any apparatus involving the magnification of note frequency current, or in which the telephone circuit is directly in series with the high voltage supply necessitates much more perfect uniformity of pressure than in the case of purely high-frequency amplification. A very suitable circuit for the amateur to make his first experiment on is that shown in Fig. 2 of *Article Seven* of this series. A study of this figure will at once make it clear that none of the current from the high voltage supply directly passes through the winding of the telephone transformer, the only current which can affect the telephones being that produced by the rectification of the high-frequency oscillations in the plate oscillatory circuit. Should, however, the D.C. supply be so unsteady that direct impulsing of the plate oscilla-

tory circuit occurs, then, of course, an intermittent rectified current will flow through the telephone transformer, producing a sound in the telephones. We therefore recommend the amateur to set up such a circuit and experimentally determine for himself whether his supply is good enough as it stands. Of course, it must be understood that slight noises will almost certainly be heard on even the most perfect supply, the question being to decide whether the noises are such as will drown out the signals which it is desired to receive or not.

Should it be found that generator noises are excessive a system of condensers and chokes can be employed to reduce the effect. Such an arrangement is shown diagramatically in Fig. 2. In this

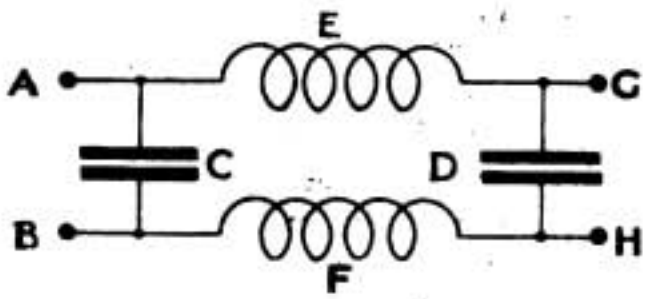



*Fig. 2.*

figure A and B are to be connected to G and H on the protection board, G and H then forming the terminals from which the supply is drawn for the operation of the receiving circuit. The device consists of two chokes, E and F, shunted on both sides by condensers C and D. Provided that the condenser C is large enough, it will act as a partial short-circuit to any fluctuations in P.D. which are of fairly high frequency, thereby reducing the variations between A and B. The chokes E and F which must be highly inductive further reduce fluctuations by offering a very high impedance to any ripples there may be in the voltage across the condenser C. The condenser D further assists in the smoothing out and acts as a reservoir condenser from which the current can be drawn for the valve. Thus, assuming that the correct values have been chosen for the chokes and condensers and that the original fluctuations are not of a too violent character, we obtain by this means a practically steady potential difference between G and H. As a preliminary experiment, two 2 mfd. paper condensers may be used for C and D and the chokes may conveniently be small ignition coil secondaries. The Mansbridge condenser is a particularly suitable type in view of the fact that it has a high insulation resistance, is practically self-sealing in the event of accidental breakdown, and is cheap. We do not recommend the amateur to attempt to make these condensers; special processes are used in their manufacture involving the use of machinery. Particulars as to windings for the chokes will be given in these pages in due course.

*High Voltage Supply for Transmitting Circuits.*

For very low power transmitters such as the amateur will probably most generally employ, the arrangements described in connection with the receiving circuits are all that he will require. It is only in extreme cases that any smoothing-out of D.C. is likely to be necessary, so that the terminals of the protection board will furnish the required voltage without further apparatus. In the case of higher powers a greater P.D. is required for the operation of the circuit and where the D.C. supply is inadequate this high voltage can most conveniently be obtained by the rectification of the alternating current from a transformer.

The necessary rectification can be conveniently carried out by means of a two-electrode or Fleming valve and a suitable circuit is shown in Fig. 3. In this figure, A is a step-up transformer delivering alternating current at the required voltage at the terminals of the secondary winding. This alternating

voltage is applied to the valve R, and since the valve possesses unilateral conductivity a pulsating direct current flows

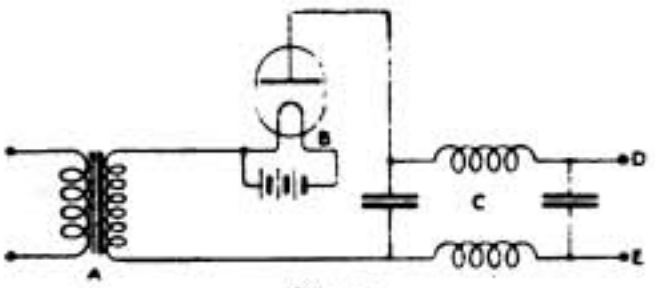



*Fig.* 3.

into and charges up the first condenser of the smoothing-out device C. This latter arrangement is exactly similar to that described in the last section. The final result is that a comparatively steady voltage is maintained across the terminals D and E.

Practical points to note are that the filament battery of the rectifier valve is directly connected to one terminal of the high-voltage winding of the transformer, and must therefore under no circumstances be touched while the circuit is in operation. Also it should be noted that when the transformer primary is switched off the condensers of the smoothing-out device remain charged, and none of the transmitting apparatus should be handled until these condensers have been discharged by short-circuiting. A special short-circuiting strap consisting of a piece of copper wire mounted in an insulating handle should be kept at hand for this purpose. The valve used must be pumped to a very high vacuum. Any residual gas will be at once evident by the appearance of a blue glow. In the event of a valve showing any signs of blue glow, it should at once be returned to the makers as a rapid disintegration of the filament will set in, resulting in a short life. The rectifier filaments of high-power valve transmitters are generally fed with alternating current from a small highly-insulated transformer thereby avoiding the necessity for any special battery. It is very unlikely that the amateur will be permitted to transmit sufficient power to warrant the use of this transformer, and we do not propose to describe it in these columns.

# Questions and Answers

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless telegraphy. Readers should comply with the following rules:* (1) *Questions should be numbered and written on one side of the paper only, and should not exceed four in number.* (2) *Queries should be clear and concise.* (3) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* **(4) The Editor cannot undertake to reply to queries by post.** (5) *All queries must be accompanied by the full name and address of the sender, which is for reference, not for publication. Queries will be answered under the initials and town of the correspondent, or if so desired, under a "nom-de-plume."* **(6) Readers desirous of knowing the conditions of service, etc., for wireless operators, will save time by writing direct to the various firms employing operators.**

L.H.G.M. (Holland).—Condensers are still used in connection with telephone transformers. The condenser is connected as in your Fig. 2, that is, across the primary winding of the telephone transformer.

The condenser is often made adjustable in steps in order to tune the primary circuit of the telephone transformer to the note frequency of any particular station.

AMPLIFIER (Hertfordshire).—(1) We do not think that the accumulation of moisture on the diaphragms of the telephones would account for the "fading away of signals" you have noticed. Unfortunately you give us no information of what detector you were using or whether you were travelling away from the station you were receiving. It may possibly be caused by atmospheric conditions or the land between the transmitting station and your receiver. The latter cause is the most probable.

Some time ago we had occasion to take down messages from an aeroplane, and noticed a similar effect, the strength of the signals then rising to a normal again. Afterwards when comparing notes with the observer it was found that the fading away was due to absorption by a cloud through which they flew.

(2) We do not think so. Mr. Bangay's book, however, covers a considerable amount of the subject.

(3) No. Valves do not amplify atmospherics to quite the same extent as they do signals, but atmospherics are of course amplified, especially with receivers using note-frequency amplification.

F.A.W. (Parkeston).—Asks for a diagram of connections for a three-electrode valve for receiving spark and C.W. Stations.

Since our correspondent is only just starting to use a three-electrode valve we would like to refer him to a series of articles headed "Construction of Amateur Wireless Apparatus" now appearing in the WIRELESS WORLD. In the October number will be found diagrams of connections of a three-electrode valve, when used for different purposes. Fig. 3 shows the connections of the valve when used as a rectifier of received oscillations.

In this particular diagram the connections show a "two-circuit" receiver, but the aerial can be connected to the grid (that is the dotted line) of the valve, and the earth connected to the lower end of the grid inductance. If these connections are used the circuit is then a single circuit receiver. Either of these two methods of connecting the valve can be used for reception of spark signals. For the reception of C.W. Stations, however, a small addition must be made to the plate circuit. A coil somewhat smaller in diameter than the grid inductance coil is inserted in the plate circuit of the valve. Break the lead between the H.T. Battery and the plate, and insert the coil between the two points.

The coil is so arranged that it can slide up to and, if necessary, into the lower end of the grid inductance coil.

The coil or "reaction coil" as it is termed can be made by winding about 20 turns of No. 30 to 36 D.S.C. wire on an ebonite former.

If the correct end of the reaction coil is connected to the plate, then the valve circuit will oscillate when the coil is just in the grid inductance coil. It is easy to tell when the valve is oscillating as the musical note of a spark transmitting station will be turned into a harsh rough sound. If this does not occur reverse the connections of the reaction coil.

A valve arranged with a reaction coil is suitable for the reception of both spark and C.W. Stations.

For the reception of spark stations the reaction coil should be so adjusted that the valve is nearly oscillating. This is the point of maximum magnification.

For the reception of C.W. Station adjust the position of the reaction coil until the valve oscillates.

Ques. 3. Nauen's wavelength is 5,500 metres. (Spark) Carnarvon's wavelength is about 14,000 metres.

Ques. 4.—Can a valve be used as an amplifier in conjunction with a type 31 Marconi Crystal Receiver?

Yes. It is better to amplify first with the valve and then to rectify the magnified received oscillations with the crystal.

E.T. (Seaham Harbour).—The wire generally used to wind potentiometers is about No. 36. It does not matter what size wire is used as long as a resistance of about 400 w. can be obtained on a former preferably about 6" long. If a thicker wire is used there will of course have to be more turns of wire and it is merely a matter of convenience as to the length of the potentiometer.

We presume E.T. wishes to use the potentiometer in conjunction with a crystal rectifier. If this is so, we would refer him to the September issue of the WIRELESS WORLD, page 353, where he will find a diagram of connections.

The lower diagram on page 353 shows the connections of a double slider inductance. Incidentally, the numbers of these two diagrams should be transposed.

"CONSTANT READER" (Co. Armagh).—(1) We are not aware of any book where collected information on the design of such apparatus is available. The most useful would probably be "Experimental Wireless Stations" by P. Edelman, or "Amateur Wireless Telegraph Designs," by Alfrec, although these do not contain by any means all the information you desire.

The bulk of such design information is generally to be found scattered through the pages of various periodicals—such as the *Proceedings of the Institute of Radio Engineers* New York; the *Electrician*; the *Electrical World*; the *Model Engineer*, and similar publications.

C.W.H. (Chester).—To give any sort of estimate of the approximate wavelength of your aerial would be a very difficult matter, owing to the complicated way you propose setting it out. Why not use one of the standard aerial systems either an inverted "L," a "T," a plain umbrella, or simply a straight wire as high as possible at one end and the other end being fixed near the ground.

We do not know if you think your aerial system has any special advantages except on the score of small height but we think the radiation from it would be extremely poor and we do not think the Post Office will let you transmit with "plain aerial."

There is no fee for matters dealt with in this section.

G.P.K. (Leeds).—1. We regret that we do not know of any book dealing with the design and construction of telephone transformers. (2).—A high tension battery made up of test tubes with a strip of copper and a strip of zinc in each test tube would be quite satisfactory for demonstration purposes in a laboratory as it can be taken down and cleaned immediately after use. If kept assembled means would have to be adopted to cover the tubes in, otherwise the electrolyte would soon evaporate. Also it would be advantageous to place strips of glass between the copper and zinc strips in order to prevent a short circuit in the cell. (3). With reference to the "earthing" of your apparatus we must remind you that we do *not* advocate the use of water pipes for this purpose. It is a very bad practice, to say the least. We do not think you will have much difficulcy with your "earth" if you use the wire fencing. Can you spread this on the ground under your aerial? The netting will then act as a counter-balancing capacity. This will not alter your tuning.

"NEWCASTLE" (Newcastle).—(1) The current passing through a selenium cell will depend on the resistance of the cell at the time of exposure to light, and will of course vary according to the brilliancy of the light. To obtain this current a local battery of not more than about 2 volts is used. To use a greater voltage would render the cell liable to damage. (2) The resistance of a selenium cell may be anything beween 100 and 1,000,000 w. so that the current due to a 2V. cell would be very small. Taking, as an example, the resistance of a cell in the dark, as 10,000 w. we have a current of 0·0002 amps. On exposure to light the resistance falls to 2,000 w. we then have a current of 0·001 amps. It will be seen, therefore, that the relay will have to be very sensitive to work on this current.

*(We regret we are compelled to hold over a number of replies.)*

# Company Notes

## MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED

## EXTRAORDINARY GENERAL MEETING

CONSIDERABLE PROGRESS IN WIRELESS TELEPHONY.

An EXTRAORDINARY GENERAL MEETING of Marconi's Wireless Telegraph Company (Limited) was held on Thursday, November 13th, at the Connaught Rooms, Great Queen-street, Kingsway, W.C., to consider a resolution authorizing the increase of the capital to £3,000,000. Mr. Godfrey C. Isaacs (Deputy Chairman and Managing Director) presided, and there was a large attendance of shareholders.

The Secretary (Mr. H. W. Corby, F.C.I.S.) read the notice convening the meeting.

The Chairman said:—Ladies and gentlemen, we have convened this meeting, as our circular has informed you, for the purpose of considering a resolution which is set out upon the notice convening the meeting, authorizing the increase of the capital of the company to £3,000,000 sterling by the creation of 1,500,000 additional Ordinary shares. When I last had the pleasure of addressing you, on August 7th, I then told you that I fully contemplated the necessity of my calling you together again some time in the autumn to consider an increase of capital. On that occasion I gave you a great deal of information respecting the developments of the company's business, which alone might have gone a long way towards justifying the resolution which we proposed to submit to you. Much, however, has occurred since that date, and arrangements of great magnitude and importance have been made for which considerable additional capital will be required. Our commitments on business and agreements already entered into in the East are very considerable, these alone requiring in the neighbourhood of one million sterling; and the arrangements entered into in respect of developments in South America will call for another million sterling. These are only two instances, but there are many more which entail the provision of smaller sums which in the aggregate represent a much bigger total. But apart from engagements to which we are already committed we have considerable other business under negotiation, and I think we should fail in our duty to you if our business were in any way prejudiced in consequence of our not having foreseen in good time the capital expenditure for which the probabilities of the future would call.

LESSONS OF THE WAR: FOREIGN GOVERNMENTS AND WIRELESS STATIONS.

There is no doubt that the war has brought home to every Government and to the peoples of every country the great necessity of wireless telegraph services for all purposes. Wireless telegraphy before the war was regarded, I think, by most as something which had a utility and was promising, and it was turned to account in a comparatively small degree in many countries largely as a result of the individual efforts of private enterprise. The war, however, clearly demonstrated to everybody that wireless telegraphy was no longer a toy, but had become a really reliable means of telegraphic communication. Consequently so soon as the Armistice was declared and the possibility of supply of material and construction of stations came into reasonable prospect of execution, nearly every Government turned its mind seriously to the problem of how best this new art could serve them. Germany, it will be remembered, had to rely entirely upon wireless telegraphy for external communication during the war, and the absence of all cables did not prevent their conducting very efficient telegraph services with countries as distant as the United States of America, and during the early part of hostilities with colonies at far greater distances.

France has lost no time in making provision for a chain of stations which will enable her to have thorough communication with all her colonies, no matter how far distant, and with all other parts of the world. A number of stations are being erected by her both in Europe and abroad for these purposes. The French company, in which we are substantially interested, is engaged in constructing these stations, and by reason of our close association they are able to give the benefit, not only of their own latest inventions and patents, but also of all those belonging to this company. Italy, Spain, Portugal, Belgium, Holland, Denmark, Sweden, and the new Balkan Republics are all considering or negotiating for the erection of long-distance independent wireless communication, and stations of the latest type will be erected in each of these countries.

In North America a number of high-power stations have been erected and a large number of additional stations are about to be built by the new American Radio Corporation,

about which I will say a word or two later. In South America we are building stations and there is considerable further work in prospect. The East I have already mentioned, but in addition to the commitments to which I have referred, negotiations have recently been opened for additional work of considerable importance. The time is perhaps not far distant when much of our attention must be turned to Russia.

### Commerce and Telegraphic Delays.

So far as this country is concerned, and its Dominions and Dependencies across the seas, as far as I know, beyond the announcement which has already been made by His Majesty's Postmaster-General as to the stations in England and Egypt, no decision has been taken. I had hoped when I addressed you last that ere this there might have been a defined policy and that the large sum of money which had been paid to us in damages and which I proposed not to touch would have been turned to good account for the nation. (Hear, hear.) This money could have been so usefully expended in helping towards the provision of better telegraphic communication with the Dominions and Possessions beyond the seas. Every one of us has been urged to do, and is doing, I hope, his utmost to develop the trade of the country, and there is little doubt, in my opinion, that only substantial increase in our exports will have any important bearing upon the amelioration of exchanges and reduction in the cost of living. But we are at the present moment and in the future shall be yet more dependent upon quick communication to hold our own in the world's commercial competition. But what is the position today? We all find ourselves hampered in all our business negotiations through the terrible delays in communicating abroad. To obtain a telegraphic reply from the East, one must wait two or three weeks. And even with the Continent, I am still being informed by my correspondents that it is almost useless to send telegrams, for invariably they arrive after the confirmatory letter. It is true a six-hour wireless service is being conducted by the Post Office with Holland and Denmark, but either the traffic is such that the time allotted for the service is insufficient, or the stations which are being used for the purpose are of an old type and built for other purposes, for there has been no noticeable improvement in the expedition of the telegraph services.

### Wireless Telephony.

As regards the Imperial Chain of Stations something, I believe, is being done in continuing the construction of the English and Egyptian stations, but I cannot believe that the installation of an obsolete system will be persisted in. (Hear, hear.) I feel confident that we shall not much longer lag behind. We must have an improved telephone service, as we must have the best possible wireless service. I feel sure that this country will soon wake up to the necessities of the times and eventually will demand, and the Government will recognize that it requires, the latest and best possible wireless chain of stations. (Hear, hear.) When that day comes, and it may be very soon, we propose to be ready.

I have so far spoken to you of wireless telegraphy, but there is another field of development which will call for very considerable resources, and that is wireless telephony. Considerable progress has been made and is being made daily in this new art, and a great future lies before it. It is already assuming a practical commercial shape and gives promise of an immediate extension to our business throughout the world.

### The Company's Financial Resources.

I have probably said sufficient to justify the resolution which we propose to put to you. That we are in a very sound financial position you know from our last balance-sheet. Our reserve account then stood at £1,100,000; we have since received £590,000, the amount of the award, and we have sold the whole of our shareholding in the American Marconi Company, which will add a further substantial sum to our resources. But after very full and careful consideration your board is of opinion that considerable additional capital will be required in order that your company shall continue its progress and have the means of turning to full advantage the opportunities of the commercial developments of its business which peace will bring to us after five years of work devoted to purposes of war.

### Sale of the American Marconi Shares.

I have mentioned the sale of our American shares, but I think it right to tell shareholders that the arrangements we have made with the General Electric Company of New York and the American Radio Corporation are of such importance that we feel satisfied that besides obtaining a reasonable price for our interest in the American company, we have secured as further consideration advantages of far-reaching importance which will cement and strengthen our world-wide organization, the fruits of which will ripen, we hope, in the near future.

Whilst upon this subject I would like to say for shareholders' information that the circular which was issued by the American Marconi Company, full and explicit as it was, did not, in my opinion, make clear to our many shareholders, who are also shareholders in the American company, what they are receiving in exchange for their shares. I had understood that shareholders would receive one Preference and one Ordinary share for every share held, and that these shares will be marketable and very soon command a good premium, but besides this there were substantial assets remaining to the American company which comprised very considerable amounts payable by the American Government and large sums payable by others in respect of the use on a very large scale of the American company's patents for many

years. These amounts have increased as years have gone by, partly because decisions of the Courts were required—(these have now been obtained)—and in part because accounts could not be adjusted during the war. These sums have therefore accumulated and must represent a very considerable total. I am glad to say that my views have been confirmed within the last 48 hours. I have received a letter informing me that it is agreed that this matter was not made sufficiently clear by the circular. It is proposed that a scrip certificate shall be issued to every shareholder in the American Marconi Company after, or at the time of, his exchanging his American shares for the Radio Corporation shares, which scrip certificate will entitle him, first, to the dividend which is to be declared shortly, and, secondly, to his quota of the moneys which have to be received from time to time and as and when they are received. (Hear, hear.)

A Reply to Criticism.

Before formally putting to you the resolution there is one word I would like to say in reply to some criticisms which have been addressed to us from our friends in Ireland, arising, I think, from some misunderstanding. It is thought that there is an inconsistency in the wording of that resolution and the statement in our circular that an issue will be made as soon as possible after the confirmatory meeting if the resolution be approved, "on favourable terms to shareholders," whereas the resolution provides that the increase of capital shall be issued to "such persons, firms, or corporations as the directors think fit." This seems to have been understood to mean that the shareholders would not have the opportunity of subscribing for the shares. This is not either the intention or the meaning of the resolution, which is framed in the usual form and, I believe, is the exact wording of other resolutions which we have submitted to you on previous occasions. Shareholders may rest quite confident that their interests alone will be studied by the directors, and the shares will be offered to them on the most favourable terms consistent with the interests and requirements of the company. (Hear, hear.) I now beg to move "that the capital of the company be increased by the creation of £1,500,000 new Ordinary shares of £1 each, to be issued to such persons, firms, or corporations, at such times and at such price or prices, and upon such terms and conditions as the directors think fit, such shares to rank for dividends declared in respect of the period commencing the 1st day of January, 1920, but in all other respects to rank *pari passu* with the existing £1,250,000 Ordinary shares of £1 each." (Cheers.)

Mr. Sidney St. J. Steadman seconded the resolution.

Shareholders' Questions.

Captain Bernard Daly (Dublin) said that he had been asked by a number of shareholders to inquire what their position would be in any issue of the new capital. There was a strong feeling that the present Ordinary shareholders should be entitled to an allotment in proportion to their holdings in priority to any corporation or outsider. (Hear, hear.)

Mr. George L. Moore observed that, as the previous speaker had referred to the Ordinary shareholders, he would like the chairman to define the position of the Preference shareholders, of whom he was one. He took it, subject to the chairman's correction, that the Preference shareholders, after payment of the Ordinary dividend, were entitled to rank in all respects with the Ordinary shareholders. Continuing, Mr. Moore said that they had all listened with very great pleasure to the speech from the chair, though not with any greater pleasure perhaps than they expected, as Mr. Godfrey Isaacs always gave them a lucid and interesting address. His only wonder was whether the proposed increase of the capital to £3,000,000 was sufficient in view of the handsome terms in which the chairman had spoken of the company's prospects in all parts of the world. But no doubt the directors had well considered the matter, and had decided, what with reserves and award money, that the increase now recommended was sufficient. He had nothing more to say except to compliment the chairman and directors on the position of affairs, and he was sure they considered themselves fortunate in having Mr. Godfrey Isaacs occupying the position he did. (Hear, hear.) They all knew that that gentleman came of a very clever and wide-awake family. (Hear, hear.) The Marconi Wireless Company was a live concern and would keep going ahead in spite of all obstacles—Government or otherwise. (Cheers.)

Mr. S. H. Roche said that he had come to the meeting on account of statements contained in the circular sent out to the shareholders, and to ask how the holders of Ordinary shares were going to be treated when the new capital was issued.

Chairman's Statement as to New Issues.

The Chairman—Ladies and gentlemen, the shareholder from Ireland has put to me a question which a shareholder wrote to me about and also wrote several letters to Irish and English newspapers. I do not quite know what the directors have done to deserve the criticism which he suggested in his letter. There is nothing whatsoever, so far as I can gauge, that justifies any suggestion that the directors contemplate doing otherwise than they have always done in the whole history of the company—that is, that anyone who is not a shareholder should get any advantage that a shareholder should not have first of all. (Hear, hear.) That has not been our practice; we have never done anything of the kind, and in future we do not intend to do it. I thought I had made that perfectly clear in my reply to the Irish shareholders. I thought

I had made it perfectly plain that nothing of the sort was intended by the circular nor would be in any way adopted by the board. (Hear, hear.) I think the statement itself was perfectly clear. The words of the resolution, that the directors shall have power to issue shares "to such persons, firms, or corporations" is quite the ordinary form, but it seems to have been responsible for giving rise to this misapprehension. But I think the Irish shareholders forget, and perhaps others forget, that besides individual shareholders in the company, there are firms and corporations who may be shareholders, and in taking power in the resolution to allot shares you will agree that we must take power to allot shares to such firms and corporations, as well as to personal shareholders. (Hear, hear.) Perhaps that will be deemed a full and sufficient reply to the question which has been put to me about the Ordinary shares. With regard to the Preference shares, Mr. Moore has correctly understood the position except in so far as the first preferential right of dividend is concerned. It is after the ordinary shareholders have received 10 per cent. that the Preference shareholders rank in all respects equally with the Ordinary shareholders.

### Future Proposal for Conversion of the Preference Shares.

Now, ladies and gentlemen, it had been my intention to suggest to you at this meeting that we should get rid of our Preference shares—that we should find means of converting them into Ordinary shares. To-day, with the capital standing at what it does, and with the assets being what they are, it seems to me there is no reason to have 250,000 Preference shares, especially if we are going to have 2,750,000 Ordinary shares. I should like to see those Preference shares converted into Ordinary shares, and I should have proposed it to you to-day, but for the fact that the matter presents some difficulty and requires some time before it can be put before you—it also, I think, requires the sanction of the Court—and there was not time without delaying the meeting, which I did not want to do; but at a future time I propose submitting some such proposal.

A Shareholder said he should like some information with regard to the large sum owing by the Government to the company for work during the war. It seemed to be rather "hanging fire" for no particularly sound reason. He would like to know if there was any prospect of an early payment, and what addition it would make to their funds.

### The Company's Claims Against Government Departments.

The Chairman: With regard to the sums due to the company from the Admiralty, the War Office, and the Air Ministry, there is unfortunately a reason for the delay in their payment. One important matter which will govern very largely the amounts which will be due to us must be settled by arbitration—it has been agreed throughout that it should be settled by arbitration—and the only reason why that has not yet been dealt with is that Lord Moulton, who it was agreed long ago should act as arbitrator, has had his time so much taken up by other public matters of importance. However, I believe Lord Moulton is now fixing a date, which will not be very far distant when this arbitration will be heard, and thereafter I hope we shall be able to make progress with all these matters with each of the respective Government Departments. As to the payment of services rendered during the war, I am sorry to say that we have not progressed. I think I told you at the last meeting that unfortunately we had been unable to get any reasonable offer in settlement, and had had finally to have recourse to another Petition of Right. Well, we have been awaiting a communication from the Post Office in respect of that matter, and all I can say is that I do very sincerely hope that that communication is going to be of such a nature that, with the great desire we have to avoid anything in the nature of unpleasantness with any Government Department, we may be justified in agreeing to it. You may rest assured, so far as the board is concerned, and I think it will be your wish also, that even at a sacrifice we would settle the matter sooner than be forced into a Court of law again. That is the view I hold, and I believe it is the view of my colleagues and I hope yours too. (Hear, hear.) I trust we shall not be called upon to make too big a sacrifice, but the matter must be settled; it has to be settled in our interests and in the country's interests.

Mr. A. C. Clarke asked if there were any reason why the shareholders should not on that occasion be informed of the terms of the proposed new issue.

The Chairman: I think for the best of all reasons—we have not yet made up our minds.

Mrs. Barbara Baynton said that several widowed ladies who were shareholders would like to thank Mr. Godfrey Isaacs for the care and attention with which he had handled the business of this company. Through both "good and evil report" he had stuck to it, and she wished to express her admiration and deep gratitude on behalf of herself and others.

Mr. Charles Terry said that after the tremendous services which the company had rendered during the war he thought it was a disgrace that the Government had not settled their claim. (Hear, hear.)

The resolution was then put to the meeting and carried unanimously.

The Chairman: We have received proxies from 3,091 shareholders endorsing and approving this resolution. Ladies and gentlemen, I thank you, and the lady shareholder who was good enough to say a few words of appreciation of my work. (Hear, hear.) We like to hear these things sometimes, and more particularly when they come from the fair sex. (Hear, hear, and laughter.) That concludes our meeting.

# AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED.

## DIRECTORS' REPORT.

*Presented to the Shareholders at the Twelfth Half-Yearly Ordinary General Meeting, held at the Registered Office of the Company, "Wireless House," 97, Clarence Street, Sydney, on Friday, August 29th, 1919, at 12.30 p.m.*

Your Directors have pleasure in submitting herewith the Balance Sheet and Profit and Loss Account for the six months ended June 30th, 1919.

The net profits of the business for the half-year amount to £4,207 7s. 3d., which, together with £743 2s. 5d. brought forward from last account, leaves a balance of £4,950 9s. 8d. to the credit of the Profit and Loss Account.

From the above amount, which is available for distribution, your Directors propose to pay a dividend for the half-year at the rate of 5 per cent. per annum. This will absorb £3,500, and will leave a balance of £1,450 9s. 8d. to be carried forward to next account.

The several departments of your business are steadily expanding, although in common with all other businesses the problems of transition from a war period to peace are being experienced.

It is again possible to send wireless messages to ships at sea from any ordinary telegraph office on shore, but the Australasian passenger services are not yet fully restored.

Your Directors have reason to suppose that future legislation following the lines of that recently passed in the United Kingdom will make it necessary to instal wireless apparatus in all sea-going vessels of 1,600 tons and upwards.

It is hoped that the Company will shortly be able to proceed with the development in Australia and New Zealand of the Relay Automatic Telephone System which has recently been installed throughout Australia House and other important buildings in the United Kingdom, and for which the Company holds a sole agency.

The question of direct wireless services between Australia and countries overseas is being considered by your Directors in conjunction with the Marconi Company. From expert advice received and by actual tests carried out by the Managing Director, your Directors are satisfied that such services can be successfully established if they are conducted on proper lines and so long as no attempt is made to combine a commercial service with a naval service. The requirements and the organisation of the two are entirely different, and any attempt to combine them would lead to inefficiency in one or both services.

Several additional wireless patents have been added to those covered by the Company's sole and exclusive licences.

In view of the declared policy of the Federal Government to protect Australian industries, your Directors expect that it will be possible to continue and increase the manufacture of many classes of electrical apparatus in your factory, which is now one of the best equipped private electrical works in the Commonwealth.

In view of the expansion of the Company's work, your Directors have under consideration an application to the Commonwealth Treasurer for permission to increase the capital of the Company. Any proposal of this nature, when matured, will of course be submitted for the approval of the Shareholders in the prescribed manner.

Your Directors propose submitting a Special Resolution immediately after the Ordinary Meeting, substituting One Annual General Meeting for the Half-Yearly Meetings, but the authority given in Art. 129, for the payment of half-yearly dividends, will remain.

Dividend cheques will be available on the 29th instant, immediately the dividend is passed.

THOMAS HUGHES, Chairman.

ERNEST T. FISK, Managing Director.

Sydney, August 19th, 1919.

### CHAIRMAN'S ADDRESS.

In moving the adoption of the Report and Balance Sheet, the Chairman, the Hon. Sir Thomas Hughes, M.L.C., said: "I would invite your attention to the fact that the profit for the period is greater by £189 than in the past half-year and by £556 for the corresponding period of last year. The increased amounts shown for sundry debtors and creditors and Bank overdraft arise out of the increasing business."

"An additional number of vessels are being supplied with the Company's service and apparatus and it will no doubt interest you to learn that the Company is now conducting wireless services on board a considerable number of British vessels that are trading in all parts of the world and by arrangement with associated companies throughout the British

Empire and in Allied countries, we are able to provide for the shipowners a uniform organisation and apparatus of a standard pattern with that used in more than 3,000 British merchant vessels at the present day." . . . . .
"Ships carrying our apparatus and our operators can go into any of the principal ports of the world and find a depot and an inspector who is able to direct and assist the operator in all branches of his work, who understands the apparatus and is able to effect repairs or supply standard spare parts upon the shortest notice."

The Chairman went on to say that a merchant vessel at sea is through the organisations of the Company linked by its wireless with all the inland telegraph and cable lines of the world. He mentioned that the Company is expending considerable sums in the development of wireless telephony which will prove to be very valuable and particularly in Australia where aviation and wireless communication will be amongst the greatest factors in developing the vast inland territory and destroying its isolation. He said further that as a result of the successful experiments whereby wireless messages were received in Sydney direct from the Marconi Company's Trans-Atlantic station in Wales an offer had been made to provide a permanent direct commercial service between England and Australia, and added that all classes of messages would at first be forwarded by the wireless service at one-third less than the existing cable rates, and that as the number of daily messages increased beyond certain defined stages this rate would be proportionately reduced.

The Chairman then dealt with the question of obtaining a licence to work and operate wireless stations, and pointed out that negotiations for this licence were being followed up, and expressed the hope of the Directors that the Government would decide the matter without undue delay. He further urged the necessity for keeping the country's commercial wireless service quite distinct from any naval service, giving his opinion that any attempt to combine the two would destroy all possibility of efficiency on either side.

The Chairman then went on to say "we believe it has even been suggested by some of the opponents of this scheme that no company should be granted a monopoly of overseas communication, and it is an astonishing fact that such suggestions are seriously raised because there is nothing under the Wireless Telegraph Act to prevent similar licences being given other companies who can produce a workable system and who are sufficiently enterprising and courageous to undertake so great a scheme." . . . . . .

"All we have asked for is a licence to erect stations and work them under the provisions of the Act which gives the Government full control over such stations and enables it to close them or take them over not only upon the actual outbreak of war, but at any time of threatened public danger if it were considered necessary to do so."

The Chairman concluded his remarks with observations upon the manufacturing extensions of the Company's business, pointing out that it had one of the best equipped electrical workshops in the State, and that the general electrical section of the manufacturing business is now conducted by the Australectric Company which the Directors have registered in the Company's name for that purpose. The Australectric Company also looks after the Agency for the Relay Automatic Telephone System for which the Company has both the selling and manufacturing rights in Australia and New Zealand.

"At the present time the Company gives employment to a staff of 250 and is paying no less than £40,000 annually in salaries and wages."

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## EXTRAORDINARY GENERAL MEETING.

At an Extraordinary General Meeting held immediately on the close of the Ordinary General Meeting the subjoined resolutions were unanimously carried:—

RESOLUTIONS.

1. That the Capital of the Company be increased to £200,000 by the creation of 60,000 new shares of £1 each.

2. That the Articles of Association of the Company be altered as follows:—

   (a) By omitting the word "twice" in the first line of Article 55 and substituting in lieu thereof the word "once" and by omitting the words "months of February and August" in the fifth line of the same Article and substituting in lieu thereof the words, "month of August."

   (b) By omitting the word "first" in the third line of Article 90.

   (c) By omitting the word "each" in the second line of Article 142 and substituting in lieu thereof the word "the."

   (d) By omitting the word "first" in the sixth line of Article 146.

The effect of the second resolution is to substitute one Annual General Meeting for two Half-Yearly Meetings.

By Order of the Board,

J. F. WILSON, Secretary.

August 29th, 1919.

# Amalgamated Wireless (Australasia) Limited.

## BALANCE SHEET as at June 30th, 1919.

| LIABILITIES. | £ s. d. | £ s. d. |
|---|---|---|
| Capital .. .. | | 140,000 0 0 |
| Bank Overdraft . | 13,507 17 10 | |
| Sundry Creditors | 20,150 10 3 | |
| | | 33,658 8 1 |
| Reserve for— Patents, Depreciation, and Insurance .. .. | | 31,727 0 2 |
| Profit and Loss Account— Balance at Dec. 31st, 1918 .. | 4,243 2 5 | |
| Less Dividend for the Half-Year at 5% p.a. | 3,500 0 0 | |
| | 743 2 5 | |
| Plus Profit for period .. .. | 4,207 7 3 | |
| | | 4,950 9 8 |
| | | £210,335 17 11 |

| ASSETS. | £ s. d. |
|---|---|
| Patent Rights .. .. .. .. | 90,000 0 0 |
| Plant, Apparatus, Stock, Stores, Furniture and Fittings .. .. | 86,553 8 6 |
| Sundry Debtors .. .. .. .. | 23,074 7 4 |
| War Loan Bonds and Inscribed Stock .. .. .. .. .. .. | 10,387 10 0 |
| Branch Bank Balances and Petty Cash .. .. .. .. | 320 12 1 |
| | £210,335 17 11 |

## PROFIT AND LOSS ACCOUNT

For the Six Months ended June 30th, 1919.

| 1919. June 30. | £ s. d. | 1919. June 30. | £ s. d. |
|---|---|---|---|
| To Operating Expenses, Directors' and Auditor's Fees and General Administration Expenses .. .. .. .. | 15,337 4 6 | By Gross Profit from Trading, and Revenue from Wireless Stations .. .. .. .. | 22,296 16 11 |
| ,, Depreciation .. .. .. | 2,752 5 2 | | |
| ,, Net Profit .. .. .. .. | 4,207 7 3 | | |
| | £22,296 16 11 | | £22,296 16 11 |

J. F. WILSON, Secretary.
F. W. LARKINS, A.I.I.A., A.C.I.S., Accountant.
THOMAS HUGHES, Chairman of Directors.
ERNEST T. FISK, Managing Director.

I have examined the Books and Vouchers of the Company, and certify that the above Balance Sheet and Profit and Loss Account are a correct statement of the Company's affairs as shown by the books of the Company.

ALEX. JOBSON, F.C.P.A., Auditor

Sydney, August 19th, 1919.