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THE CONSTRUCTION OF WIRELESS VALVES*

By F. S. ROBERTSON, M.I.E.E.

Introduction.

IN the study of valve problems we are forced back to more fundamental conceptions than we are ordinarily accustomed to in electrical engineering work. We have to get to know something about the different kinds of electrical atoms, which fortunately for us are very much more limited in number than the chemical atoms.

There are apparently only two, namely, the electron which has been well recognised for some years as nature's unit of negative electricity, and its positive counterpart, the nucleus of the hydrogen atom, the knowledge of which we owe largely to the more recent work of Sir Ernest Rutherford and Dr. Aston. The electric charge on the electron

$$= e = 1{\cdot}591 \times 10^{-20} \text{ E.M. units,}$$

the mass of the electron m

$$= 0{\cdot}900 \times 10^{-27} \text{ grams,}$$

the mass of the hydrogen atom

$$= 1{\cdot}66 \times 10^{-24} \text{ grams,}$$

$\therefore$ the electron has a mass of $\frac{1}{1850}$th of that of the hydrogen atom.

All the chemical atoms are supposed to be made up of these two ingredients, but as to exactly how they enter into the structure of the atom is a matter which is at present occupying the attention of physicists, and is likely to do so for some time to come.

Prof. Bragg said recently at a meeting of the Institution of Electrical Engineers, that it was only when it became possible to get the electrons as "disembodied spirits," and moving with enormous velocities, that their qualities could be studied.

Unless an electron has a tremendous velocity it sticks to the next atom it meets; with a velocity of one hundred million (10^8) cms. per second, it can only move a fraction of a millimetre through air at ordinary pressure before it loses its velocity and therefore its power of going through the atoms.

Electronic Emission.

There are two factors, then, which we have to consider at the outset in the construction of a wireless valve:—

(1) The liberation of the electron;
(2) The provision of a suitable space in which there are not too many molecules to disturb the electron.

With regard to the liberation of electrons two methods would seem to be available for valve work:—

(*a*) Thermionic emission, and
(*b*) Photo-electric emission.

THERMIONIC EMISSION, which owes its name to Prof. Richardson, has been shown by him to be due to electrons inside the heated body becoming endowed with so much energy that they are able to break through the surface and get free.

In a metal some of the electrons are very loosely bound, and the effect of thermal agitation is to shake certain electrons free from their ties to the atoms when they become free to move about in the same way as the molecules of a gas, that is, their velocities

* Abstract of Lecture delivered to the King's College Wireless Society on Monday, May 30, 1921.

are distributed amongst them according to the Maxwell-Boltzmann law. According to this view, a few at any particular moment will have exceptionally large velocities, while a few will have exceptionally small velocities, the others having velocities ranging between these extreme values. Now the energy of an electron is proportional to the square of its velocity ($\frac{1}{2} mv^2$), hence different electrons have different amounts of energy. Although the electrons may be moving about freely in the interior of the metal they cannot escape from the surface unless they have sufficient energy to overcome a force of attraction which all the time tends to pull them into the metal.

Therefore very few indeed escape at ordinary temperatures, but as the temperature is raised, the number which have the requisite energy increases very rapidly, and is found to agree very closely indeed with Prof. Richardson's formula.

$$n = AT^{\frac{1}{2}}\epsilon^{-b/T}$$

The constant b is a measure of the work which the electron must do in order to escape, and is known as the emission constant. A small change in its value causes a great change in the number of electrons emitted per second, and consequently in the current which can be obtained through the valve.

This current i, in amperes per square cm., is given by the expression

$$i = 23{\cdot}6 \times 10^6 \sqrt{T}\ \epsilon^{-52500/T}$$

where T = the absolute temperature and $\epsilon = 2{\cdot}718$.

The most convenient way to arrange for the emission of electrons in valves seems to be to mount a tungsten filament in a glass bulb, which can afterwards be carefully exhausted and then to raise the filament to a very high temperature by passing a current through it, but of course it could be made to emit electrons equally well if its temperature were raised by any other means, provided always that some contact can be made with it through which more electrons can be supplied to the filament. If this is not done it would soon become highly charged positively, and no further current could be drawn from it. Tungsten has been very much used because it can be heated to a very high temperature without risk of fusion, but it is not by any means the only material used.

Wehnelt Cathodes are very much used in America. They consist of platinum wires or strips, coated with an oxide such as lime. Some are prepared by coating the strip with alternate layers of Strontium and Barium Oxides. Personally, although I have tried a good many times to make filaments of this kind, I have never been able to obtain one which remained constant very long, and I have some doubt whether it is possible to get all the gas out of the platinum itself. These coatings have the property of altering the emission constant in Richardson's formula so that large emissions can be obtained even when the filament is only just red hot.

More recently large emissions have been obtained at comparatively low temperatures from Tungsten filaments, which have had the electro-positive metal thorium incorporated in the process of manufacture, and brought to the surface by subsequent treatment. The emission from these filaments may be several thousand-fold that from pure tungsten at the same temperature.

PHOTO-ELECTRIC EMISSION.—When light waves above a certain frequency are allowed to fall upon certain substances, such as sodium, the electrons are given such a shaking up that some of them are set free from their atoms and can be drawn off from the material as an electric current. If the curve of such a current be plotted in terms of the applied potential, it will be seen that it comes down to the volt axis very steeply, which would seem to be a property which might well be cultivated for its rectifying action—Fig. 1.

Having now a means of producing our electrons we mount in the same vessel a collecting electrode, usually called the plate or anode, and a third or controlling electrode usually called the grid, which may consist of a piece of wire gauze or a spiral of fine wire surrounding but not in contact with the filament.

The Fleming valve was patented in 1904. It had only two electrodes but this was soon vastly improved by the introduction of the third electrode or grid by de Forest.

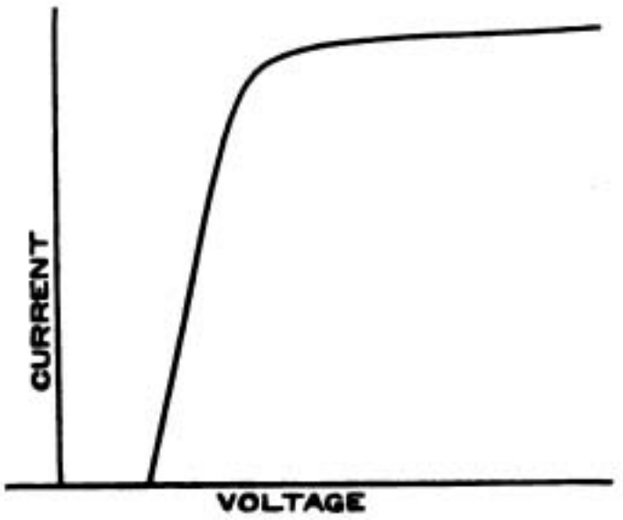


Fig. 1. *Photoelectric emission current.*

Characteristic Curves.

Curves showing the current through the valve in terms of the voltage applied between plate and filament in the case of the Fleming valve, and the currents to plate and grid in terms of the voltage between grid and filament for different steady voltages applied between the plate and filament are known as the **Characteristic Curves** of the valve, and it can be shown that the slopes of these curves and the conditions for obtaining them bespeak the goodness or otherwise of the valve for given purposes. For instance, in a receiving valve the slope of the anode current in terms of grid volts, should be as steep as possible, and the steepness should occur just where the grid current is beginning to bend up from zero.

Notice that you cannot, under any circumstances, get an appreciable current in the reverse direction through a valve if the vacuum is good enough, because you have present only electrons which are the negative charges. You may have to put on a negative potential to shut the current down, but you cannot reverse the current, however much you increase the negative potential.

If you have gas in the tubes the slope of these characteristic curves can be made much greater than if you have a so-called pure electronic discharge, because if the velocity of the electrons is increased above a certain value they can knock off one or more electrons from the gas molecules with which they come in contact. The potential required to do this is called the ionisation potential, and differs with different gases. Under these circumstances, for each electron which starts off from the filament, several arrive at the other end.

Steep curves obtained in this way are, however, a doubtful blessing, as the conditions are very apt to be unstable. Further, the relatively heavy gas molecules, having lost electrons become positively charged, and are attracted back to the hot filament which is the negative end of the system, and cause rapid disintegration of the filament, and so shorten its life.

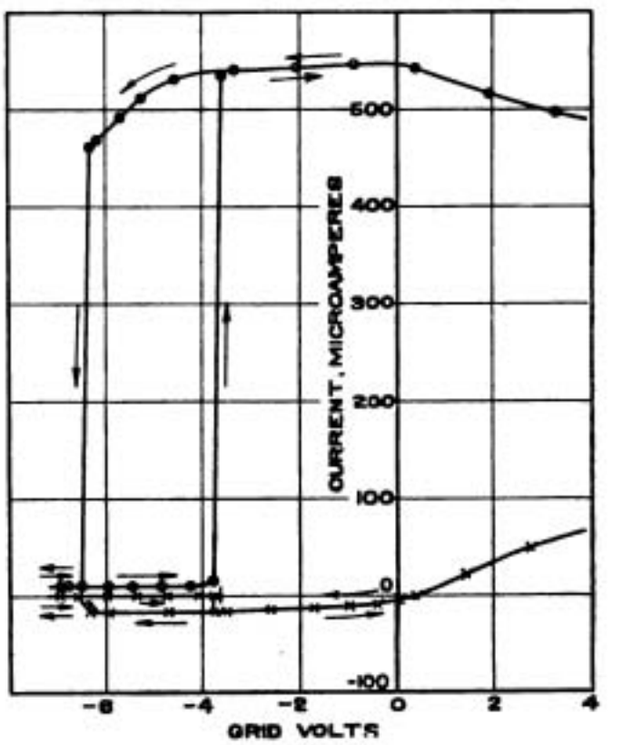


Fig 2.
Curves showing hysteresis effect in a soft valve.
Upper curve = plate current.
Lower curve = grid current.

Fig. 2 shows a sort of hysteresis effect which was produced in a tube of this kind by exaggerating the gas effect. The tube contained mercury vapour in the presence of liquid mercury at a temperature of 34·9°C. The sum of anode and grid currents is nearly constant for all positive grid voltages tested. This shows that the anode is receiving practically all the emitted electrons which are not abstracted by the grid. This corresponds to a condition of approximate saturation of the total electron current, and the ease with which this condition is attained is due to the effect of the presence of the relatively immobile positive mercury ions which counteract the negative "space charge" of the electrons.

The explanation of the sudden rise in the anode current shown in Fig. 2 is this: Starting with large negative grid potential and the anode current small, a reduction of the numerical value of the grid potential will increase the electron current through the grid to the anode. One effect of this will be to produce positive mercury ions in the space between grid and anode. Some of these ions are absorbed by the grid, some reach the cathode, and some are present in the space between the two molecules. So long as the electron current to the anode is very small in comparison with the total electron emission, the effect of the few positive ions in the space between the cathode and grid is insignificant. As soon, however, as the positive space-charge becomes comparable with the negative space-charge, a reduction in the negative space-charge results, which increases the flow of electrons through the grid, which, in turn, produces more positive ions, which further increases the effect without limit, until saturation sets in. The phenomenon is essentially unstable, and once such a condition has been set up a relatively larger negative grid potential will be necessary to destroy it than was required to establish it.

Production of the Vacuum.

Now, in order to get a pure electronic discharge we must so exhaust the vessel that there are comparatively speaking only a few molecules left, in which case the electrons produced by ionisation are only a small percentage of the total number. Such a tube is said to be a *hard tube* in contradistinction to a tube which contains gas and is called a *soft tube*.

The highest vacuum attainable at present is about 0·000000075 mm. of mercury, and even at this low pressure the number of molecules per cm. cube at 0°C. is still 2,670,000.000*.

To obtain a hard tube it is not sufficient to simply connect it up to the pumps, however good they may be, and pump it out, because you will find that the electrodes, the glass walls and even the filament itself will give off large quantities of gas as soon as you heat them or pass a discharge through the tube.

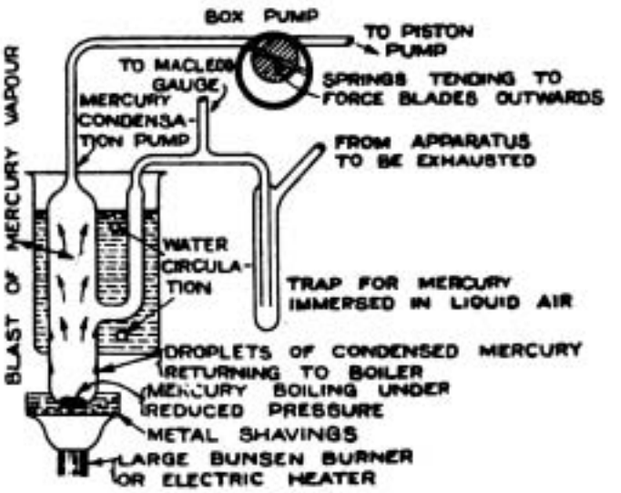


Fig. 3.

Arrangement of pumps for producing high vacua.

Fig. 3 shows the arrangement of pumps for obtaining very high vacua.

Next to the atmosphere we have a piston pump of peculiar construction, as shown more in detail in Fig. 4. A is the suction pipe, B the air port into the cylinder above the piston, C is the piston whose bucket leather is kept up to the cylinder wall by oil pressing in the annular space D. E is the piston valve and F an air pipe to relieve the piston on the first few strokes; G H and I collars and cover forming a good joint and delivery valve combined.

*General Electric Review, 23, p. 497, June 1920.

As the piston rises the port B is cut off, and the cylinder full of air carried up to the outlet valve G. No air can get past the piston as it is covered with oil. When the piston approaches the top of its stroke it lifts the valve G off its face, and gives a free outlet for the air. The oil on the piston then mingles with that about G, but the right quantity returns with the piston on the closing of G.

Special oil is used which is very non-volatile, non-solvent of air and fills all clearance space and seals the valves.

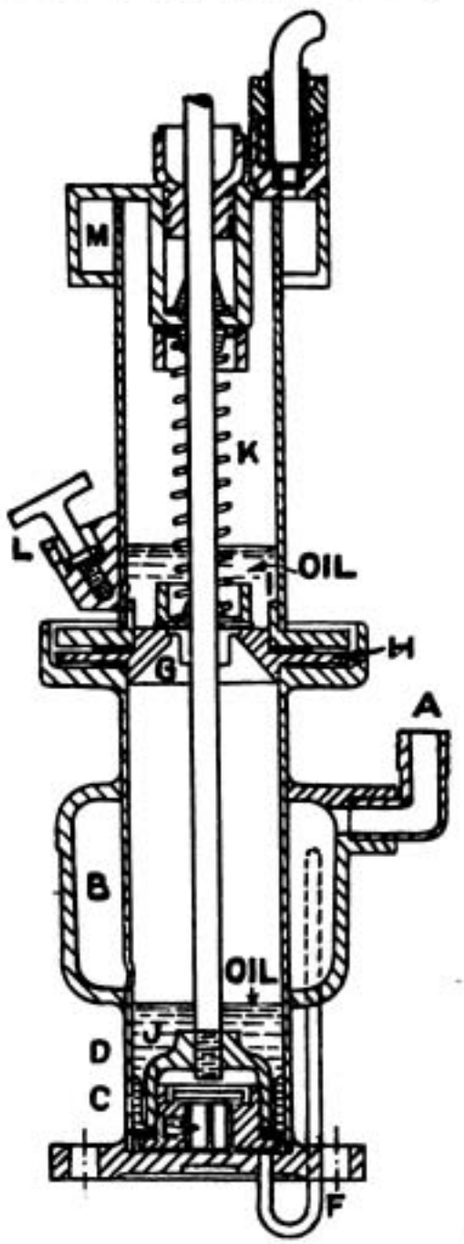


Fig. 4. Sectional diagram of piston oil pump.

It is claimed that with a single cylinder pump of this type a pressure of about $\frac{1}{4}$ mm. of mercury can readily be obtained.

This backs a rotary oil pump which runs at about 360 revolutions per minute, and is shown in Fig. 3 marked as a "box pump." It also is submerged in oil. This in turn backs a mercury vapour pump, which is scarcely recognisable as a pump at all.

The molecules of gas which diffuse into the blast of mercury vapour get so mixed up with it that they can never get back again, and so are carried away by the backing pumps. The mercury vapour itself is condensed by the water jacket, and trickles back again into the boiler. The action is thus continuous. A liquid air trap has to be used in connection with it in order to prevent mercury vapour from getting over into the tube, which is being exhausted.

In valve manufacturing works the tubes are exhausted in some such way as this, the backing for the rotary oil pump being the vacuum mains to which ordinary electric lamps are connected for exhaustion, giving pressures from 12 to 16 mm. of mercury, the glass vessel being at the same time warmed up externally by gas jets. When the vacuum is considered to be good enough a high potential is switched on between the filament and the plate making the plate positive, and the filament is heated up by passing a current through it. As soon as electrons are emitted they rush across under the action of the applied potential and bombard the plate with such violence that it soon becomes red hot, large quantities of gas are evolved, ionisation of this gas sets in followed by a blue glow. Unless the current is then switched off at once the filament would be ruined.

With the very rapid mercury vapour pumps only a few seconds are required to get rid of this gas, and the process can be repeated, until after a time it is found that the plate can be kept red hot by the bombardment without the formation of the glow, showing that most of the gas has been got rid of. The old Gaede pumps are not rapid enough for this process.

Even when tubes are exhausted in this way there are parts which do not get sufficiently heated such as leading-in wires and the glass vessel itself, so in order to get a first class vacuum for experimental work the tube itself is mounted up in a vacuum furnace heated electrically to a temperature of 750° to 800° Pt., which is measured, either by a platinum thermomenter or a thermo-junction. The tube itself is hermetically sealed on to the pumps, and is also in connection with a tube, containing charcoal made from cocoanut shells, which can be immersed in liquid air. In this way the whole tube even with the high vacuum inside it is kept red hot for 20 or 30 hours without collapsing. After this time the pumps are disconnected, and the charcoal tube, which has previously been heated, is immersed in liquid air, the valve being still kept hot in the furnace. In this way an exceedingly good and permanent vacuum can be obtained.

The Measurement of High Vacua.

The next point I should like to say something about is the measurement of these small pressures, for unless one knows how it is done it seems almost incredible that a pressure as low as 10^{-6} mm. of mercury can be measured.

The McLeod Gauge.

The McLeod gauge, depending upon an application of Boyle's Law, has been made to measure pressures very accurately down to 0·0001 mm. of mercury, Fig. 5. If v is the volume to which the gas is compressed in the upper tube, and V is the volume of the bulb, and v is made 1/1,000th of V, then when the gas at pressure P in the volume $V + v$ is compressed into volume V we have

$$\frac{v}{V - v} = \frac{P}{p} \quad \text{or} \quad p = P + 1001.$$

Hence if $p - P = 1$ mm.

then $P \times 1001 - P = 1$ mm.

or $P = \frac{1}{1000}$ mm. of mercury.

The Kundsen Gauge.

Another very sensitive gauge is that known as the "Kundsen Gauge," Fig. 6. A and B are two parallel strips placed at a distance apart, which is less than the mean free path of the molecules. Let A be at the same temperature as the gas while B is maintained at a higher temperature, T_1.

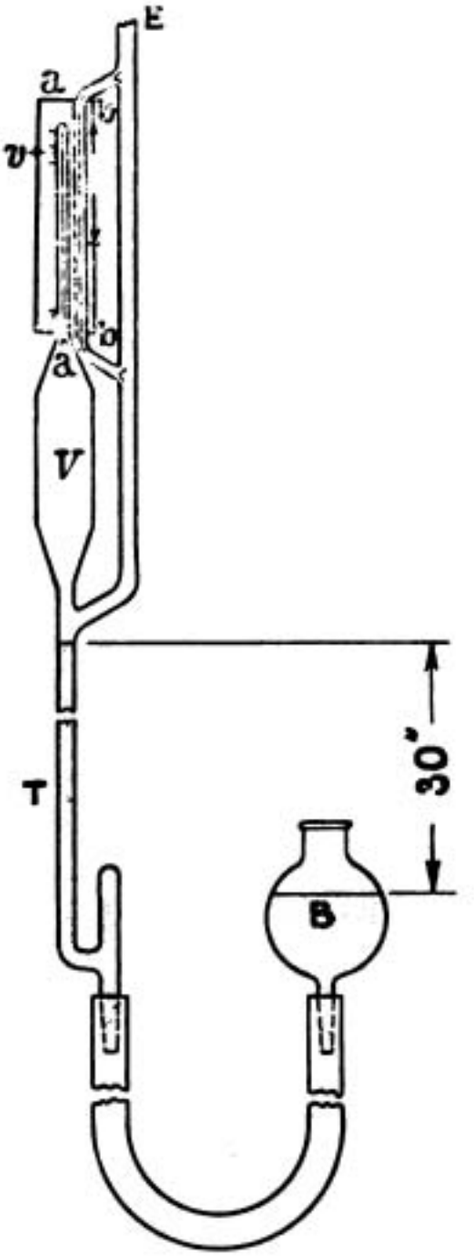


Fig. 5. Diagram of McLeod Gauge.

On the side away from B, A will be bombarded by molecules having a mean velocity G corresponding to the temperature T, as given by the equation

$$G = \sqrt{\frac{3RT}{M}}$$

These molecules will, of course, rebound from A with the same velocity. However, on the side towards B, A will be bombarded by molecules coming from B and having a higher velocity G_1, corresponding to the temperature T_1 Consequently, A will receive momentum at a greater rate on side towards B than on the opposite side, and will,

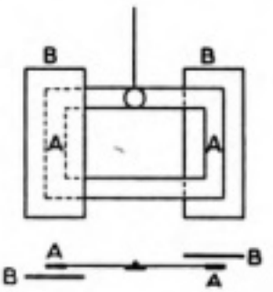


Fig. 6. Schematic diagram of Kundsen Gauge.

therefore, be repelled from B. From theoretical considerations Kundsen has shown that the force of repulsion K per square cm. of the two parallel surfaces, is given by—

$$K = \frac{P}{2}\sqrt{\frac{T_1}{T}} - 1$$

This force of repulsion is then balanced out by the torsion of the suspension fibre. The equation then takes the form

$$P = \frac{4\pi^2 ID}{rAt^2 d} \cdot \frac{T}{T_1 - T} \text{ dynes per sq. cm.}$$

where I = Moment of inertia of moving vane,
r = mean radius of moving vane,
$2A$ = area of the vane A opposite each strip B,
t = period of vibration of the vane,
D = deflection of spot of light on scale,
d = scale distance from mirror on A.

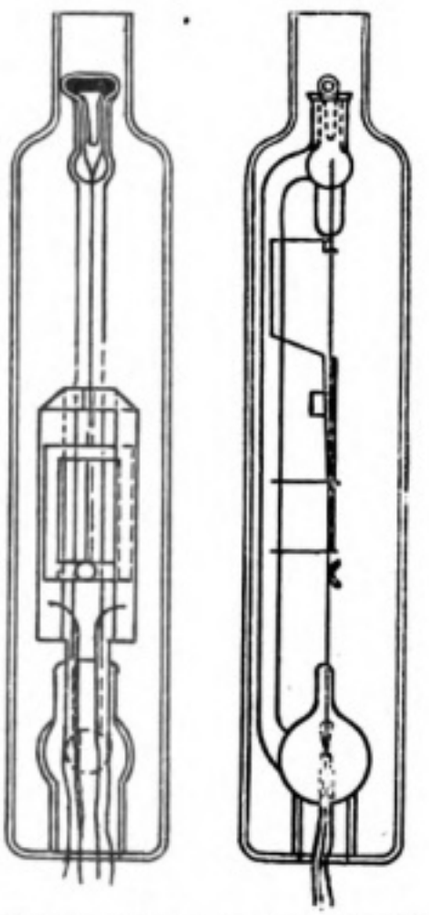
Since all these quantities can be measured directly, it follows that the device can be used as an absolute manometer, and its indications are independent of the gas to be measured. Using the above equation, we find that a deflection of 1 mm. at a metre distance with a temperature difference of 150°C indicates pressures of 1×10^{-8} to 5×10^{-8} mm. of mercury.

A modification of the simple Kundsen gauge is shown in Fig. 7.

The Thermionic or Ionisation Gauge.

This apparatus makes use of the variation of thermionic current flowing from a hot filament through a partially exhausted tube, with changes in the gas pressure.

An electron stream passing through a gas will ionise the latter when the velocity of the electrons exceeds a certain minimum value. In this process an electron is knocked out of the neutral atom by the incident electron, with the result that the residual portion of the atom is positively charged. The relation between the velocity u of the



No. 7. Shrader and Sherwood's modification of the Kundsen Gauge.

electrons and the voltage V required to produce this velocity is given by the equation: $\frac{1}{2} mu^2 = Ve$ where e = charge on electron

and m = mass of electron. Hence corresponding to the ionisation velocity there exists for every gas a minimum ionisation potential. These potentials range from one or two volts for the alkaline metals to 25 volts for helium.

The amount of ionisation produced by a given electron current in this manner increases with the gas pressure, and this fact is used for the measurement of the gas pressure in the ionisation gauge. The gauge itself consists of three electrodes arranged somewhat on the lines of an ordinary three-electrode valve, the glass containing bulb of which is provided with a outlet pipe for connection to the vessel the gas pressure in which is to be measured. These electrodes are used as cathode, anode and collector of positive ions respectively. As source of electrons a Wehnelt cathode or incandescent tungsten filament is used. The collector electrode, or grid, is placed between the anode and cathode and is connected through a galvanometer to the negative terminal of a battery whose positive terminal is connected to the main negative end of the filament, as indicated in Fig. 8. The anode potentials range from 100 to 250 volts, while the magnitude of the electron current varies between 0·2 and 2 milliamperes. With a gas pressure of 10^{-3} millimetres of mercury, the positive ionisation current was observed to be one-thousandth of that of the electron current.

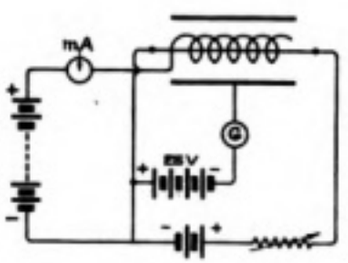


Fig. 8.

Schematic arrangement of Ionisation Gauge.

Hence with an electron current of 2 milliamperes pressures below 10^{-6} millimetres of mercury could be measured quite easily. Some curves connecting the ionisation current passing through the apparatus with the pressure of the gas are given in Fig. 9.

For very low pressure 250 volts is used on the anode and 25 volts on the collector. Under these conditions 1×10^{-6} amperes

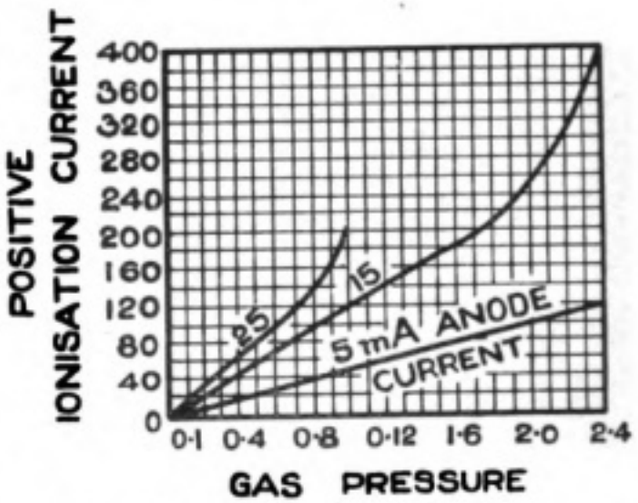


Fig. 9. *Calibration Curves for Ionisation Gauge.*

positive ionisation current corresponds to a pressure of 0·0000099 mm. of mercury for argon. The calibration depends upon the particular gas used. Under the same conditions as to anode voltage and electron current and at constant pressure, the ionisation current increases with the number of electrons in the molecule of the gas present in the tube. The number of electrons for an argon molecule (monatomic) is 18, while in a mercury molecule (also monatomic) it is 80. The ionisation currents are approximately in this ratio.

For ordinary cases the calibration for nitrogen (14 electrons per molecule) may be used as a general guide to the pressure.

Wireless Society of London.

The next meeting of the Wireless Society of London will be held at the Institution of Electrical Engineers, Victoria Embankment, (next Waterloo Bridge) on Friday, September 30th, 1921, at 6 p.m. Discussion on "Methods of Recording Wireless Signals."

EARTH WIRELESS:

Some Notes on the Power Buzzer.

By G. P. Kendall, B.Sc.

THE term "earth wireless" which is usually applied to the power buzzer-to-amplifier method of communication, is something of a misnomer, for there is no real analogy with true radiotelegraphy; the method is one depending upon conduction, pure and simple. As such, it might be regarded as outside the province of *The Wireless World*, but since ex-Army power buzzers have been upon the market, and have been purchased by numerous amateurs, a few notes on the working and use of the power buzzer may be useful.

This method of communication was of considerable importance during certain stages of the war. It first became practicable over useful distances with the development of the amplifying valve, since by means of a three-valve low-frequency amplifier and suitable earth connections, it is possible to pick up and render audible earth currents which have originated at quite considerable distances up to several miles. The problems of power buzzer-to-amplifier communication are, then, mainly of the production of suitable currents, and their introduction into the ground in such a way that the distant receiving station shall get the full benefit of them. Picking up the signals is simple: two good earth connections are made, about one hundred yards apart, and a lead is taken from each to the input terminals of the amplifier. Any earth currents which may be passing in a direction anything like parallel to the line joining the two earths (known as the base-line) will pass through the amplifier and, if alternating or intermittent in character, will be rendered audible in the telephones.

To turn to the transmitting end. The whole secret of this method of communication depends upon the fact that if a current be caused to flow between two earth connections it does not pass direct from one to the other in a straight line, but diffuses over a wide area in a manner resembling the familiar representation of the field of a bar magnet (Fig. 1). Of course, such a symmetrical distribution as that of the figure would only occur in the case of a medium of perfectly uniform conductivity. In practice the earth current is found to distribute itself over the space between the earths of the base in a very irregular manner, following moist tracts, spreading out widely to avoid dry ones, and so on. The skilful power buzzer operator takes advantage of all this to drive as much of his earth current as he can out to the distant station. In general, he endeavours to get two good earth connections in two *separate* damp places; the drier and less conductive the ground *between* them, the better, since these conditions cause the current to spread widely.

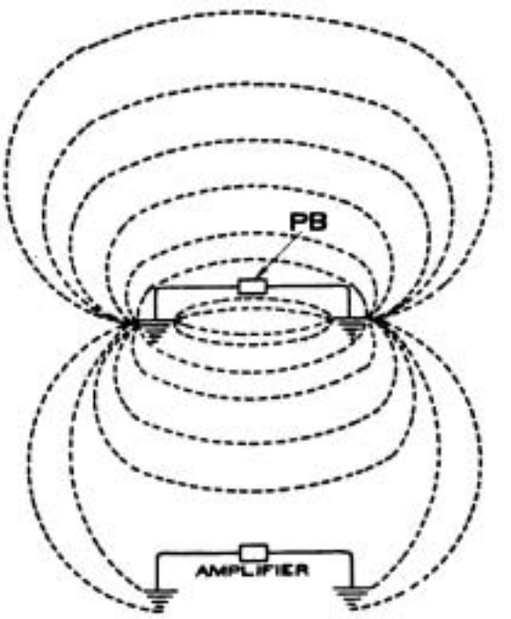


Fig. 1.

Earth Wireless: indicating the distribution of earth currents from the power buzzer PB.

It will be readily seen from Fig. 1 that the base-line of the transmitter must be oriented in a definite direction to ensure that some of the diffused earth current shall flow parallel to the receiving base-line and hence pass through it. The actual laying out of the bases is done by compass, according to a method to be given later. Another point

indicated by the diagram is that the length of the base determines the distance to which the earth current will spread; the longer the base, the greater the range of the power buzzer.

The type of current required is obviously an intermittent or alternating one of fairly high voltage, and of such a frequency as to give a good musical note. The most convenient source of such current is a small induction coil, and as such the power buzzer may be regarded. Its special characteristics are a secondary, wound to give a large volume of current at only a moderately high pressure, and a special form of contact breaker, giving a steady high note and capable of carrying a heavy current.

The mechanical features of the buzzer I do not propose to describe; they are simple enough to be readily understood by anyone possessing one of these instruments and would be of no interest to others.

A simple diagram of the circuits of a power buzzer is given in Fig. 2.

The range obtained with the standard army power buzzer working on 10 volts, received by a three-valve amplifier and with bases of 100 to 300 yards, may be expected to be about 3,000 yards, but varies very considerably with local conditions, such as character of soil, quality of earth connections, and so forth.

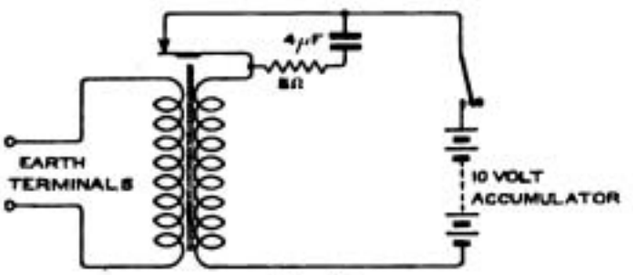


Fig. 2.

As an instance of the influence of the type of soil, a freak range of five miles was once obtained with the standard instruments on the Downs, near Dunstable, where the soil is dry and chalky, whereas, on the low ground near the town, it was difficult to get a range of 1,000 yards. Patches of damp ground between the stations often produce extremely perplexing results. In general, it is useless to attempt to work across rivers, marshes or lakes.

Having dealt briefly with the working of this method of communication, I append a few practical notes.

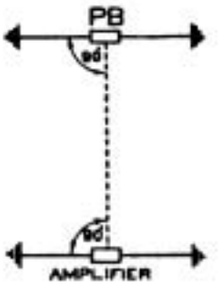


Fig. 3.

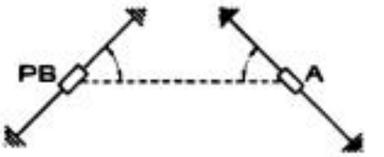


Fig. 4.

Base-lines.—The longer the better; not less than 100 yards for anything but the shortest ranges. Bases must be oriented so that the maximum earth current from the power buzzer is made to pass through the amplifier base-line. The ideal arrangement is to have the bases parallel to each other, and at right angles to a line joining their centres (Fig. 3), but failing this, best results are generally obtained by employing this rule: Lay the bases so that they make equal angles with a line joining their centres (*see* example in Fig. 4). The wire used should be heavy rubber-covered cable of not less than No. 18 S.W.G. copper for both transmitting and receiving bases.

Earths.—Must be good. Moist ground is essential. Each should consist of five or six metal pins driven about a foot into the ground, and all connected together. It is best to arrange the pins in a straight line at right angles to the base-line, spacing them about two feet apart. Always try to avoid introducing resistance into earth leads and earth connections.

A pond or stream will often provide *one* good earth for a base, *but not two*, because if both earths are placed in the same marsh or stream, a form of short circuit results and the earth current fails to spread out.

Adjustments of Buzzer.—The standard

buzzer, whether as a separate unit or fitted into a complete power buzzer-amplifier set, will be found to be provided with a set of spare armatures of three types, each giving a different note. They are marked A, B and C, and give notes of the following frequencies :

A = 640 per second.
B = 730 „ „
C = 540 „ „

Their purpose was to reduce the jamming troubles which resulted when a number of power buzzers were working in the same area, by giving distinctive notes to different stations.

The armature is adjusted by means of the large thumbscrew on the front of the buzzer. First see that the armature is not screwed right down on to the core. Then, with the key pressed, screw down the thumbscrew until a full clear note is obtained. Now screw it down further until the note is on the point of becoming hoarse (" spluttering "). When using a power buzzer-amplifier set, further correct the adjustment to give a maximum reading on the ammeter in the earth circuit.

Keep the buzzer contacts clean by the occasional use of a smooth file.

In conclusion, two words of warning. Firstly, experiments with power buzzers require Post Office sanction. Secondly, *don't* risk shocks from the secondary of the buzzer. You will regret it deeply if you get one.

A BRADFORD EXPERIMENTAL STATION.

MR. E. P. BURGESS sends us a photograph of his station at Queen's Road, Bradford. The set is home-made except for such items as telephones, valves and batteries. The apparatus consists of a 2-valve set, the second valve being used as a low-frequency amplifier; this, and the inter-valve transformer and filament resistance terminals, etc., are mounted on a panel as seen in the photograph, the other valve being mounted on the H.T. battery box, which contains the two H.T. batteries, one of 50 and the other of 40 volts.

The tuner on the left-hand side of the picture will tune from 600 up to 12,000 metres, with the conjunction of the variable condenser. With the aid of small fixed condensers 24,000 metres can be reached without any loading coil. For ships " pancake " coils give better results than the large tuner, so a panel has been constructed which is also seen on the left of the photograph above the large tuner. Any " pancake " coil may be fitted on this panel in a few

seconds, the aerial and earth leads being brought to the terminals on the face of the box or panel ; the reactance is also taken to the lower terminals. A variable condenser on the grid works better than the usual fixed capacity type. Signals from all the well-known high power stations are read with ease when the telephones are on the table, and also several 600 metre stations, including ships; NSS can be read every day with the telephones " on," of course, the time signals being very clear.

The aerial consists of two 50-ft. wires, 7 ft. apart, 30 ft. high at the lower end, and 40 ft. at the high end, the down leads are taken from the high end into the skylight of the " wireless room." The earth lead goes to the water pipe. The " pre-war " transmitting coil and jigger are still on the table, and are seen on the right-hand side, but, of course, are not used in these days.

THE BRITISH ASSOCIATION MEETING, 1921

THE annual meeting of the British Association for the Advancement of Science is this year once again being held in Edinburgh. On four previous occasions only during the ninety years of its existence have the Association's meetings been held in this historic Scottish city. These former meetings were held in 1834, 1850, 1871, and 1892 respectively. This year's meeting, which is under the Presidency of Sir T. Edward Thorpe, C.B., D.Sc., F.R.S., is, however, of especial interest, as several changes have been introduced into the routine of the section meetings, with a view to their better filling the needs of modern scientific development. Chief amongst these changes may be mentioned the spreading out of the sectional Presidential addresses over a longer period, so that those interested can attend others than the one delivered to their particular section. Modern scientific development tends not only to a greater specialisation, but has in many ways emphasised the interdependence of various branches of science upon each other, thus rendering it all the more imperative that workers in one sphere should have the freest possible access to the work being done in others.

As on previous occasions the papers of wireless interest read this year are spread over two sections—Section A, which is nominally devoted to mathematics and physics; and Section G, which deals with engineering. This division serves but to emphasise both the wide ground covered by radio subjects, and the need of as little overlapping as possible of the meeting times of these two sections.

In Section A, an interesting communication was made by Mr. A. A. Campbell Swinton, F.R.S., entitled "The Reception of Wireless Waves on a Shielded Frame Aerial," in which he described experiments which he has recently carried out in order to test a suggestion made by Mr. N. P. Hinton, a member of the sub-committee in Directional Wireless of the Radio Research Board. This suggestion was that improved directional receptive properties might be obtained by enclosing a frame aerial in a large metal tube or wire spiral, open at the ends.

The frame aerial used for the tests was a circular one 1 ft. in diameter, and having 100 turns of No. 20 S.W.G. wire wound on it. Measurements were in all cases made on "spark" signals received from the Eiffel Tower on a 2,600 metres wavelength. It was found that the mere presence of a spiral of wire on a square frame of 18 ins. side outside the above frame aerial produced no appreciable effect unless the ends of the outer wire spiral were short-circuited, in which case the signals were weakened to the extent of some 50 per cent. When each individual turn of the outer spiral was short-circuited the signal strength was further reduced—to about 25% of its initial intensity—but even under these conditions the spiral had little effect upon the directional properties of the frame aerial inside it. Closing the ends of this tube—which was some 4 ft. long, by grids of copper wires, produced no further reduction, and the addition of a complete case of iron wire netting outside the whole caused little further diminution of signal strength. The frame aerial also retained its normal directional properties under these conditions.

Enclosing the frame aerial in a square copper box ($\frac{1}{32}$ in. metal thickness) of 2 ft. side disclosed the fact that the amplifier and other apparatus external to the box was picking up signals, so that in further experiments the additional precaution was taken of enclosing the amplifier, batteries, telephones, and all auxiliary apparatus in the copper box as well as the frame aerial. The sounds emitted by the telephones were listened to by means of a rubber tube extending outside the box.

When the box was completely closed the equipment was found to be completely shielded from the incoming signals, but it was found that the narrowest possible opening between the lid and the side of the box was sufficient to enable the signals to be heard faintly, emphasising the importance of com-

plete metallic continuity in all attempts at the screening of wireless apparatus. When one side of the box was opened and pointed in the direction of Paris—the frame aerial being in the same plane—signals were heard, but they were completely cut off when the opening was turned round at right-angles. It is interesting, however, to note that when the open end of the box was turned round into a direction *away from* Paris signals were again received with apparently the same strength as when it was pointed to Paris. This result is particularly interesting, and may be of importance in connection with theories of the mode of transmission of wireless waves.

The experiments go to show that upon the scale employed, the use of a shielding tube or box does not assist in improving the directional properties of the loop aerial.

Another paper before Section A, although not of direct wireless utility, but interesting as dealing with an application of the three-electrode thermionic valve, was read by Mr. J. J. Dowling, M.A., on "The Recording Ultra-Micrometer." The term ultra-micrometer is one applied to an instrument making use of a three-electrode valve for the measurement of minute distances. Such an apparatus was described by Prof. Whiddington before the Wireless Society of London, and the account of his lecture was printed in these columns.* It will be recollected that the apparatus he described made use of three sets of oscillating valves, two of which heterodyned each other, while the third heterodyned the beat note of the first two. The changes in distance to be measured varied the capacity of one of the valve circuits, and so changed its oscillating frequency and the resulting beat notes.

In the apparatus described by Mr. Dowling, the heterodyning valves are dispensed with, and only one oscillating valve is used. As before the condenser of the oscillation circuit of this valve is varied by the changes of distance to be measured, but in this case the plate circuit of the oscillating valve includes a sensitive galvanometer. The normal steady plate current flowing through this galvo is balanced out by shunting it with a few cells connected through a high resistance so as to tend to pass a current through the galvanometer in the reverse direction to the normal plate current. The resistance in the shunt circuit is adjusted until the galvanometer deflection is reduced to zero. If then the resistance of the shunt circuit is large compared with the resistance of the galvanometer, the major portion of all *changes* in the normal plate current will flow through the galvanometer. This method is, therefore, well adapted to measure small changes in the normal plate current of the oscillating valve.

Now the current flowing in the plate circuit of an oscillating valve varies with the frequency of the currents set up by that valve, and therefore varies also with the capacity of the condenser in the oscillation circuit, which is maintained by the action of the valve. A curve can therefore be plotted out connecting the plate current with the distance between the plates of the condenser in the oscillation circuit. Small changes in this distance can thus be read off directly from the deflections of the galvanometer. Although, on first consideration, one might think that this method would be too rough for any very accurate measurement, yet it is stated in the paper that movements as small as a ten-millionth of a centimetre can easily be detected. By an apparatus of this kind the decrease in the effective weight of a body weighing one kilogram, can be measured when it is raised up a matter of some 3 ft. only—the change of its apparent weight being due to the change thus made in its distance from the centre of the earth! The apparatus is also being successfully applied to researches on the growth of plants.

On the eve of the opening of the meeting—*i.e.*, on September 6th—a popular lecture was given by Sir Oliver Lodge on the subject of "Speech through the Aether." To him, he said, "the aether was the most material thing in the universe," since it extends through all space and through all matter, and is the

* *The Wireless World*, 8, pp. 739–742, January 22nd, 1921.

medium for the conveyance of all forms of radiation. Sound, however, is not conveyed by the aether, so that to accomplish wireless telephony sound waves must be caused to influence waves of higher frequency, which could travel through the aether to the distant receiving station, and there be resolved back again into ordinary sound waves in the air. Only a small fraction of the energy of the original waves reaches the receiving station, so that wireless telephony might be likened to shouting in the open air, whereas ordinary wire telephony resembles talking through a speaking tube.

In Section G (Engineering) a paper was contributed by Mr. J. Scott-Taggart on "Two New Negative Resistance Devices for Use in Wireless Telegraphy." In this paper he first gave a brief summary of the previously known "negative resistances"—chief amongst which is the electric arc—and of their uses for the production of continuous oscillations. The first special device with which the paper particularly dealt, is termed a "Negatron," and consists of a special form of thermionic valve or tube, having two anodes in addition to the usual grid and filament electrodes. In use this tube is arranged so that the two anodes are between them drawing the saturation current from the filament. Under these conditions, then, an increase of the positive potential applied to the grid or control electrode—which is of flat form, and is between the filament and one of the anodes only—will increase the flow of current to that anode. But since the tube is saturated, this can only occur if the other (or main) anode is robbed of some of its current.

The main anode is appropriately connected to the grid or control electrode, so that when the potential of the main anode is increased, the grid becomes more positive, and as a result the current flowing to the main anode is reduced as has already been explained. There is thus a "negative-resistance" effect between this main anode and the filament, since an increase of the applied voltage is accompanied by a decrease of current, and *vice versa*, Such an arrangement can be used to set up continuous oscillations by connecting it in series with an appropriate oscillatory circuit.

The second negative-resistance device described in this paper is termed by the author a "Biotron," since two ordinary patterns of three-electrode valves are used with an appropriate coupling between them by means of resistances. The valves are arranged so that an increase of the potential of the anode of the first valve increases the positive voltage of the grid of the second valve, thus increasing the anode current of the second valve, and lowering the voltage on its anode, since a resistance is joined in the circuit. The anode of the second valve is connected to the grid of the first so that this decrease of anode potential is communicated back to the first valve, making its grid more negative. The anode current of the first valve is thus reduced, so that once again we have here a negative-resistance effect in which an increase of voltage applied to the anode of the first valve brings about a decrease in the current flowing in the circuit.

In addition to the above information relating to wireless matters, some of the many uses of wireless communication were brought home to the members of the Association by means of a special branch of the Meteorological Office, which was provided in Edinburgh by the Air Ministry during the week, September 7th to 14th, in which the meetings took place. A wireless receiving apparatus has been erected in the Natural Philosophy Department of the University, and the daily European synoptic weather bulletins picked up by this apparatus provide the means for filling up each morning a large scale weather map erected in the entrance hall of the department. Special forecasts for the weather in the Edinburgh district are also provided, based on the information thus obtained, and on special telegraphic and telephonic messages sent to the office for that purpose.

P. R. C.

DUTCH CONCERTS.

IN the September 3rd issue of *The Wireless World* we published a letter received from Mr. W. W. Burnham on the subject of the concerts given by the Nederlandsche Radio-Industrie. We undertook, subject to the wish of our readers, to accept subscriptions for a fund to go towards the upkeep of these concerts, and, at the same time, we invited readers to let us have their views on the subject for publication in *The Wireless World*.

A list of subscriptions actually received up to the date of going to press is published below; in addition intimations have been received from many others of their intention to subscribe as soon as the list was opened :—

	£	*s.*	*d.*
Mr. J. C. Walker	3	3	0
Messrs. Burnham & Co.	2	2	0
J. R. C.	2	2	0
Mr. W. J. Crampton	2	2	0
Dr. Nesbitt Burns	1	1	0
Messrs. Arnold Mack & Co.	1	1	0
Mr. W. R. Wade	1	1	0
Captain R. B. Turbutt	1	0	0
Mr. J. A. A. Yeo	1	0	0
Mr. G. Smith Clarke	1	0	0
Mr. P. R. Coursey		10	6
Mr. P. W. Harris		10	6
Mr. H. S. Pocock		10	6
Captain J. D. Adamson		10	0
Mr. H. Bevan Swift		10	0
Mr. W. G. Boothroyd		5	0
Mr. E. J. Simmonds		5	0
Mr. D. M. Burn		5	0

Below we reprint extracts from some of the letters received :—

"I see in your number of September 3rd an appeal from Mr. W. W. Burnham for subscriptions to enable the Nederlandsche Radio-Industrie to 'carry on' with their concerts.

I hope that such an appeal will have every response from English amateurs, and be the means of showing the Nederlandsche Radio-Industrie how much we appreciate their concerts.

Since my friends and myself have had so many pleasant hours listening to their concerts, I have great pleasure in enclosing cheque towards this fund."

* * *

"We all know that these concerts are a great factor in amateur pleasure and progress, and we are only too pleased to have the opportunity of subscribing."

* * *

"I was very interested to read Mr. W. W. Burnham's letter in your issue of September 3rd, and consider the proposal put forward a very reasonable one . . . which I hope will be well supported by British wireless amateurs. . . . I have recently been getting very frequent 'jamming,' apparently by amateurs in the Birmingham district, and I would like to suggest that British amateurs, having transmitting permits, should refrain from transmitting on wavelengths between 900 and 1,300 metres while the Dutch Concert is in progress."

* * *

"In reference to Mr. Burnham's letter in the current issue of *The Wireless World*, suggesting a subscription list be opened to defray the cost of the Dutch concerts, I am sure this should meet with the approval of the majority of amateurs in this country. I shall certainly bring it before the members of our club.

Mr. Izerda, Organiser of the Dutch Concerts, whose voice is now familiar to most of us.

I should like to make one suggestion, that PCGG gets back on his 1,150 metres wave, or, perhaps better still, 1,200 metres. As it is at present with him working on 1,050 metres he is too near the amateur wavelength, and is frequently jammed. We cannot expect amateurs to give up the whole of Sunday afternoons if they wish to carry on experimental transmissions for the benefit of those who are listening to the Dutch concerts. Also, much jamming is experienced from the Navy when they are using 1,005 metre wave. This would not be so bad if PCGG were on a longer wavelength. At any rate we should not get our heads knocked off.

It is a pity we have not a British station such as Chelmsford, which would give us a concert once a week, and perhaps half-an-hour's news a day with our breakfast. I should think it would pay the Marconi Company to run a telephonic news service and occasional concerts on the same lines as the Poldhu press service."

"In regard to Mr. Burnham's letter in your last issue I would like to confirm how much I appreciate the concerts given by our friends at the Hague on Thursdays and Sundays. . . . During my visit lately I was able to see the amount of attention and work they gave to this interesting transmission."

* * *

"I am glad to see Mr. Burnham's letter, having had delightful experience of these concerts for some

Mr. W. W. Burnham.

time. I feel it a duty to subscribe, and if you open a list please put me down. A short time ago I visited the transmitting station at the Hague. I can bear testimony to the splendid work of Mr. Izerda, director of the Nederlandsche Company. Anyone who has had experience of telephonic transmission can realise the efficiency of that work.

It is delightful to hear that the power is to be increased, and I am looking forward to much enjoyment of the concerts during the winter. Mr. Izerda told me that it might not be possible to continue the work, especially on Sunday afternoons when we enjoy the concerts most. I trust, therefore, that wireless societies and your good self will come to his aid, and so make permanent one of the finest innovations brought into wireless."

* * *

"I see by Mr. W. W. Burnham's letter in *The Wireless World* that the power of these concerts is to be increased, and I think that now is an opportune moment for British wireless amateurs to come forward with subscriptions to show their appreciation of the concerts."

* * *

"Herewith cheque in order to help to keep the Dutch concerts going."

"I personally much appreciate these concerts and hope they will be continued in the future. The prospect of increased power is a good move."

* * *

"I was very much interested in the correspondence regarding the Hague concerts, and pleased to hear they propose increasing their power so as to take in a larger circle of listeners. Being a successful receiver of the above I naturally wish the concerts every success, and to help to defray costs and instal new apparatus I should like to suggest that each member of each Society should pay at least 1s. or 2s. each in support."

* * *

"I think that it is quite right that English amateurs should contribute something to the expense of running these concerts which must give pleasure to so many.

At the same time I do not think any increase of power is necessary or desirable as far as English amateurs are concerned. At present in the South of England the power is quite enough to enable them to be received on the one-valve circuit, and with an additional note amplifier they are as loud as anyone could want. These concerts act as a spur to all beginners to make their apparatus as efficient as possible, and I think that it would be a pity if this were removed.

It would be surely better if the Dutch Company continued on the present power with a little help from us than that they should be compelled to either obtain more help from us or close down. If I wanted to hear the Dutch concerts louder than they are at present I would much rather spend a little extra money on my own set in the way of

Mr. Bakker of the Nederlandsche Radio Industrie.

adding a note magnifier than I would on sending a a subscription to a foreign firm."

* * *

"I sincerely hope that English amateurs will show their appreciation of the enterprise of the organisers of the Dutch Concerts by contributing generously towards this fund.

It is a lasting disgrace to the officials of this country . . . that numbers and numbers of those wireless amateurs who so readily took their places as trained men (and not at the country's expense) in the fighting forces at the outbreak of war, should now have to help little Holland to send out concerts, which we ought by right to be doing ourselves.

"I, for one, shall continue to fight tooth and nail against this cool and calculated oppression."

* * *

"I have read with interest the letter to you from Mr. Burnham *re* the Dutch concerts. I have derived much pleasure from the transmission (and also disappointment), and am pleased to give a small donation to be added to your list."

* * *

"With reference to Mr. Burnham's letter in *The Wireless World* of September 3rd, with regard to subscriptions for the Dutch concerts, personally, I consider this a very excellent and fair suggestion, and I am sure it will meet with a ready response from the numerous amateurs who are all out for the concerts."

* * *

"With reference to the proposal to increase the activities of the Dutch concert programmes I really think the matter is one which should commend itself to all interested amateurs, and it should command their hearty support. The concerts as transmitted now are not available for all persons, many of whom are limited to very simple apparatus often installed under difficult circumstances. It is all very well for the man with a number of valves, his difficulties are fairly easily got over. It is the amateur who has to make do with simple apparatus at home which makes the reception of these concerts under the present circumstances an extremely difficult matter.

May I be permitted to suggest that all wireless clubs make the matter one for discussion among their members, and thus get to know the exact opinions expressed by them, and if the result is unanimously in favour of supporting by a small subscription list our Dutch experimenters at the Hague, I think some tangible appreciation of their efforts on our part would be amply repaid."

* * *

"I was very interested in Mr. W. W. Burnham's letter *re* the "Dutch Concert," which appeared in your issue of September 3rd, and I would be quite willing to contribute a small subscription towards the expenses of this Company in providing concerts *pro bono publico*, providing the transmitting power is increased, and no doubt there are many amateurs who, like myself, live at too great a distance from the Hague to hear more than the carrier wave at present power who would be pleased to subscribe also."

"I take much pleasure in enclosing a small subscription towards the cost of the Dutch concerts, as proposed by Mr. Burnham in your current issue. I think all who, like myself, have spent many hours listening to these concerts, will willingly subscribe. I am also interested to hear they will shortly be given on increased power. Perhaps this will enable some of our heterodyning confrères to open up their reactance couplings a little, and cut out what our "ultra-scientists" describe as "extraneous noises," but what we generally describe in plainer language not always consistent with a quiet Sabbath afternoon.

I further trust that the programme will continue to be cosmopolitan in character, and not entirely devoted to the lighter class of music. There are always plenty listening who appreciate the best in music."

* * *

"My committee feel that, bearing in mind the great pleasure these concerts have given, and the interest aroused in them, it would be a great loss to the amateur wireless enthusiasts if they were to stop.

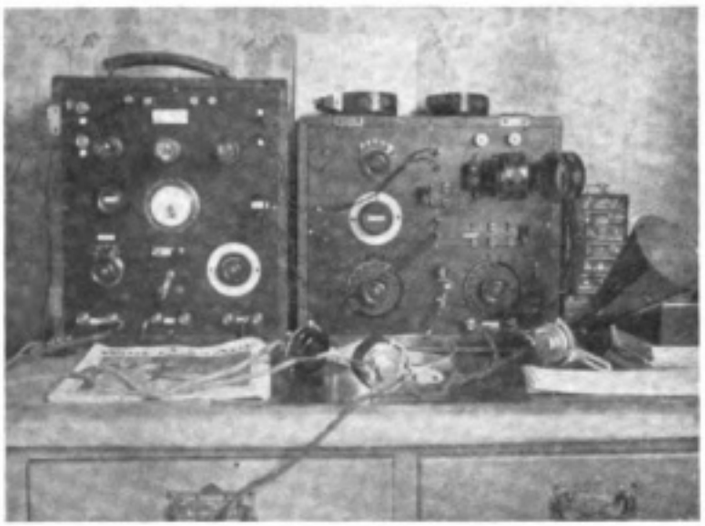
It is to be hoped that all clubs will fall in with the suggestion of Major Burnham, and send in subscriptions when the 'fund' is open. The matter is to come up for discussion at our next committee meeting, and I have no doubt the scheme will receive practical support from this Club."

Where the Dutch Concerts come from; The Works of the Nederlandsche Radio Industrie, at the Hague.

AN AMATEUR-BUILT RECEIVING STATION

THE following description and photograph of a portable, three-valve, low-frequency amplification receiver may be of interest to those who are keen on building their own apparatus.

The valve panel is fitted to an empty Mark III* tuner case, size 11¾ ins. by 12¾ ins. by 5 ins. inside ; various parts of a Mark III tuner have been used in its construction.



Behind the valves are fitted two low-frequency transformers, and a three point switch on left side of voltmeter enables one, two, or three valves to be used as required ; valves not in use may be taken out. The voltmeter, which reads by pressing the button below the dial, gives the potential drop across the filaments. On the right is the filament regulation for the amplifying valves, giving 340° variation. Separate regulation is used for the detector valve. L.T. switch and terminals for H.T., L.T. and telephones are fitted below. The A and E terminals on left of panel are connected internally to corresponding plug sockets to right of valves. Below these are sockets for tuner reactance connection between telephones and the plate of No. 3 valve.

To right of photograph is the tuner unit. This is divided into two sections. On the left is a short wave inductance with 5-point switch and 0·0005 mfd. condenser in parallel. This tunes from 100-700 metres with standard aerial. Reaction coil works on rotary principle with ebonite former.

The long wave section comprises plug sockets for connection to valve panel, holder for De Forest coils, and 0·0015 mfd. condenser across A and E sockets. A throw-over switch connects a perikon detector in series with telephone terminals of tuner, across the aerial tuning coil which allows plain-aerial crystal reception.

Sockets to right of switch enable condenser to be used independently of A and E connections when switch is over in that direction.

The small throw-over switch in centre of panel enables tuner to be used with either single or double tuner circuit and reaction.

The home-made loud speaker, which gives good results, consists of metal cone soldered into cylinder, into the ends of which Brown's "A" type earpieces are fitted.

Signals have been received regularly at York on indoor aerial from OSM, NSS, LCM, PCGG, 2AZ, and others.

A STATION IN ESSEX

The accompanying photograph is of a 3-valve set belonging to Mr. B. H. Colquhoun, of Felsted, Essex.

FIFTY YEARS OF ELECTRICITY*

THE MEMORIES OF AN ELECTRICAL ENGINEER

PROFESSOR J. A. FLEMING, F.R.S., whose most recent honour is the award of the Albert Medal of the Royal Society of Arts for 1921 in recognition of his many valuable contributions to electrical science, has conceived the happy idea of recording the progress of electrical engineering since 1870, the year in which he attained his majority. Under the title of "Fifty Years of Electricity—The Memories of an Electrical Engineer," he tells in his own inimitable way a story as absorbing as any yet written on electricity and its applications. "1870," says Dr. Fleming, "was a year of importance in electrical invention. Prior to that date electrical engineering may be said to have been limited to telegraphy, land and submarine." It will thus be seen that practically every phase of electrical work is covered in Dr. Fleming's book, and with a great deal of this work he has had a close personal connection.

This vivid sketch occurs in an introductory chapter, outlining the stage of electrical knowledge prior to 1870. Chapter I deals with telegraphs and telephones in the last fifty years; Chapter II with dynamos, alternators, transformers, and motors; Chapter III with electric lamps and electric lighting; Chapter IV with electric heating, cooking and furnaces in five decades; Chapter V with electric supply stations, storage batteries, railways and the transmission of power; Chapter VI with theory and measurements; and Chapter VII with wireless telegraphy and telephony.

In spite of the difficulty of explaining some of these matters without recourse to mathematics, the author has succeeded admirably without printing a single formula. Many passages are amusing as well as informative. Thus, in describing Edison's pioneer work in the distribution of electrical energy for lighting, Dr. Fleming gives details of the dynamos. They would be counted small in these days, being merely sufficient to maintain about 1,500 Edison 16 c.p. lamps in action but then they were reckoned otherwise. "At the date when these machines were built," says the author, "they excited great wonder from their size, which was beyond anything then constructed. They became known as 'Jumbo' dynamos, the name being taken from that of a very large tame elephant then at the Zoological Gardens, which was a great favourite with children from the number he could carry on his back at once. . . . On many occasions it was necessary for Mr. Edison to take off his coat and practically instruct the workmen in the laying of street mains. . . . At first it was considered quite a feat if a dynamo could be kept going for a day or so without some failure necessitating a stop for repairs."

Dr. Fleming concludes his book with a strong appeal for the organisation of effective methods of encouraging technical discoveries and improvements. "Science," he remarks, "is said to be a coy mistress who will not be wooed for the sake of her dowry of useful applications. . . . If we could have peeped into the laboratories of the Royal Institution in Albemarle Street, London, in the autumn days of 1831, and seen Faraday busy with his magnets, copper wire and discs and iron bars, we might perhaps have wondered that so much time and intelligence were not better bestowed. But, as we have seen, those epoch-making experiments have rendered imperishable services to humanity."

* "Fifty Years of Electricity—The Memories of an Electrical Engineer." By J. A. Fleming, D.Sc., F.R.S. (Crown 4to, 384 pages, and 111 plates.) Just published by The Wireless Press, Ltd., 12/13, Henrietta Street, London, W.C.2. Price 30/- net. Postage 9d.

NOTES AND NEWS

BÉ Transmissions.

In the August 20th issue of *The Wireless World* it was mentioned that BÉ transmits the Dutch weather report at 12.10 B.S.T. We are now informed by a Dutch correspondent that this transmission takes place at 19.40 B.S.T. also.

Wireless Telephony for the "Quest."

Two Marconi 100-watt wireless telegraph and telephone sets are being fitted on board the *Quest*, Sir Ernest Shackleton's vessel of exploration. One set is for permanent use on board the ship, and the other for base work on land. The range of each set is about 100 miles.

The Avro aeroplane which is being taken with the expedition, will also be fitted with a wireless telephone set, so that it may be able to maintain telephonic communication with the *Quest*, and also with Sir Ernest Shackleton's land base.

Wireless Training for Officers.

A wireless telegraphy course for officers of the Royal Corps of Signals, or officers attached or seconded thereto, of the rank of captain or subaltern, who have undergone the "A" wireless course or a short wireless telegraphy course, and are recommended for further instruction, will be commenced at Maresfield, on July 7th next, and continue for two months.

New Wireless Transmission.

On September 2nd, Lyons (LY) notified Rufisque (FRU) that a service would be commenced on September 5th from 9 to 11 hours G.M.T., on a wavelength of 24,350 metres.

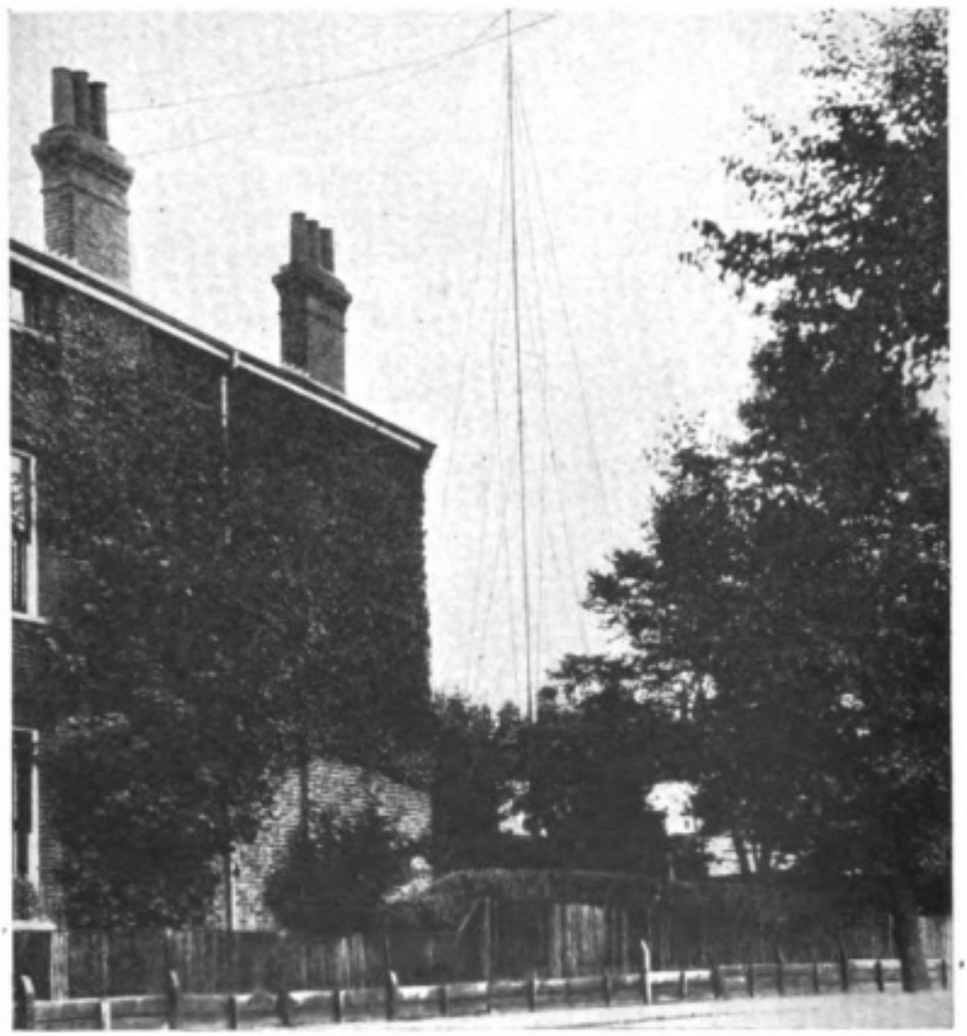
Press News from Karlsborg.

The Swedish Postmaster-General notifies that the station at Karlsborg (SAJ) transmits Swedish Press news twice daily, at 1000 G.M.T., on 4,200 C.W., and at 2000 G.M.T., on 2,500 metres spark.

Distributing Market News by Wireless.

The Board of Agriculture at Missouri, U.S.A., is considering the possibility of employing wireless as a means of distributing market news to farmers throughout the State.

The government market news information will be received at the radio office of the State Marketing



The new mast erected by Mr. W. W. Burnham at his house at Blackheath. The mast is 80 feet high and is made of McGruer hollow spars 15' × 4" diameter guyed every section to strainers. Truss bar in centre to take aerial strain. Aerial is on 8 foot horizontal spreaders.

Bureau off the leased wire of the United States Bureau of Markets. That wire will connect Jefferson City with the office of the Bureau at Washington, as well as with practically all of the large grain, live stock, hay, fruits and vegetables, dairy products, and other markets in the United States.

A powerful transmitting set will be installed at the offices of the State Marketing Bureau at Jefferson City, located in Missouri's beautiful new capitol building, whose dome is 280 ft. from the ground. From this central point of the State the radiophone should operate at its maximum efficiency to the advantage of Missouri farmers. The service is expected to be begun this autumn.

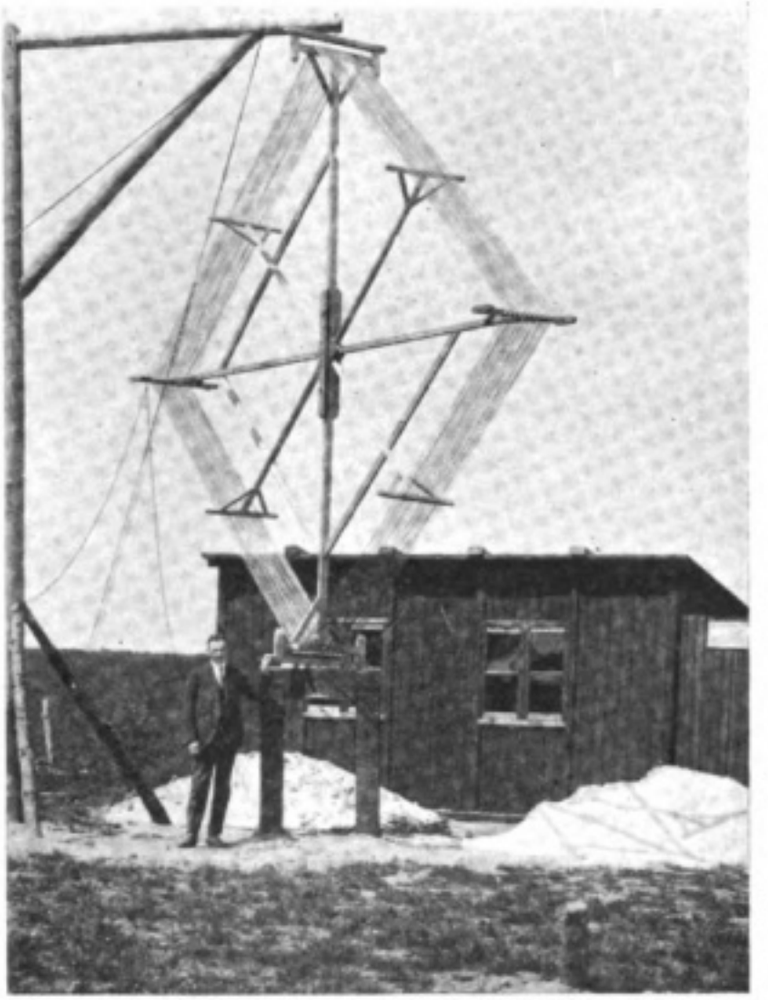
The Missouri State Marketing Bureau will organise the wireless amateurs in that State, of which there are several hundred widely scattered in rural communities, into a state organisation for receiving and distributing the market news information. A continued campaign will be made to install radiophone receiving outfits in every town of any size in the State.

Imperial Wireless.

Captain L. Carus-Wilson, M.C., is being sent to Egypt to represent the War Office in connection with the establishment of the Imperial Wireless Chain.

French Wireless Station Damaged.

As a result of a violent storm two of the towers of the Lyons high power wireless station are reported to have crashed. These towers are over 600 ft. in height, and as a result of the damage to the station, communication with America and with the Far East is suspended.



Rotating Frame Aerial in use at PCG (Sambeek, Holland) for experimental purposes.

Rotating Frame Aerial.

The accompanying photograph shows a rotating frame aerial in use at PCG (Sambeek, Holland) for experimental purposes.

PCG is the Dutch receiving station for direct communication with Bandoeng (PKX) Java.

The frame aerial is 3½ metres square and has 40 turns of insulated wire. Honeycomb coils are used in the receiver and a five-valve high frequency amplifier. With this set PKX can be read daily.

Transmissions from PKX are from 5.40 p.m. to 10.40 p.m. G.M.T. on 8,500 metres, C.W. arc.

Wireless News Service.

Tidens Tegn, one of the leading Norwegian newspapers, has installed in their Christiania office a wireless telephone set for the purpose of receiving news from Koenigswusterhausen (LP).

Wireless Saves Shipwrecked Crew.

The crew of a Swedish motorship, *The Elmaren*, were recently shipwrecked on an island in the Indian Ocean. They are reported to have attracted the attention of a passing ship by means of wireless telegraphy signals transmitted from a station erected during their six weeks on the island.

The Editor of the "Year Book of Wireless Telegraphy and Telephony" has notified us that he will be glad to receive, for inclusion in the 1922 Edition of the Year Book, now in course of preparation, particulars of Schools and Colleges giving instruction in Wireless Telegraphy and Telephony.

WIRELESS CLUB REPORTS

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary.
The Editor will be pleased to consider for publication papers of unusual or special interest read before Societies.

Glasgow and District Radio Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Robert Carlisle, 40, Walton Street, Shawlands, Glasgow.

Although not much has been heard of this Club through the medium of the Press, it must not be assumed that it is in a "state of suspended animation," as nothing could be farther from the truth. Since we last appeared in print a number of meetings have been held at which matters of much interest to wireless men were brought before the members.

Prior to the closing of the 1920-21 session a lecture was given by Dr. Houston at the University. The subject chosen was "Optical Signalling." Dr. Houston reviewed the various methods of signalling used throughout the ages up to the present, viz., fires, beacons, flags, etc., but his remarks had reference chiefly to the numerous methods of secret signalling by visual means which had been tried during the war, including ultra-violet and infra-red rays, polarised light, colour filters, etc. A system invented by Dr. Houston, which used an ordinary telescope and a 1½ volt bulb, was clearly explained and demonstrated, and aroused great interest. Suitable apparatus was used to illustrate each system. At the conclusion Dr. Houston answered a number of questions.

At a later meeting Mr. A. F. Gray, one of the Club members, kindly brought along his apparatus to headquarters. This included a Mark III tuner, with valve amplification, and a home-made 2-valve set used in conjunction with a 3-valve ex R.A.F. amplifier. The switching arrangements of this showed much ingenuity on the part of the maker. Mr. Gray gave full constructional details and circuit arrangements, after which the apparatus was connected to the aerial, and signals were heard all over the room.

The Club's first "Field Day" was held on Saturday, August 20th, at Bellahouston Park, Glasgow, which was kindly granted for the occasion by the Glasgow Corporation, through the courtesy of Mr. Whitton, Director of Parks. Two aerials were erected on suitable trees in different parts of the park. One station was equipped with a spark transmitter and 2-valve receiving apparatus, while the other station was fitted for reception purposes only, the gear consisting of a 3-valve amplifier and a Mark III crystal set. The valves were kindly loaned by Messrs. Mullard Valve Co., London. All the instruments and accessories used, with the exception of the Club apparatus, were kindly placed at the Club's disposal by Messrs. N.B. Wireless Schools, 206, Bath Street, Glasgow, and Messrs. W. A. C. Smith, 236, Argyle Street, Glasgow. Splendid results were obtained, numerous British and Continental stations, as well as shipping and the Club's portable station, being loudly heard. During part of the programme the transmitting station was operated by a lady member of the Club, Miss Knowles, who holds a First Class Certificate of Proficiency in Wireless Telegraphy. The outing was an enjoyable one, and provided a welcome change from the usual indoor work.

The 1921-22 session commenced with the annual general meeting on Wednesday, September 28th, at 8 p.m., and the Committee are already licking things into shape for the winter months.

Members are reminded that the annual subscription of 10s. is due on October 1st. New members are charged an entrance fee of 5s. in addition. Intending members should send a stamp to the Hon. Secretary for particulars.

The North London Wireless Association.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. J. W. S. Prior, c/o Superintendent, Peabody Buildings, Essex Road, N.1.

On July 11th, Mr. W. Alan Saville lectured on "Basket and Honeycomb Winding." He very clearly described the best methods of winding and sizes of wire most suitable, and exhibited a portable single valve set of his own manufacture in which both types of coils were used, covering all wavelengths. On this set being connected to the Association's aerial quite good signals were received. Mr. Saville was bombarded with many questions, to all of which satisfactory replies were given. Before concluding, Mr. Saville very kindly undertook to supply any of the Association's members diagrams of connections of his set, together with particulars as to values of coils, etc., and finally presented the Association with a set of basket coils. In closing the meeting, the Chairman paid a tribute to the excellent finish and general appearance of Mr. Saville's set, and said he hoped members had duly observed this, and that they would endeavour to reach a similar high standard in the making of their own sets. He proposed a hearty vote of thanks to Mr. Saville for his interesting lecture and for the set of basket coils. This was responded to by all.

On July 18th Mr. A. de Villiers gave constructional details of a very useful brace he had made. He exhibited the tool and described the many useful purposes to which it could be put.

The Association's membership is now well over fifty, and still going up. It has splendid accommodation in the Physics Lecture Theatre at the Northern Polytechnic Institute, Holloway Road, for the holding of its meetings, and, thanks to the Institute authorities, has a 150 ft. aerial. Now the winter is approaching the Association is looking forward to a good series of lectures and discussions, and intends adding to and developing its receiving set as much as possible. The Hon. Secretary will at all times be pleased to supply particulars as to membership, etc., to those wishing to join the Association.

North Middlesex Wireless Club.

(Affiliated with the Wireless Society of London.)

For particulars apply to the Hon. Secretary, "Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

The seventy-third meeting of the Club was held at Shaftesbury Hall, Bowes Park, N., on September 7th, and was well attended. After half-an-hour's Morse code practice, during which time other members made good use of the Club's receiving set, with good results, the chair was taken by the President, Mr. A. G. Arthur, who called on Mr. A. J. Dixon to give an address on the "Construction and Maintenance of Accumulators."

Commencing by describing the early types of secondary batteries, Mr. Dixon mentioned that the modern cell represented an improvement in construction and design only, the principles involved being the same as in the older types. The efforts of manufacturers had been directed towards producing a plate that would insure, amongst other qualities, continuity of paste and freedom from distortion. By the courtesy of the Edison Swan Electric Co., Ltd., of Ponder's End, the lecturer was able to show specimens of the latest advance in grid construction made by this firm, and he passed these round for inspection, together with some finished plates, kindly loaned to him for the purpose. He also showed examples of the complete battery, explaining the salient points of the different types on the market.

Regarding the maintenance of accumulators, Mr. Dixon gave a number of useful hints, pointing out the importance of using pure acid and distilled water in making up the electrolyte. This, he said, was a point very often overlooked by amateurs, but made a great difference to the life of the cell. Such matters as the correct way to charge a battery, the treatment of sulphated plates, the prevention of corrosion on terminals, etc., were all touched on in turn, and a number of questions put by members were answered to their satisfaction. The Chairman had a few remarks to make, and a vote of thanks was proposed by the Secretary and seconded by Mr. Midworth, and carried with enthusiasm.

Before the meeting broke up, Mr. Evans exhibited a beautiful example of instrument work, known as a valve bridge, for use with a Morse inker. This, he explained, was one of the only two in existence.

The West London Wireless Experimental Association.

(Affiliated with the Wireless Society of London.)

The first meeting of the winter session took place on September 1st last at the Club-rooms, Belmont Road Schools, Chiswick, at which there was a good attendance. The Chairman announced that a monthly prize of half-a-guinea would be given, the first one to be for the best paper of the month on "Wireless" (commencing Septenber 15th), and the second one for the best constructed apparatus. Other schemes to be arranged in due course. Full particulars of the Society will be gladly furnished by the Hon. Secretary, S. J. Tyrrell, 2, Providence Road, Yiewsley, Middlesex.

Brighton Radio Society.

(Affiliated with the Wireless Society of London.)

A meeting of the above Society was held on Thursday, September 1st, 1921, when the second session opened with an excellent attendance.

Several items of interest were discussed concerning the future operations of the Society.

The following change is recorded:—Mr. M. G. Foster was transferred from the Technical Committee to the Executive Committee vice Mr. O. G. Sandford, resigned, and Mr. J. S. Skinner was unanimously elected to the Technical Committee vice Mr. M. G. Foster.

One new member was elected.

The Society's Club-room installation is completed and working, the P.M.G.'s permits having been secured for both this and a portable receiver.

There was no further business, and the meeting was adjourned until September 15th.

Any gentlemen interested are invited to communicate with the Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton, who will be pleased to furnish full particulars as to membership, etc.

Edinburgh and District Radio Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary and Treasurer, Mr. W. Winkler, 9, Ettrick Road, Edinburgh.

The members of the Society held their usual monthly general meeting on September 7th, when various items of minor importance were discussed. Amongst other things it was decided to recommence Sunday meetings (3 p.m.) on and after October 2nd. The Wednesday 8 p.m. meeting to be continued as usual.

Mr. Crichton, the Vice-President, addressed the meeting, and advised all members who could take full advantage of the British Association meeting, which was about to be held in the town, as this was an exceptional opportunity for everyone seriously interested in scientific work. We were also indebted to the British Association in that, through its meeting in the town, we had the pleasure of welcoming Lieutenant Duncan Sinclair, from the Air Ministry, who was in charge of the meteorological wireless telegraph receiving station connected with the British Association, and who honoured us with a visit on this occasion. He very kindly agreed to demonstrate the apparatus he was using to the members of the Society, who met for this purpose on the following Saturday afternoon, when they enjoyed an extremely interesting hour.

The Society had the pleasure of assisting Mr. Scott-Taggart in the erection of the receiving apparatus required to demonstrate the working of his invention, the "Negatron," before the British Association on Tuesday, the 13th ult., when the messages from Aberdeen and Paris were duly received and were made clearly audible to everyone in the lecture room—and also, we learned later, to most people in the building.

We have also to express our thanks to Mr. Scott-Taggart for the demonstration of the "Negatron" oscillator which he gave to our members, and for the very clear and concise way in which he described its use and method of working.

All members are particularly asked to be present at the next general meeting, October 5th, 8 p.m., when we hope to announce the winter syllabus and discuss the more or less important business of the winter season.

Dartford and District Wireless Society.

(Affiliated with the Wireless Society of London.)

The usual fortnightly meeting of the above Society, held on Friday, August 26th, 1921, at Dartford Grammar School, was well attended, and proved to be of an exceptionally instructive and interesting character.

Dr. L. J. Miskin presided, and after the minutes of the previous meeting had been read and confirmed and business items discussed, the various sets brought by the members for demonstration were fitted up, some excellent signals being received, which, with the aid of a loud speaker, were audible to all present.

It is a noteworthy fact that all the instruments demonstrated at this meeting were constructed entirely by the individual members themselves, and the results obtained clearly show that amateur-constructed apparatus is quite capable of giving professional results.

Full particulars as to membership, etc., can be obtained from the Hon. Secretary and Treasurer, Mr. E. C. Deavin, 84, Hawley Road, Wilmington, Dartford.

Borough of Tynemouth Y.M.C.A. Amateur Wireless Society.

(Affiliated with the Wireless Society of London.)

An auspicious gathering took place on September 5th in the Y.M.C.A., South Shields, on the occasion of the opening meeting for the second session of the above Society. There was a very good attendance.

Dr. Jas. A. Hislop acted as chairman in the unavoidable absence of the President.

Before calling upon the lecturer, the Chairman addressed the meeting, and in suitable words welcomed all the old and new members to the Society.

Mr. Geo. J. S. Littlefield was then called upon to deliver his lecture, the first of a series of four, upon "The Construction of a Single Valve Receiver."

His first lecture dealt mainly with aerials and earths, etc., and the information imparted was of very great assistance, not only to those who were contemplating the erection of a single-valve set, but to those who were already in possession of one.

A vote of thanks to Mr. Littlefield was proposed by the Chairman and seconded by Mr. R. Morley, the members showing their appreciation in a very hearty manner.

Meetings are to be held every Monday evening, except the second Monday in the month.

The Committee have arranged an excellent programme, and everyone is looking forward to a very successful season.

Hon. Secretary, Mr. L. L. Sims, "Eynesbury," Cleveland Road, North Shields.

The Wireless and Experimental Association.

Wireless and Experimental Association, Central Hall, High Street, Peckham: Secretary, Mr. G. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

At the meeting of the Association on Wednesday, August 31st, the question of assisting towards the upkeep of the Dutch Concerts, as mentioned in the current number of *The Wireless World*, was brought up, and upon the motion of the Secretary, seconded by Mr. Voigt, and carried unanimously, it was resolved to make a grant from the Association's funds as a nucleus for a general subscription list. The immediate response was very encouraging, as the unselfishness of the organisers so far in broadcasting their music, etc., for the furtherance of amateur wireless work is highly appreciated.

Mr. Horwood then continued his lecture on the oils, dealing particularly with physical and chemical tests. Transformers for the Campbell Swinton H.F. Amplifier were dealt with by Mr. Kennedy, and short-wave tuners by Mr. Knight.

On Wednesday, September 7th, a lecture was given by Capt. Donisthorpe on his newly invented "Thermagnion."

Showing how the visible straight cathode stream in a long tubular glass can be deflected by a permanent magnet, he next demonstrated that the more complex distribution of negative electrons in a thermionic valve can be modified and controlled by an external electromagnet.

Giving the preference to a soft valve, potentiometer controlled detection and magnetic modification he demonstrated that all the effects of reaction can be obtained without the usual reactance coil, thus avoiding possible embarrassment owing to patent rights.

The meeting followed the lecturer through diagrams, characteristic curves, and experiments, and at the end of the most successful lecture the members have had, a cordial vote of thanks was passed to Capt. Donisthorpe, who suitably replied.

The relaxed conditions of purchasing and possessing wireless apparatus were discussed, and particular note was taken of the permission to use "toy" apparatus for sending and receiving. It is devoutly to be hoped that the boy next door won't be trying to send 50 yards the next time we are trying with seven valves to hear the American Amateur.

The Willesden Wireless Society.

On August 30th, our Chairman gave us a chatty lecture describing the life of a wireless operator throughout the late war. He very ably recalled the conditions which existed when wireless was first used at the front, besides giving us brief descriptions of the sets then used in the Service. Altogether a very interesting evening was spent.

We had a general demonstration of members' sets on Tuesday, September 6th. Mr. Corsham exhibited a portion of the direction-finding apparatus on which he is at present engaged, and which was recently commented on in our local press. Mr. Vernon-Barker also exhibited his 4-valve German amplifier, which was finally worked in conjunction with Mr. Corsham's apparatus.

A series of lectures has now been decided upon by the committee with which to start our winter session. These are as follows:—

September 12th.—"Oscillatory Circuits," by Messrs. C. S. Dunham and F. A. Tuck.
" 19th.—"Properties of Crystal Detector Circuits," by Mr. Wyatt.
" 26th.—General demonstration.

October 4th.—"The Theory of the Thermionic Valve, Part I," by Mr. Corsham.
" 11th.—"The Theory of the Thermionic Valve, Part II," by Mr. Corsham.
" 18th.—"The Theory of the Thermionic Valve, Part III," by Mr. Corsham.

Members are reminded that as the above series has been arranged as an instructive course, regular and punctual attendance is greatly desired by the committee.

Some of our members have now obtained licences for portable sets. Some field days are contemplated, of which more anon.

In our report of September 17th we mentioned Mr. C. S. Dunham as of "The Marconi Co." this should have read "The Marconi Scientific Instrument Co."

Further particulars can be obtained from the Hon. Secretary, Mr. F. A. Tuck, 87, Mayo Road, Willesden, N.W.10.

The Ilford and District Radio Society.

Hon. Secretary, Mr. L. L. Vizard, 12, Seymour Gardens, Ilford.

The Quarterly Meeting of the Society was held at headquarters on Wednesday, August 17th, 1921, the chair being taken by the Vice-President. After the Secretary had read the minutes, the Treasurer submitted the cash book to members with the request also for more subscriptions to be paid in.

Members then settled down to discuss what was to take place during the winter session, and a very satisfactory programme was arranged.

The meetings are to be divided up into three sections, viz.: (1) Buzzer practice. (2) Elementary lectures. (3) More advanced lectures. The first section will occupy half an hour, the second section three-quarters of an hour including a quarter of an hour for questions, and the third section will be carried on until the meetings close at 10 p.m. Mr. Welch kindly offered to take the elementary lectures, and up to the time of writing no decision has been arrived at as to who will take the more advanced lectures. The first meeting of the winter session commenced August 31st, and the last meeting will take place March 29th, 1922, and every third meeting will be devoted to lectures and demonstrations.

Mr. J. E. Nickless, M.I.E.E., is giving us the first of these, and is lecturing and demonstrating on "The Efficiency of the Tuned Anode and Grid Leak Circuits."

On August 31st we commenced our winter session, and Mr. Welch gave his first elementary lecture. Everybody turned up early for the buzzer practice and throughly enjoyed the lecture.

The last three-quarters of an hour was spent by a lecture from the Secretary on "The Best Method of Receiving Telephony without causing Jamming," and a lengthy discourse was the result. The Secretary is pleased to be able to announce that the P.M.G. has granted the Society a transmitting and receiving licence both for portable and fixed station, and we hope to have some very good field days in the near future. Will all intending members please call or write to the Secretary at the above address.

Halifax Wireless Club.

The annual meeting of the Club was held on Wednesday, August 31st, 1921.

There was a good attendance of members, presided over by Mr. Walter Emmott, M.I.E.E., M.I.Cons.E., the president of the Club.

After the usual formal business, the Hon. Secretary gave his report on the progress of the Club during the past year. It was reported that the Club was approaching its hundredth member, and that at least 25 of the present membership had receiving stations of their own. Reference was made to the transmissions of the Club set, and also to the great help received from Mr. P. Denison, 2KD, with his transmissions. Fifteen lectures had been held during the past year, all of which had been exceedingly helpful and interesting to the members.

The Treasurer's report showed that the income of the Club had managed to keep the expenditure in hand, and that there was a little balance to carry forward.

The election of officers, etc., for the coming session resulted as follows:—*President, Mr. Walter Emmott, M.I.E.E., M.I.Cons. E.; * Vice-Presidents, Messrs. J. R. Clay, G. E. Rawling, H. Mortimer, J. G. Stirk, H. Emmott, A.M.I.E.E., A. Gledhill; Committee, Messrs. J. E. Mitchell*, W. R. Haswell, B.Sc., J. H. Hardy, Wh.Sc., A.M.I.E.E., Harold Town and W. J. Holroyd; Hon. Treasurer, Mr J. R. Clay, The Towers, Sowerby Bridge; Hon. Secretary, Mr. Louis J. Wood.*

By a practically unanimous vote, it was decided to allow ladies to become members of the Club, a privilege withheld from them up to the present.

The Hon. Secretary briefly outlined the syllabus for the coming session. Fifteen lectures have already been arranged, and more are in negotiation. It is hoped to have one lecture per week, a buzzer class on another evening per week, and if the demand is sufficient, a series of constructional classes will also be held.

At the close of business light refreshments were served, and under the mellowing influence of coffee, difficulties were brought out and solved to everybody's satisfaction.

First lecture, October 5th. Mr. P. Denison on "Amplifiers," Part I.

Hon. Secretary, Mr. Louis J. Wood, Clare Hall, Halifax.

The Lowestoft and District Wireless Society.

The Society has now considerably extended its Club-room at Bridge Road, Oulton Broad, and a 3-valve experimental board has been installed and a full programme has been prepared for the winter session which commenced on September 13th.

A hearty welcome is extended to all amateurs visiting Lowestoft and the surrounding districts.

Meetings are held weekly on Tuesday, at 7.30 p.m. Full particulars of the Society are obtainable from the Hon. Secretary, L. Burcham, "Gouzeacourt," Chestnut Avenue, Oulton Broad.

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* Re-elected.

The Stockport Wireless Society.

During the last month the members of the above Society have been busily engaged installing the new receiver.

On August 27th, the set was tried out and the results gave the greatest satisfaction. The aerial proved to be very efficient, and the Society having now obtained a room entirely for the use of members, is likely to make great headway during the coming winter.

A course of instructional lectures was commenced on September 7th, and every Friday night the members meet for buzzer practice. Many of the members show themselves as embryo experts, and dot and dash chasing seems to have become quite a popular recreation amongst them.

Hon. Secretary, Mr. R. H. Jackson, 54, Prince's Street, Stockport, will be pleased to give particulars of membership.

Smethwick Experimental Wireless Club.

Hon. Secretary, Mr. R. H. Parker, Radio House, 31, Wilson Road, Smethwick, Birmingham.

A most successful meeting was held at the Club's headquarters in the Physics Laboratory, at the Municipal Technical School, Mr. A. Adams, F.I.C., F.C.S., in the chair. Mr. G. Whitehouse was called upon to give his lecture on "Fundamental Principles of Electricity." The lecturer, in as simple language as possible, outlined the electrical units, and his remarks were admirably illustrated by practical experiments in the School's power house.

The Club is now making excellent progress towards the completion of the construction of an efficient receiver.

Would all intending amateurs please communicate with the Secretary.

Epsom and District Amateur Radio Society.

The Treasurer of the above Society wishes to inform members of the re-opening of the Club.

A meeting of the Committee will be held on Monday, October 3rd. Every member's presence is requested to discuss the working of the Club for the next period.

New members with an interest in wireless telegraphy will be welcomed on Wednesday, October 5th. It is hoped there will be quite a number of new members present then.

Would prospective members kindly communicate with the Treasurer, Mr. J. B. Plenty, for full particulars of membership.

The Southend District Wireless Society.

The weekly meeting of the above Club was held at the Argyll Institute on Friday night, September 9th, at 8 p.m.

Mr. Knight gave some interesting experiments on his home-made Wimshurst machine, with Geissler tubes and other apparatus.

Mr. L. Bridge then gave an exhibition of various types of wireless valves, both receiving and transmitting. In the meantime the Club's frame aerial was connected up to Mr. Boddy's home-made 3-valve amplifier and fair results were obtained.

The Chairman then called upon Mr. Falkus to give a lecture on C.W. transmitters. The lecturer gave a clear description of C.W. apparatus, commencing at Hertz's discovery, leading up to modern C.W. transmitters of telephony and telegraphy.

All interested in wireless are invited to communicate with the Hon. Secretary, Mr. C. Jackson, 80, Leigh Hall Road, Leigh-on-Sea, Essex.

MISSING.

Oscar Crommelin Gray, aged 17, looks older, height 5 ft. 11 in., brown hair, hazel eyes. Has a scar in front of right ear running up into and forming a thin white vertical line through hair. Boots have "13" in brass studs under instep. Disappeared from Liverpool Street Station on morning of Thursday, 15th September, following a fall that morning which injured his head. Is very interested in wireless telegraphy and it is thought he may consciously or subconsciously visit wireless stations or wireless apparatus manufacturers. His parents seek information. Their address is Bretts Hall, Tendring, Essex.

DIRECTORY OF EXPERIMENTAL STATIONS.

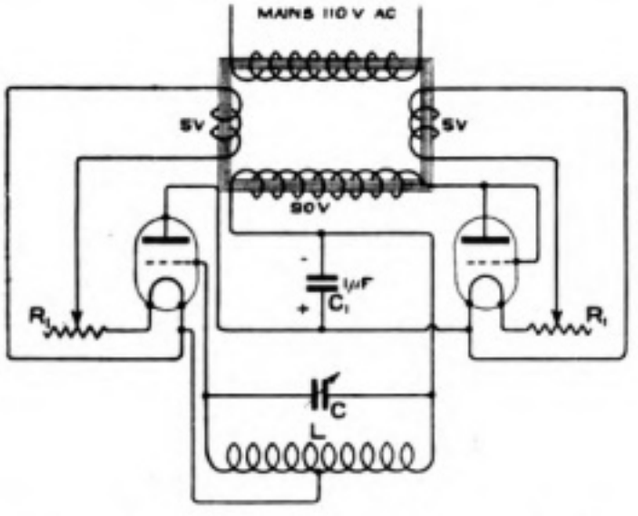
ADDITIONS.

Call Letters.	Power in Watts.	Wave-lengths in Metres.	Hours of Working.	System.	Name and Address.
2 KB	10	180	7.30–9.30 p.m.	C.W., Telephony and T.T.	W. E. Earp, 675, Moore Road, Mapperley, Nottingham.
2 KN	Artificial Aerial only.			C.W. and Telephony.	A. B. Day.
2 LA	—	180 1,000	7–8 and 9–10 p.m.	C.W. and Telephony.	H. F. Yardley, 121, Victoria Road, Headingley, Leeds.
2 LB	—	180 1,000	7–8 and 9–10 p.m.	C.W. and Telephony.	H. F. Yardley, 6, Blenheim Terrace, Leeds.
2 NA	10	1,000	6–8 and 9–12 p.m.	C.W. and Telephony.	H. Frost, Longwood, Barr Common, Walsall.
2 OI	Artificial Aerial only.			C.W., Telephony and T.T.	Colin Bain, Newcastle-on-Tyne.

HETERODYNE RECEPTION USING ALTERNATING CURRENT SUPPLY ONLY

AS a further suggestion to the use of A.C. for working receiving valves (see *The Wireless World*, May 14th, 1921, p. 103), I tried to build a heterodyne set fed only with A.C. from lighting mains. Having got quite good results in the reception of C.W., I hope the following description and circuit diagram will enable anyone interested to experiment with the arrangement.

L and C are respectively variable inductance and capacity of the proper values to make an oscillating circuit in resonance with the wavelength to be heterodyned (or, better, to give the necessary beats). On the left, the connections of this circuit go to a receiving valve. This heterodyning valve has its



filament lighted, through a rheostat of a few ohms, by A.C. reduced to 5 volts.

For the high-tension (40-80 volts) on the plate of the heterodyning valve, I resorted again to a device already described (see the above reference), but perhaps a short description will be helpful.

A valve has grid and plate connected together, and with the secondary of a transformer, the filament being heated from a special secondary giving 5 volts. It is well-known that positive unidirectional current can be drawn from the heated filament, and, therefore, feed the plate of the heterodyning valve. The other end of the principal secondary acts as a negative terminal, and is connected to the oscillating circuit of the heterodyne. A fixed condenser of about *one* microfarad is shunted between positive and negative leads, steadying the impulses and providing a path for H.F. oscillations.

One transformer connected with lighting mains (as per diagram) is simpler, but, if preferred, two or three can be used, with their primaries in parallel, giving respectively 5 volts and 40-80 volts.

With this set, C.W. stations are heard almost exactly as if the set worked with accumulators or cells. It is true that it requires an extra lamp for rectifying H.T. voltage, but, in the long run, the lamp is much cheaper than the usual sources of voltage, and no charging is needed.

Prof. M. Moye,
University of Montpellier (France).

A NEW STATION IN HOLLAND

The photograph, kindly supplied by a Dutch reader, shows a group of students from a Commercial School who recently paid a visit to the Wireless Station at Kootwijk,

near Apeldoorn, Holland. This station is under construction and will be completed in 1922.

CORRESPONDENCE

To the Editor of *The Wireless World*.

Sir,—Having noticed a letter from "Experimenter" (Glasgow) on the question of "attic aerials," I am evidently using an aerial such as he describes, and I get top-hole results with only one valve. During the Derby racing days I got speech as plainly as on the ordinary telephone, and I can get any amount of 600 stuff, ships, etc. I use (and at present it's the only one) an aerial consisting of two No. 16 S.W.G. copper wire suspended by *string* from the laths that support the slates on the roof, length about 40 ft., distance apart 5 ft., and my earth is the bathroom water pipe. *All* my apparatus is home made, and I think I am very lucky to get such good results.

IMPROVISOR.

To the Editor of *The Wireless World*.

Sir,—I notice in the issue of September 3rd, a letter from the Leicester Society with respect to a weekly wireless concert from Marconi's Wireless Telegraph Co., Ltd.

On behalf of the Club I wish to add our request to theirs, and trust that this desirable object can be achieved.

It does seem queer that here in England, the home of wireless, we have to rely on our telephony from either local sources, or Holland and Germany.

I quite appreciate that the transmission of weekly concerts will be a more or less expensive proposition, but I do not suppose that The Hague people are exactly philanthropists, but use their concert as propaganda for the sale of their manufactures, and this would apply equally to an English concert.

I have no doubt that if the promoters of an English concert were to appeal for some subscription to carry on this work, they would meet with far more support than the Holland people will get, though I do not belittle this latter transmission at all, I consider the Dutch concert one of the finest tuning tests at present existent. Certainly if a set will tune this concert it is good for anything.

I hope that other societies will add their appeal for something British for this, the finest of hobbies and let us have less dependence on foreign enterprise. 'Twas ever thus, and I suppose 'twill ever be so.

We are approaching our hundredth member at Halifax, and the institution of an enterprise which would not need umpteen valves to make audible would arouse enthusiasm for an additional weekly club night to the one we already hold for lectures and study.

LOUIS J. WOOD,
Hon. Secretary.
The Halifax Wireless Club.

To the Editor of *The Wireless World*.

Sir,—With reference to the letter by Mr. T. S. Skeet on the subject of Mr. Campbell Swinton's amplifier published in your issue of September 3rd, I may say that when testing an amplifier of this kind over a year ago we carefully tried which gave the best results, the tuned anode or the tuned grid circuit. Taken all together we found that for strength and selectivity the anode circuit was the best to tune, and in consequence constructed the amplifier referred to by Mr. Campbell Swinton and Sir Henry Jackson on those lines. We have recently been experimenting with a two-valve receiver, 1 H.F., 1 rectifier, capable of having both circuits tuned. This confirms the above in practice: if both circuits are tuned there appears to be a slight increase in strength only but an increase in selectivity as would be expected. Such complications would almost place a multi-valve amplifier out of court by reason of "the handles to turn."

H. C. H. BURBURY.
Operating 2AW with Mr. H. H. T. Burbury.

USING COMMON BATTERY FOR AMPLIFIER AND RECEIVER.

NO doubt many readers have purchased one of the German 4-valve low frequency amplifiers from one of the high or low-priced sources available. It is stated that they must be used with separate H.T. and L.T. batteries, but they can be modified so as to use the batteries of the receiving set as follows:—

1. *To break the wire joining the input primary to the secondary.*—The right hand input socket has three wires coming from it. Find the one which goes to the centre switch and leave it. Disconnect the other two from the socket, but leave soldered to each other.
2. *To prevent the filaments lighting up even if switched "off."*—The switch is placed in the — lead. Remove the wires and place it in the + accumulator lead instead. If the heterodyne receiver has its switch in the — lead it must be treated similarly. This is due to the variety of wires which run to earth forming alternative paths past the switch.
3. *To disconnect the telephones from earth if desired.*—Two wires come from the second telephone socket counting from the left. Cut the wire which leads off towards the left.

H. E. ADSHEAD.

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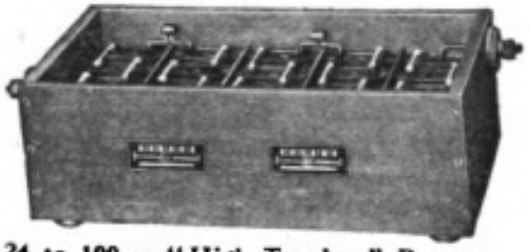

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QUESTIONS AND ANSWERS

***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 work. 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.**

B.M H. (Finsbury Park).—(1) Arrangement B will give the best all round results.

(2) The variable condensers A1 and A2 are unnecessary. Connect a 0·002 mfds. block condenser across the winding of the transformer which is in series with the reaction coil. Connect the grid leak of the rectifier from the grid to the negative of filament. Connect all transformer windings to the filament negatives, not positives.

"WIRELESS NOVICE" (Alfreton).—Except that the fixed condenser should be connected across the telephones and not across the crystal, the diagram given is correct for the simplest crystal circuit. The whole of your inductance will just tune to 2,500 ms. Your best plan will be to listen for the Eiffel Tower time signals, during the day (times given in August 6th issue chart) set the slider so that all the inductance is in the circuit, and the crystal and telephones across all the inductance, and adjust the crystal until you hear the signals. You can then readjust the inductance for ships.

C.W.A. (Southfields).—If your condensers are very good we think the suggested re-arrangement for use with a single H.T. battery should work all right. It will, however, be necessary for you to use condensers of good quality. We doubt if the circuit has any special advantages. It will be liable to give considerable radiation from the aerial. One reason it is not very good for C.W. is that with this arrangement the reaction coil will have to be rather large, which will not make the tuning of the aerial circuit very convenient.

"APPAM" (Ilford).—(1) The arrangement of the circuit is all right, except that you should not short circuit the loading coil when it is not required. It is much better to remove it from the circuit.

(2) About 7" × 3", wound with No. 22.

(3) The capacity will hardly be large enough. Use twice, or even three times the number of plates.

D.F.C. (Clifton).—(1) About 150 volts.

(2) Wind the low resistance side to about the resistance of your microphone, using wire of about No. 32 or 34. H.R. winding can hardly be too high, say, 10,000 ohms. of No. 44. We should be inclined to omit the leak shown.

(3) We should strongly advise you to leave them out.

(4) Quite impossible to say, depending as it does on a number of factors, as, for instance, the earth resistance, about which we know nothing.

C.W. (Birmingham).—(1) A frame aerial using a given length of wire is much less sensitive than the same amount of wire used as an outdoor aerial, but is quite satisfactory if sufficient amplification is used, say, 4 valves. A frame should not, in general, be less in diameter than about 3'.

(2) The circuit is quite good, except that the grid condenser and leak should be on the other side of the variable condenser, *i.e.*, between it and the valve grid. An extra loading coil can be introduced in series with A.T.I. if desired.

RADIO (Weymouth).—(1) A.T.I.—6" by 6", wound four pile with No. 26. Reaction coil—6" by 4½", wound single layer with No. 30. A.T.C., in parallel with the A.T.I., 0·001 mfds.

(2) For windings see recent articles. For a circuit see Fig. 3, page 304, August 6th issue.

(3) Not known.

(4) Information given is not sufficient to identify the station. A long dash of this type is usually sent for testing purposes.

"ZINK," (Thames Ditton).—(1) and (2) Consult the diagram and article on page 199, June 25th issue. You can easily add an additional valve, connected in the same way as the second valve shown, if you desire. We do not know of a suitable book to refer you to. For such a long range it would be necessary to use several different sets of coils for the tuned circuits. We should recommend you to try basket coils about 4" in diameter, wound with about No. 26, finding out by experiment how many to connect up together for each wavelength range.

(3) In the set shown telephones should be not less than 6,000 ohms, but L.R. telephones with a telephone transformer would improve the set.

(4) The "Year Book of Wireless Telegraphy" contains the information you require.

R. McC. (Balham).—(1) Either of the methods suggested are feasible, but both would most probably give you a good deal of trouble. We rather prefer that of the sketch submitted.

(2) Certainly, provided the distance from the transmitter was not great.

(2) Two baskets 3½" in diameter, wound with No. 22 wire, should give the range you require.

(4) Yes.

W.W.R. (Hawick).—(1) You should be able to receive fairly high power commercial or Government sets at the distance of London with either of the types of set you suggest, but with neither of them are you likely to get small power amateur, aircraft, or similar sets.

(2) The choice between the sets is largely a matter of your individual taste. The resistance-capacity amplifier will not be good on short waves. We ourselves would rather prefer the single valve

outfit, as it would appear to offer better chances of experimental alteration, and additions, if desired, at a later date.

"FRAME" (Antwerp).—(1) This depends on the wavelength required, which you do not specify. They should be about the values normally used for an A.T.I., and reaction coil for the maximum wavelength you propose to reach.

(2) We should suggest basket coils, say 4" in diameter, wound with No. 32, two or three being used for each of S_1 and S_2.

(3) C 0·003 mfds. and Cr 0·0002 mfds. should be suitable values. The latter should be resistance shunted if the valves are hard.

(4) As this set is of unusual type and general interest, we reproduce your diagram Fig. 1.

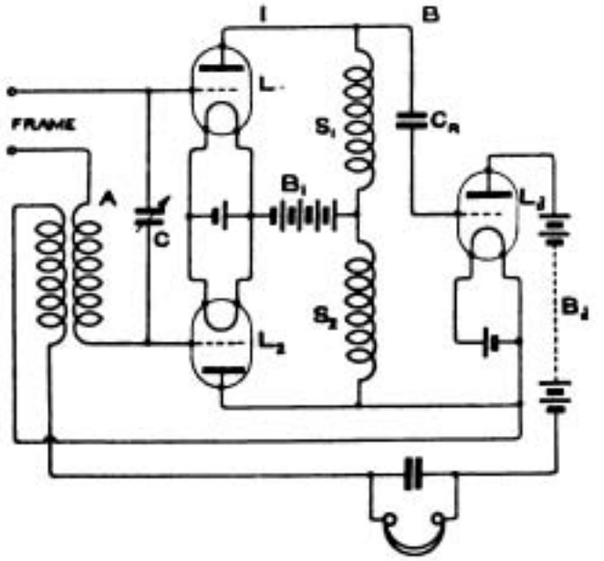


Fig. 1.

We have no actual experience of the type, but the principle involved is quite sound, and we should expect to be able to get very good results after experimenting to find the best values for the coils and couplings.

G.F.K. (Epsom).—(1) You might get other aircraft stations such as Lympne with careful tuning, also experimental stations near London.

(2) About 6,000 ms., but there will not be anything for you to listen to above about 3,000 ms. It would improve the set considerably to rewind the coil with No. 22, which will give all the range you require.

(3) Probably Eiffel Tower scientific time signals.

(4) We do not know of any station which answers to this description.

C.N. (South Norwood).—The following, it is understood, are new abbreviations in place of the old QRU (and its additions, official or otherwise):—

QTA - I have nothing for you.
QTB - Have you anything for me?
QTC - I have something for you.

"OSCILLATOR" (Forest Gate).—The T type transmitting valve, which is now obsolete, is of the soft variety, and requires 40 volts positive on the grid to give an anode current of approximate 30 milliamps. If this is done the set will probably oscillate satisfactorily. The circuit mentioned was more or less experimental, and is not now used exactly as shown.

V.A.R. (Kobenhaun).—(1) and (2) We have no practical experience of this circuit, so cannot say much about its possibilities. From the windings given in the article in Chapter 31 of the book "Practical Wireless Stations," it appears to be intended for comparatively short wavelengths. We cannot say if it is suitable for every wavelength, or for a big range of wavelengths—which can only be determined experimentally. For very long wavelengths an inconveniently large amount of inductance would be required to tune the anode and grid circuits.

(3) The article is not very clear on this point. The inner coil must be made to turn round inside the outer coil, so that the planes of the two windings may be at right angles or parallel as desired. For this purpose the inner coil must be mounted on a spindle, with a handle and pointer attached.

(4) It should be a variable condenser for preference.

H.S.N. (Reading).—(1) Unless you can raise the part of the aerial between the two houses above the roof you will not obtain much benefit from this 20' of the aerial. Mount the pole at the extreme end of the garden, and use a twin wire aerial, with wires 4' to 6' apart, and clear of the trees. Adjust to the permitted length by means of rope at the house end. The lead in can be taken from a point directly over the hut.

(2) We do not recommend you to spend the sum mentioned on a crystal set, as the number of spark stations received would not justify the expenditure. For considerably less than this you could make an efficient crystal set yourself, or, far better, a single valve reaction set.

"ILATUM" (London).—(1) The article in question, "Year Book," page 1,160, Fig. 11, refers to a special 4-electrode valve circuit, in which rectification takes place between the outer electrode and the filament. This electrode is adjusted to the best rectifying point by means of a potentiometer. Its action is not similar to the dull filament action although the circuit as a whole can be adjusted for limiting the strength of signals by means of the filament resistance.

(2) This is rather misleading as you say, and really should be shown as in your diagram.

R.K. (New Brighton).—(1) We do not know of a good practical book. Bangay's "Elementary Principles" will give you a good insight into the action of various parts.

(2) Yes. Use a single No. 16 copper wire, or, better still, some of the flexible stranded aerial wire as advertised in our columns.

J.W.W. (Forest Hill).—(1) R_1 is the filament resistance whose value and current carrying capacity will depend on the type of valve you use. 3 ohms will probably be sufficient, wound with No. 16 Eureka wire. R_2 is the grid potentiometer, which may be 300-400 ohms, wound with No. 36 Eureka wire.

(2) Not unless you insert a reaction coil in the circuit, between the anode and the telephones. Couple it into the A.T.I. Connect a 0·002 mfd. block condenser across the H.T. and telephones.

(3) It depends on the size and make of the cell. Ordinary pocket lamp batteries of good make will last for months if kept dry and not short-circuited, but we prefer a larger size.

(4) This is Morse for "V," which is used for test purposes.

R.G.W. (Wimbledon).—(1) When H.R. telephones are connected in the positive side of the H.T. battery, there is a possibility of the insulation of the windings breaking down to earth under the potential of the battery.

(2) In multi-valve circuits on a common H.T. battery, the use of a telephone transformer is almost essential, for the reason discussed above. In almost any other circuit its use is quite optional.

(3) Honeycomb coils can be made to give a much bigger inductance in a small space than a basket coil, which is the chief reason for their use.

E.J.O. (Bradford).—(1) Wavelength with 0·0005 mfds. across the A.T.I. is approximately 10,000 ms. For the reaction coil—with no condenser—wind 6" of No. 28.

(2) Approximately 0·0005 mfds.

(3) If each earpiece is stamped 1,000 ohms, they are 2,000 ohms total resistance. They should be used as H.R. telephones.

(4) Yes.

E.A. (Goodmayes).—Connect a variable condenser of about 0·0005 mfds. across the A.T.I. to increase the wavelength and improve the reception of C.W. Increase the capacity of the telephone condenser to about 0·0015 mfds., and connect it also to the H.T. battery.

COIL (Newark).—(1) 0·0015 mfd. is really too large for the secondary of a crystal set. The aerial wavelength will be 3,000 ms. maximum, and the secondary (with a 0·0015 condenser) about 8,000.

(2) The capacity will depend on the dielectric constant of the material used. 1/16" dielectric is too thick. Use waxed paper, 0·005" (the thickness of thin writing pad sheets when waxed), then the capacity or sheet of dielectric, 4" × 3" overlap, would be approximately 0·001 mfd.

(3) Yes.

T.W.G. (Birmingham).—(1) On large ships a 3-valve amplifying detector is provided to be used in conjunction with the tuner of the crystal set. Also a local oscillator for C.W. reception.

(2) At the present time the "Wireless Year Book," 1920 and 1921, describe these.

S.W.P. (Boscombe).—(1) Except for the fact that your diagram (which is very difficult to understand) shows the H.T. battery completely out of the plate circuit, it appears O.K., and incapable of alteration to advantage.

(2) The terms are equivalent. Any combination of two coils, between which the degree of coupling may be considerably varied, is a loose coupler, and may be used for obtaining variable reactance.

(3) A.T.I., 10" × 6", of No. 22. Reaction coil, 6" × 4" of No. 28.

(4) Scrap the switch. At most two or three tappings are required on a reaction coil. The reaction coil must be situated close enough to the A.T.I. to be inserted in it when required.

S.P.B.A. (Iceland).—When using rectified A.C. as anode voltage in power valve working it is necessary that the rectified impulses should be smoothed out to obtain a steady voltage for oscillator valve anodes. This smoothing out is obtained by passing the rectified impulses into a large capacity storage condenser from which almost steady D.C. voltage is obtained. Owing to instantaneous differences between the current put into the condenser, and that taken out, there is a slight ripple on the condenser voltage, which gives the characteristic hum of a valve set. At low frequencies this ripple is more pronounced than at higher frequencies. With double rectification the frequency of this ripple is double the supply frequency. With D.R. the transformer secondary voltage should be twice that for single rectification to obtain the same voltage from the condenser. The connections for double rectification are shown in Fig. 2.

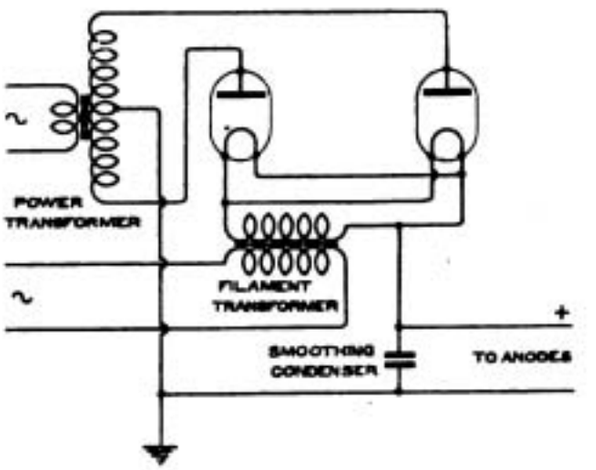


Fig. 2.

F.A.C. (Southport).—For a frame aerial set you will require at least three valves. We recommend you to start first of all with an outside aerial, with a single valve set. See recent constructional article, and the Question and Answer column. Also Bangay's "Elementary Principles," and also "The Oscillation Valve," obtainable from our publishers. We will give you windings when you decide on a set.

W.B.P. (Monkseaton).—(1) (*a*) 4,000 ms. (*b*) 9,500 ms.

(2) The reason is that you short the reaction coil. For spark signals it should be adjusted almost to the point of oscillation.

(3) It would be very weak and almost inaudible. 4,000 ms. 12.30 to 13.30 G.M.T.

(4) Yes. Tables given at G.M.T.

G.A. (Cape Town).—(1) It will not make a great deal of difference.

(2) Yes.

(3) Yes.

(4) Any good insulated conductor will be suitable for a receiving aerial down lead.

W.J.T. (Norbiton).—(1) Probably the reaction coil has a natural wavelength of about 800 ms.,

which will produce this effect. If you set the oscillator with a weak reaction coupling you can take some winding off so as to reduce this natural wavelength. If you are using honeycomb coils try a different coil.

(2) Probably this is the hum caused by the smoothing condenser ripple. See the reply to **S.P.B.A. (Iceland)**.

(3) We regret we have not the information required.

(4) This information appears from time to time—perhaps not always under this heading.

R.H.P. (Birmingham).—(1) For a single valve this is the best circuit to use.

(2) They are standard low resistance telephones, total resistance 120 ohms. *i.e.*, 60 ohms to each earpiece.

(3) The secondary may be wound directly over the primary, if you are sure that the primary is OK. Windings should be—H.R. 3 oz. of No. 44, and L.R. 6 oz. of No. 30. Core should be of soft iron wire, about 3" long, and ¼" diameter.

(4) Telephony is better on a good single valve set than with a crystal, owing to the advantages gained by use of the reaction coil.

C.W.P. (Southampton).—(1) and (2) The circuit submitted is badly proportioned. The primary maximum wavelength is 14,000 ms., and that of the secondary is 7,000 ms. Re-arrange the circuit as shown in figure 3.

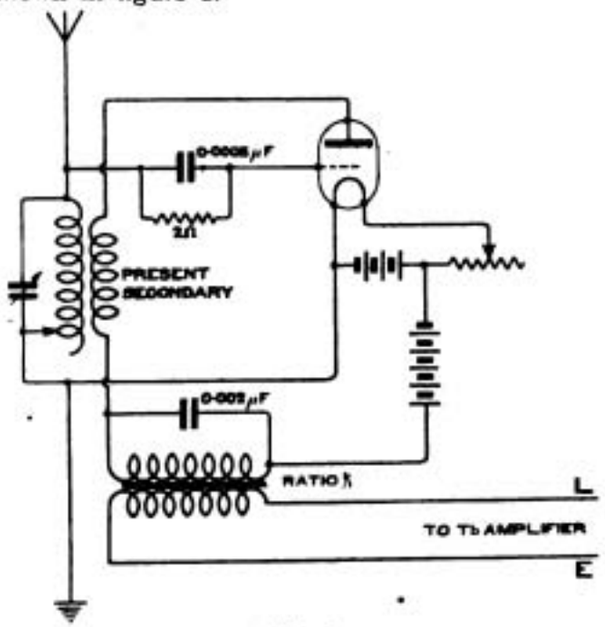


Fig. 3.

(3) No. The circuit shown above will be suitable for C.W. reception.

(4) No, not unless the slabs are carefully proportioned, and a variometer used.

E.B. (West Hampstead).—(1) Use 10 ozs. of No. 40 for the primary. The resistance will be about 2,500 ohms instead of 4,500 ohms. This is not important, as the number of turns count more than the actual resistance of the winding.

L.F.I. (Bedford).—(1) These groups of six figures are the actual times in minutes, seconds, and hundredths of a second of the first and last dots of the 300 dots sent as scientific time signals. Taking one set of your figures, *e.g.*, 300387, this corresponds to a time of 10 hours, 30 minutes and 3·87 seconds. The figures corresponding to the hour are not sent, as they are sufficiently obvious without doing so.

(2) There are many possibilities to account for this, as temporary failure of power, or of the signalling keys.

(3) This indicates that MPD is relaying the message for BYA.

C.E.G.B. (Shoreham-by-Sea).—(1) Probably somewhat less than 1 milliamp.

(2) This depends on the constants of the set, but is probably about 0.10 to 0.15 milliamps for strength 7 and 0.20 to 0.25 milliamps for strength 10.

(3) Quite sound, but rather complicated by switches.

(4) Results would be fair, but not very good on a frame; but should be quite good with a P.M.G. aerial and a loud speaker.

H.C.O. (Copenhagen).—The dimensions you ask for depend entirely on the wavelength you require, about which you say nothing. However, assuming a maximum of about 5,000 ms., the following values would be suitable: A.T.I. = 20,000 mhys.; closed circuit coil coupled with it — 9,000 mhys; primary of L_3, 750 mhys; secondary of L_3 (in plate circuit) — 2,000 mhys; L_2 — 9,000 mhys: C_1 and C_3 = 0.001 mfds: C_2 = 0.0001 mfds.

X.Y. (Cambelltown).—Please note that disguising fourteen questions under four headings does not make four questions of them, and, as you have no back numbers to refer to, we can only afford space to deal with a few of them.

(1) It is possible that the Secretary of the Society might be able to supply the information you require. There were at least three sets dealt with on the date you give, and we cannot determine from your remarks to which one you refer.

(2) A grid leak is put across the terminals of the condenser in the grid circuit.

(3) A slate pencil will do if of suitable dimensions, and if kept dry

(4) The best way to keep down radiation from a receiving circuit is to arrange that the aerial circuit is not one of the circuits in which oscillations are directly maintained by the valve. It should be coupled as loosely as possible to the oscillating circuits.

SHARE MARKET REPORT.

Prices in the Wireless Group as we go to press, September 22nd, are :—

Marconi Ordinary	£1	16	0
,, Preference	£1	16	0
,, Inter. Marine	£1	2	0
,, Canadian		6	3
Radio Corporation of America :—			
Ordinary		11	0
Preference		10	0

The WIRELESS WORLD

FORTNIGHTLY] OCTOBER 15th, 1921. PRICE 6D NET

THE WIRELESS WORLD

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

VOL. IX. No. 41. OCTOBER 15TH, 1921 FORTNIGHTLY

NOTES ON SHORT-WAVE RECEPTION

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

THE attempt again to be made this year by the American Radio Relay League to get into touch with British wireless amateurs, as announced in a recent issue of *The Wireless World* (see pages 383-384, September 17th, 1921), introduces many reception problems which in themselves differ somewhat from those usually encountered in normal working. Some of the difficulties lying in the way of such a test were pointed out in the announcement above referred to, but it may be of interest to consider the matter somewhat more in detail here.

Several possible ways of arranging the receiving apparatus are open to experimenters, and have already been described in these columns,* and it is not proposed to attempt to "lay down the law" with regard to which is the one method that should be used in all cases, as such an attitude might tend to stifle individuality in the design of the receiving apparatus.

As is well known, effective amplification of these short wavelengths is by no means easy, mainly on account of the much greater importance of stray capacities. Take, for instance, the case of a resistance coupled amplifier, which is one of the simplest to construct and use, any capacity between the plate of the valve and the remainder of the output circuit—H.T. battery, or filament circuit—will act as a shunt to the anode resistance and will consequently reduce its effective impedance. There will therefore be less amplification at these higher frequencies. For instance, suppose that this stray capacity amounts to but 10 cms. (or 0·000011 microfarad), and that an anode resistance of 100,000 ohms. is normally used. The effective impedance of the capacity and the resistance in parallel is $R/(1 + RC)$, where R = the resistance in ohms., C = the capacity in farads, and $p = 2\pi$ times the frequency of the current. If we express C in microfarads, and p in terms of the wavelength λ in metres, the above expression becomes :

Effective impedance =

$$R \Big/ \left(1 + R\frac{C}{10^6} \times \frac{2\pi \times 3 \times 10^8}{\lambda}\right)$$

$$= R \Big/ \left(\frac{1 + 600\pi RC}{\lambda}\right)$$

$$= \frac{R\lambda}{\lambda + 600\pi RC}$$

Hence in the example we have chosen, the effective impedance of the anode circuit at a wavelength of 6,000 metres is

$$\frac{100{,}000 \times 6{,}000}{3000 + 600\pi \times 100{,}000 \times 0{\cdot}00001}$$

* See particularly, *The Wireless World*, 8, pp. 581—583, November 13th, and pp. 609—617, November 27th, 1920.

$$= \frac{6 \times 10^8}{6{,}000 + 600\pi}$$

$$= \frac{6 \times 10^8}{6{,}000 + 1{,}884} = 76{,}100 \text{ ohms.}$$

or a decrease of nearly 24 per cent. as compared with the value of the anode resistance alone.

At a wavelength of 200 metres under the same conditions the effective impedance of the circuit will only amount to

$$\frac{100000 \times 200}{200 + 600\pi \times 100000 \times 0{\cdot}00001}$$

$$= \frac{2 \times 10^7}{200 + 1884}$$

= 9697 ohms., or a decrease of over 90%

This means that whereas with long wavelengths the valve capacity does not cause very much loss, for short waves there is very little amplification at all. Nor under these conditions can much advantage be gained by increasing the value of R, the resistance in the anode circuit, even should it be desirable to put up with the disadvantage of the higher H.T. voltage that would then be necessary. Thus, suppose that under the above conditions the anode resistance were doubled in value, we should find that the effective impedance of the circuit, at a wavelength of 200 metres, would only be increased to 10,080 ohms. as compared with 9,697—a trifling increase compared with the disadvantage of having to increase the voltage of the H.T. battery to nearly twice its former value.

Some other method of amplification must therefore be used if possible that will not introduce so much loss of amplification. The valve capacity should evidently be made to serve some useful purpose instead of merely causing loss. The valve capacity will probably be most useful if it is employed to effect a tuning of the anode circuit, or to help in such a tuning operation. At least two ways of effecting this are possible—using a tuned anode circuit with either a transformer or a capacity coupling between the valves. These two are indicated diagrammatically in

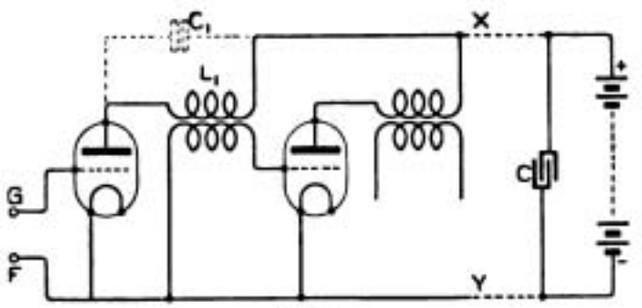


Fig. 1.

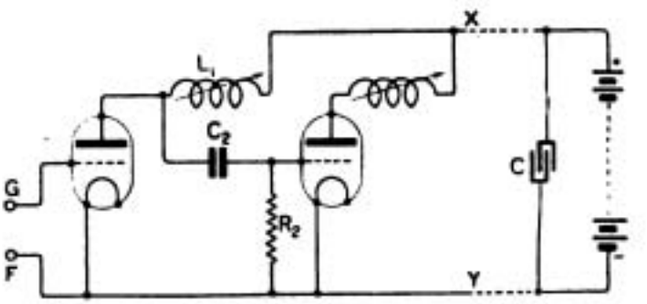


Fig. 2.

Figs. 1 and 2, which show two valves only. Identical methods can be extended to any reasonable number of valves, but difficulties will always be experienced when using more than about three high frequency valves owing to the great tendency of the set to oscillate continually. This state should, of course, be avoided.

The coil L, in the anode circuit of the valve (Figs. 1 and 2) may be tuned to the frequency of the currents being received by means of an additional capacity C_1 of small value connected across its ends. This condenser should be kept as small as possible, while it is preferable to dispense with it entirely, and so to wind the coil L_1 that the valve capacity alone is sufficient to tune it to the required wavelength. To aid the adjustment of such an arrangement the coil L_1 should preferably be provided with tapping points or be constructed on a variometer principle.

In the case of a tuned transformer coupled amplifier the intervalve transformers may be arranged in any one of several ways, chief amongst which may be mentioned

(1) those in which the primary and secondary coils are put on to an ebonite former on the lines of those described recently in these columns by Mr. A. A. Campbell Swinton; (2) those in which the primary and secondary are separated, but fixed in position relative to each other, such as when they are wound on concentric cylindrical tubes; and (3) those in which the two coils are more widely separated, somewhat like a loose-coupled receiving tuner. The conditions of operation of the intervalve transformer differ somewhat in these different cases, particularly as regards the tuning of the circuits. In the case of a transformer having separated coils, each winding can be individually tuned to the required wavelength since the coupling between them is loose; but with the closer coupled patterns, the transformer must be treated as a complete unit for tuning purposes, and it becomes practically impossible to adjust the winding or tune the coils to any given wavelength unless they are associated with the valves and circuits with which they are ultimately to be used.

If the windings of the intervalve transformers are permanently adjusted to a given wavelength, maximum amplification will be obtained at or very close to that wavelength, and the amplification will fall off rather rapidly for waves on either side of the one which gives maximum amplification. Such an amplifier will therefore be very selective, and will consequently not be suitable for use over a range of wavelengths. Should it be desired to time the set for use over a small range of wavelengths—such as will be required for the above-mentioned experiments on reception from America—it becomes desirable either to add a very small tuning condenser in parallel with each anode coil, or to provide a few tappings on it by means of which the tuning adjustments can be made.

The main disadvantage usually experienced with a high-frequency amplifier arranged on these lines, is the great tendency to set up sustained oscillations by reason of the unavoidable reactions between the various coils and circuits. To limit this tendency to self-oscillation, it is desirable to connect across the H.T. battery as large a condenser as possible—say at least 1 microfarad—as this will tend to prevent the magnified high-frequency potentials occurring in the last valve of the series from being handed back to the earlier valves by reason of the potential drop in the resistance of the H.T. battery. The presence of the large condenser shown at C, in Figs. 1 and 2, provides a by-pass path of very low impedance to high-frequency currents, and hence reduces the effective high-frequency potential difference between the common anode lead X and the filament lead Y to a very small value.

Thus, supposing that a condenser of 1 microfarad is used, and that the alternating component of the anode current of the last valve of the series is $\frac{1}{2}$ milliamp., the p.d. between the leads X and Y, due to the impedance of the condenser, will be approximately—

$$V = \frac{I \times 10^6}{Cp} = \frac{0{\cdot}5 \times 10^6}{10^3 \times 1 \times 2\pi \times 1{\cdot}5 \times 10^6}$$

$$= \frac{1}{6000\pi}$$

$$\doteqdot \frac{1}{18500} \text{ volt}$$

for a wavelength of 200 metres, so that even with this large condenser there is still an appreciable high-frequency voltage across its terminals, although this voltage is small compared with what would be present were the condenser omitted, and the H.T. battery had any appreciable resistance.

Some control of the self-oscillating properties of the amplifier can be obtained by fitting a grid potentiometer to regulate the mean grid potential of all the amplifying valves. Such an arrangement is indicated in Fig. 3, which illustrates a tuned reactance-capacity coupled type of apparatus. This potentiometer P can either be fed from the filament battery as shown in the diagram, or a separate battery can be employed, but the former is usually sufficient, since positive grid voltages are generally all that is required

to stop the set oscillating. The separate battery should be used when it is necessary to obtain a larger range of potentiometer voltages, both positive and negative with respect to the filament.

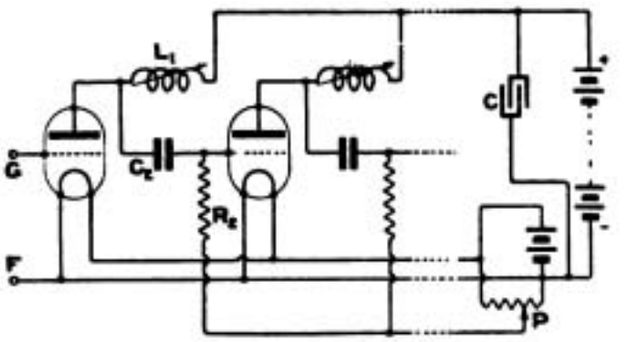


Fig. 3.

For the reception of C.W. signals on these wavelengths, some form of heterodyne is practically essential. Several alternatives are possible, but not all of them are equally suitable, nor desirable, for use. The simplest way of obtaining the necessary heterodyning currents is to allow the receiving set itself to oscillate and to slightly detune it from true resonance with the incoming signals so that beats are set up in well-known manner. This arrangement is usually termed the "autodyne" method of receiving C.W., and is the one most commonly adopted in amateur receiving equipment. As pointed out elsewhere in this issue, the use of the autodyne method on short wavelengths does not, of itself, introduce much loss of signal strength as compared with the very considerable loss incurred at long wavelengths, but most especially for the purposes of the Trans-ocean tests mentioned above, *the use of the autodyne method should most emphatically be avoided.*

The above-mentioned natural tendency of a multi-stage radio-frequency amplifier to set up persistent self-sustained oscillations converts such a set into an autodyne receiver unless every precaution is taken to prevent such self-oscillation. When this is done, by appropriate adjustment of the relative positions of the parts of the circuit and of the grid and H.T. potentials and filament currents, a separate heterodyne is necessary for the reception of C.W. signals. A separate heterodyne consists simply of a single valve provided with coupled grid and anode circuits so that continuous oscillations are set up by the valve. The frequency of the oscillations set up may be regulated by means of a variable condenser in one of the valve circuits, and thus may be adjusted to any desired value in relation to the frequency of the incoming signals so that beats are set up between them.

In many cases in the past, when a separate heterodyne unit has been employed it has been arranged close to the aerial circuit of the main receiver or amplifier, so that it induces high frequency oscillations in the aerial itself, which interfere with the incoming signals and produce beats. This arrangement is not good, since the aerial will *still be radiating.* It is true that the heterodyne radiation set up in this way will not be quite so strong as when an autodyne receiver is used, as the two circuits are no longer in tune, but for the same reason that the autodyne does not introduce much less of signal strength at short wavelengths, there will not be very much diminution of the radiation by this method. To reduce this radiation the heterodyne must be coupled to the receiving amplifier as far away from the aerial as possible, so that the heterodyne currents have to travel back through the amplifying valves before they can reach the aerial circuit.

The arrangement of the heterodyne to secure this result will be discussed further in a later article, which will also include some data for the construction of a heterodyne unit suitable for use in the reception tests for the American signals.

It is hoped that all British wireless experimenters who contemplate taking part in these receiving tests will use some form of separate heterodyne arranged so as not to radiate during reception, and that when sending in their names for these tests they will indicate the arrangement that it is proposed to adopt.

AN EIGHT-VALVE RESISTANCE-CAPACITY AMPLIFIER

By W. K. Alford (*President, Aldershot Radio Society.*)

THE amplifier herein described was constructed for D.F. experiments on the location of "x" centres, using an 8 ft. × 6 ft. frame.

The use of transformer-coupled amplifiers for the purpose has been relinquished, as they were found very unsatisfactory, particularly from their propensity of "picking up" energy on their own account, which is fatal to serious D.F. work.

The photographs (Figs. 1 and 2) are more or less explanatory of the general layout of the amplifier and the method of wiring which has proved very successful in combating the stray capacity trouble and parasitic noise which abounds in amplifiers wired on the usual principle.

The anode resistances are made from "Bristol board" soaked in Indian ink and graphited to a resistance of 60,000 watts. They are then coated with shellac varnish, which increases the resistance to the required value of 80,000 watts.

The grid resistances are constructed (in precisely the same manner) to a resistance of 3 megohms.

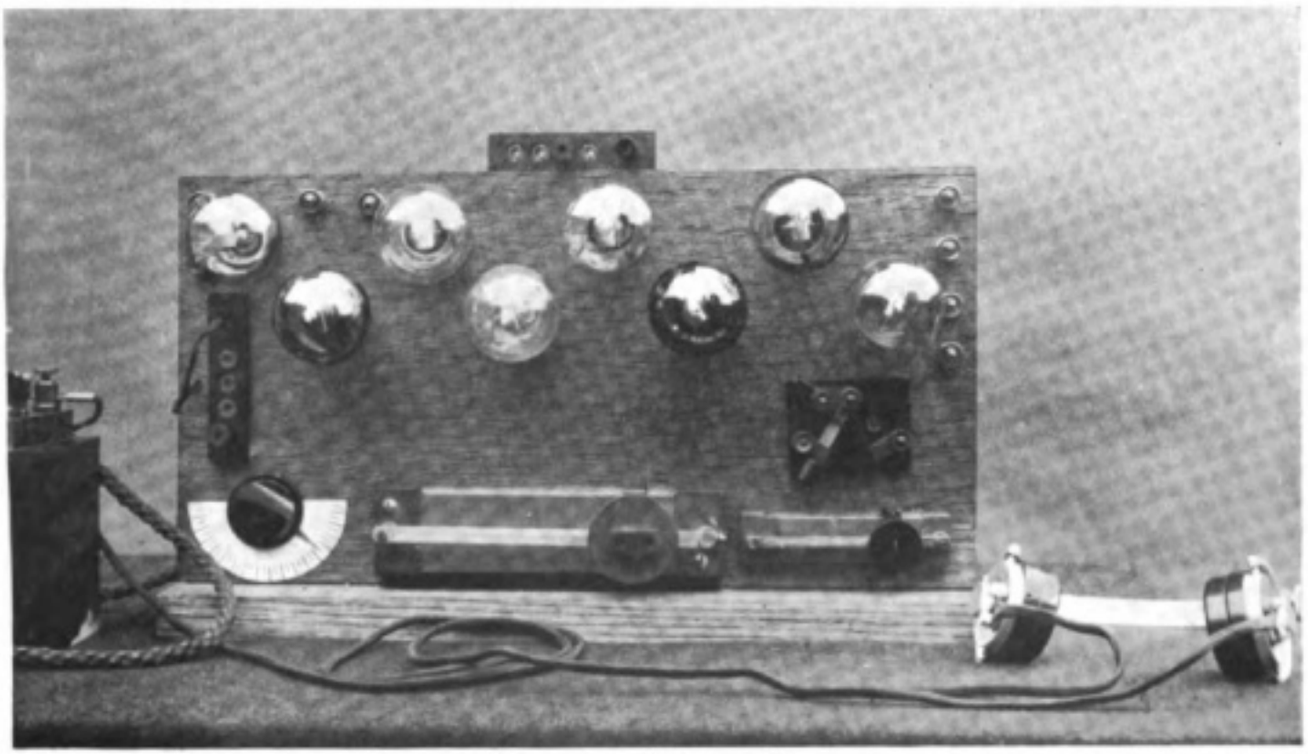
The condensers, of 0·0005 microfarads were made from a mica insulated condenser taken from a small spark set and split into portions.

Arrangement is made for the use of 3, 4, 6 or 8 valves by means of plugs, and the capacity-reaction condenser is capable of being placed between the grid of valve 1 and the anodes of valves 2, 3, 4 or 5 by the same means.

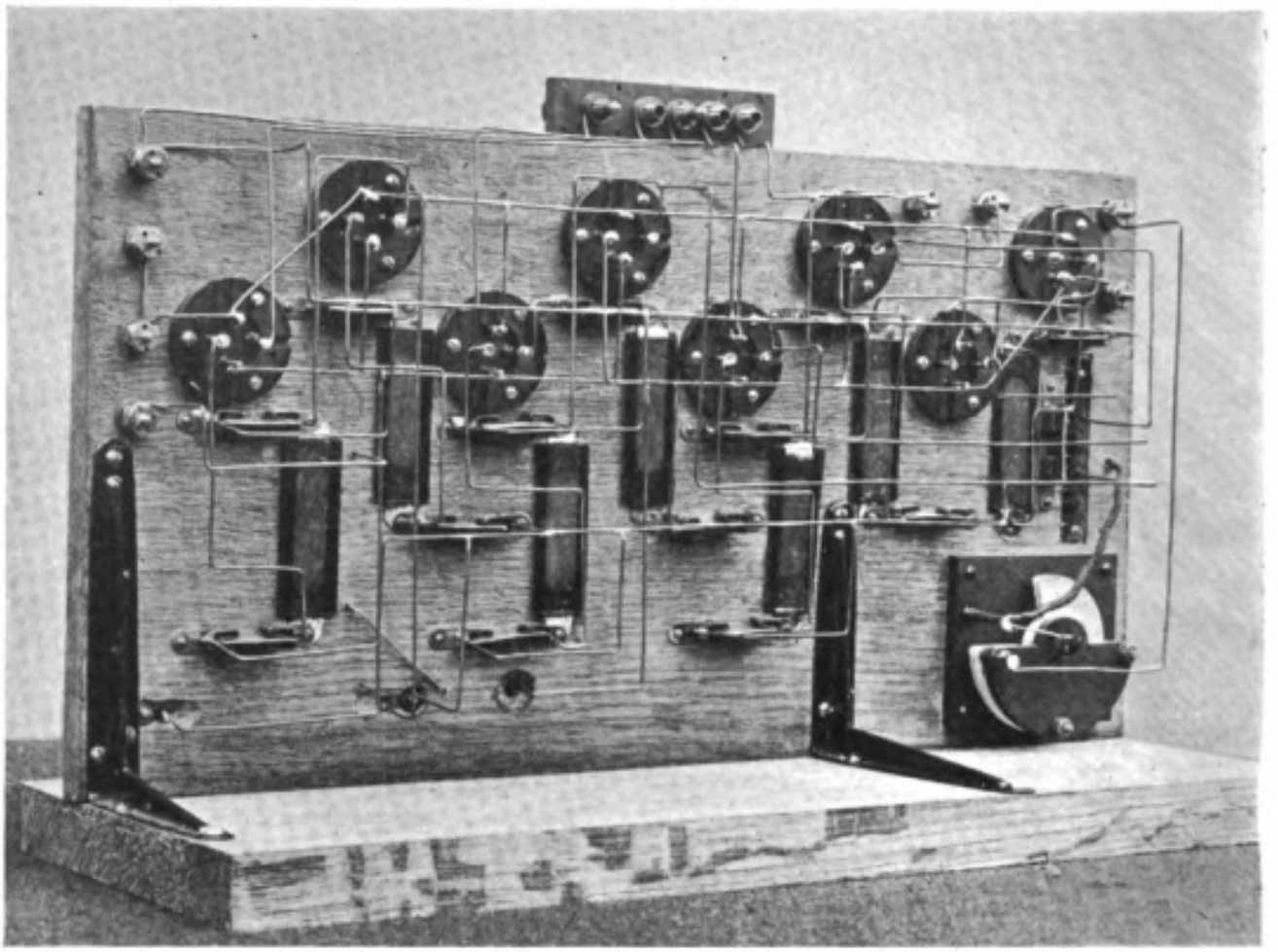
The fact that the whole amplifier is mounted on wood may not appeal to some, but the oak employed is very old and dry, and it is well known that some woods in this condition are equal to ebonite in insulative properties. In addition, cost of wood is small compared with the ebonite.

The oak was, of course, treated with varnish to exclude moisture.

The amplifier is very efficient in action



Front view of the Amplifier.



A view of the back of the panel showing the wiring and general lay-out.

and is remarkably silent. The latter property has since been improved by careful selection of valves.

The amplifier is not productive of exceptionally strong signals owing to its pronounced "limiting" properties, but two American stations have been heard and D.F.'d on the frame previously mentioned.

A SLAB-INDUCTANCE TUNER

By H. E. Adshead, B.A.

GENERAL DESCRIPTION.—The photograph, which shows the general appearance of the set, has been taken from behind, the better to indicate the fittings. The reaction coil has been reversed to show the wire, and the Telefunken valve moved to one side. In use the operator is at the other end where the tuning stand and condensers are near at hand. At the foot of the T piece can be seen the series-parallel switch for A.T.C. In the parallel position, the moving plates should be on the earth side, then the capacity of the hand will not affect the tuning. Observe the 0·0015 mfd. condenser is placed for the left hand, as the other one is usually holding a pen. On the right is a small one-plate condenser, taken from a "remote control unit," the other plate having been removed. This gives very fine tuning for telephony when joined across the larger

A SLAB-INDUCTANCE TUNER

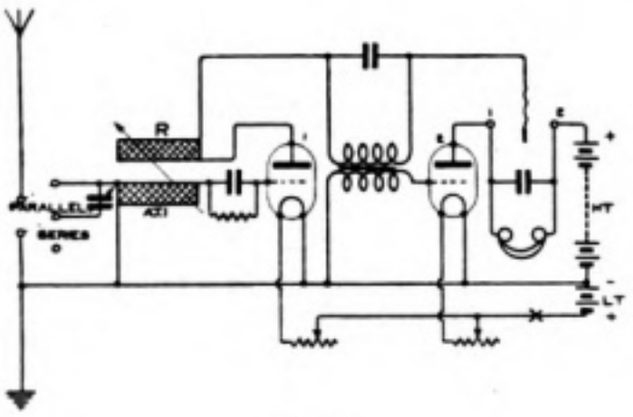


Fig. 1.

A.T.C. by outside leads. 40° on this is equal to only 1° on the other. The instrument is assembled from a Mk. III ebonite top, a Mk. III condenser, the parts of an aeroplane "remote control," etc., with holders for two (or three) English valves, and two German ones. Its "innards" were collected from many different firms at all sorts of prices, the total cost of materials being about £7 10s. The connections are the usual ones for a 2-valve L.F. amplifier, but a diagram is given in Fig. 1.

In the photograph (Fig. 2) a flexible lead (from the valve transformer primary) will be seen going to one of the telephone terminals, B, on the right. It is in this position when *one* valve is in use. If *two* are wanted, it is changed to the other terminal and the second valve's filament resistance turned on. Though this method for one valve still leaves the transformer winding in the reaction circuit, it makes no appreciable difference, and the change over is simplified. The H.T. and L.T. leads are connected to the 4 pin plug shown in front (also taken from the "remote control unit") and plugs into the sockets C seen vertically above it. The aerial and earth terminals are the large ones in the (photographic) front. The three hexagonal nuts hold up aluminium brackets attached to the transformer and telephone blocking condenser. The other fixed condensers and grid leak are screwed round the sides of the transformer. The positions of the various pieces were so chosen as to employ as many as possible of the existing holes in the Mk. III top, the surplus ones being filled in with black sealing wax.

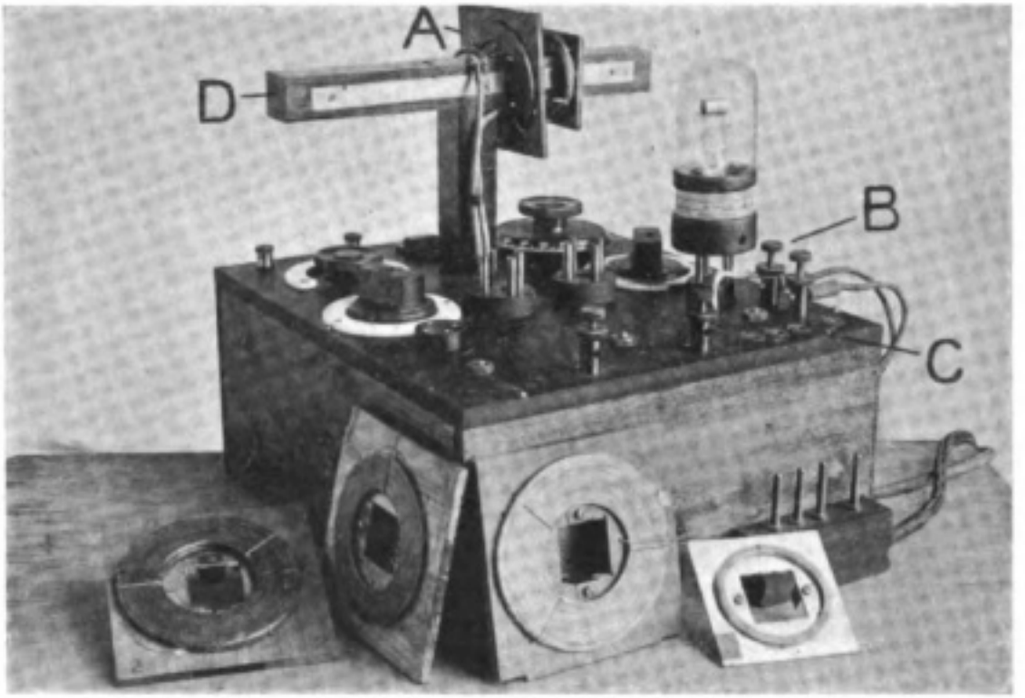


Fig. 2.

THE TUNING STAND.—This and the slab mounts are made of wood, but ebonite would look better. The horizontal bar D is 9 ins. by $\frac{15}{16}$ in. square. The vertical one $3\frac{1}{2}$ ins. high and morticed into the other, not screwed. The horizontal bar has a $\frac{7}{16}$ in. strip of brass along each vertical face connected to aerial and earth respectively, by flexible leads running down in front. Short strips top and bottom, 2 ins. long, are provided for reaction coil, A, connected to leads running down the back to plate and transformer. Small wood screws secure the strips at the ends, which, having been first drilled, are then dented into the soft wood with a centre punch so that the screw heads are flush. Avoid putting the screws exactly opposite or they may short circuit. Each inductance slab is tied on to a piece of wood and the ends of the wires taken to two small L-shaped contacts on opposite sides of the central $1\frac{1}{16}$ in. square clearance hole—(see photo. and Fig. 3). After finding which way round each coil has to be to react, a strip of red paper is glued on the front edge as a guide.

Fig. 3.

It will be noticed that the long brass strips do not come quite to the end. This enables 2 coils to be slipped out of contact without complete removal when the other end is in use. When purchasing the set of slabs, order an extra one for use as a permanent reactance. The one $\frac{3}{8}$ in. wide can be duplicated. Some of the larger coils will very likely be improved by taking off five turns if they just miss a desired station at the lower end; signals on the next smaller coil and full condenser not being so loud.

MODIFICATIONS.—If a two-circuit receiver is wanted the bar can be made hexagonal. A still more convenient design might be to dovetail in thick strips and then turn the bar cylindrical in a lathe. The various coils could then be exchanged by rotating them merely.

PERFORMANCE.—Unfortunately, I have not been able to compare the signals on this tuner with other people's apparatus on the same aerial, but I believe these coils to be fairly good in North Essex. On one valve (German), I can clearly hear the aeroplane DH 18RO speaking as far as Bois de Crecy (130 miles). [On two up to Poix (160) but atmospherics are troublesome.] The American stations are readable except NSS and I do not hear the actual note of Warsaw's spark. The famous Dutch concerts and Amsterdam are quite clear, the particular setting of the coils for this being as in the photograph.

WAVELENGTH CALIBRATION.—With this form of tuner it is interesting to draw a graph of condenser readings and wavelengths for each coil. If the *square root* of the condenser degrees be plotted against wavelength, the curve is a straight line and only two points are required to locate it. One of only two points must not be in the first 20° of the condenser as the variation is not linear below this. The calibration waves of LO, FL and YN are available, and many of the high power European stations can be relied upon, and there is a check when a station comes upon two coils or if harmonics (*e.g.*, BYC) are audible. Having established a set of lines and ascertained the stations' wavelengths, they may be replotted on to a second diagram with plain condenser readings for abscissa. This time the lines will be flat curves. As many persons seem puzzled by square roots I might explain that by the aid of a book of tables one looks up the square roots of 10°, 20°, 30°, 140°, etc., and marks *these* values off along the squared paper. Thus, suppose you listen to LO sending 1,300 m., 1,600 m., and 2,000 m., and get on coil No. 6 the silent points at 0°, 46°, 115° respectively. Look up the roots of these and find 0, 6·78, 10·72, and scale *these* off against the wavelengths. The second and third points may be joined by a straight line which can be produced back to 20°,

it will then require curving gently upwards to go through the first point. Thus drawn, the wavelengths of all other stations heard on this coil can be read off at once. If the reader does not understand the subject of graphs at all, he should certainly make himself acquainted with this valuable system. The best section-ruled paper should not be ruled at all, to employ a Sinn Feinism, but be printed from a plate. It is easily recognised by its white margin all round. With the ruled stuff the lines run off the edges of the sheet and are rarely evenly spaced.

HIGH TENSION BATTERY.—There seems to be a general fancy for making these from the small 2 in. by ¾ in. cells. It is a great mistake and waste of money. Make them from the larger 2 in. by 1¼ in. or even 3 in. by 1¼ in. torch cells, and they will last 12 months. They should be each dipped in hot wax and then, when the zinc corrodes, the contents will not run out and they will carry on till they become "lepers as white as snow." The cost of these bought direct from the Efandem Company is no more than that charged for the usual small size all done up in cardboard at a shop. Of my 60 cells bought over a year ago, 40 are still uncorroded and going strong.

SENSITIVE GALVANOMETER.—By employing the largest 3-layer slab for the vertical coil, and putting a compass in the centre, one can form a very sensitive temporary instrument. For example, a current of 200 microamps gave a deflection of 27° so that one has the equivalent of a Weston galvanometer for nothing!

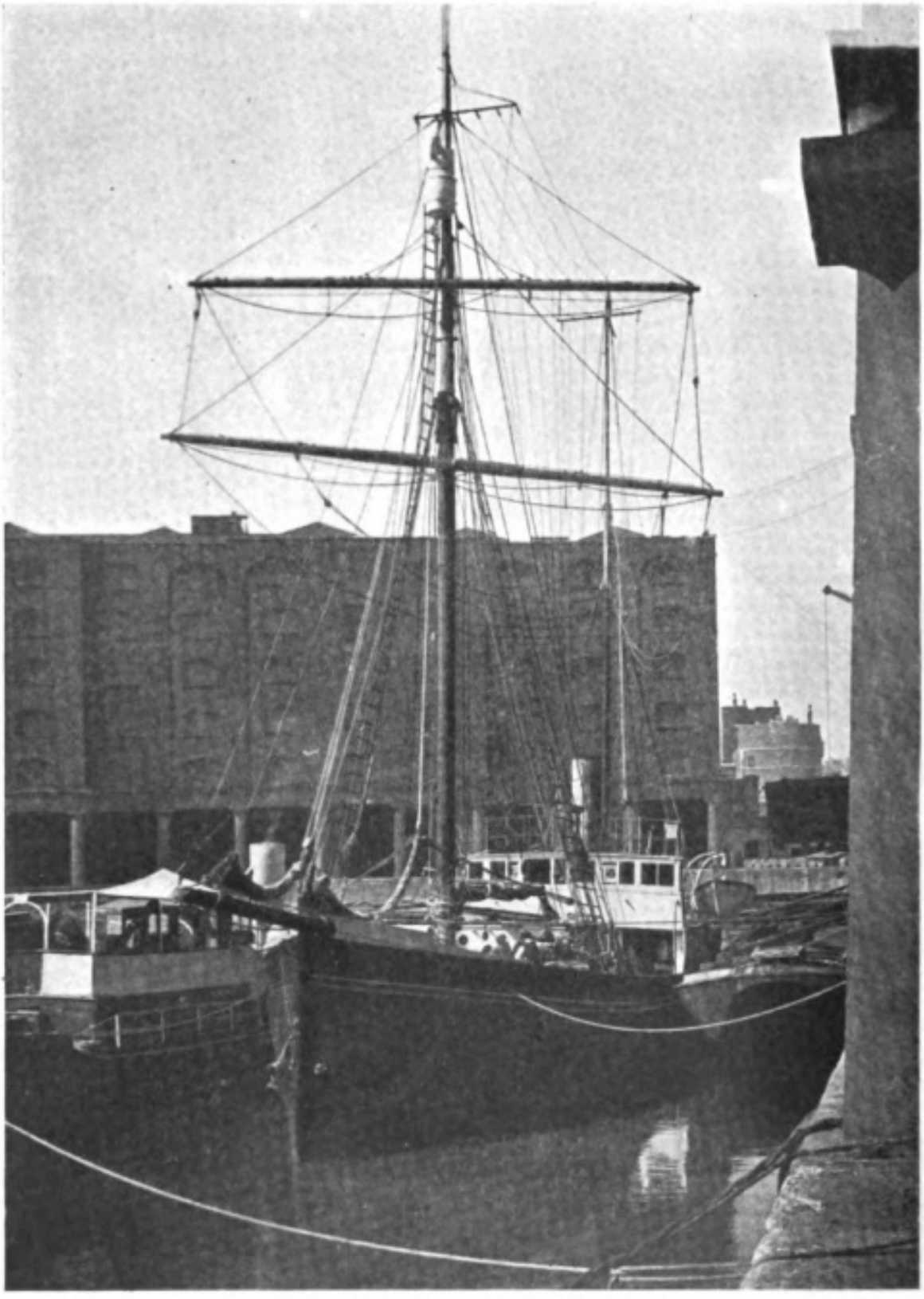
AMATEUR PHOTOGRAPHERS.—These may be interested by the following details. The information given in D. Charles' article (*The Wireless World*, February 5th, 1921) was followed. A white reflector was provided to lighten the shadows on the left, and muslin hung across the window to subdue the high lights. The exposure was 4 times the meter reading. The lense was focussed on the central valve holders, and stopped down to F/32 to give necessary depth of focus. The ordinary hand camera was tilted steeply forward, but the distortion is not very noticeable. Exposure about 30 seconds.

DIRECTORY OF EXPERIMENTAL STATIONS

ADDITIONS

Call Letters.	Power in Watts.	Wave-lengths in Metres.	Hours of Working.	System.	Name and Address.
2 DX	10 & 50	180 1,000	7.30-9.30 p.m.	C.W. and Telephony.	W. K. Alford, "Rosedene," Camberley, Surrey.
2 JX	10	1,000	7-9 p.m. Weekdays, 11-12 a.m. Sundays.	C.W. and Telephony.	L. Vizard, 12, Seymour Gardens, Ilford.
2 KW	—	—	—	—	W. R. Burns, Sale, Cheshire.
2 MF	—	1,000	Various	C.W., Telephony and interrupted C.W.	Marconi Scientific Instrument Co., Ltd., 21/25, St. Anne's Court, Dean Street, W.1.
2 MH	10	180	—	Telephony	A. Lawton, Brown Edge Vicarage, Stoke-on-Trent.
2 NN	10	180 1,000	—	—	Brig. General Palmer, Epping.

Mr. C. S. Baynton notifies us that the particulars of wavelengths and times of working of his station, given on page 330 of the August 20th issue of *The Wireless World*, should read: Wavelength, 180 and 1,000; hours of working, 3-10 p.m. weekdays, 11-1 p.m. Sundays: other particulars as already given.



The "Quest" in a Thames-side Dock. The aerial wires are distinctly visible.

THE "QUEST"

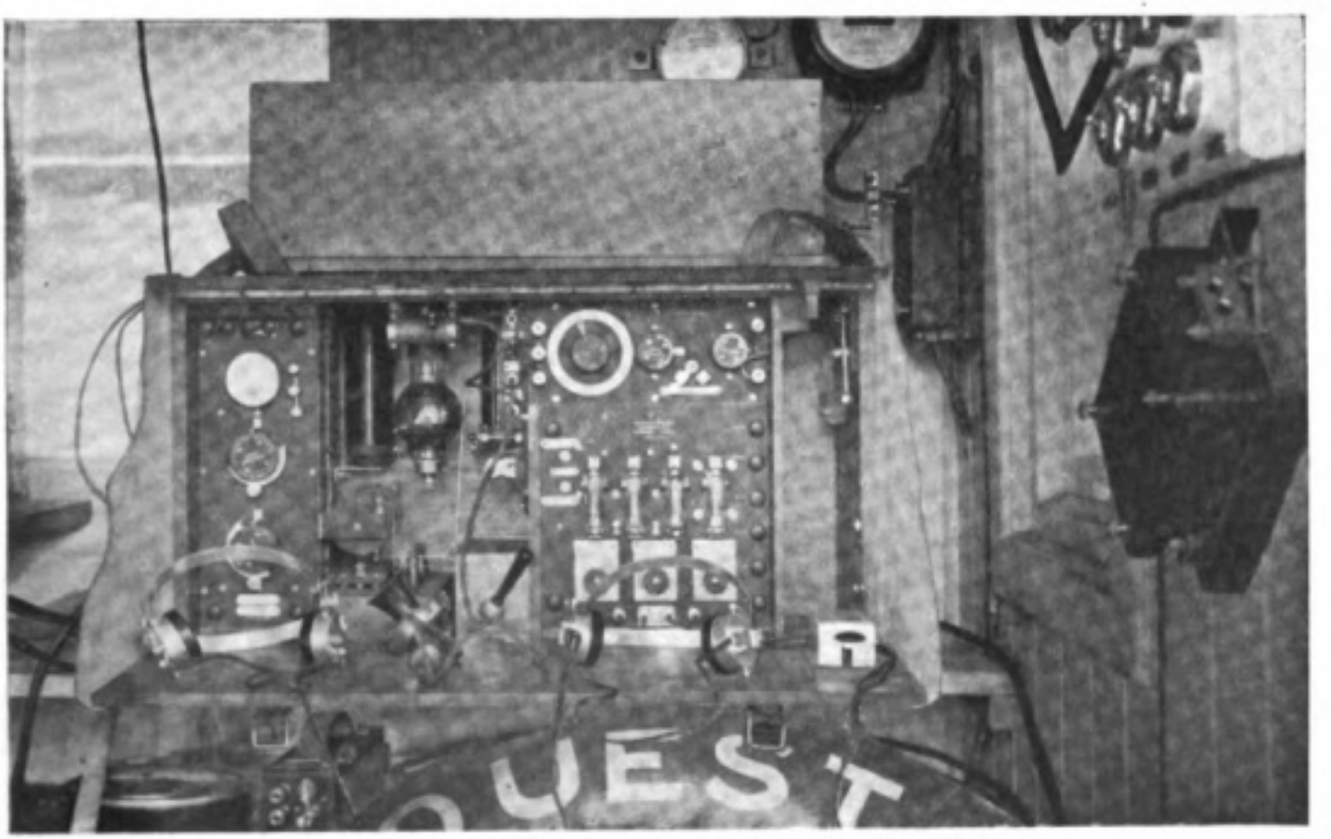
THE DEPARTURE OF SIR ERNEST SHACKLETON'S EXPEDITION FOR THE ANTARCTIC

A VERY successful demonstration of wireless telephony between a field station at Galleywood Race Course, Chelmsford, and Sir Ernest Shackleton's ship, the *Quest*, took place on Saturday, September 17th.

At the invitation of Sir Ernest Shackleton, a representative of the Marconi Company accompanied the *Quest* as far as the Thames Estuary. The *Quest* left St. Katherine's Dock, London, sharply at 1 p.m., and was towed out to London Bridge. Many thousands of people lined the bridges and wharves and banks of the river. The vessel passed under the Tower Bridge, which opened to allow her to pass up to London Bridge. She then "swung" and proceeded slowly down river, Sir Ernest Shackleton personally acknowledging the cheers of the big crowds.

At 2 p.m. telephonic communication was opened with Galleywood, Chelmsford, where several Press representatives took part in conversations. The *Quest* employed her auxiliary 100-watt *YB*1 Standard Marconi portable outfit, which has a petrol generator as the prime mover in order to make the set self-contained for Antarctic working. A similar complete outfit is provided for a "base" station, and the Baby Avro aeroplane is also fitted with a standard aircraft transmitter and receiver. The speech was remarkably good and clear both ways, the distance being 25 miles. General palaver was kept up until about 3.30 p.m., when, en route to Gravesend, Sir Ernest Shackleton gave his farewell speech as follows :—

"Being en route for Plymouth at the outset of a long voyage, I want to



The 100-watt Wireless Set installed on the "Quest."

send to the people of London and the whole British Empire the grateful thanks between Sir Ernest Shackleton and the Press Representatives.

The "Quest" bids farewell to London.

of myself and of the members of my expedition for the interest shown in our enterprise. It was a spur to endeavour to hear the farewells from the bridges and banks of our historic River Thames."

A general conversation then took place

By means of her wireless equipment the *Quest* will be able to keep in touch with the world, and it is probable that wireless telegraphy will play an important part in the attainment of that success which we wish the Expedition.

THE CONSTRUCTION OF A C.W. WAVEMETER

WITH SPECIAL REFERENCE TO HETERODYNE RECEPTION

By CYRIL T. ATKINSON.

THE use of a separate generator to provide the necessary local oscillations for the "beat" reception of continuous waves seems to be very little used by the private experimenter, but a little thought will serve to show that this method possesses several important advantages over the more usual "autodyne" system.

In the first place, the objectionable radiation from the receiving aerial, is, to a very

THE CONSTRUCTION OF A C.W WAVEMETER

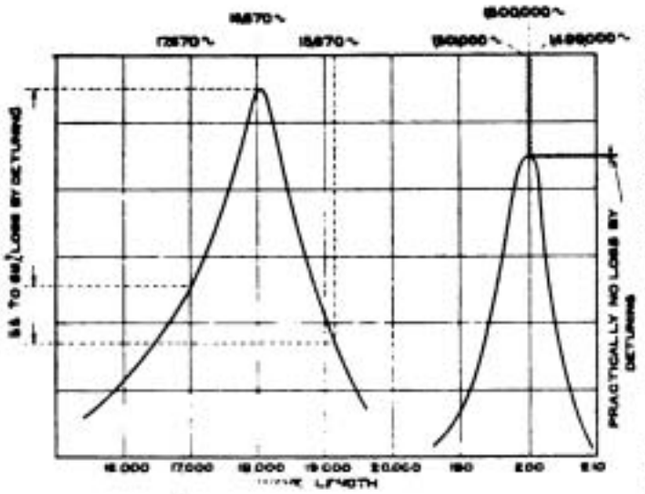


Fig. 1.

great extent, eliminated, and, secondly, the reception circuit can be accurately tuned to the wavelength of the station being received. The magnitude of the loss incurred by the absence of this exact tuning in the autodyne is not often realised, and to make this clear Fig. 1 has been prepared.

It will be seen that in order to obtain a "beat note" in the telephones of 1,000 per second (which, by the way, is a very usual value), we must detune the circuit to the extent of over 1,000 metres when receiving a station of 18,000 metres wavelength, and the loss is from 55 per cent. to 68 per cent. When the received wave is only 200 metres, however, the detuning is only about 1 metre for 1,000 cycle note, and, therefore, practically no loss is incurred.

From this it will be gathered that the loss increases with the wavelength being received, and the purpose of this article is to describe the construction of a heterodyne suitable for waves of from 5,000 to 20,000 metres. It is over this range that the extra efficiency will be appreciated. The design is probably not original but it is quite effective, and the stable nature of the inductances, together with their compactness, render the construction of an accurate and portable set a simple matter.

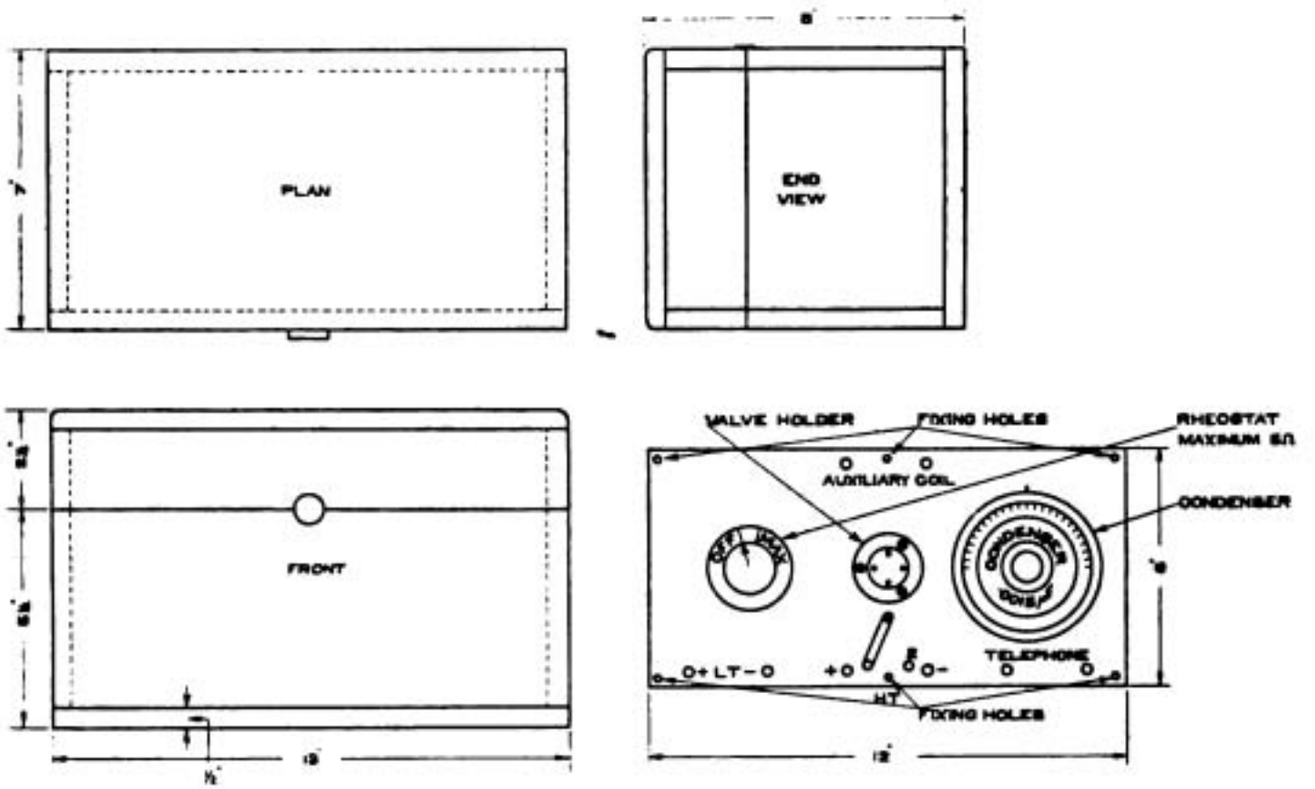


Fig. 2.

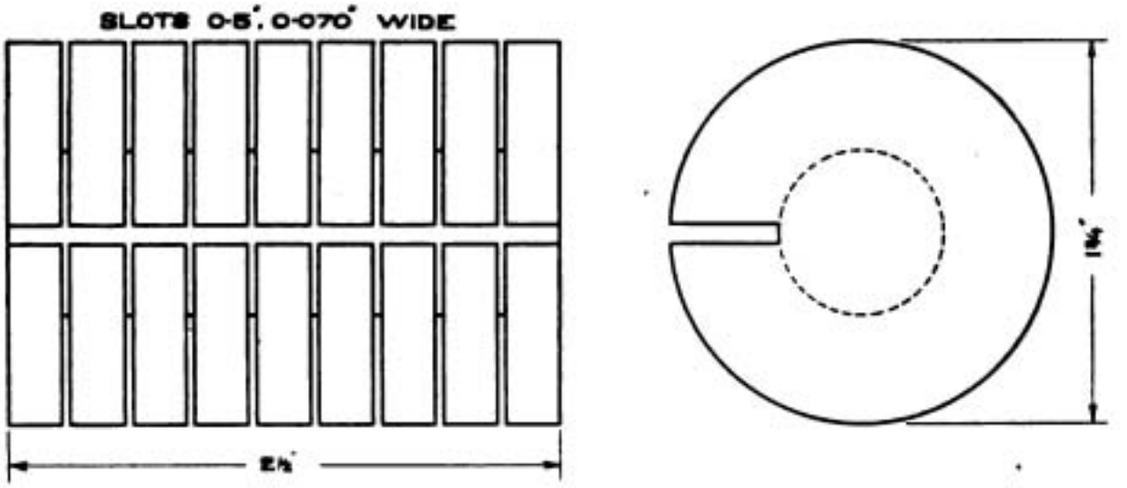


Fig. 3a.

To commence with the case. This should be constructed of any good well-seasoned wood to dimensions given in Fig. 2. It may be polished or varnished to the taste of the individual constructor. The ebonite panel upon which all the apparatus and terminals are mounted should be ⅜ in. thick and fitted by being screwed to fillets on the inside of the case so that its upper surface is flush with the edge of the same. A condenser of 0·0015 microfarads is next required, and here the writer recommends a Mark III* Tuner A.T.C., which is well made and quite suitable for the purpose. The plate and grid inductances are wound in slots in an ebonite former. They each consist of four slots containing 600 turns of 40-gauge D.S.C. wire. All necessary data is given in Figs. 3*a* and 3*b*.

It will be seen that the plate winding only

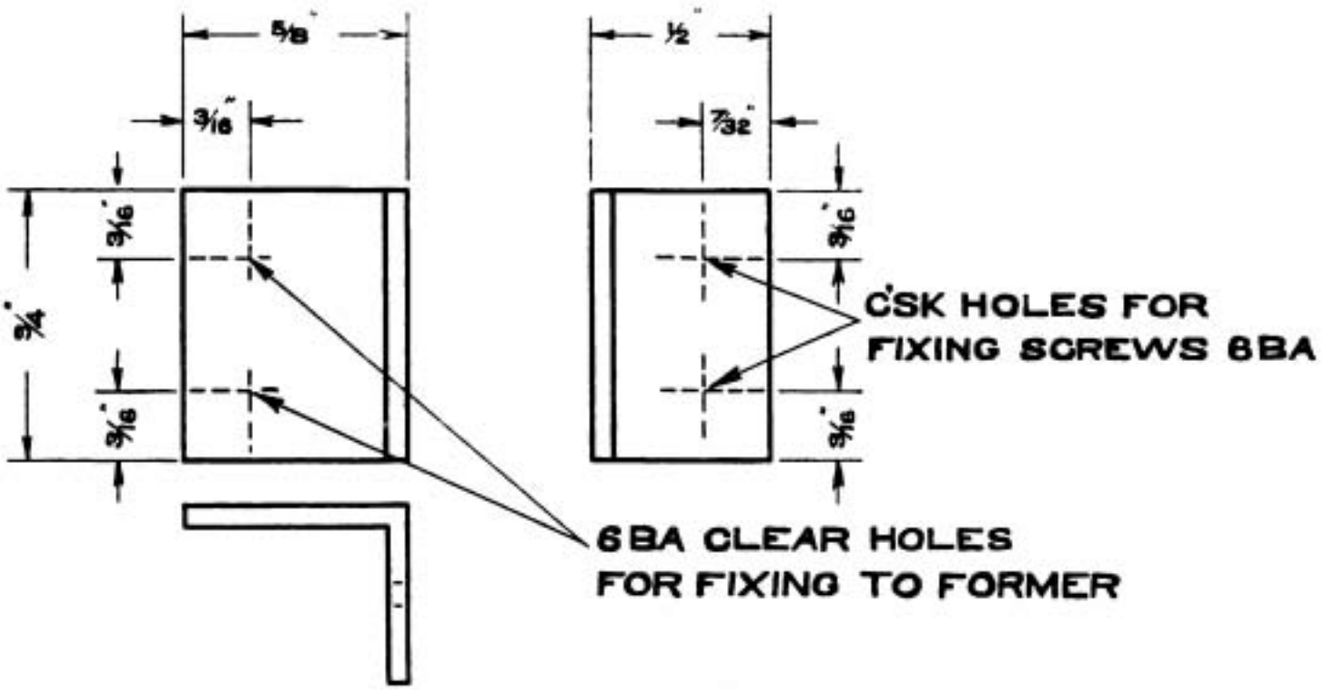


Fig. 3b.

is tapped in the middle to give a more open scale on the lower wavelengths. The ranges are approximately 5,000 to 8,000 metres when half the winding is in use, and up to 20,000 with the whole. The connections and other details are clearly given in A and B, Fig. 4, and it now only remains to give a few hints with regard to the operation.

It will be seen that provision is made to

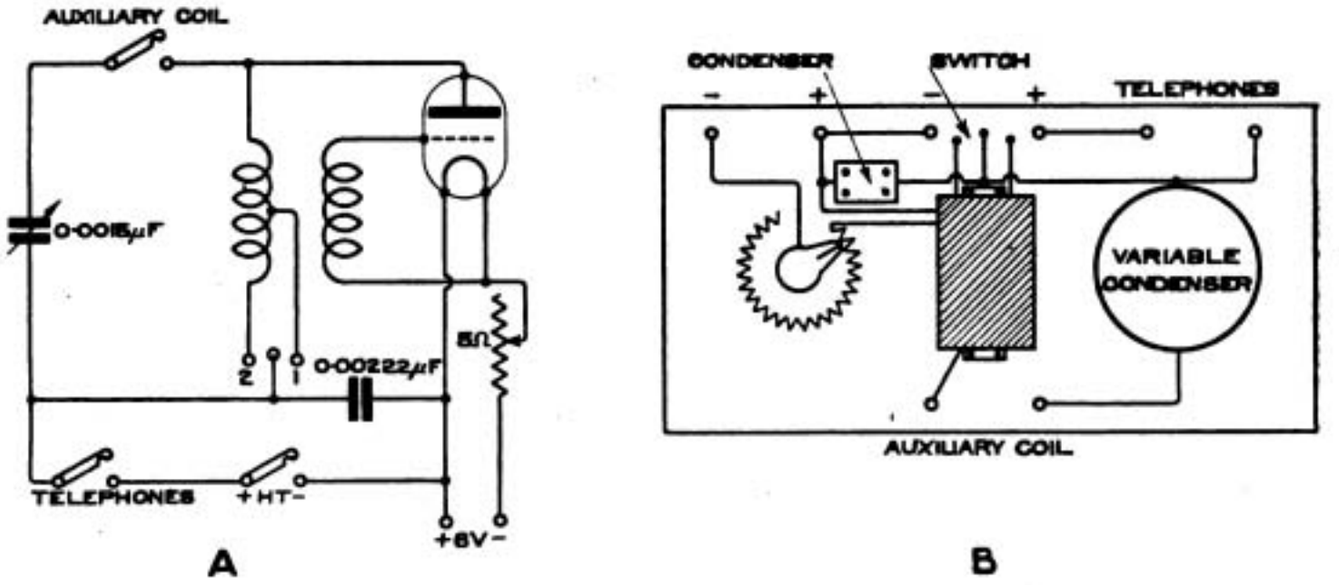


Fig. 4.

short-circuit the three sets of terminals marked "H.T. + −" "'PHONES" and "AUXILIARY COIL" respectively. For use as a separate oscillator it is often quite possible to work in this manner by simply standing the set near to the receiver and operating the valve from the same L.T. accumulator as that set. This is a very interesting feature, as many people seem to suppose that a separate heterodyne requires to be practically another receiving set.

Of course, should the above mentioned method not prove satisfactory, the power can be suitably increased by the introduction of an H.T. battery in the appropriate place, while for better coupling a coil of a few turns can be inserted between the terminals marked "Auxiliary Coil," and adjusted in relation to the receiver. For use as a wavemeter the set will require calibrating, and for this purpose the waves radiated on the 1st and 15th of each month from FL and YN will be found very useful.

Two curves should be made, one with the "Auxiliary Coil" "out," and the other with it "in." "High resistance" telephones should be inserted as marked, and the waves it is intended to measure can be picked up and the "*still point*" of zero beat located. The wavelength will then be accurately determined from the value on the curve for that particular condenser reading.

In conclusion the average "R" type valve works quite well with this circuit, and will generally oscillate quite readily without any additional H.T. Should this not be the case, however, the use of an E.S.2 will, in nearly all cases put things right.

TRANSATLANTIC TESTS

The attention of all readers is invited to the article which appeared on pp. 383—384 of the September 17th issue, entitled: "Short Wave Signalling Across the Atlantic." The greatest enthusiasm is being shown in these tests in America, and it is hoped that all experimenters on this side will co-operate in the endeavour to achieve success by registering their names amongst those taking part in the attempt to receive the signals.

HIGH FREQUENCY TRANSFORMER AMPLIFIERS

THE amateur wireless worker's greatest problem to-day is without doubt that of the Intervalve High Frequency Transformer. It is his need of information on this subject that we now hope to supply.

In the early days of valve magnifiers when the great usefulness of high frequency magnification was realised it was found necessary to have some other means of joining valves in series, as it were, than by the use of tuned anode and grid circuits. If two valves were to be joined in series for H.F. magnification it meant adjusting and tuning four circuits, a cumbersome process which meant that the set could only be used on a pre-arranged and adjusted wavelength.

Some research workers turned to the resistance coupling method, which, provided the capacity of the intervalve condenser is the most suitable one for the range of wavelengths upon which it is desired to work, gives fairly uniform magnification over a very large range of wavelengths (with the exception of short waves).

Other workers turned to the transformer coupling method which is a logical development of the loosely coupled tuned grid and anode circuits.

With the transformer method one winding of a tightly coupled air-core transformer* is connected in the anode circuit of one valve, and the other winding is connected to the grid of the next valve. The arrangement of such a circuit is shown diagrammatically in Fig. 1.

In practice two types of transformer are used :—

(*a*) Tuned transformers wound with copper wire, and

(*b*) Untuned or semi aperiodic transformers, wound with resistance wire, and whose principle of action is slightly different from that of the tuned transformer.

Turn to the diagram Fig. 1 and consider the tuned type of transformer.

* There are certain French H.F. amplifiers which have extremely thin iron cores to their H.F. transformers.

If oscillations are induced into the circuit LC, the high frequency voltage changes across the inductance L will cause similar changes in the grid potential of the first valve. The anode current will vary in step with these voltage changes which means that current flowing through the primary winding of the transformer is varying at high frequency. This varying H.F. current will cause H.F. voltage changes to be induced across the ends of the secondary winding. This secondary winding has very little damping—it is of comparatively low resistance—and is therefore capable of being set into oscillation. The voltage changes induced across the ends of the winding tend to make it oscillate. Now this grid winding has self-inductance, and a very small self-capacity, and also has the very small capacity of the grid of the valve across it. This inductance and capacity will give the secondary of the transformer a certain definite wavelength. This is known as the natural wavelength, or natural frequency, of the transformer.

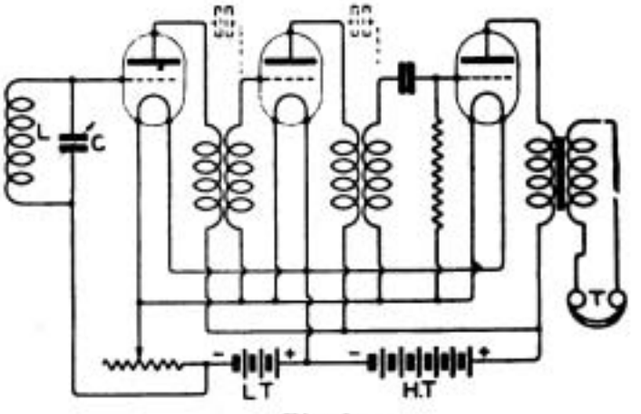


Fig. 1.

If the frequency of the current changes in the anode winding is the same as the natural frequency of the grid winding—the two circuits are in resonance, and the oscillating current set up in the grid winding will be a maximum, and the voltage changes on this, the second grid, will be a maximum also.

As the frequency of the anode current changes gets farther away from the natural frequency of the transformer, the value of

the oscillating current in the grid winding of the transformer becomes less, and consequently the voltage changes on the second grid become less also, so that the magnification given by the second valve is less than that given when the circuits are in resonance.

If this reasoning be followed it will be seen that at a certain wavelength—the natural wavelength of the amplifier transformers—maximum magnification is obtained and that the magnification drops away on either side of this natural wavelength.

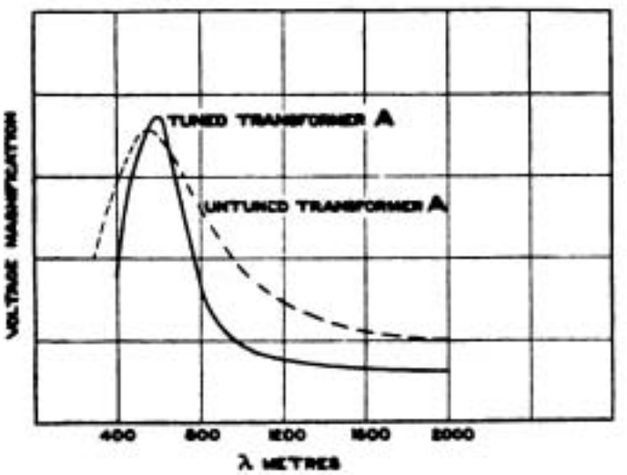


Fig. 2.

In Figs. 2 and 3 the full line curve shows the magnification obtained, expressed as voltage magnification (which will be defined later) plotted against wavelength. These show the natural wavelength of tuned transformer A to be about 600 metres, and its useful range of wavelength to be from 400 to 800 metres only. Tuned transformer B has a natural wavelength of about 3,000 metres, and its useful range of wavelengths is from about 1,000 to 5,000 metres. These wavelength ranges are for damped waves. The continuous wave range is longer, and will be explained later.

From the foregoing it will be seen that tuned transformers are useful for working on certain limited wavelength ranges, but for all-round work an amplifier which has a much flatter characteristic curve is desirable. This can be obtained by the use of untuned heavily damped transformers which, however, give much less magnification per valve than tuned transformers.

Turn again to Fig. 1 and consider what would happen if the transformers were wound with resistance wire instead of copper wire, and assume that the resistance of the windings is considerable, say 20,000 ohms.; the voltage changes on the grid of the first valve will cause changes at high frequency in the anode current flowing through the transformer primary winding. These changing currents will cause voltage changes across the secondary winding, but owing to the high damping—the resistance of the transformer windings—only a very feeble oscillating current can be set up even at the natural frequency of the windings. However, owing to the resistance of the anode winding there is a considerable voltage drop across this anode winding due to the H.F. current changes. By means of the capacity between the two windings, which offers only a low impedance to high frequency currents, this voltage change across the anode winding passes through the capacity of the transformer windings to the grid of the next valve, and helps to increase the magnification. It is found that an amplifier with resistance transformers has a more or less pronounced natural wavelength, but that the characteristic curve is flatter.

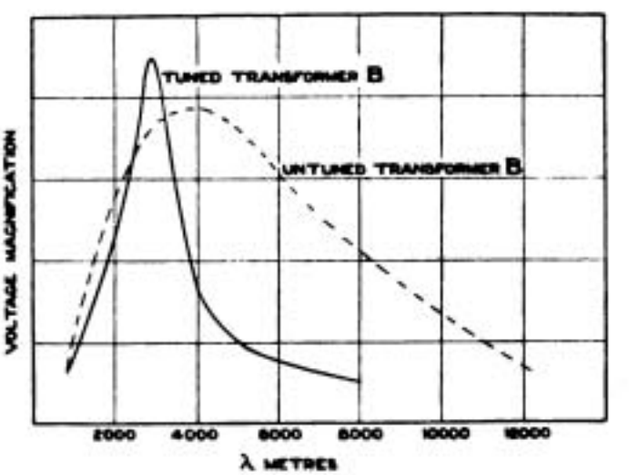


Fig. 3.

The dotted curves in Figs. 2 and 3 give examples of two such amplifiers.

Untuned transformer A has a natural wavelength of about 600 metres, and is useful for a wavelength range of 300 to 1,200 metres.

Untuned transformer B has a natural wavelength of 4,000 metres, and has a useful range of 1,000 to 10,000 metres. These wavelengths again are for spark signals.

No figures of voltage magnification as the two curves in each figure are not strictly comparable in that sense. The voltage magnification per valve is nearly twice as much with one tuned transformer as with one resistance transformer as there is much less loss in the copper winding.

The practical application of the foregoing will be dealt with in a subsequent article.

THE RECONDITIONING OF DRY CELLS

THE common dry cell is a primary battery of the Leclanché type. The electrodes are zinc in ammonium chloride, and carbon packed with manganese dioxide; the zinc is dissolved, and the hydrogen liberated at the carbon terminal is re-oxidised by the depolariser, the manganese dioxide, which is itself reduced to manganese oxide by doing its duty. In the dry cell the ammonium chloride is made into a paste with flour, gelatin, plaster, etc., and the porous pot for the carbon and the dioxide of the wet cell is replaced by a bag or sack. In normal times dry cells are so inexpensive that a well-known English textbook of 1916 on primary batteries did not refer to the regeneration of dry cells at all. The cell was, and is, simply discarded when the potential difference at the terminals has run down from 1·5 volt to about 0·8 volt. During the war, however, manganese became so scanty and precious on the Continent that attempts were made to regenerate dry cells, *i.e.*, the exhausted depolariser. The regeneration, one might think, simply means a re-oxidation of the manganese oxide. That is only partly correct. Recent experiments, notably by R. Nowotny, of Vienna (*Elektrotechnik und Machinenbau*, July 17th, pages 349 to 354) tend to show that the cleaning of the electrodes and the removal of deposits clogging the pores of the pot or bag and of the depolariser itself, are more important than the actual re-oxidation of the manganese. This is fortunate, for the re-oxidation cannot be effected by simple chemical means, and the effective electrolytic treatment could hardly survive war conditions.

In his tests, Nowotny takes new and old cells, short-circuits them through 20 ohms. and determines the potentials at intervals for forty days, when the cells will be exhausted. The two processes first tried, of R. Lohstein and of R. Gollmer, treat the bags with sulphuric acid, a rather strong acid being used for two days in the former case, a weaker acid (10 per cent.) for two hours, followed by washing and drying for weeks in the latter, more elaborate method. Nowotny observed that the treatment indeed raised the potential difference to two volts, because, he suggests, the newly built-up cell is really a zinc-carbon couple in sulphuric acid, as long as the acid has not decomposed the ammonium chloride. But the subsequent exhaustion under his test conditions was rather rapid, whilst under the less severe intermittent service of the cells in practice fairly satisfactory results are said to have been obtained. He ascribes the success rather to the solubility in the acid of the double zinc-ammonium chloride —a salt which forms an incrustation in the cell, being insoluble in the cold ammonium chloride of the cell—and to the clearing of the pores than to any noteworthy re-oxidation of the manganese oxide. Clogging is also produced by impurities of the cell materials.

The assumption seems justified in view of the efficacy of other regeneration processes in which a re-oxidation of manganese oxide

could hardly take place. The superficially cleaned bags are boiled in ammonium chloride ; the dried mass is then ground up, and again compressed in bags. The treatment, which was adopted in Germany, is not economical, since it practically means making new electrodes out of old materials ; but the essence of the process seems to lie in the cleaning and boiling in ammonium chloride. Nowotny boiled the cleaned bags twice for two hours in a solution of 10 per cent., and then washed the bags ; the so-treated cells gave 88 per cent. of the watt-hours of new cells. Moreover, Olivier, an official in the German telegraph department, who had, since 1917, regenerated some 12,000 dry cells by an electrolytic method, admitted, early in 1920, that the electrolytic oxidation of the manganese did not appear to be essential to his process, by which he prolonged the life of the cells by twelve months and more. He charges the cleaned cells like accumulators, in water to which ammonium chloride is added, by currents of 0·2 ampere for twenty hours renewing the electrolyte. A similar electrolytic process of Friedrich was adopted by the department in their works at Berlin, Hamburg, and Dortmund, after trying various other processes which proved failures. Nowotny himself made his cell-charging experiments in sulphuric acid. He noticed a temporary rise in the electromotive force and a decided increase in the proportion of manganese dioxide in the depolariser, as one would expect ; all the same, his regenerated cells did not keep their superiority long. It is interesting to read that in the stress of war-time some small German stations had to rely entirely on regenerated cells, and that they could work with them. Thus regeneration of dry cells by simple means seems possible.—*Engineering.*

RADIO-TELEGRAPHIC WAVES

A PUBLICATION has just appeared,* prepared by the Wireless Board, giving a list of radio-telegraphic waves for both spark and continuous wave systems. The range covered is from 50 metres to 30,000 metres, and indication is given where certain waves have already been allotted for specific purposes as well as the wavelengths employed by a number of high-power stations.

The wavelength in metres is given in a marginal column, and the corresponding frequency in kilo-cycles is given in another column. In a third column the corresponding resonance constants (or " L.S." values) are given. The " L.S." value being the product of the inductance L in microhenries, and the capacity S in jars (1 jar = 1,000 cms. = $\frac{1}{900}$ microfarads).

This publication is of great value to those interested in wireless, commercially or otherwise.

* The Wireless Board List of Radio-Telegraphic Waves (price 1s. net). Obtainable through the Wireless Press, Ltd.

DUTCH CONCERTS

SINCE the publication of the list in our last issue, the following additional contributions to the Dutch Concerts Fund have been received :—

	£	s.	d.
The Wireless World	5	5	0
Wireless and Experimental Association	3	0	0
Mr. F. H. Berryman	2	2	0
Mr. W. S. Hubbard	1	1	0
" Billy Jones "	1	1	0
Mr. H. E. Adshead	1	0	0
North Middlesex Wireless Club		10	6
Mr. S. R. Wright		10	6
Mr. J. P. Beeson		5	0
Mr. J. Wood		5	0

Regarding the transmissions of music on Sunday afternoons, it is understood that arrangements have now been made for the transmissions of special English interest to take place between the hours of 4 and 5, legal time, instead of at indefinite intervals over a longer period. It is sincerely hoped that all experimenters, whether they are interested in the Dutch Concerts or not, will refrain from transmitting during this hour on Sunday afternoons.

WIRELESS CLUB REPORTS

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary.
The Editor will be pleased to consider for publication papers of unusual or special interest read before Societies.

The Wireless Society of London.

A meeting of the Wireless Society of London was held on Friday, September 30th, 1921, in the Lecture Hall of the Institution of Electrical Engineers, Victoria Embankment, W.C.2. The chair was taken by the President, Major J. Erskine-Murray, at 6 p.m.

The **Hon. Secretary** read the minutes of the previous meeting, which were duly confirmed.

The **President** then called upon Mr. Coursey to open the discussion on "Some Methods of Recording Wireless Signals." (See next issue of *The Wireless World* for full report.) The discussion was continued by Messrs. A. A. Campbell Swinton, H. de A. Donisthorpe, R. E. H. Carpenter, R. H. Klein, W. H. Shortt, W. Bowyer, J. H. Reeves, A. F. Bartle, of the Greenwich Wireless Society, and H. S. Pocock. Written communications from Messrs. H. H. Burbury, A. W. Sharman, A. Lander, J. A. Henderson, and Marconi's Wireless Telegraph Co., were also read.

During the meeting the Past President, Mr. A. A. Campbell Swinton, was asked to take the chair, as the President had an engagement elsewhere.

At the conclusion of the Discussion the Chairman announced that the following candidates, whose names had been balloted for by the meeting, had been duly elected to membership of the Society :—

Members : Thomas A. Simpson, A. C. Bowles, Francis D. Acland, W. Smalley, A. Hinderlich, J. C. Walker, William H. Lawes, Arthur de Villiers, Cecil F. Wade, Herbert J. James, Archibald P. Welch.

The meeting terminated at 7.55 p.m.

It is requested that any member of the Society or any affiliated Society not in regular receipt of the publications and notices issued by the Society should at once communicate with the Hon. Treasurer, Mr. L. F. Fogarty, Dene Cottage, Manor Way, Ruislip, Middlesex.

North Middlesex Wireless Club.

(Affiliated with the Wireless Society of London.)

The seventy-third meeting of the Club, held on September 21st, took the form of a "Sale of Members' Surplus Stock." A large and varied collection of apparatus was on show, ranging from the early attempts of a beginner in 1912 to some of the latest examples of wireless work.

Members of the Committee took it in turns to act as auctioneer, and a considerable amount of cash changed hands. It was remarkable how articles which their owners had come to regard as useless and only fit for the scrap heap, were readily converted into cash. At the same time there were a number of bargains to be had, and many members were able to purchase useful, and in some cases, valuable, instruments at a very low price.

It is proposed to form a Junior Section of the Club, and further details of this will be announced in due course. The Secretary would be glad to hear of any prospective junior members.

Leicestershire Radio Society.

(Affiliated with the Wireless Society of London.)

A meeting of the above Society took place at the Vaughan Working Men's College on Monday, September 12th, the President, Mr. C. T. Atkinson, being in the chair.

After the usual preliminary business had been dealt with the Secretary took the opportunity of pointing out the lack of enthusiasm that had been noticed during the last few months, and made it understood very clearly that without better co-operation between the members in attending meetings and taking a more serious interest in the working of the Society, the aims that had been in view when the Society was reformed would be defeated, and it would become a Society in name only.

A special meeting would be called at which all members would be asked to give opinions and express wishes as regards the carrying on of useful work.

Mr. C. T. Atkinson was then called on to give his lantern lecture on "Aircraft and Wireless." By the aid of some excellent slides the whole subject was ably dealt with in a comprehensive manner. Technicalities were discussed in a manner that showed a thorough grasp of the subject by the lecturer, and several very interesting points were touched on, the only pity being that such an admirable subject lacked a full audience. Those that were there admitted that a really enjoyable evening had been spent, and each went away a lot more enlightened than previously.

At the conclusion of the meeting a request was made by a member for the name of an offending station whose harmonics and fundamental are disturbing the whole neighbourhood by a continued emission of C.W. waves, night and day No one, however, could definitely say who it was, and the members would be pleased to receive information from someone better informed than themselves.

Will all communications in the future be addressed to the Secretary, Mr. Jos. W. Pallett, at his new address, 24, Glenfield Road, Leicester.

Sunderland and District Amateur Radio Society.

(Affiliated with the Wireless Society of London.)

The Society commenced their winter session on August 19th last, when the Chairman (Mr. Rowe) exhibited an ex-German trench amplifying set to an interested audience. After explaining the functions and uses of the set, it was mentioned how it might be converted to a single-valve heterodyne set, the conversion of same and details of construction to be the subject of a future lecture on September 2nd.

Mr. Hodgson exhibited component parts of his own manufacture, amongst which was a valve

panel embodying several convenient features for the purely amateur use.

The exhibit of the evening was the A.B. vario tuner, for which a patent is pending. The set has a wavelength range from 400 to 5,000 metres. With this set no variable condenser is necessary, tuning being on the variometor principle. The evening concluded with a discussion on the various exhibits, questions on the vario tuner being predominant.

An extensive syllabus of lectures and demonstrations have been arranged for the winter session, and it is hoped to hold a public exhibition in the near future.

Newcastle and District Amateur Wireless Association.

(*Affiliated with the Wireless Society of London*).

Club meetings have taken place regularly on Thursday evenings as arrangement. Attempts to receive the Hague concert have met with no success—due to two causes, local induction from lighting and power mains, also—(very much, also)—lifts, when working. The induction from the latter being as strong as signals from GCC, who is about 8 miles away. An extremely long earth lead is our chief trouble, connection being made to a water pipe between the 4th and 5th stories of the building. There is no doubt about the capabilities of the various sets that have been tried, as these have been, and are regularly successful at owner's homes. Meetings to continue for present on Thursdays.

Hon. Secretary, Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

Folkestone and District Wireless Society.

(*Affiliated with the Wireless Society of London.*)

Hon. Secretary, Mr. H. Alec S. Gothard, A.M.I.R.E., 8, Longford Terrace, Folkestone.

The monthly general meeting of the above Society was held at headquarters, on Wednesday, September 7th, at 7.30 p.m., Mr. A. H. Ullyett, F.R.G.S., in the chair.

The meeting was followed by a very interesting lecture, entitled "High Speed Wireless Telegraphy Working," delivered by the Vice-President, Lieut. D. A. Butler, R.E. The lecturer who has had a great deal of experience in this method of W/T. working, took great pains in making his very interesting subject quite clear, minutely explaining every detail.

Lieut. Butler was accorded a hearty vote of thanks by the Chairman on behalf of all.

A public exhibition is being arranged for the end of October, and any firm wishing to exhibit their apparatus, are requested to communicate with the Hon. Secretary at their earliest convenience.

The following is a copy of a telegram dispatched by the above Society to the wireless officer of the Shackleton Antarctic Expedition:—

"To—
"The Wireless Officer,
"*Quest*,
"Shackleton Antarctic Expedition."

"The officers and members of the Folkestone and District Wireless Society wish you the very best of luck on your adventurous voyage.

"On behalf of the above Society,
"H. Alec S. GOTHARD,
"Hon. Secretary."

Derby Wireless Club.

(*Affiliated with the Wireless Society of London*).

Commencing in October, the present arrangement of informal fortnightly meetings will be discontinued in favour of the following programme:—

October:
Wednesday, 5th.—The Technical College, 7.30 p.m., Mr. A. N. Lee, "Thermionic Valves," Part I.
Saturday, 8th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Wednesday, 19th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Saturday, 22nd.—The Court, Alvaston, 7.30 p.m., Mr. A. N. Lee, "Thermionic Valves," Part II.
November:
Wednesday, 2nd.—The Technical College, 7.30 p.m., Mr. E. F. Clark, "Crystal and Single Valve Receivers," Part I.
Saturday, 12th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Wednesday, 16th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Saturday, 26th.—The Court, Alvaston, 7.30 p.m., Mr. F. F. Clark, "Crystal and Single Valve Receivers," Part II.
December:
Tuesday, 6th.—*Public Demonstration* of Wireless Telephony, etc., in Lecture Theatre, Technical College. Particulars later.
Saturday, 10th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Wednesday, 21st.—The Court, Alvaston, 7.30 p.m., Mr. E. V. R. Martin, "Reception of Telephony."
January:
Wednesday 4th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Saturday, 14th.—*Annual General Meeting*, The Court, Alvaston, 7.30 p.m.
Wednesday, 18th.—Informal meeting, The Court, Alvaston, 7.30 p.m.
Saturday, 28th.—Informal meeting, The Court, Alvaston, 7.30 p.m.

The Committee will be very pleased to receive offers to read papers.

Will any member having a subject for discussion at the Annual General Meeting, let the Secretary have particulars by January 1st, for inclusion in the Agenda.

Hon. Secretary and Treasurer, Mr. W. Bemrose.

Liverpool Wireless Association.

Mr. Oswald J. Carpenter, A.M.I.RadioE., of The Marconi Scientific Instrument Company, Ltd., lectured before the Society at the Royal Institution, Liverpool, on September 14th, Prof. E. W. Marchant, D.Sc., presiding.

Mr. Carpenter first dealt in detail with the technical arrangement of the Marconi standard 3-valve amplifier for marine use, and paid special attention to the ingenious "limiting" device which enables signals having the *same* wavelength to be separated. This is effected by lowering the

saturation point of the rectifying valve until both the "jamming" and "jammed" signals are of equal intensity. Providing there is a difference in the amplitude or decrement of the two signals they can now be separated by an application of the following phenomena.

A 3-electrode valve possesses rectifying properties either at the lower bend or saturation bend of its characteristic curve, and also at a point on the straight portion of the curve, when the amplitude of the signal is sufficient to take advantage of the differential effect of the two bends. Signals of different amplitudes will therefore have the best rectifying point some distance apart, and for any particular amplitude there is a point at which rectification is nil.

The lecturer next dealt with the manner in which the 3-valve receiver in question had been superseded by one utilising a single valve having four electrodes, *i.e.*, a filament, plate, and two grids, one enclosing the other. The outer grid was shown connected to the positive pole of the filament heating battery through the high-tension battery and an inductance coil, telephone receivers being placed in the plate circuit which was attached to the negative pole of the filament battery. Electrons emitted by the filament lose their velocity and are altogether stopped before reaching the plate by reason of the falling potential gradient. Any small increase in electron velocity will result in a number of electrons reaching the plate thus producing a current in the plate circuit, whilst a decrease in this velocity will produce no plate current. The plate circuit consequently delivers rectified current.

The electron emission from the filament will be modulated at radio frequency by signal currents impressed upon the inner grid which is attached to the antennæ. Therefore, large currents will flow in the outer grid circuit, which is arranged on the lines of the plate circuit of a 3-electrode high-frequency amplifying stage. If a high-frequency transformer be connected so that one winding is in the outer grid circuit and the other in the plate circuit, the outer grid current variations will be transferred to the plate circuit. The valve is therefore acting as an amplifier of radio frequency currents

If now the plate circuit be coupled back to the inner grid by means of an iron-core transformer (1:1 ratio), the note-frequency currents in the plate circuit will be impressed upon the inner grid and again amplified.

Thus, the Marconi 4-electrode valve is able to amplify radio-frequency and audio-frequency currents and to rectify simultaneously, thus dispensing with the three 3-electrode valves necessary to perform these operations.

The arrangement is not suitable for self-heterodyne on account of a slight tendency to howl, but this may be corrected by adjusting the filament temperature. The anti-jamming feature can be applied to this valve by making a slight variation in the potential of the plate relative to the filament. This may be effected by shunting a resistance across the filament battery and connecting the plate circuit to the regulating arm.

The lecturer next dealt with the arrangement of 3-electrode valve circuits, and showed that those suitable for telegraphy were often relatively inefficient when applied to the reception of telephony. High-frequency amplification is practically essential in the latter case, and various arrangements were discussed in detail. Graphs were drawn showing the relative efficiencies of transformers employing copper windings, resistance-wound transformers with linking capacities, non-inductance resistance couplings and tuned plate circuits. A circuit was shown which effected radio-frequency amplification, rectification and note-frequency magnification. Electrostatic reaction was provided and the filament-grid potential was controllable.

A 3-valve arrangement combining these features and consisting of a type M.18A Receiver and a type M.24 Magnifier was then connected to two wires suspended in the lecture room. Niton, Le Havre, Boulogne, North Foreland, Lands End, and other 600 metre stations were received with true spark frequency, and could be heard at a distance from the telephones. On the other wavelengths Lafayette, Nauen, Eilvese, Rome, Moscow, Eiffel Tower Spark and many other stations were audible to all in the room.

At the conclusion of a very instructive lecture and demonstration Professor Marchant proposed that the cordial thanks of the Society be extended to the Marconi Scientific Instrument Company, Ltd., and to Mr. Carpenter for the most lucid and comprehensive manner in which he had dealt with his subjects. Dr. Richardson seconded, and the proposition was carried in the usual way.

Hon. Secretary, Mr. J. Coulton, 98, Ampthill Road, Liverpool.

The Wireless and Experimental Association.

The Wireless and Experimental Association at the Central Hall, on Wednesday, September 14th, continued the adjourned discussion on the "toy" wireless apparatus. There was very evident apprehension on the part of members as to their liability to be upset by the ether din created by some child in the neighbourhood when he opened his Christmas stocking. Until his batteries gave out there was little likelihood of hearing anything else. The members considered the 50 yards transmission should be tested on a good crystal detector and a pair of 60-watt Brown receivers as a maximum. Mr. Foord exhibited a polarised relay made up from a dissected Brown receiver, which gave quite good results when tested with a quarter of a milliampere of current.

The Association, at their meeting in the Central Hall, Peckham, on Wednesday, September 21st, 1921, discussed at length the question of the forthcoming Atlantic tests, and two of the members were going to do all they could to get the signals. The other members promised them all the assistance in their power, even to imposing a self-denying ordinance by keeping out of the aether while their confréres were listening. It is the irresponsible and unattached enthusiast whom they fear most, however. Mr. Kloots put a diagram on the blackboard, in which the three valves were connected by three separate H.T. batteries, and this called for a deal of comment. Mr. Voigt wanted to know if any substance was an insulator at a temperature of 200° C. For the benefit of

all members it was agreed to read through Bangay's book on "The Valve," and discuss the points raised at successive meetings, so as to augment our practical knowledge of the valve with the theories so lucidly set forth in the book. A sum of £3 was contributed for the Dutch Concert Fund.

Hon. Secretary, Mr. Geo. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

Wimbledon and District Wireless Society.

A meeting of the above Society was held on Wednesday, September 21st, 1921, Mr. A. V. Ballhatchet in the chair. A paper entitled "Simple Circuits Suitable for Short-wave Transmission and Reception," was given by Mr. G. W. Hale.

Mr. Hale pointed out that it often happens that amateurs using single valve receivers are not satisfied with the results obtained, and that in order to improve reception they decide that they must use additional valves. If the maximum efficiency is obtained in the first valve then no objection can be raised to this method, but in most cases the highest degree of efficiency is not reached in the first valve, and no amount of note magnification will bring in signals of a really satisfactory strength unless they are already audible, when the telephones are used with the first valve alone. He then proceeded to enlighten the meeting as to how the maximum efficiency could be obtained. He thought that the single-circuit receiver with reaction coil must take a place a long way behind the two circuit or inductively coupled receiver, even though the operation of the latter is more complicated. This fact was especially noticeable on the short waves from 180 to 300 metres. Mr. Hale dealt with his subject in a very masterly manner, and everyone present were unanimous in the belief that the paper they had just heard was one which would be of great service to wireless amateurs generally.

Mr. Ballhatchet, in proposing a vote of thanks, remarked that he was afraid that Mr. Hale had given them a little more than some of them could digest in one evening. He thought that the Society was very fortunate in having such a keen research worker in their midst, and that the most beautiful part of the paper just read was that no alteration was proposed without there being a reason assigned for it, and which Mr. Hale had not himself tried.

The vote of thanks, seconded by Mr. L. F. Ostler, was duly accorded.

The next meeting of the Society takes place on October 22nd, when a smoking concert will be held. Intending members are reminded that the annual general meeting takes place in November, when new members will be enrolled.

Particulars can be obtained of the Secretary, Mr. W. G. Marshall, c/o Technical Institute, Wimbledon, or 48, Warren Road, Merton, S.W.19.

The North London Wireless Association.

At our last meeting during the period of enrolment for the evening classes at the Northern Polytechnic Institute, Holloway Road, the North London Wireless Association, with the assistance of Messrs. Auckland & Son, of No. 395, St. John Street, demonstrated the reception of speech and music by wireless. The apparatus, kindly loaned by Messrs. Auckland & Son, consisted of a single-valve receiver, covering wavelengths from 300 to 30,000 metres, and a 4-valve amplifier and Brown loud-speaker, and very good results were obtained, the speech and music being easily heard all over the Physics Lecture Theatre, where the demonstrations took place.

The Association's best thanks are due to Messrs. Burnham & Co., of Deptford, Mr. Basil Davis, of Marble Arch, and Mr. Wilkinson, of Kilburn, who were good enough to assist by transmitting from their well-equipped stations, and greatly added to the success of the demonstrations, the result of which was that several additions were made to the Association's already long list of members. This Association is doing good work for the amateurs of North London, and holds its meetings every Monday evening at the Northern Polytechnic Institute. Particulars of membership, etc., may be obtained from the Hon. Secretary, Mr. J. W. S. Prior, c/o Superintendent, Peabody Buildings, Essex Road, N.1.

Bradford-on-Avon Wireless Society.

Hon. Secretary, Mr. H. Helps, 4, Ivy Terrace, Bradford-on-Avon, Wilts.

A meeting of the Committee of the above Society was held at the County Secondary School, Bradford-on-Avon, on Tuesday, September 20th.

The Secretary announced that Brig.-General Palmer had accepted the office of Vice-President, and Mr. Claude Willcox, of Warminster, that of Consulting Engineer to the Society.

He added that Mr. Willcox had kindly invited the Society to inspect his station, and to hear the wireless concert transmitted by the Hague (Holland), on Sunday. The visit was arranged for Sunday, September 25th, members proceeding by charabanc.

The question of meetings having arisen, it was decided to set apart at least one night a week for Morse practice, the reading of papers and for discussions, demonstrations, etc. The first three meetings will be open to the general public, when papers will be read by Mr. J. A. Cooper, who has been appointed lecturer to the Society. It is hoped that all interested, especially scouts and members of the Church Lads Brigade, will attend.

An offer was received of other papers and of a demonstration of a Marconi M15 receiver. The Committee decided to approach the Governors of the Secondary School with a view to erecting an aerial there for such demonstrations and experimental work generally.

The Society is beginning to grow and the Hon. Secretary will be glad to receive applications for membership from anyone in the neighbourhood who is interested in wireless.

Brighton Radio Society.

(Affiliated with the Wireless Society of London).

A meeting of the above Society was held at 7.30 p.m., on September 15th, when there was a very good attendance.

After the business items had been dealt with by the Chairman, Mr. W. E. Dingle, a very interesting demonstration of a 3-valve receiver was given by Mr. C. L. Fry, junr., when Mr. A. Blackburn obliged by the loan of his loud-speaker. Signals

were heard several yards off, and the Dutch concert was picked up at about 8.30 p.m

Following upon a kind offer made by Mr. C. E. Fry, senior, to loan his motor car for an afternoon's excursion for the purpose of conducting outdoor experiments, a trip was made accordingly on Saturday afternoon, September 17th, when a party left Brighton at 3.0 p.m. for the Dyke, when several interesting experiments were conducted, which proved the advantages obtainable with a directional aerial, so far as the strength of signals was concerned. It was also found that an aerial of insulated wire was much more satisfactory and greatly eliminated statics.

After a very enjoyable afternoon the party returned at 5.30 p.m.

Any gentlemen interested are invited to communicate with the Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton, who will be pleased to furnish full particulars as to membership, etc.

The Bournemouth and District Radio Club.

At the meeting held on September 21st the chair was taken by Capt. Hobbs, M.C., A.M.I.R.E. The minutes of the previous meeting were read, together with the terms of agreement between the Club and the Y.M.C.A., all items were verified, and voted unanimously.

Mr. Adams, the Secretary of the Birmingham Scientific Wireless Club, paid a visit, and spoke very highly regarding the conditions on which the Bournemouth Club was formed. He assured the meeting that the conditions as agreed to between the Club and the Y.M.C.A. were absolutely ideal, in fact he knew of nothing to equal it, as besides the wireless side of the questions, each member could enjoy the full privileges of the Y.M.C.A. The Chairman of the Bournemouth Club, in return for the very kind greetings conveyed by Mr. Adams from the Birmingham Club, asked him to take back with him the very hearty greetings of the Bournemouth and District Radio Club, and on behalf of all present to assure any of his members of a very hearty welcome to our gatherings at any time when they may be in Bournemouth.

Mr. Riceman spoke a few words of assurance that our Club-room would be ready for our opening meeting on October 5th, when Capt. Hobbs will give a display of messages being automatically printed from reception on an indoor aerial.

The Chairman then brought forward an offer of some apparatus at a very reasonable figure, such as the Club would require. It was proposed, seconded, and carried that the goods under question be procured.

Capt. Hobbs promised to give the Club a necessary tuning coil, and Mr. Dyke also promised a tapping key; several members paid a year's membership. Altogether a most interesting evening was spent. Arrangements are being made for female members and male members whose age brings them under the Y.M.C.A. rules.

Full particulars regarding memberships, fees, etc., may be obtained from the Secretary, Mr. T. H. Dyke, Hon. Secretary, 2, Iris Road, Winton.

The Working Men's College Wireless Club.

On Monday, September 12th, the first annual general meeting of the above Club was held at the College, in Crowndale Road, N.W.1, at which the general business was discussed and arrangements made for the continued activity of the Club during the coming session. The Club was formed early in the summer and has at present about 20 members. Since forming, buzzer classes have been held on Monday and Thursday evenings, with the result that a receiving speed has been attained by several members. The buzzer classes will continue on Mondays and Thursdays for the present, but it is hoped later to spread them over several evenings in the week. The Club has been fortunate enough recently to get hold of a Mark III short-wave, also long-wave tuner, and 3-valve note amplifier, which have been attached to a temporary aerial by members, and are giving excellent results. It is proposed during the winter to hold lectures on wireless, and to give a display at the College on Founders' Day (October 29th). The Club would welcome new members, who would also have the use of a well-equipped laboratory. The fee has been fixed for the coming year at the moderate sum of 5s. Prospective members must first become members of the College itself, by joining any one of the classes shown in the prospectus (sent on application). The Committee would be very glad to hear from any gentlemen who have the facilities, and would care to send out a wireless musical entertainment at a fixed time on October 29th, 1921, for the benefit of visitors to the College on Founders Day.

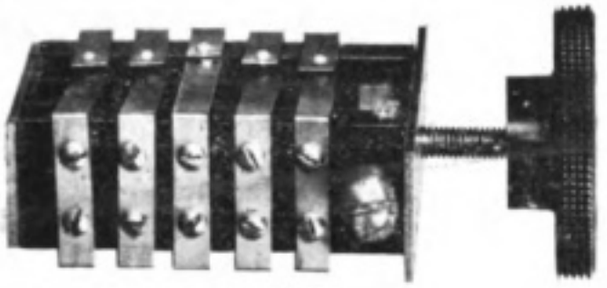
Hon. Secretary, Mr. W. F. Matt, c/o Working Men's College, Crowndale Road, N.W.1.

Stoke-on-Trent Wireless and Experimental Society.

On August 28th, the Stoke-on-Trent Wireless and Experimental Society had an enjoyable outing to Wickestone Rocks, Biddulph Moor. The Society holding a permit for a portable set,

Some members of the Stoke-on-Trent Wireless and Experimental Society at the outing on Aug. 28th.

members were able to take with them their apparatus for reception. Early in the afternoon a member, Mr. Gaskell, was able to get the Dutch Concert on his set, a Burndept Ultra III, the music being heard by all the members quite distinctly and greatly appreciated. Early in October we are hoping to hold a demonstration, which will be the



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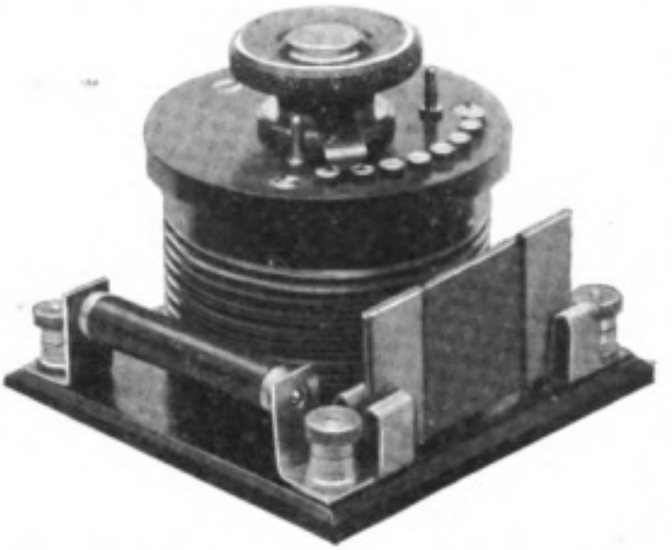

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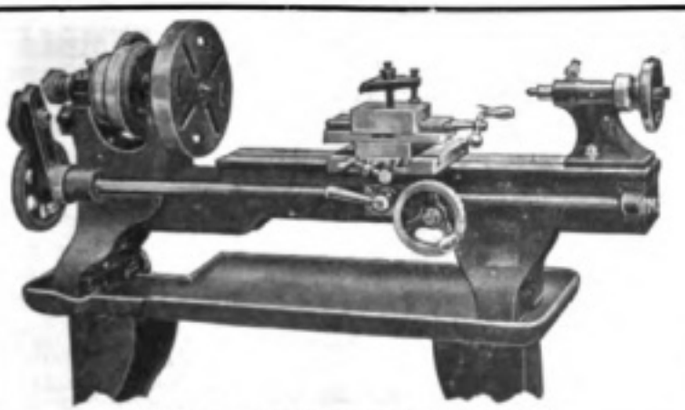

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first to be held in the Potteries, and we hope not the last. Anyone interested should communicate with the Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

Huddersfield Wireless Society (Y.M.C.A.)

The above Society is about to re-open for the coming winter session. The Hon. Secretary will be glad to hear from all old and new members also those persons who are desirous of joining the Society. Will all persons interested kindly communicate with the Secretary, Mr. F. Simpson, 25, Bk. Colne Street, Aspley, Huddersfield.

Wireless Society for Southwark and District.

Will all interested in the above kindly communicate with Mr. René Stone, 178, Walworth Road, Walworth, S.E.17. Beginners invited.

Radio Society for Highgate and District.

As there seems to be many wireless enthusiasts in Highgate, and as a Club in the immediate district has been a long-felt want, it has been suggested that all interested should write to Mr. L. R. Rowlands, 25, Cholmeley Park, Highgate, N.6, so that a preliminary meeting might be arranged.

CORRESPONDENCE

To the Editor of THE WIRELESS WORLD.

SIR,—May I be allowed to add an afterword to my letter, which appeared in your issue of September 3rd, *re* "Tuning of H.F. Transformers." It would appear from further experiments which I have carried out, that the results obtained are equal, whether the tuning condenser is in parallel with the transformer primary, *or* secondary. It seems to be a fact, also, that the condenser, when in either position, does actually tune *both* primary and secondary circuits simultaneously; owing, no doubt, to the capacity between the transformer windings. This statement seems to be proved by the following results, obtained experimentally. Signals received are precisely the same whichever circuit has the condenser in shunt; also the capacity required is of the same value to tune transformer to a given frequency. If *each* circuit has a condenser, signals are still of the same strength, and the *sum* of the capacities of the two condensers will equal the capacity of the one condenser (used in the first experiment) when the transformer is tuned to the same frequency. No variation of signal strength can be noticed in the second experiment, whatever the *relative* values of the two capacities, provided the sum of their values is constant (as stated above).

T. S. SKEET.

Leicester.

September 9th, 1921.

To the Editor of THE WIRELESS WORLD.

SIR,—I am asked by the Committee of the Stockport Wireless Society to write to you in support of the Leicester Society's movement to institute a programme of concerts from a British source.

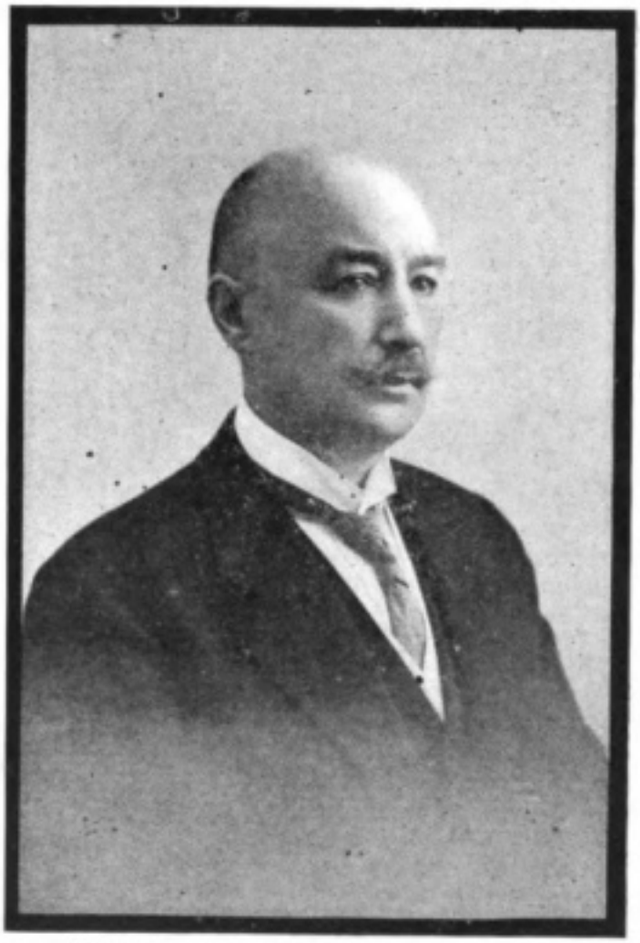
It seems so strange that concerts addressed to British amateurs should be transmitted from the continent. Moreover, owing to the comparatively low power used, a deal of difficulty is experienced in the North of England in obtaining audible signals through jamming and valve howls.

We are sure that if arrangements could be made to broadcast concerts from a central station such as Leafield, the result would be a fillip to the wireless instrument trade that would amply repay the cost of transmission.

R. H. JACKSON,
Hon. Secretary.
The Stockport Wireless Society.

OBITUARY

The death, as a result of a railway accident, occurred on September 19th, of Colonel Thomas Thomassen Heftye, Director-General of Telegraphs, Norway. Except for a brief interval during which he held the position of Minister of Defence, Colonel Heftye has been Director-General of Telegraphs since 1905, and has been responsible for the development of wireless telegraphy in Norway. Realising from the first the importance of wireless telegraphy to his country, he exerted all his efforts in that direction, and was successful in establishing a national system for Norway.



The late Colonel T. Thomassen Heftye.

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 work. 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.**

NOVICE (Wimbledon).—(1) and (2) Either of these connections will spoil the results obtained, and should be avoided if possible. Shorten the aerial and earth leads as much as possible, and do not run them near or parallel to other wires or to each other.

(3) We have no personal experience of the quality of the set referred to, but if reasonably well designed it should be of quite good type for a beginner's use.

(4) No, certainly do not use lead-covered wire for leading in wires.

AMATEUR (Cumberland).—(1) and (2) See Fig. 1 for a circuit to convert an amateur mechanic crystal set. It will be best to keep the primary and secondary coils as made in the set and cut

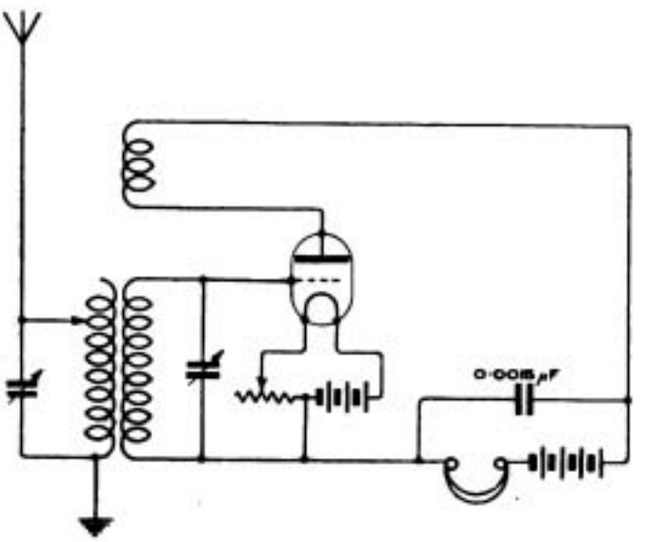


Fig. 1.

out the end of the primary former farthest from the secondary to admit the reaction coil. Make the reaction coil as large in diameter as possible, and wind it with several inches of No. 28.

R.H.A. (Roehampton).—(1) Approximately six foils with overlap of 6 by 2 cms.

(2) Possibly Nantes and Nauen, but only weakly. There are only a few spark stations now working in Europe on 3,000 to 5,000 ms. Adapt your set for a single valve with reaction for C.W.

(3) Try the circuit shown in Fig. 9, page 368, of the issue for September 3rd.

(4) They should be left open.

B.D.H. (Headingly).—(1), (2) and (4) For a beginner single layer cylindrical coils will be the most suitable for both A.T.I. and reaction. They should be so mounted that one—usually the reaction—can slide in and out of the other.

(3) A good rule is to make the inductance of the reaction coil about half the inductance of the A.T.I.

EDGBASTONIAN (Birmingham).—(1) See Fig. 3, page 277, of the issue for July 23rd for a suitable diagram.

(2) The aerial wire is too thin: use No. 18 gauge.

(3) For a crystal set the aerial cannot be made too high.

[Please note that your letter to us was unstamped.]

G.J.S. (Bures).—(1) If possible use the maximum length allowed—100 ′ single wire; otherwise, use a twin-wire aerial.

(2) Make it as high and as long as possible in conformity with the regulation lengths.

(3) It would seem to be all lead-in. Keep the lead-in as high as possible, and try it.

(4) Yes. It will pick up signals, whether insulated or not.

C.S.A. (Edinburgh).—(1) About 4,500 ms.

(2) Wind single layer with No. 30.

(3) Reactance coil need not be rotatable, but should be capable of sliding inside the A.T.I., as the exact position required varies with circumstances and must always be obtained for good results.

(4) Yes.

C.J.F. (Stafford).—(1) Arrangement of coupling coil in parallel with A.T.I. is wrong. Couple the reaction coil either with the A.T.I., or with a coil in series with it. Reaction coil should be on the other side of the telephones. A.T.C. should be above the A.T.I.

(2) H.F. amplification will give somewhat better results than L.F., but will be more trouble to design. Your present coil is of L.F. type, but should be increased to about double its present resistance. Secondary can be 6,000 ohms of the wire submitted, which is No. 40.

(3) Consult any of the receiver and amplifier diagrams recently published, as the alterations necessary will differ with different types of amplifier.

(4) R valves will do: filament volts 6, and H.T. about 70.

TIME SIGNALS (Worksop).—(1) For the 11.30 or scientific signals, see reply to R.C.M.R. (Eastbourne), on page 367 of August 6th issue.

(2) Full interpretation of the 11.49 signals is too lengthy to give here; it will probably be sufficient for your purpose to know that—

(*a*) First dot commences at 11.44;

(*b*) The last D finishes at 11 hrs. 46 mins, 55 s. ;
(*c*) The dot immediately after this is 11 hrs. 47 mins. ;
(*d*) The last six finishes at 11 hrs. 48 mins. 55 secs. :
(*e*) The final dot is at 11 hrs. 49 mins.

A.S. (Stourbridge).—(1) Set is O.K., except that we should prefer to place the A.T.C. on the earth side of the coupling coil. Also interchange your condensers.

(2) Spark and telephony, but not C.W.

(3) About 6,000 ms., but you will find no stations to listen to in the upper part of the range.

(4) O.K.

S.S. (New Shildon).—(1) Yes.

(2) With skilful construction and handling the circuit you sketch should give the best results.

(3) About 5" by 4", wound with No. 28.

(4) Tappings are hardly necessary, but you can put two or three if you like. There is no need to tune the reactance coil by means of a condenser.

H.G.L. (London, S.W.).—The switch A on your set is quite useless, as the lower position has no advantages over, and is definitely worse than the upper, which may be made a permanent connection.

(1) About 4,500 and 100 ohms.

(2) 0·0004 mfds.

(3) 0·002 mfds.

(4) We cannot say, as the sample of wire referred to has not come to hand. Range will be about 3,000 ms., if No. 24 wire is used.

J.S. (Taunton).—The time signals referred to are the scientific or astronomical signals. After the time signals the actual times of the first and last dots of the series are signalled by means of a code, for which see reply to R.C.M.R. (Eastbourne), on page 367 of the August 6th issue.

C.M.R. (Clayton Bridge).—(1) For the Hague concerts use the A.T.I. and A.T.C. in series. Do not have a separate slider for the grid ; connect it to the top end of the A.T.I. With careful adjustment you may just get the concert. Another valve would greatly improve results.

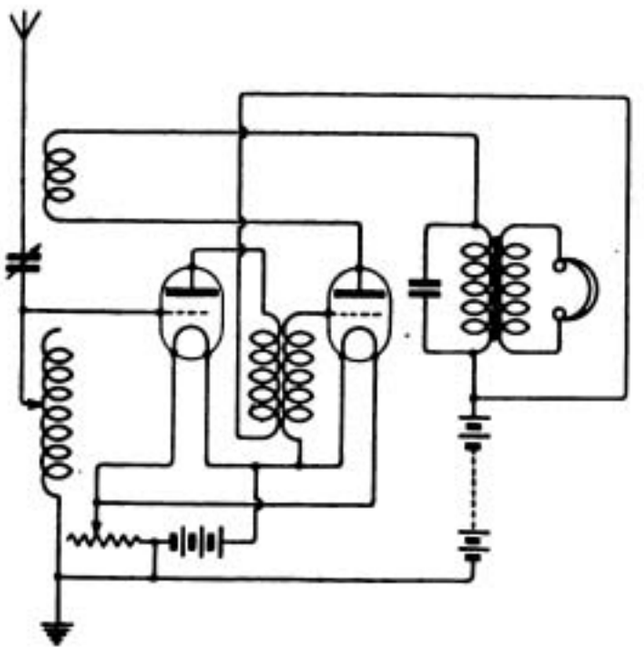


Fig. 2.

(2) Tuner will be suitable, except No. 36 is too fine for the A.T.I.

(3) Connect several slabs in series, noting that the current flows in the same direction round each slab. Use several slabs for both A.T.I. and the reaction coil. Adjust reaction by altering the positions of the coils.

(4) We should prefer the outside one.

A.E.W. Clubmoor).—We regret that we have no detailed information on the constants of this tuner. It could only be used with a valve as a detector unless considerable structural alterations are made, as for the introduction of a reaction coil.

L.G. (Weston-super-Mare).—(1) No. 22, 6,750 ms. singly, and No. 24, 8,600 ms. singly. Approximately 12,000 ms. with the two coils in series and the condenser across both.

(2) It will be only just audible.

(3) Try the circuit of Fig. 2 without a crystal. Wind the intervalve transformer for a best wavelength of 1,000 ms.

(4) For a V.24, 24 to 40 volts. For an R.40 to 60 volts, according to the make.

F.H. (Hammersmith).—(1) Yes, a good arrangement.

(2) Yes.

(3) Yes, and there should be a condenser across the anode winding of the first intervalve transformer.

(4) Yes.

R.G.T. (Fulham).—Unless the reaction coil has been carefully proportioned it will be difficult to obtain the best reaction coupling with the fixed coil, as described. It will probably be much better to make a sliding coil set. Thirty-two tappings on a 10" A.T.I. are quite unnecessary with a variable condenser : 8 to 10 would be ample. The normal R valve is of hard type, though admittedly not as hard as some others, as, for instance, the B valve.

E. RN. W. (Merioneth).—(1) Provided that a good aerial is used, signals should be received. No. 28 is too fine for an A.T.I. for a set of this type. Use No. 22 or 24.

(2) About 2,000 ms. if wound with No. 28, and 1,500 ms. when A.T.I. is of No. 24.

(3) No mention is made of the material between the tubes. Owing to the thickness of the dielectric the capacity will be very small, almost certainly less than 0·0001 mfds.

R.G.L. (High Wycombe).—(1) 600 to 5,000 ms.

(2) Reaction coil 4" by 8", wound full of No. 28. Arrange to slide it in and out of the A.T.I.

(3) Short wave A.T.I., 200 to 1,400 ms., 4" in diameter and 6" long, full of No. 24.

(4) Reaction coil 3" diameter and 5" long, wound full of No. 28.

H.C.R. (Colwyn Bay).—(1) The circuit is wrongly connected. Connect as in Fig. 5, page 218, of June 25th issue. The set should receive ships and the 600 ms. coast stations. As you do not

give windings, we cannot say whether you will be able to get such stations as FL.

(2) Carborundum steel, with a potentiometer, or zincite-bornite, without a potentiometer.

(3) There is no book other than the Year Book, published at 21s., which gives a complete list of call signs.

E.G.R. (Westminster).—(1) 6,500 ms.

(2) No, the CRR circuit is much the better of the two, as it is essentially a 2-circuit auto-coupled receiver, while yours is a single circuit receiver. Moreover, the CRR circuit allows better capacity-inductance ratios to be used.

(3) No, the wire is too fine; but to get the range with thicker wire a former of much larger diameter will be required.

(4) Carborundum is more stable. Zincite-bornite is more sensitive, but it is more easily thrown out of adjustment.

H.L. (Wolverton).—(1) The inductance A is an ordinary variable one for varying the wavelength of the aerial circuit. No reaction coil is shown in the diagram mentioned, but one can be connected in the circuit, between the anode and the telephone transformer, if desired. It should magnetically couple into the grid inductance A.

(2) For an amateur set the aerial condenser should not have a greater maximum capacity than 0·001 mfds.

(3) This is obviously a telephone transformer. An intervalve transformer would be shown in the circuit between two valves.

(4) Triode is a name given to valves by Dr. Eccles. A soft valve is one in which evacuation is not carried to the extreme limit, a very small amount of gas being allowed to remain in the tube. The principle of action is then slightly different and the valves are more sensitive but less stable than the hard type.

W.H.R. (Tooting).—(1) and (2) If the coupling between the plate and grid coils is sufficiently tight and the connection to the plate coil the right way round, the set will be self-heterodyning, in which case it will be suitable for C.W. reception. For spark and telephony it should be almost but not quite oscillating.

(3) For wavelength calculation the diameter of the formers should be given in order that the inductance may be calculated.

(4) An R valve, which is not of a soft type, will be quite suitable.

MATRICULANT (Stepney).—(1) A single wire aerial: total length of aerial, including down lead, 100 feet. Double wire aerial: total length of wire, 140 feet.

(2) Yes.

(3) No effect except to assist it to increase the wavelength of the aerial circuit.

(4) About 6 oz.

G.H.I. (Leyton).—(1) Inductance, 18,500 mhys; wavelength, 3,600 ms.

(2) Mark III A.T.C., 0·0015 mfds. Wavelength in parallel, 10,000 ms; in series with aerial and inductance, 3,600 ms.

(3) Inductance, 30,000 mhys.; wavelength in series with aerial, 4,500 ms. Coils 1 and 3 joined in series together, and with the aerial will give a maximum wavelength of 6,000 ms.

H.R.T. (Holloway).—Connect a reaction coil in the anode circuit of the valve and couple it with the secondary inductance. The single wire aerial will give better results if you can raise the height at the 10-foot end. The secondary condenser has too big capacity; it tunes the secondary to 7,000 ms., whereas the aerial only goes up to 3,000 ms. Use a grid leak of about 2 megohms between the grid and the negative filament. The telephones are fairly good, but you will probably get better results with 120 telephones and a good transformer.

R.P. (Greenwich).—(1) With condenser in series, a minimum of 300 and a maximum of 3,500 ms., approximately. With the condenser in parallel, a maximum of approximately 8,000 ms.

(2) It does not much matter. Presspahn less than $\frac{1}{32}$ inch thick, should be used.

(3) The number of coils required for reaction will vary according to the amount of A.T.I. in use. Six coils should be sufficient for the whole range.

F.A.A.B. (Romiley).—(1) The amplifier in question can be used with a frame, but signals will not be very strong with only two valves. Use a 3 or 4 feet frame. With a frame aerial, its winding, with possibly a loading inductance, will be joined across the terminals of the tuning condenser. The grid and filament of the first valve will also be put across this condenser.

(2) The size of the formers will depend upon the wavelength range desired and the capacity of the tuning condensers. They might be made 12" long and 6" diameter for the outer former, and the same length with 5" diameter for the inner for a fairly short range set.

(3) Make four or five tappings to the inner coil, and fit a slide to the outer coil.

(4) The diagram shows HR telephones, but LR telephones with a transformer may be used. The same dimensions probably will do for both amplifiers.

A CORRECTION.

C.N. (South Norwood).—Apologies for the incorrect information supplied you in last issue.

The interrogative form of QRU is rendered unnecessary through the introduction of QTC "Have you (something) (anything) to communicate?" *Answer.* "I have something to communicate." *or* "I have message (s) for . . . ."

SHARE MARKET REPORT.

The past fortnight shows a slight decrease in prices of Marconi shares.

Prices as we go to press, October 6th, are:—

Marconi Ordinary	£1	12	6
,, Preference	£1	12	6
,, Inter. Marine	£1	1	3
,, Canadian		6	0
Radio Corporation of America:—			
Ordinary		11	9
Preference		9	9

The WIRELESS WORLD

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VOL. IX. No. 42. OCTOBER 29TH, 1921 FORTNIGHTLY

A SEPARATE HETERODYNE FOR SHORT WAVE WORK

AN INSTRUMENT WHICH CAN BE USED FOR THE TRANSATLANTIC TESTS

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

IN the last article on Short Wave Reception, reference was made to the necessity for the use of a separate heterodyne when receiving. Although the loss of signal strength by not doing so is negligible at a wavelength of 200 metres, the very undesirable heterodyne radiation that otherwise takes place renders imperative the use of a separate oscillating unit in any such test as the forthcoming transatlantic transmissions of the American Radio Relay League, during which many experimental stations on this side will be listening-in simultaneously on the same wavelength.

The mere employment of a separate heterodyne unit, however, is not of itself sufficient unless proper precautions are taken in its use. For instance, in many receiving stations direct coupling between the aerial circuit and the heterodyne is used, with the result that on short wavelengths the radiation from the aerial is practically as strong as if an autodyne receiver were employed. The conditions are slightly improved if the heterodyne is coupled to the secondary circuit of a loose-coupled receiving tuner, but for short waves the improvement is not great, because the heterodyne has to be so slightly detuned from the frequency of the incoming signal in order to keep the beat note frequency within the audible limits that to all intents and purposes the heterodyne and the aerial are in tune, as regard the transfer of energy between them. On long wavelengths the much larger frequency difference between the two circuits, limits very considerably this transfer of energy, so that the heterodyne radiation is reduced by this method.

For 180 or 200 metre reception then, we must look for some other means of reducing the radiation when receiving The most practicable method is to keep the separate heterodyne unit as far away as possible from the aerial circuit, and also from the tuned secondary circuit coupled to the aerial, and to couple it on to some other part of the receiving circuit, so that there is at least one valve between the aerial and the part of the circuit to which the heterodyne is coupled. One possibility is indicated in Fig 1 for the case of a 4-stage radio-frequency tuned impedance-capacity coupled amplifier and detector. This receiver consists of the usual aerial circuit A L_1 C_1 E, and secondary circuit L_2C_2 tuned to the incoming signal. The first four valves are arranged as radio frequency amplifiers, and have impedance coils L_3 L_4 L_5 and L_6 in their plate circuits which are capable of being tuned to the

frequency of the signals, either by being made on the variometer principle, or by having small variable condensers (not exceeding, say, 0·00025 microfarad maximum each) shunted across the fixed coils. The coupling between the valves is provided by the inter-valve coupling condensers C_3 C_4 C_5 and C_6, the grid leaks R and R′ being added to maintain the grids of the valves at the proper working potential. It may be noted that all these grid leaks with the exception of R′ belonging to the detecting valve, are connected to a common potentiometer P, so that the working potential of the grids of all the amplifying valves can be controlled. Similar control of the grid potential of the

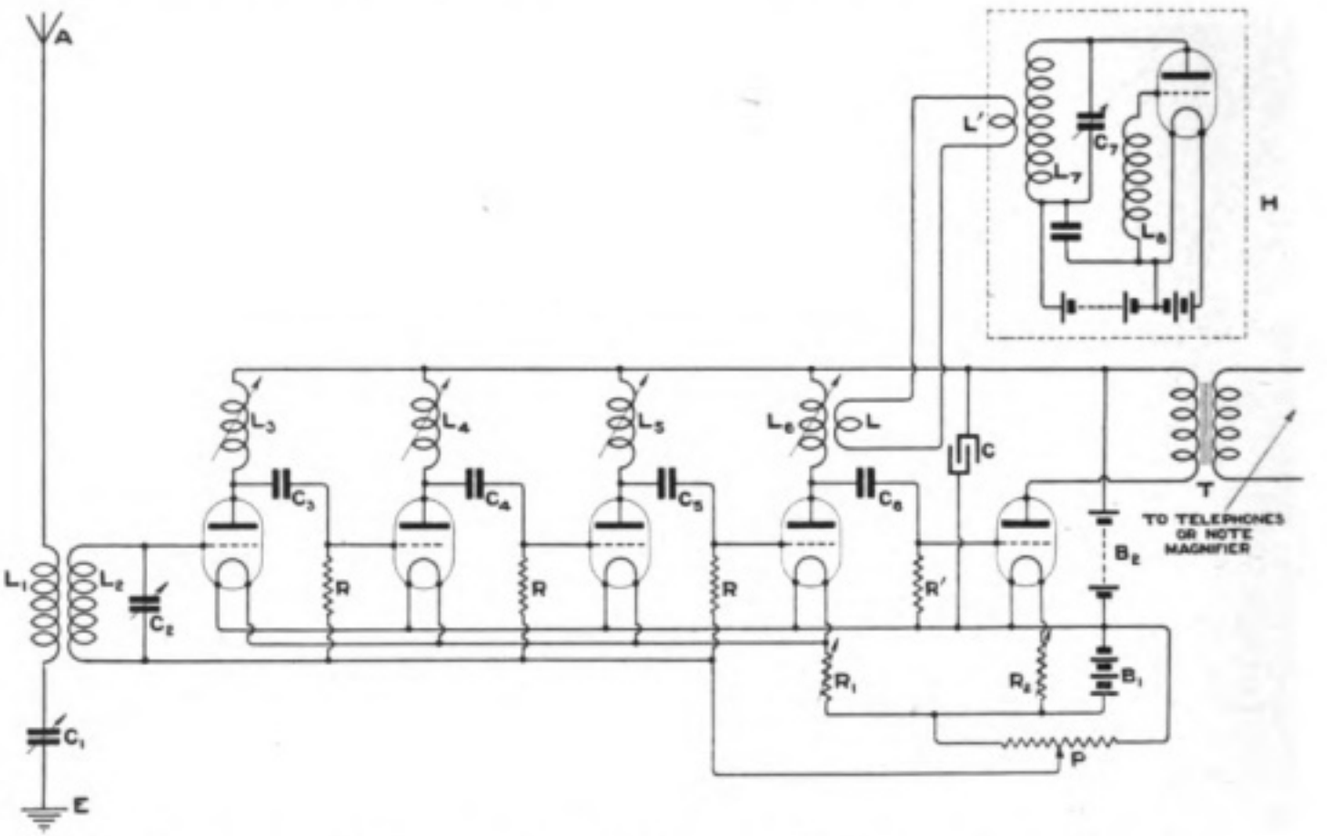


Fig. 1. Tuned 4-valve capacity coupled Amplifier and Detector with separate heterodyne.

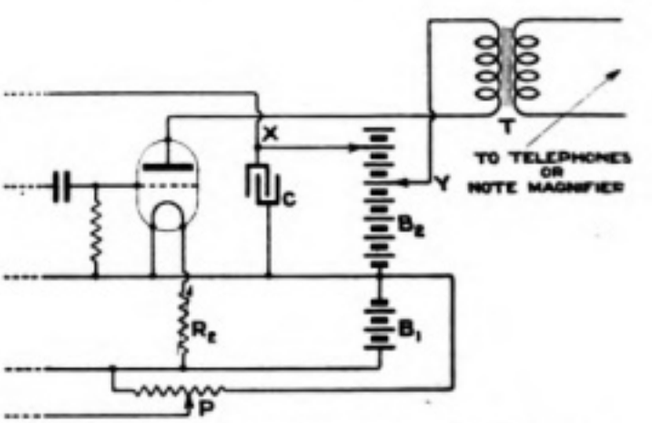


Fig. 2. Alternative arrangement of H.T. battery connections in Fig. 1.

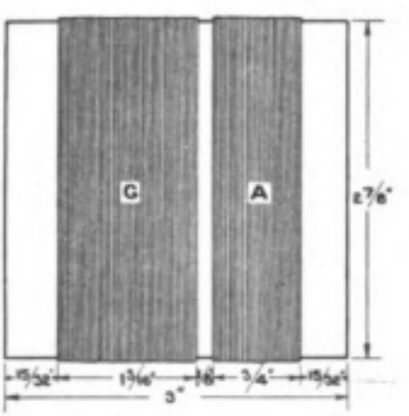


Fig. 3.

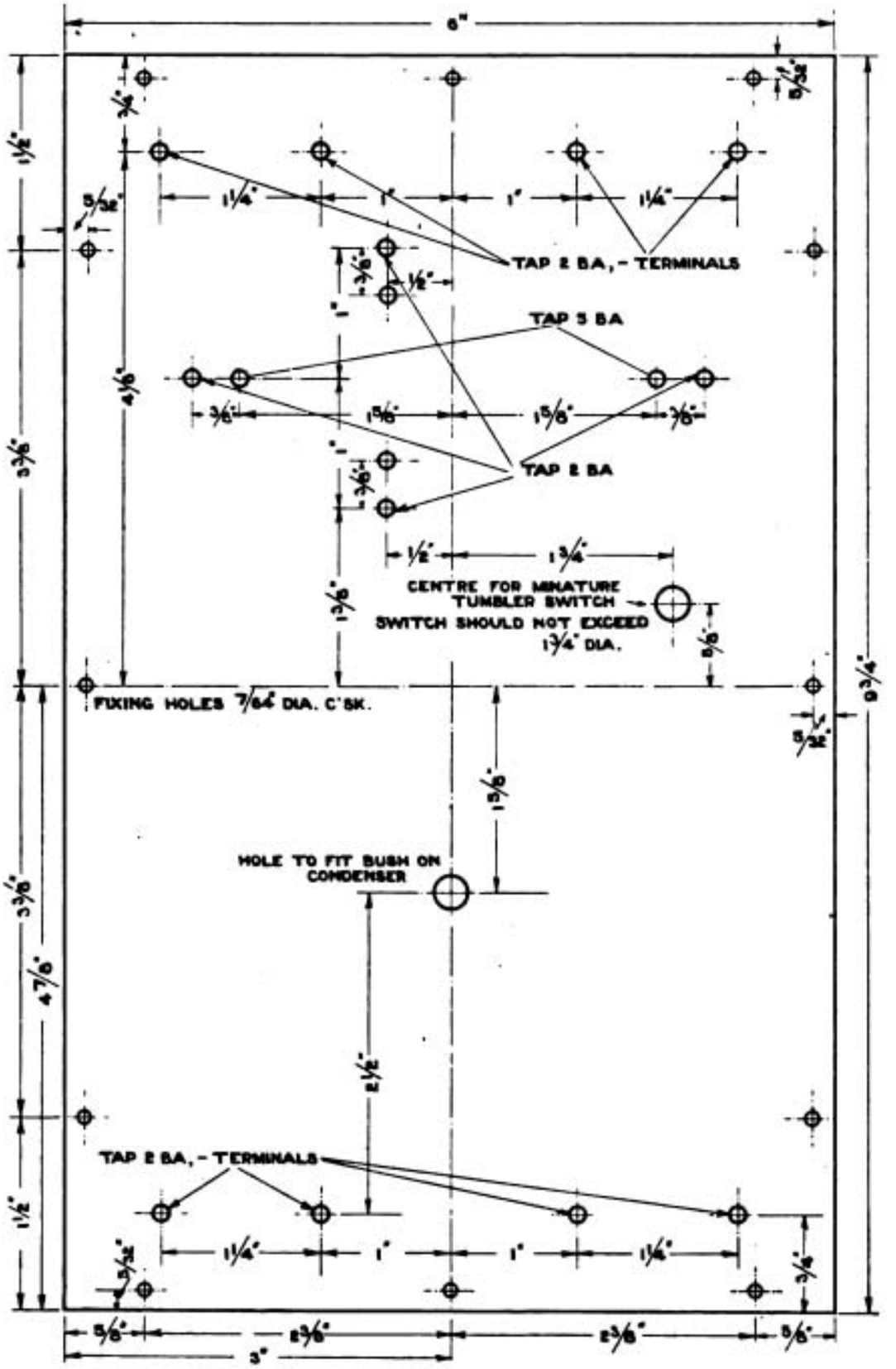


Fig. 4. Drilling diagram for Ebonite top of Instrument.

detecting valve is not usually so necessary if the proper grid condenser C_6 and leak R' are chosen, and the temperature of the valve filament is capable of adjustment by a separate filament resistance. C is the large blocking condenser across the H.T. battery, the need for which was emphasised in the last article.

Since it is generally desirable to use different valves for the amplifying and for the detecting stages, it is often necessary to employ different H.T. battery voltages for these two cases. This can be done, even when using a common H.T. battery, by providing separate tapping connections for the amplifying and detecting valves. Such an arrangement is shown in Fig. 2, which represents merely the right-hand part of Fig. 1, with the necessary alterations. The H.T. tapping connections for the amplifying and detecting valves are designated by X and Y respectively, the arrowheads indicating the adjustability of the points of connection to the H.T. battery.

Reverting to Fig. 1, the separate heterodyne unit is shown at H, and consists of an ordinary 3-electrode valve, provided with an oscillatory circuit, L_7 C_7 (the condenser C_7 being variable), and a grid reaction coil L_8. The usual H.T. and filament batteries are, of course, necessary. The whole unit including the batteries may often with advantage be enclosed in a copper box to screen it from affecting the other circuits except where required, and a coupling circuit L'L, consisting of small coils having one or two turns only, brought out to enable the heterodyne E.M.F. to be introduced into the circuit of the amplifier only where required. The coupling between L and L_6 is variable in order to adjust the effective strength of the heterodyne.

If the amplifying valves are maintained from self-oscillation such an arrangement as that just described will confine most of the heterodyne current to the detecting valve, and prevent it from passing back to the aerial circuit. The heterodyne unit must, of course, be kept as far away from the aerial circuit connections as possible, and used near the detector end of the amplifier.

A convenient heterodyne unit for use in 200-metre reception, such as required for the arrangements outlined above, may be constructed in the following manner. This instrument will also be found very suitable in connection with the ordinary 180 metre communications licensed by the Post Office in this country. The anode and grid coils may be wound on the same former, closely adjacent to each other, as indicated in Fig. 3, in which G represents the grid coil and A the anode reaction coil. If the diameter of the winding former—which may be a waxed cardboard, or an ebonite tube—is $2\frac{7}{8}$ ins., and its length 3 ins. as shown, the grid coil G should have 28 turns of No. 20 S.W.G., D.C.C. copper wire, wound with the turns touching so as to occupy a length of $1\frac{3}{16}$ ins. A space of $\frac{1}{8}$ in. is left between the windings, and the anode coil A of 17 turns then put on, using the same wire. A variable condenser, having a maximum value of approximately 0·00025 microfarads is used for tuning purposes, and should be connected across the grid coil G. For convenience the whole instrument may be mounted in a wooden box, with an ebonite top on which the valve holder, and the terminals for the H.T. and L.T. batteries are mounted. Convenient dimensions are indicated in Fig. 4, which also gives the positions of holes for drilling. This ebonite top should be $\frac{3}{16}$ in. to $\frac{1}{4}$ in. thick.

The outside dimensions of the box are $9\frac{3}{4}$ ins. by 6 ins. by $4\frac{3}{4}$ ins. deep, and it is constructed of wood $\frac{1}{4}$ in. thick. Any convenient wood may be used, although, of course, the appearance of the instrument is improved by using a hard wood such as mahogany or teak.

The ebonite top is fastened in place with $\frac{1}{2}$ in. brass screws (size No. 4), using the outer holes, marked in Fig. 4. These are shown as $\frac{7}{64}$ in. diameter, and are suitable for No. 4 countersunk or raised head brass screws. They should be countersunk so that the bevelled parts of the screw heads sink in flush with the surface of the ebonite.

(To be continued.)

A SCHOOL RECEIVING SET—II.

CONSTRUCTIONAL DETAILS

By W. Wade.

IN response to numerous enquiries for working details of the "School Receiving Set," described on page 389 of the September 17th issue of *The Wireless World*, the writer has much pleasure in furnishing the following particulars.

The Carrying Case.

The general arrangement and dimensions are shown in Fig. 1, the depth of the box being 6 ins. and the width of inside partitions and shelves 4 ins. This partitioning allows for two 15-volt units in the H.T. compartment, and a 4-volt 40 amp. hour accumulator in the L.T., but slight variations could, of course, be made to suit individual requirements.

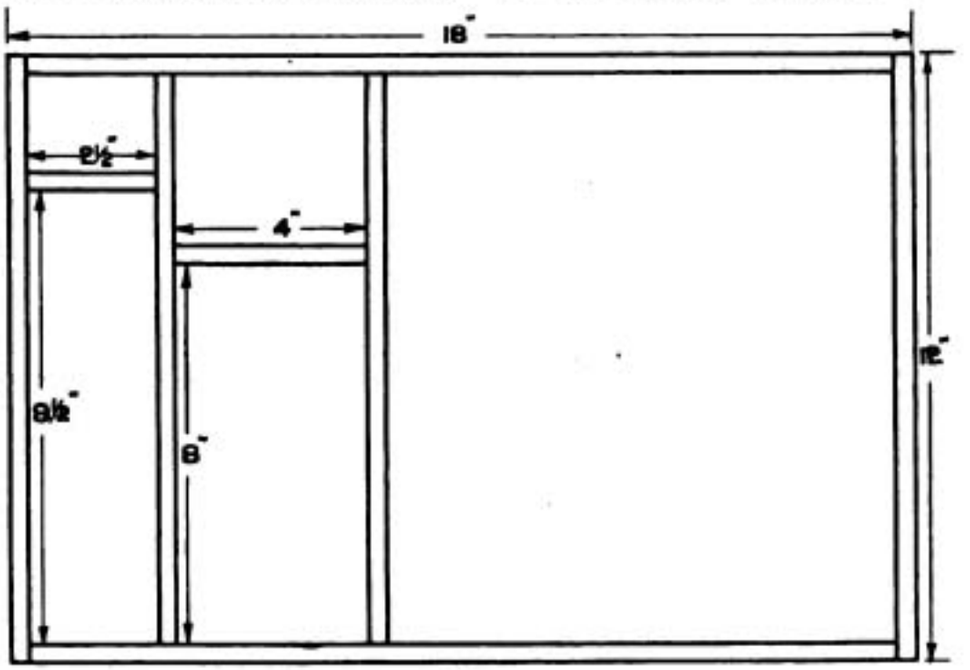


Fig. 1.
Dimensions of the carrying case—front view.

Baseboard.

A 10-inch square of any thoroughly dry wood, about ½-in. in thickness, will be needed for this. If desired it may be stained black to imitate ebonite, but care must be taken in the choice of the stain used, which must contain no lampblack or any form of free carbon. A packet of dye answers the purpose very well. After staining, it must be thoroughly dried again and then paraffin waxed. Both sides should be treated alike to prevent warping. If this waxing is well done, the ebonite terminal blocks shown in photograph and diagrams *may* be omitted, but, of course, their use gives better insulation. In the original model they were made from scrap material, and the size being of no account their positions are merely indicated in Fig. 2. If more convenient to the maker the valve-holder and grid condenser (with leak) may be mounted separately, as may also the two tuning condensers.

Grid Condenser.

From a piece of mica 0·002-3 ins. in thickness (*i.e.*, a little thinner than the paper on which this is printed), cut a rectangle, 1¼ ins. by 1 in. Now cut two pieces of tin or copper foil, as shown in Fig. 3 (*upper figure*) and fix one on each side of the mica by means of shellac varnish so that

the lugs for connections come at opposite ends of the rectangle, *i.e.*, not vertically above each other. Shellac the rectangular part down to its base and make connection with the lugs by means of small screw terminals and washers.

Tuning Condensers.

These are made similarly to the grid condenser, and the dimensions are shown in Fig. 4. Only one foil plate is shellaced on, however, the upper moving plate (the earthed one) being cut from sheet zinc.

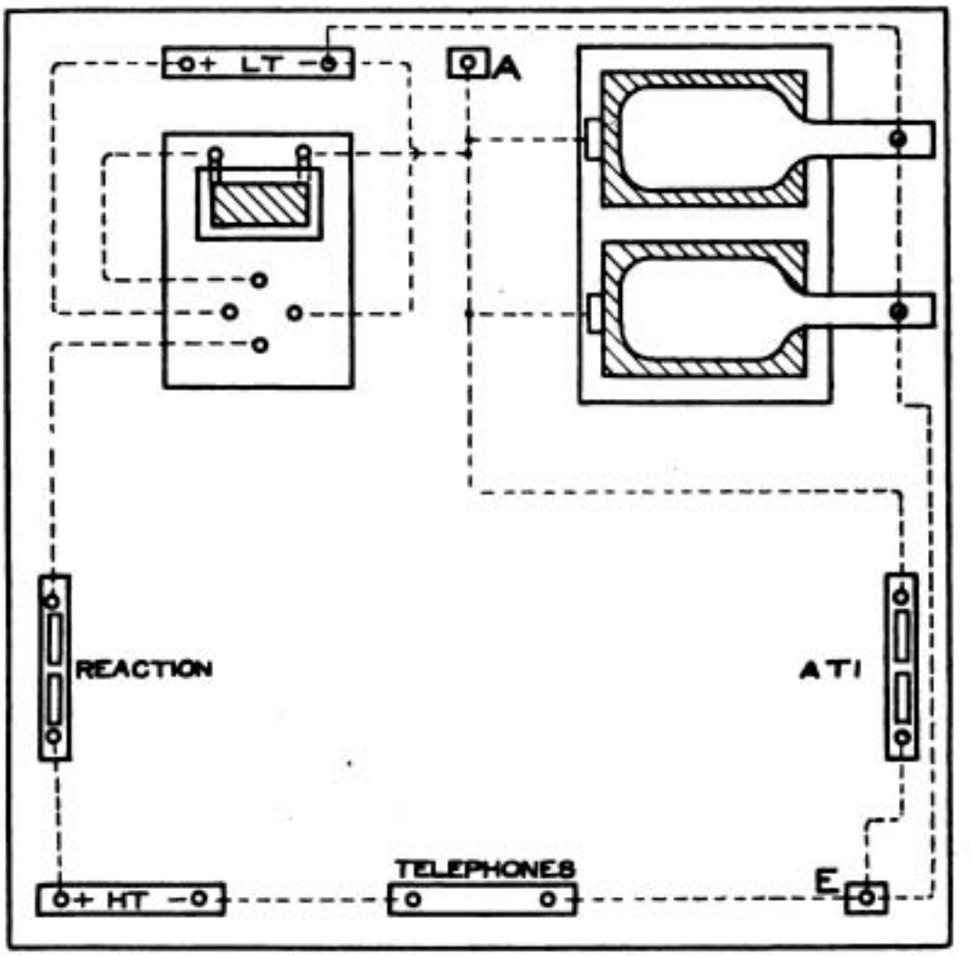


Fig. 2.
Arrangement of the various units.

The Leak.

If the grid condenser is mounted on ebonite, make two pear-shaped marks with a good BB pencil over the terminal holes, as shown Fig. 3. (*lower half*) and screw the lugs carefully down to these. The leak is afterwards completed by joining the two narrow ends with another pencil line, the best thickness for which must be found by experiment.

If mounted direct on the waxed baseboard, the pencilling must be done on a strip of cartridge paper placed in position under the lugs.

Connection to this moving plate is best made by soldering a loop of flexible wire on to it. This avoids the noise and uncertainty arising from a rubbing contact made at the pivot screw.

Tuning Coils.

These are wound on formers each made of three waxed wooden discs (cigar boxes furnish admirable material) glued together, as shown at Fig. 5. (*upper half*). If desired a ¼ in. hole may be bored through the centre to admit a brass rod for ease in coupling, as shown in the photograph. For still greater simplicity, however, they may merely rest flat on the

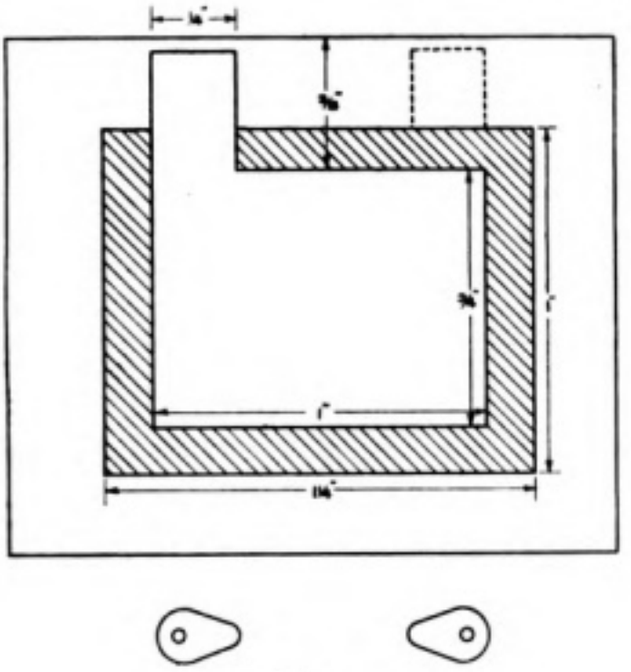


Fig 3.
Dimensions of condenser plates.

bottom of the carrying case, one overlapping the other. For best results wind four coils with 32 or 34 D.C.C. wire, the number of turns in each being 60, 100, 200 and 500 respectively. To the ends of the windings solder pieces of well insulated flexible wire, about a foot in length, and to the other ends of

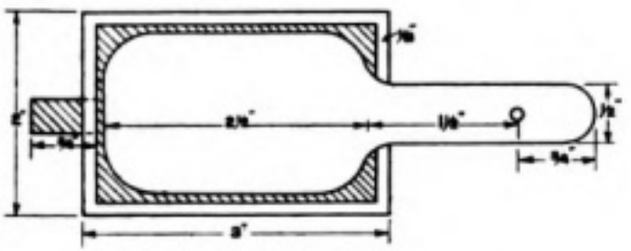


Fig. 4.
Dimensions of condenser plates.

these attach any small two-pin plug. Improvised ones may consist of pieces of ebonite 1 in. by $\frac{3}{8}$ in. by $\frac{1}{4}$ in. to two opposite faces of which are attached strips of brass foil, the plug socket simply consisting of two pieces of spring brass, bent as shown in Fig. 5 (*lower half*).

Connections.

The lay-out of wiring is clearly shown by the dotted lines in Fig. 2. No. 22 bare copper wire, run in insulating sleeving, making the neatest and most serviceable job.

General Notes.

1. Care must be taken when plugging in the coils to see that they are in the right sense. If, on bringing the coils close together and touching the aerial terminal with the finger a click is heard, all is well. If not, simply turn over *one* of the coils or reverse *one* plug.

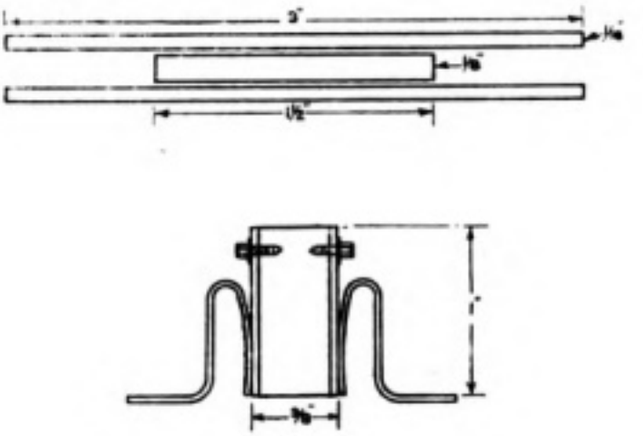


Fig. 5.

2. Use the 200-turn coil for reactance with either of the other three as A.T.I., and he 500 turn one when the 200 turns are A.T.I.

3. A set carefully made on these lines, unpretentious though it be, will work quite as well as some much more expensive bought articles.

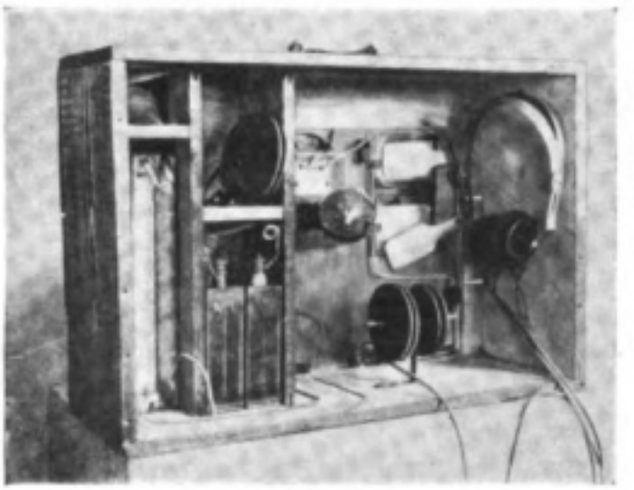


Fig 6.
The complete set.

SOME METHODS OF RECORDING WIRELESS SIGNALS*

Mr. Philip R. Coursey.

The subject of the recording of wireless signals is one that dates back almost to the earliest beginnings of wireless signalling. As is well known the first practical wireless receiving apparatus used on a commercial scale employed the coherer acting upon a relay so that the messages were recorded on a Morse printer. Such methods are of little use now-a-days.

Time will not permit of a detailed account of all the various methods that have been or are capable of being used for the recording of wireless signals, but it may be of interest to draw attention to some of the methods that are applicable at the present day, both for experimental and for commercial work, and it is hoped that other members present this evening will be able to give us their actual experiences in the operation of some of the methods here referred to.

After the introduction of crystal receivers into practical wireless communication work the recording of signals fell out of use since such detectors were adapted to the more sensitive reception of signals by telephone. Even crystal receivers, however, are capable of operating some form of recording apparatus and an Einthoven Galvanometer, working in conjunction with a moving strip of sensitive photographic paper may be employed when taking down incoming signals. Such a method is applicable to C.W. reception as well as to spark, without the use of any heterodyne.

It is perhaps, also, not so generally known that a crystal receiver can be used to operate a syphon recorder for the direct recording of incoming signals on a paper tape. The operation of an ordinary pattern of relay with a Morse printer is difficult with a crystal receiver, and the rectified currents are small unless the signals are very loud. Brown's relays, particularly of the "W" type, are adaptable to crystal working, and can be made to actually give a make and break contact that can be used to control a Morse printer. The old Orling jet relay was also remarkably sensitive and could be applied to such detectors.

Any means of recording the sounds heard in the telephones of a wireless receiver may be applied to any form of detecting apparatus that can be used with such telephones. The best known method is that involving the use of a dictaphone recorder by means of which the incoming signals are recorded on a moving wax cylinder, and subsequently decoded by ear. This method is particularly adaptable to high speed signalling, as the dictaphone can be run on a lower speed when transcribing the record. The Poulsen telegraphone, in which the incoming signals are recorded on a moving steel tape, as variations in the magnetisation of the steel tape or wire, is also applicable to similar uses.

When employing valve amplifiers and detectors many other arrangements of recording apparatus are open to use. The simplest of all arrangements is to make use of the variations in the plate current of the detecting valve, which occur when signals are received. These variations may be used to actuate a recorder of the syphon type or some similar apparatus, but without the addition of further auxiliary apparatus they are not readily applicable to the operation of a make and break relay and a Morse printer.

One of the chief problems experienced in valve work for recording purposes when using a valve is that if a very sensitive relay is in series with the valve it will go over to "marking" and remain there, because of the steady plate current which flows in the valve circuit. There are several methods of balancing out the effect of the steady plate current flowing through the valve and the receiving relay. Many of these methods have been used from time to time, and doubtless there are many here who can give us their experiences, such as making use of an appropriate potentiometer fed from

*Discussion before the Wireless Society of London, on Friday, September 30th, 1921.

the plate battery so that the current through the relay or other recording apparatus is normally at or near zero when no signals are being received.

Another way in which the steady plate current may be balanced out has recently been described by E. F. W. Alexanderson in a U.S. patent specification. The arrangement is on the lines of a Wheatstone bridge, and was there described primarily as a means of receiving C.W. signals without the use of a heterodyne, but with slight modifications it can be applied to recording. It consists of a Wheatstone bridge made up with two arms in the form of fixed resistances, and two arms containing three electrode valves as indicated in Fig. 1. The incoming signals alter the grid potential of one of these valves so that the bridge is unbalanced and a current thus enabled to flow through the relay or recording apparatus connected in the galvanometer arm of the bridge.

I shall be interested to hear if anyone has tried this arrangement, as I have not used it personally.

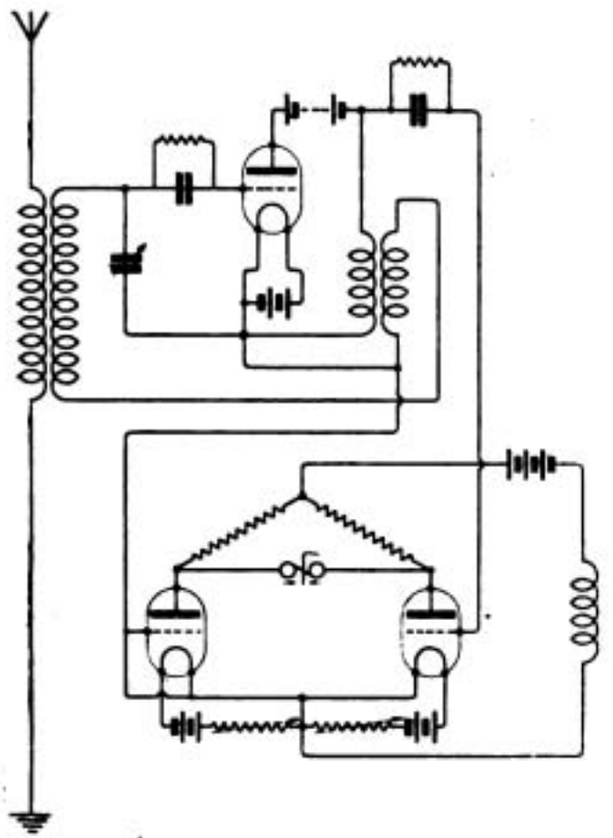


Fig. 1.

Abridged circuit due to Alexanderson.

As regards relays particularly applicable to valve reception mention may be made of the Turner trigger relay, which may be used to operate an ordinary make-and-break relay for the recording of the signals on a Morse printer.

Another form of relay on which I do not think much work has been done, is the Hall relay, in which an air blast is used. The incoming signals cause a heated wire to be moved in or out of the air blast. When the hot wire is in the air blast the wire is cooled and its resistance is altered so as to upset the balance of a bridge arrangement, and so operates the relay and records the incoming signals. The air blast is arranged to be in a sound-sensitive condition, so that its movements can be controlled by the sounds in the receiving telephone, which is fixed adjacent to the air jet.*

The Johnsen and Rahbek apparatus, in several of its various forms, is applicable to the recording of wireless signals. Details of several of these arrangements have recently been published in *The Wireless World*.†

Low frequency valve amplifiers may be adapted to any form of receiver to effect the recording of the incoming signals, and by using a circuit specially arranged to be sensitive to very low frequency currents greater sensitiveness is obtainable.

The accounts, which I hope we shall hear this evening of the practical working of these various methods should form an interesting means of comparing their relative merits.

Mr. A. A. Campbell Swinton.

The earliest record of wireless signals with which I personally have had experience were some experiments made in 1910, by Messrs. Poulsen and Pedersen, between Knockree, which is near Tralee, on the West Coast of Ireland, and Lyngby, near

*U.S. Patent 1378345, published May 17th, 1921.

†See *The Wireless World*, 9, July 9th, July 23rd, August 6th, and August 20th, 1921.

Copenhagen, a distance of 950 miles. The arc system was installed with a 40 H.P. generator, and the signals were successfully recorded at Copenhagen without any relay. There were no wireless relays then, in fact relays were scarcely known except in telegraphic work. The instruments used were simply a crystal detector and Pedersen's

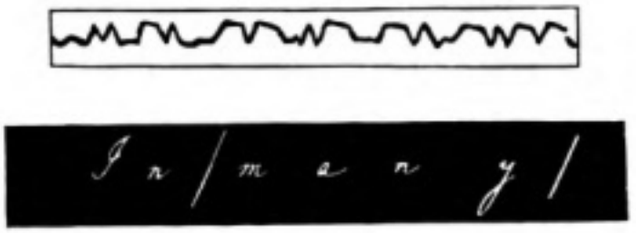


Fig. 2.
Specimen of record from Lyngby made in 1910.

tikker, and the current passed through the tiny gold wire of an Einthoven string galvanometer, which, although only a few inches long, had a resistance of several hundred ohms. When the current passes through the crystal the wire moves from side to side. The motion is exceedingly small. Light is thrown on the wire from a slit, and then through a microscope on to a moving photographic strip, the slit being horizontal and the wire vertical. The shape of the wire itself across the slit is largely magnified upon the moving tape, and in that way signals were recorded. You have got to remember that the whole of the energy in that arrangement came from the distant station. No energy was put in at the receiving end, so that the delicacy of the apparatus was marvellous. Fig. 2 shows a portion of the slip that was recorded on that occasion. I think this was taken at 62 words per minute. Records were obtained at 150 words per minute quite successfully, but they were not quite so clear. Of course, the actual movements of the gold wire were in the neighbourhood of thousandths of an inch, but they were magnified up to the size shown in the figure.

Personally, I had nothing to do with any recording of wireless for a year or two after this, but in 1913 I rigged up an apparatus for recording signals by means of a manometric flame, which is a sensitive flame that jumps readily if it hears any sound. The telephone of the wireless receiver is simply held against it, and connected with the base of the chamber, and every time a sound comes the flame jumps, due to the changes in air pressure made by the vibrations of the diaphragm. Fig. 3 shows signals recorded by this method. To get the Eiffel Tower and the Admiralty a simple arrangement of the telephone working from a detector was used.

From that method I went on to photographic methods, and all of the records shown in Figs. 4 and 5 are photographically

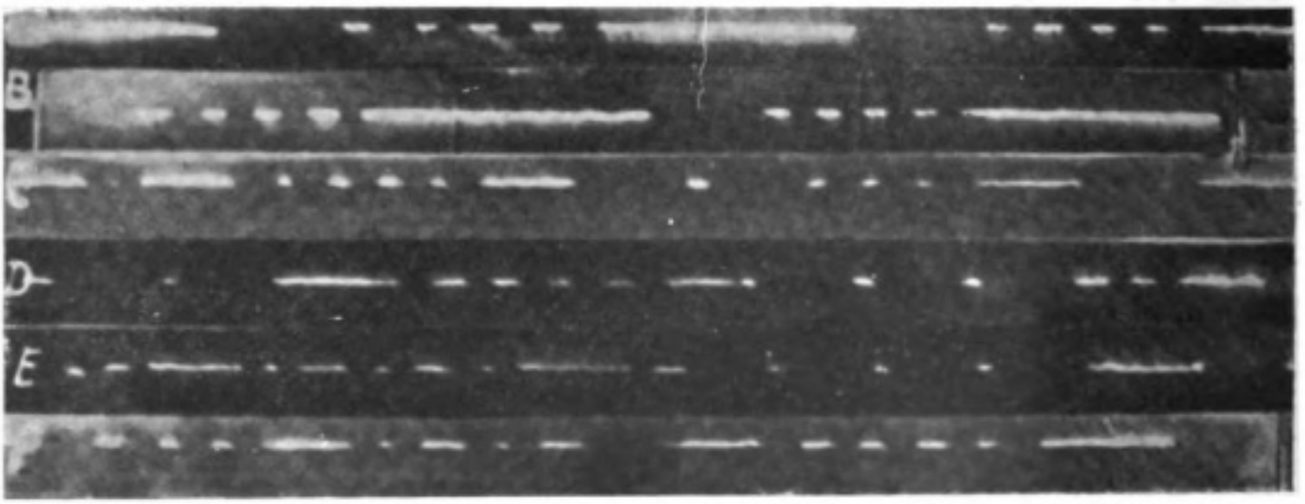


Fig 3.
Signals recorded in 1913 *by manometric flame method*

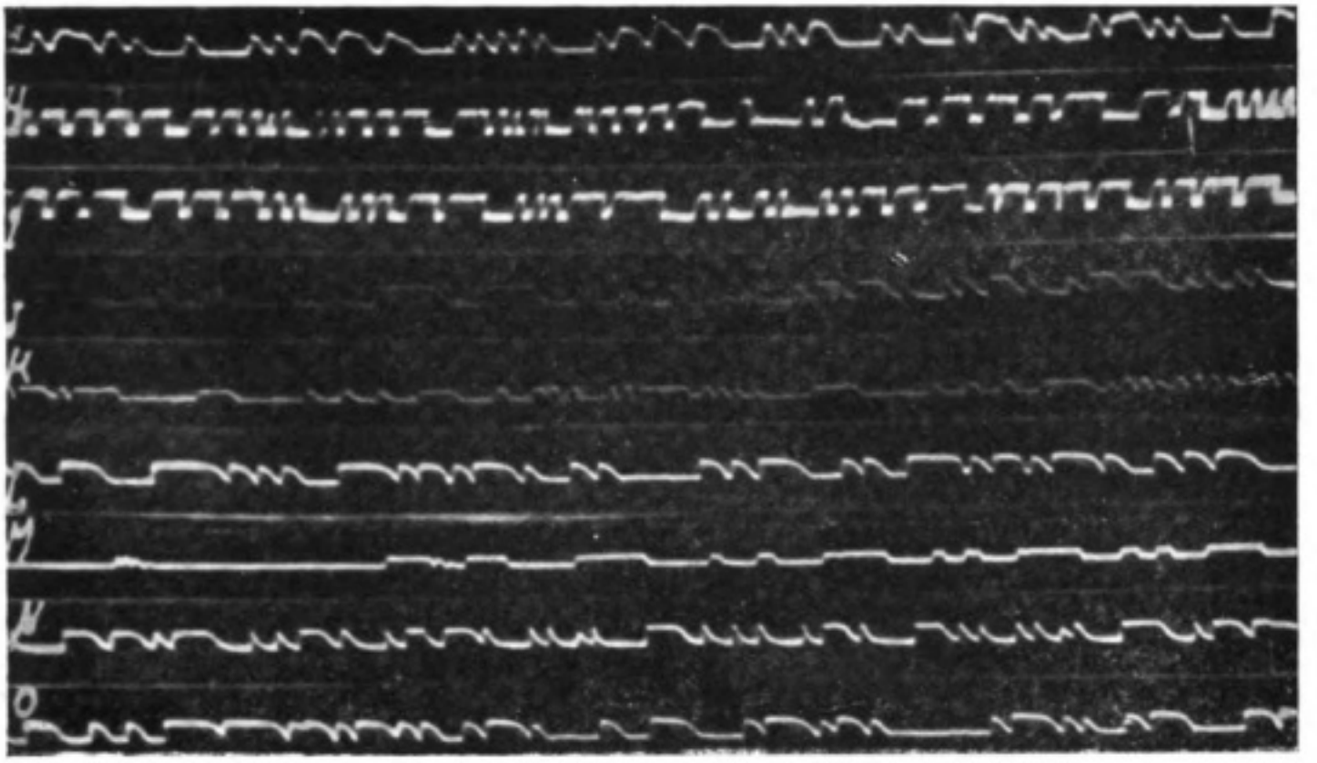


Fig. 4.

Records taken by photographic method.

done with a quick-period mirror galvanometer, the spot of light focussing on to moving photographic paper.

I then began recording with Brown's relay, and some of you will remember that at a previous meeting of this Society in this room we recorded a special message sent by Commander Ferrié from the Eiffel Tower.* (*The original of this message was shown after the meeting.*) Three Brown relays of different

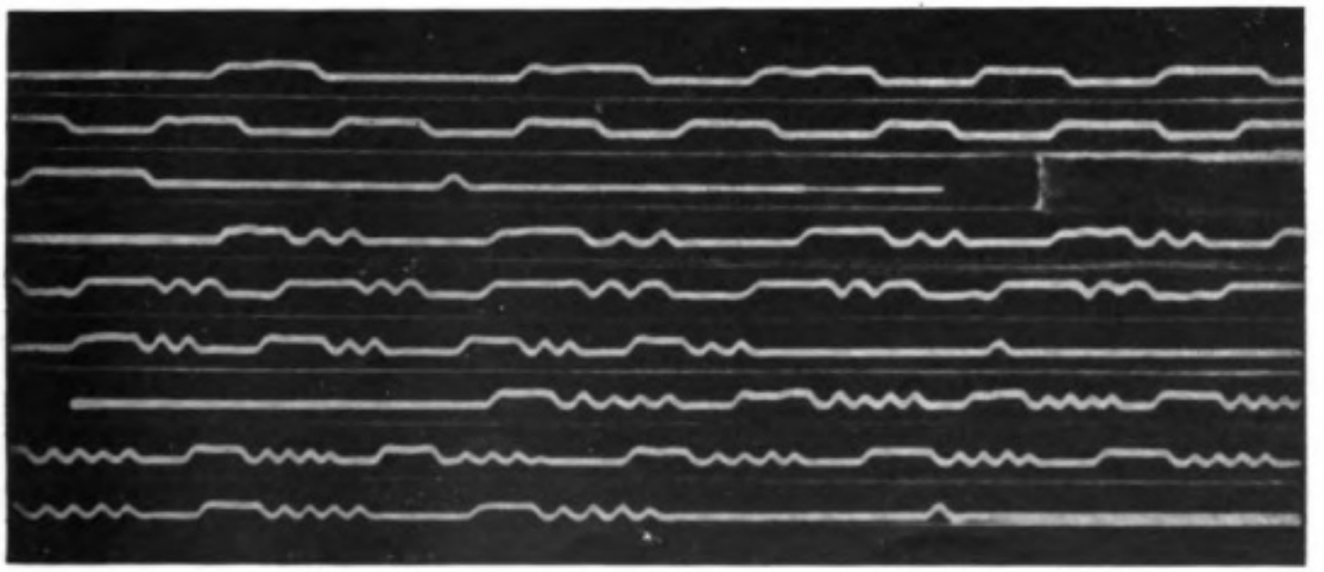


Fig. 5.

Photographic record with mirror galvanometer.

* First Presidential Address to the Wireless Society of London, Jan. 21st, 1914.

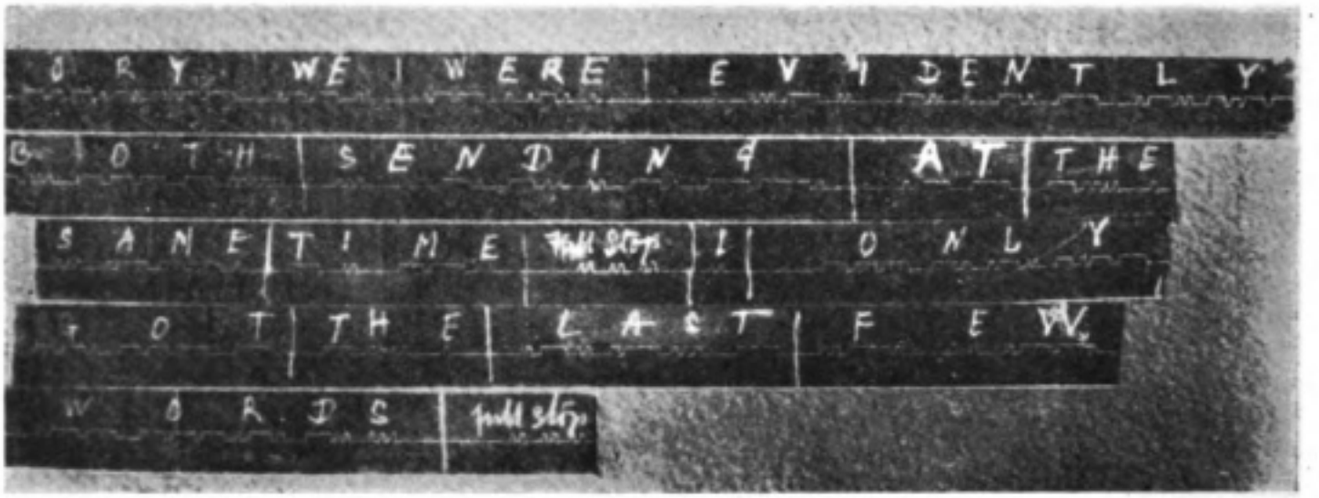


Fig. 6.

Short wave message taken on syphon recorder.

types were used for this recording, all in cascade and working a syphon recorder. It takes some management to get them to work, but when they do work the results are excellent. These experiments carry us on up to the date of the war and the production of valves, and I have a number of records from various stations taken with valves.

Fig. 7.

Mr. Coursey has referred to the limitations of valves, one point being that the signals as they arrive weaken the current, and so, unless some special device is added, an ordinary Morse inker makes a mark when there is no signal, and ceases to make a mark when the signal comes. That can be got over by putting a relay in series. Another way is to use a polarised magnet for the Morse inker, and make the plate current weaken that magnet, so that when the plate current is weakened by the incoming signal the magnet is strengthened and works in the ordinary way. Another way is to turn the Morse inker upside down and put the magnet on the top instead of underneath so that when the signal comes it marks. The syphon recorder you can make work whichever way you like, but here again there is one little

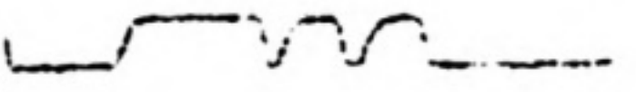


Fig. 8.

point, and that is, if you heterodyne signals, sometimes, instead of getting what you want, you will get space waves. If you then turn

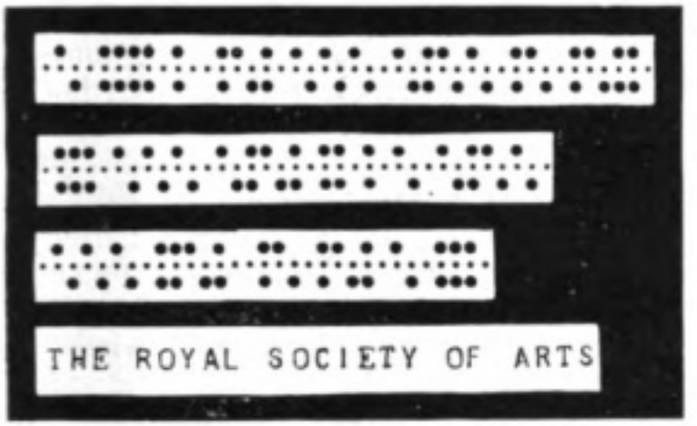


Fig. 9.

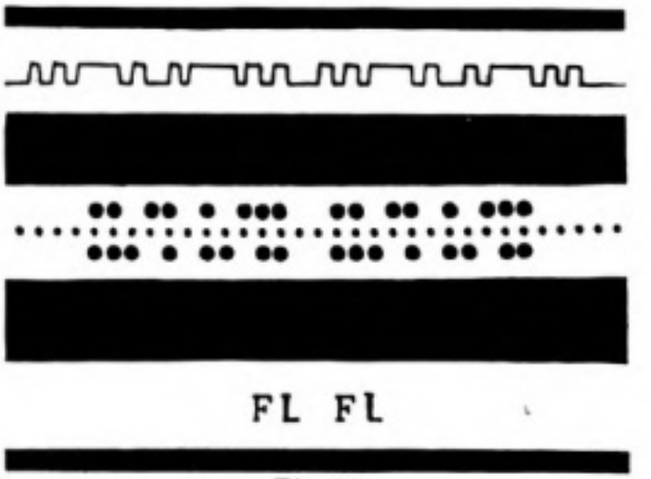


Fig. 10

the record upside down and read it backwards it will read correctly. In the syphon recording examples that I have shown the syphon moves across the paper, making wavy lines. Mr. Burbury, a member of this Society, has made a syphon recorder which works in the opposite way. Instead of having the coil vertical he has put it horizontally, and instead of moving across the paper it moves at right angles and writes like an ordinary Morse inker. It gives very pretty signals and is more sensitive. There is a tendency for it to stick to the paper, but it makes very pretty records and is more sensitive. I have one or two more examples of tape to show ; Fig. 6 goes back to the early days of working with a syphon recorder and Brown relay. It is a pre-war short wave message received with a Brown relay and a syphon recorder. When the natural frequency of the Brown relay was made to correspond to the very low frequency

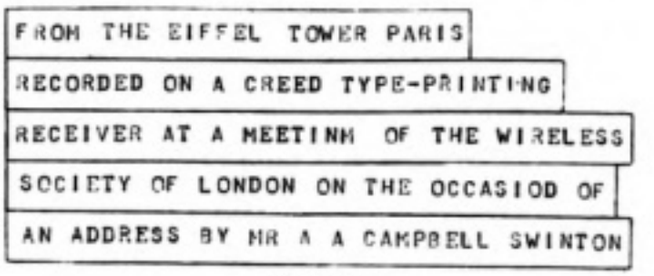


Fig. 11.

of the alternations you got better effects. You got a dash with a lot of dots, the dots being made up of four or five smaller dots, as in the specimen, Fig. 7. On the other hand, if you damped these you got an effect

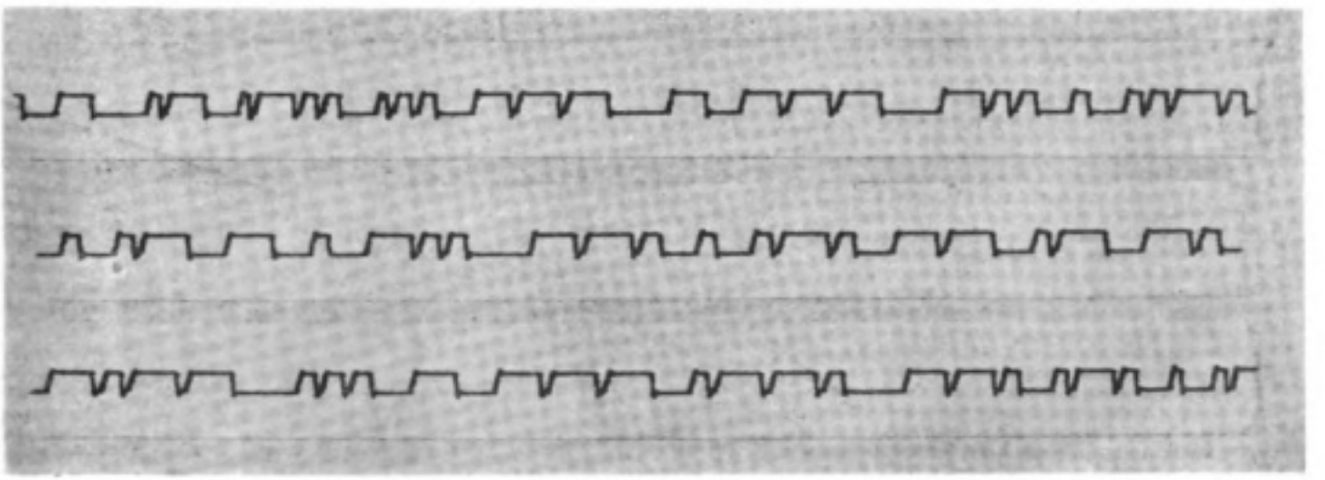


Fig. 12.
Transmission from Horsea received on a frame aerial.

like that shown in Fig. 8, which is more natural. It is a pre-war short wave message received with a Brown relay and a syphon recorder.

We now come to more modern things—a Creed perforator. Fig. 9 shows a specimen of the Creed perforated strip with the corresponding printed tape. Fig. 10 shows the same thing taken with the undulator. Fig. 11 shows some of the Creed slip received during a meeting of this Society last year.†

Those who work with a syphon recorder may not be aware that you can get syphons of silver tube. The ordinary syphons are made with glass and are apt to break, and they get stopped up and when you are cleaning them they are liable to break. It may not be known to everybody that you can get silver tubes from Messrs. Johnson and Matthey which are as fine as glass syphons, and you can bend them into any shape without breaking them. The greater number of the more recent records I have made were done with syphons of that description.

Fig. 12 shows a specimen of transmission from Horsea, taken on a syphon recorder, using a one-metre diameter frame aerial and a six-valve amplifier, composed of three H.F., one detector and two L.F. valves, in conjunction with a three-valve amplifier for very low frequency current. A separate heterodyne was used.

Capt. H. de A. Donisthorpe.

In the absence of the designer I have pleasure in reading you a brief description of an ingenious device, patented by Mr. F. Haynes, for the purpose of recording wireless signals. I personally have seen this apparatus under working conditions, and can testify to its reliability.

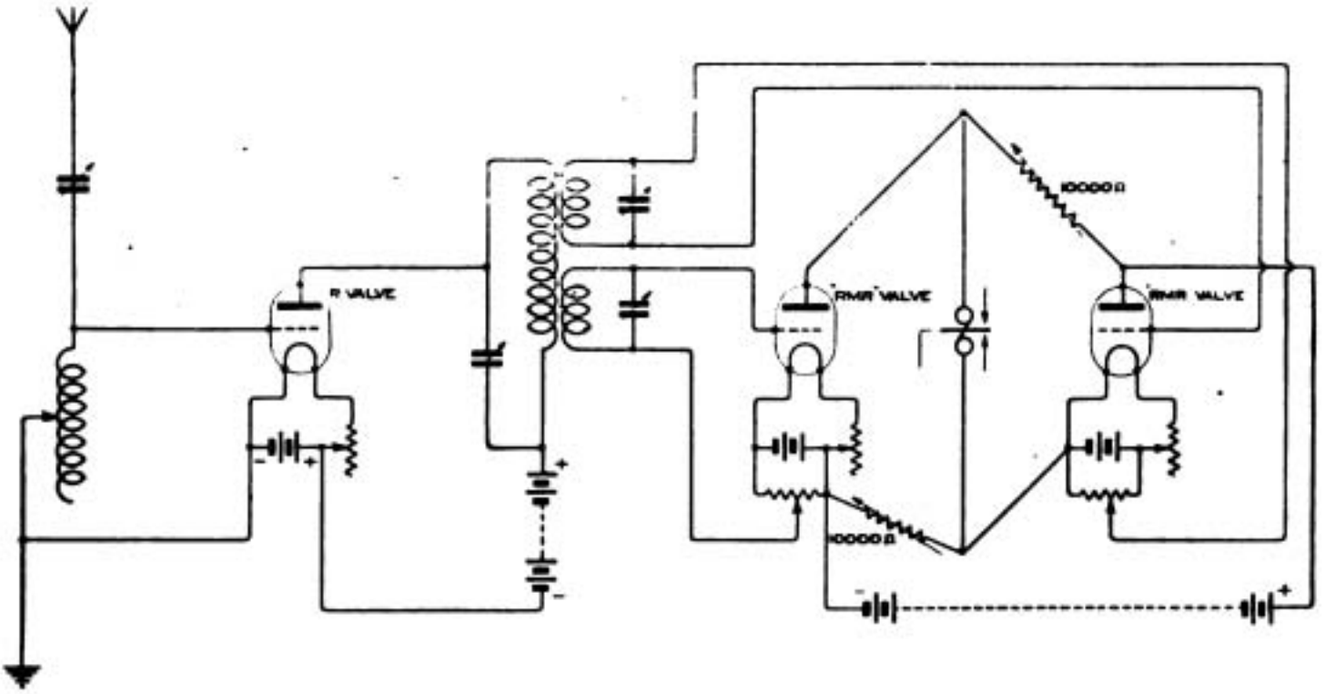


Fig. 13.

I am afraid that this is rather a repetition of what we have heard from Mr. Coursey concerning the invention of Alexanderson, but perhaps it will interest some if the device of Mr. Haynes is described at length, and, with your permission, I will just explain the diagram of connections (Fig. 13) of the circuit employed.

Action.

The system introduces the well-known Wheatstone bridge. Valves are arranged in two opposite limbs of the bridge, and resistances in the other two. A sensitive polarised relay, such as a Post Office standard "B" relay, or a Siemens' relay of the type

† Meeting of the Wireless Society of London, Nov. 18th, 1920.

popular among experimenters, replaces the bridge galvanometer. The relay is joined to an inker. The bridge is balanced by adjusting the resistances. Amplified oscillations are applied to the valve grids by means of an oscillation transformer having two independent tuned secondaries. Valves of the "steep curve" type are used, such as the "RMR" type. The grid potentials are controlled by means of potentiometers, and the valves have good rectifying properties. Fluctuations of grid potential give rise to currents in the valve plate circuits, the effect being equivalent to a drop of valve resistance. The direction of the secondary windings of the transformer is arranged in such a way that each half-oscillation causes the effective resistance of each valve to drop in turn. Thus, when using good rectifying valves each oscillation will cause a direct current to flow across the bridge relay for a duration of time almost equal to that of oscillation, and each half oscillation is made use of. Moreover, the value of the current through the relay is greater than the plate currents of the valve. A train of undamped oscillations gives a direct and practically uninterrupted current through the relay. A damped train also gives a direct current, but of an increasing and then diminishing value, and quite suitable for the operation of the relay.

An alternative arrangement is to detect the signal by means of the usual heterodyne and detector arrangements and apply the amplified signals to the bridge valves. In this instance "R" type valves may be used with grid condensers or grid cells of suitable value to control the grids and render the valves stable.

Design.

The valve bridge is constructed in the form of a panel and provided with valve holders and filament resistances. The filament current should be adjustable to a critical value. The balancing resistances are variable and have values of 5, 10, and 20,000 ohms. It is convenient to arrange a switch to disconnect one of the valves from the bridge and substitute a resistance in its place. This resistance has a maximum value of 1,200 ohms, and is variable in steps of 100 ohms. Potentiometers control the grid potentials. The high frequency transformers which are rotatable are arranged in a box beneath the panel. Low frequency transformers are also provided for use when the instrument is to be operated on magnified signals at note frequencies.

Operation.

The instrument is easy to operate and entirely stable, and will run without further adjustment when once set up. The relay operates on all signals that can be heard and the valve bridge on occasions appears to be more sensitive than telephone receivers. Signals that are difficult to read are printed out in a reliable fashion. Tuning adjustments are critical, and although jamming may be heard in the telephones, the inker rarely records simultaneous signals. The current supplied to the relay is usually sufficient to render its adjustment easy. For example, when used in a Siemens' relay with adjusting screw, the screw may be turned through a complete revolution without upsetting the working. Ship stations give clear marking on the tape and for C.W. signals it is usually only necessary to employ one valve in the bridge, replacing the other with a resistance. The C.W. signals are, of course, recorded without self or separate heterodyne, and the dangers of causing interference by oscillating receiving circuits obviated.

Mr. R. E. H. Carpenter.

In approaching the problem of the operation of printing telegraph apparatus or of automatic call devices from radio signals, it is necessary to take greater precautions as regards the accuracy of signal form; that is to say, the accuracy of duration of dots and dashes, than is required when receiving by ear, or when the signals are inscribed on a tape by some form of syphon recorder, or a Wheatstone receiver. More particularly is this the case when high telegraphic speeds are to be used.

Further, for the operation of the relatively heavy mechanism involved, it is almost always necessary to insert some form of

mechanical relay between the valve circuits and the apparatus itself.

Again, this relay will generally have to operate at the Morse rhythm frequency, and not, as in the case of oral reception, at the beat note frequency produced by the heterodyne. To achieve the last object it is generally found convenient to rectify the radio-frequency beats to an audio-frequency at some stage in the amplification scheme, a scheme as this, since the relay is fed directly from circuits intimately associated with the tuning apparatus, that adjustments of the relay, without disturbing the tuning, become difficult. This method has, however, been used to some extent by the speaker, and is certainly a highly sensitive one, since it is, of course, possible (although dispensing with a separate heterodyne) to tune exactly to the frequency being received.

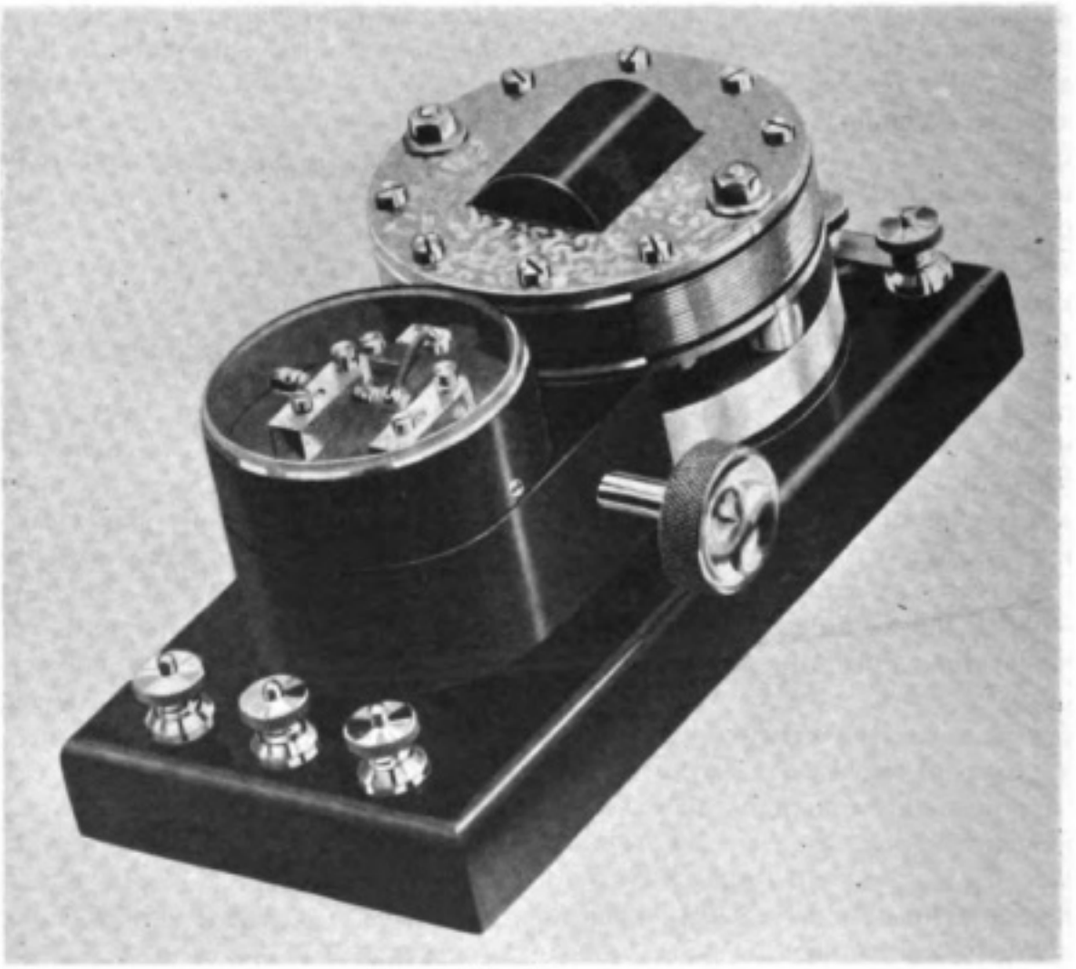


Fig. 14.
The Relay Unit.

to further amplify the beat note, and, finally, to again rectify the beat note to a Morse rhythm frequency. It is, however, quite possible to amplify the radio frequency only, to dispense with a heterodyne, and to rectify the radio-frequency currents direct to Morse frequency, without the use of any beat note. It is generally found, however, that in such

I do not propose to concern myself very greatly with the radio circuits to be employed, since these do not present any very special differences from those habitually used for the telephonic method of reception; except that it seems desirable to point out that for continuous working, particularly at high speeds, the employment of a grid condenser for

rectification is undesirable on account of the liability of strong strays to cause temporary paralysis of such a circuit. We will therefore pass direct to the consideration of the methods which the speaker has found convenient for the application of relays to valve circuits.

In the first place, it was found that whilst a number of sensitive relays were available all those tried had some disadvantage or other from the point of view of either—(1) stability of adjustment and general robustness; (2) firm and steady contact pressure; (3) ability to work at high speeds, (4) sensitivity; or (5) transit time.

The moving coil relays, whilst highly sensitive, are, generally speaking, not at all robust mechanically, and the contact pressure and freedom from bounce leaves much to be desired.

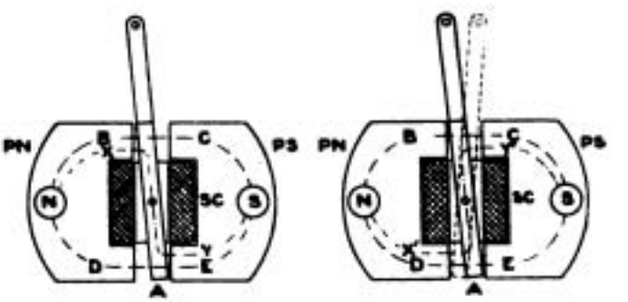
Furthermore, they are generally quite unsuitable for operation at high telegraphic speeds, their transit time being very high.

The standard form of a P.O. relay is not very sensitive, and necessitates the pushing of amplification to a higher degree than is desirable. Some forms of Siemens relay, whilst more sensitive, show a tendency to bounce at the contacts, whilst other designs of relay at present on the market, for which a very high degree of sensitivity is claimed, were found to be unstable in their adjustments, and to require for reliable operation, a very much larger current than that stated to be necessary for them. An attempt was therefore made to design a relay which should be free from the defects enumerated; the result—so far as the external appearance of the instrument goes—is shown in Fig. 14. The magnetic circuits employed, shown in Fig. 15, are similar to those used by Cromwell Varley as far back as 1856. The proportioning and general design of the instrument, however, on which depends mainly its performance, is totally different.

On extensions NS of the cores of a field-magnet, Fig. 15, are threaded packets of laminations PN, PS, forming the pole-pieces between which the laminated armature A is pivotally mounted. This armature is embraced by the signals coil SC, which is fixed and does not move with the armature. When the armature is at rest some of the flux crosses the polar gaps as at B, C, D, E (Fig. 15 (*a*)). A proportion, however, will travel *via* the part XY (Fig. 15 (*a*)). It will thus be seen that the adjacent polar faces of the field magnet and armature have more flux than the distant faces, and that the armature will be held over even though the signalling current which placed the armature in that position has ceased.

On the setting up of a signalling current in the opposite direction, a sufficient magneto-motive-force is provided to annul the flux XY, and to set up a flux X′Y′ (Fig. 15 (*b*)) in its place; thus the distant polar faces will have more flux than the adjacent faces, and the armature will experience a torque which will begin to move it as indicated by the arrow.

The contact is, of course, mounted on



(*a*) *Fig.* 15. (*b*)

the extension of the armature A. The base casting on which the relay is mounted and the relay itself, have purposely been made somewhat massive, and the bias adjustment screw, the milled head of which may be seen projecting on one side of the relay in the photograph (Fig. 14) is of the differential type, giving an extremely fine adjustment. The whole design has been made robust, or, as our American friends would say, "rugged," so much so, that the adjustments of the relay, once having been made, will not generally have to be disturbed until it becomes necessary to re-burnish the contacts or clean the instrument.

With regard to sensitivity with a winding

of 3,200 ohms resistance, a current change of 1/10 milliamp is quite sufficient for reliable working at speeds up to about 100 words per minute. The relay is inserted directly in series with the anode of the last valve of the note magnifier, a parallel condenser of suitable value to by-pass the audio-frequency component of the anode current being connected across the relay windings. The grid of this valve has impressed on it a negative voltage sufficient to reduce the anode current, when no signals are being received, to something of the order 0·01 milliamp. Using an ordinary R type triode with an anode potential of 100V, this condition will be realised with about — 12 to — 15 volts on the grid. The objects of applying this negative voltage are four-fold.:

Firstly : To make the valve function as a rectifier of the audio-frequency currents to transform them to unidirectional pulses of Morse rhythm frequency—(the audio-frequency ripple is smoothed out by the condenser connected in parallel with the relay).

Secondly : Since the valve is now operating at a point well down below the lower bend of the characteristic curve interference of small amplitude, such as that due to the nearby presence of running motors or the faint hiss and growl almost always audible when valve amplifiers are being used, will not affect the bias of the relay. This will be seen from a consideration of the fact that no appreciable change in the anode current takes place unless a signal of sufficient amplitude is impressed on the grid to carry the operating point round the lower bend in the characteristic curve.

Thirdly : It will be found that most relays are rendered relatively insensitive by the presence of an appreciably steady current, that is to say : that a change of from nothing to 1/10 milliamp is far more effective with most relays than a change of from say 0·5 to 0·6 milliamp.

Fourthly : When there is a high negative voltage applied to the grid of the valve the internal resistance of the valve is also high. Now the time taken for the current in a circuit containing inductance and resistance to rise to within $1/\epsilon$ of its final value, is given in seconds by the expression $t = \frac{L}{R}$ It will therefore be seen that by keeping the grid at a higher negative potential it is possible to use a relay of much higher inductance and therefore greater current sensitivity than would otherwise be permissible without making the operation of the relay sluggish, particularly at high speeds.

Finally, the filament of this last valve is dimmed to such a point as will slightly reduce the current change available on the weakest signals from which it is desired to work, received from the corresponding station.

Under these conditions, the signal will always sweep the valve from the bottom to the top of its characteristic on every signal, and the maximum and minimum currents will both be rigidly limited. Hence, variations in strength of the received signal will not cause variations in the relative duration of marks and spaces ; that is to say, the bias of the relay will not be affected. Further, if this precaution of dimming the filament is not taken, a powerful atmospheric of the click type, although of too short duration in itself to cause much disturbance, will so much increase the current through the relay as to leave the iron in a magnetically saturated condition, and this effect may take an appreciable duration of time to disappear.

Using the precautions briefly outlined it is found, provided the filament batteries are kept properly charged, that the apparatus can be left set up, and that on switching on the filament batteries the whole gear will immediately begin to function perfectly without the necessity for making any adjustments whatsoever. Whilst these precautions are particularly applicable to mechanisms other than syphon recorders or the like, it will be found that their adoption in ordinary recording systems will stabilise, and help to make reliable the operation of the latter, and will tend towards the production of uniformly-shaped and easily-legible signals.

Various types of bridge connection, designed to supply the relay with complete reversals of current have been tried, but are not, in my opinion, worth the extra complexity involved.

I have in addition two picture slides which illustrate the undulator of Messrs. Creed & Co. Fig. 16 shows an undulator. The instrument

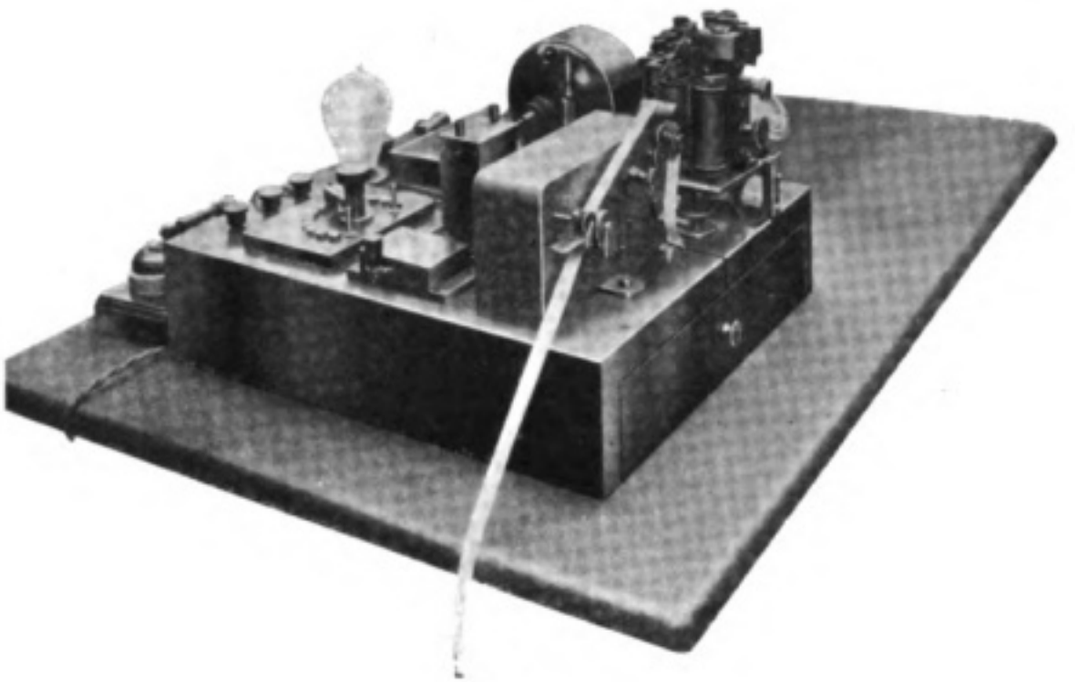


Fig. 16.

The Undulator.

All systems of printing telegraph apparatus do not, of course, need such very high accuracy of signal form as the preceding remarks might suggest. With a Creed receiver in particular, there is a very large tolerance of distorted signal. As an example, it may be mentioned that when working at 100 words per minute the receiver will accept and print perfectly signals distorted to an extent of 27 per cent. of a dash length in either direction. As, however, distortion will occur as a result of atmospherics, and in the case of high power stations—as a result of the difficulties encountered in keying, it is desirable to do everything possible to eliminate distortion and changes in bias at the receiving station. Furthermore, when this is done, a larger margin of speed variation, as between the Wheatstone transmitter at the sending station, and the receiving instrument, is permissible, than would otherwise be the case.

is a modified form of robust syphon recorder, with a little electric motor for driving it.

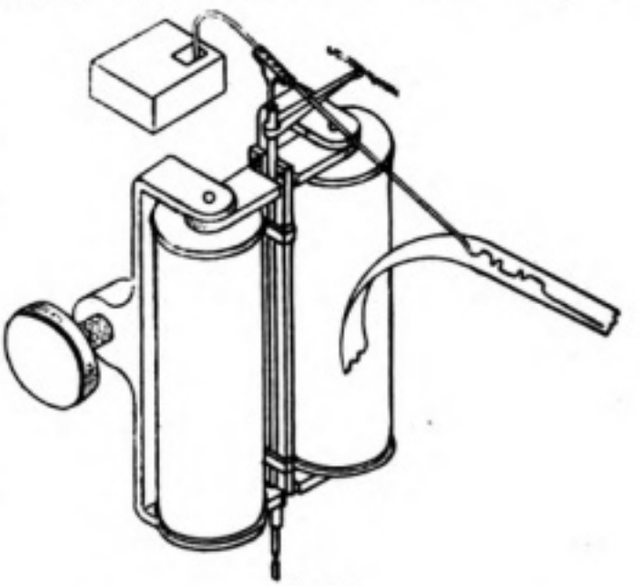


Fig. 17.

Rough diagram of Undulator movement.

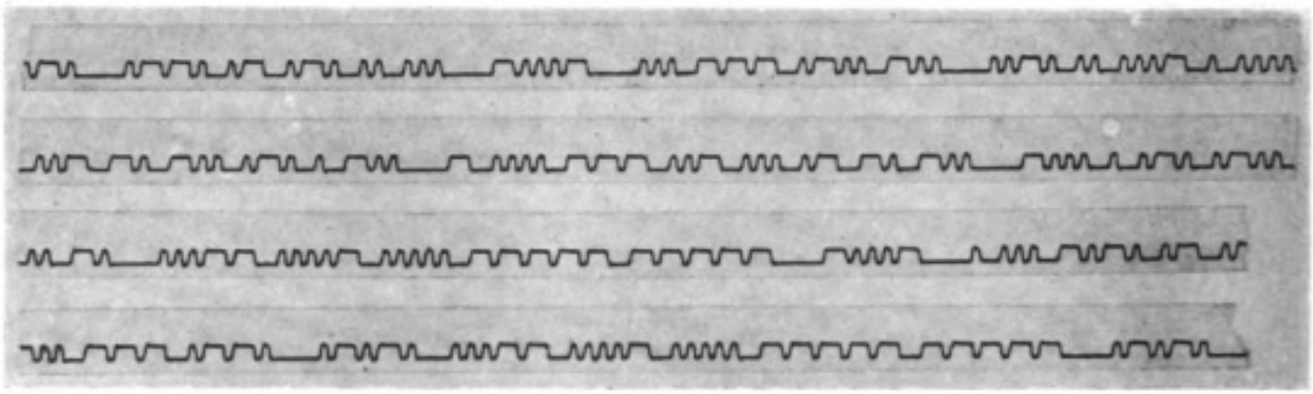


Fig. 18.

Signals recorded at 70 words per minute.

In the brass box seen in the illustration there is a continuously variable gear which controls the speed at which the paper is moved forward, making it possible to receive signals at any speed from the slowest hand-sending up to about 250 words per minute. At the back of the base will be seen a stud resistance which is connected in shunt with the recording part of the instrument for the control of the amplitude of the current which passes through the coils.

Fig. 17 shows quite roughly the movement of the recording portion of the undulator. It will be seen that there is a double-pole electro-magnet controlling the movements of a vertical spindle, with two little bar magnets on either side of it. The milled head seen in the diagram is for opening or closing the electro-magnet, thus controlling the amplitude of the signals and, to some extent, their form. The signalling current is passed through the electro-magnet. The instrument works best with complete reversals of current, which are, of course, readily obtained from the two contacts of the controlling relay. Two coil springs may be seen in the upper part of the diagram, which serve to hold the syphon in a central position on the paper when no current is flowing. A milled head screw adjustment (not shown in the diagram) is provided for these springs, and the damping of the movement can be varied by altering the pressure of the syphon tube on the paper strip.

Fig. 18 shows an example of the type of signals produced by the instrument. These were received at a speed of about 70 words per minute.

(*Discussion to be continued in next issue.*)

A "WIRELESS" TESTIMONIAL.

In Grateful Appreciation

Earl Kullman

World's Championship Boxing Contest

Jack Dempsey, United States

vs.

Georges Carpentier, France

National Amateur Wireless Association

The Radio Club

The diploma shown above was awarded to a wireless amateur in America for his voluntary services rendered in connection with the discrimination of Wireless Telephone reports of the recent Dempsey v. Carpentier fight.

HIGH FREQUENCY TRANSFORMER AMPLIFIER—II.

A GENERAL CONSIDERATION OF THE ACTION OF THE TRANSFORMER

IN our last article, in describing the action of the resistance transformer amplifier, it was stated that the high frequency voltage drop across the anode winding was communicated to the grid of the next valve through the medium of the capacity between the two windings of the transformer (not, be it noted, the self capacity of each winding, which should be kept as small as possible). It is sometimes found that on the longer wavelengths this capacity is not sufficient for good results, in which case a fixed capacity condenser is connected between each anode and the succeeding grid, as shown dotted in Fig. 1 The best value of capacity should be determined experimentally.

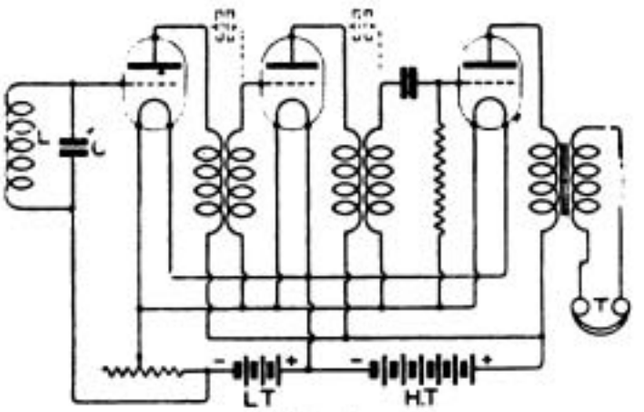


Fig. 1.

Before proceeding to consider the design and construction of H.F. transformers, consider briefly the working of a reaction coil in conjunction with such an amplifier.

Fig. 1 shows diagrammatically a three-valve amplifier with two high frequency transformers. A reaction coil may be connected either in the anode winding of No. 2 valve, the grid winding of the third valve or the anode winding of No. 3 valve. This winding should couple into the inductance of the oscillating circuit LC. It is well known that for a set to "react" or "oscillate," it is necessary that the main inductance and the reaction coil should be so connected that the direction of windings bear a certain relation to one another. With a reaction H.F. amplifier it is found that under certain conditions the direction of the reaction coil reverses, which means that the reaction coil leads have to be reversed.

These conditions are :—

(*a*) When the number of H.F. magnifying valves is altered.

(*b*) When changing from below to above the natural wavelength of the amplifier.

The reasons for this are as follows :—

(*a*) If a signal coming on to the grid of the first valve makes the grid potential a little more positive, there is an increase in the anode current. This increasing current in the anode winding of the transformer induces a voltage across the grid winding of the transformer, the direction of which voltage, according to Lenz's law, is such as to make the second grid more negative. If the grid of this valve is more negative its anode current will be reduced, and the voltage induced across the third valve grid winding will be such as to make the third grid more positive, again in accordance with Lenz's law. To summarise this, if the first grid is made more positive then the third and fifth will also be more positive, while the second and fourth will be more negative. From this it will be realised that as the polarity of the valves changes the direction of the current flow in the reaction coil is reversed, thus necessitating a changing over of the reaction coil connects for oscillation.

The reason for the reversal of the reaction coil when passing from below to above the natural wavelength of the amplifier is not so simple, but is fairly obvious.

Stated briefly, it is this : At the natural wavelength of the amplifier, assuming that the transformer has inductance and self capacity, the inductive reactance and the capacity reactance neutralise one another, and the phenomenon of resonance takes place, the amplitude of the current being limited only by the resistance of the winding. If the wavelength is less than the natural wavelength, the inductive reactance is greater

than the capacity reactance and the current will lag behind the applied oscillating voltage, and its value will be limited by the impedance of the circuit—the difference between the inductive and capacity reactances. If however, the wavelength is above the natural wavelength of the amplifier, the capacity reactance will be greater than the inductive reactance, and the current will lead the applied oscillating voltage, and will be limited by the impedance of the circuit—the difference between the capacity and inductive reactances.

It will thus be seen that in passing from below to above the natural wavelength of the amplifier the direction of the current flow has been reversed. Hence in order that the set may oscillate, the reaction coil must be reversed.

A little thought will show that for a multivalve transformer amplifier to oscillate with one reaction coil having either one, two, three, or more valves in circuit it is necessary to so design the reaction coil that the set will oscillate satisfactorily with one valve. Then as the number of valves is increased, and the current changes become larger, the coupling between the reaction coil and main inductance may be weakened, by separating them, in order to obtain the best results.

The amplification value of a transformer amplifier.

A valve is said to have an "amplification factor" of say 5 when a unit change of grid potential gives the same change in the anode current as a change equal to 5 units in the anode voltage would do. With a multivalve amplifier, if the first valve gives a voltage magnification of 5, the second valve will give a voltage magnification of 5 times 5 = 25, because the voltage change of its grid is 5 times the voltage change on the first grid. A third valve will give 5 times 5 times 5, equal to 125 voltage magnification. This assumes that there is no loss in the transformers. However, with copper wire transformers, the loss will be very small at the resonance wavelength, and the amplification per value will almost equal the amplification factor, but with a resistance transformer, owing to loss due to the resistance of the windings, the voltage amplification per value is considerably less than the amplification factor. For example, the voltage amplification of a valve with an amplification factor of 5 will be about 3 when used in a resistance transformer amplifier. This difference will be appreciated when it is realised that instead of 5 times 5 times 5, equal to 125 quoted above, this would become 3 times 3 times 3, equal to 27. From this the importance of making extremely efficient transformers for resistance amplifiers will be realised. To obtain the best efficiency the resistance of the transformer should be approximately equal to the anode resistance of the valve when the grid is at the normal working potential. This valve is of the order of 30,000 ohms, and therefore, to obtain an efficient transformer, the winding must be done with the finest wire obtainable so that the required resistance may be obtained on a small former, and thus keep down the self capacity of the winding.

In the next issue we hope to deal with the method of measuring the voltage amplification at different wavelengths, and thus obtaining the true maximum wavelength of the amplifier. Also we hope to deal with two or three types of transformers.

(To be continued.)

SHORT WAVE ATLANTIC SIGNALS

A PLEA FOR GENERAL CO-OPERATION IN A GREAT EFFORT TO ATTAIN SUCCESS.

Date and Time of the Signals.

As announced in the September 17th issue of *The Wireless World* these Test Signals will will be transmitted by American experimenters each evening commencing at midnight, G.M.T. from Dec. 8th to Dec. 17th, inclusive.

SHORT WAVE ATLANTIC SIGNALS

Wavelength and Power of Transmitting Stations.

The wavelength which will be used by American transmitting stations is 200 metres, and the power will not exceed 1,000 watts. It is to be expected that there may be some slight divergence from the exact wavelength, but this is unlikely to exceed about 15 metres either way.

Number of Transmitting Stations.

It is understood that, at a Convention of the American Radio Relay League held in Chicago, August 31st-September 3rd, the wildest cheering greeted the announcement o the Transatlantic Tests, and applications to take part were made in hundreds. We are informed by the American Radio Relay League that there will be, in all, ten or fifteen thousand transmitters, both spark and C.W., taking part in a preliminary distance test to be carried out in America, and those who are the most successful will be chosen to transmit for the Transatlantic Tests.

Prizes for Successful Competitors.

A number of valuable prizes are being offered by various manufacturers of wireless apparatus to be awarded to those who are successful in the reception of the signals. Particulars of these prizes will be given in a later issue of *The Wireless World.*

The Importance of the Tests.

One can hardly over-estimate the scientific interest which the successful reception of short wave signals over this distance would create.

How to Enrol for the Tests.

All who wish to take part in the endeavour to receive the Transatlantic Signals should send in their names to Mr. Philip R. Coursey (who is the organiser on this side of the Atlantic), c/o The Wireless Press Ltd., 12-13, Henrietta Street, London, W.C.2. The following particulars are all that is required :—

1. Name.
2. Address.
3. Type of receiver to be used.
4. Size of aerial.
5. Greatest distance from which short wave signals (*i.e.*, under 300 metres) have been heard.

America's Enthusiasm.

American amateurs have considered the question of sufficient importance to vote a considerable sum of money, through the American Radio Relay League, to send over to this country one of America's experts in short wave reception, in order that, in endeavouring to get the signals, he may know for himself the difficulties to be encountered.

There is no doubt that the American amateurs, in sending over a representative to this country, do so with a feeling of considerable assurance that he will meet with success.

Now it is not to be thought of that English amateurs should stand aside and watch our American friends achieve the success so far denied to us, who have already had the advantage of a rehearsal in the Tests conducted last year. The American magazine *Q.S.T.* commented on the lack of success in the Tests carried out last year in the following words :—

> Such reception is a new field for British experimenters, and they hardly can be expected to show the same performance as an American dyed-in-the-wool ham who has learned how to get amateur DX only after years of patient struggle. We have tested most of the circuits used by the Britishers, and find them one and all decidedly inferior to our standard American regenerative circuit using variometer tuning in secondary and tertiary circuits. We would bet our new spring hat that if a good U.S. amateur with such a set and an Armstrong Super could be sent to England, reception of U.S. amateurs would straightway become commonplace.
>
> We do not mean to deprecate the loyal co-operation shown by our English confrères, however. For the admirably complete way in which they go into a problem we have the greatest respect, and we are most sincerely grateful for their interest and enthusiastic co-operation in this, our first attempt to get overseas on schedule. We will all hope for better luck next time.

If our efforts were so criticised then, one dares not think what will be said if a "good U.S. Amateur" must come over here to show us how it should be done !

WIRELESS CLUB REPORTS

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary.

The Editor will be pleased to consider for publication papers of unusual or special interest read before Societies.

Wireless Society of London.

The next meeting of the Society will be held on Wednesday, October 26th at 6 p.m. at the Institution of Electrical Engineers, Victoria Embankment. A short paper entitled "SELECTIVITY IN WIRELESS TRANSMISSION AND RECEPTION" will be read by MR. M. CHILD. It is hoped that members will contribute to the discussion.

Tea will be served in the building at 5.30 p.m.

The West London Wireless and Experimental Association.

(Affiliated with the Wireless Society of London).

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

The members of the Association enjoyed a record meeting on Thursday evening, September 23rd. It was very gratifying to find all members with one exception turned up in strong force with their friends to welcome Capt. W. R. H. Tingey, who had arranged to give a lecture and demonstration, having brought a vast amount of apparatus with him.

At 7.35 p.m. Capt. Tingey commenced his lecture, and with use of blackboard diagrams, went fully into various circuits which, with his large experience, he recommended to amateurs to commence with. Capt. Tingey had kindly arranged for his station 2LW to transmit gramophone music for the benefit of those present, and from 7.45 p.m. to 8 p.m. the audience was able to hear the music and chimes by aid of a "loud speaker." From the applause which burst forth upon the lecturer it was evident that the results were excellent.

The President, Mr. G. Oxford, moved a very hearty vote of thanks to Capt. Tingey for such a good lecture, and this was fully confirmed by all present in the usual manner. After the meeting all were invited to inspect the apparatus which filled two large tables, and great interest was centred upon the set of calibrated inductances, which played a large part in the demonstration.

Meetings of the Association are held every Thursday evening at Belmont Road Schools, Chiswick. The Secretary will have much pleasure in answering any enquiries respecting the Association with regard to membership, routine, etc., etc.

North Middlesex Wireless Club.

(Affiliated with the Wireless Society of London.)

The 74th meeting of the North Middlesex Wireless Club was held at Shaftesbury Hall, Bowes Park, on October 5th. The chair was taken by the President, and after the minutes of the previous meeting had been read, the Chairman announced that by the kindness of Mr. W. W. Burnham, telephony tests would be sent at 9 o'clock, from Blackheath. The Club's set, in charge of Mr. L. C. Holton, was connected up to the aerial, and at the appointed time Mr. Burnham's voice was heard sending greetings to the Club. He then announced that he would put on some music, and the audience were then treated to a selection of classical records. So clear was the music that the secretary, who had seriously debated whether he should go to a local concert instead of the Club that night, decided that he had done well to come to the meeting.

When the music was finished, Mr. Burnham wished the members "Good night," and closed down.

Hon. Secretary's address—"Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

Folkestone and District Wireless Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. H. Alec S. Gothard, A.M.I.R.E., 8, Longford Terrace, Folkestone.

To open the winter sessions, the members of the above Society, by kind permission of the President, were able to pay a visit to the local power station, on Sunday afternoon, October 2nd. The Vice-Chairman, one of the engineers-in-charge, very kindly conducted the party round, explaining every thing in detail. Starting at the point at which the coal was fed into the furnaces, the party proceeded through the station, visiting the workshops, generating plant, switchboards, etc., finishing up with a climb of 40-50 steps to the top of the cooling towers.

Members who visited the local Power Station.

It was announced that the next lecture which will be illustrated by lantern slides will be given by Dr. H. A. Eccles, on "The History of X-Rays." This will be held at the Croydon Polytechnic on November 5th, 1921.

It was stated that Mr. E. M. Spink had, owing to business matters, found he was unable to carry on with the Secretarial duties, and accordingly resigned. The Society thereupon unanimously elected Mr. B. Clapp, Meadmoor, Brighton Road, Purley, who will be pleased to receive applications from intending members.

WIRELESS CLUB REPORTS

On Wednesday, October 5th, the usual monthly meeting was held at Headquarters, at 7.30 p.m., Mr. A. H. Ullyett, F.R.G.S., in the chair. After the minutes of the previous meeting had been read and confirmed, the meeting proceeded to amend Rule 3. This was carried through, and in future will read as follows:—"That no person be eligible for full membership until he has attained the age of 18, but by special nomination of the Committee, a person under 18 years of age, may be elected to associate membership."

Two gentlemen were elected to full membership, and one to associate membership.

The Committee have decided to temporarily postpone the Society's exhibition.

Full particulars as to membership, etc., may be obtained on application to the Hon. Secretary.

Croydon Wireless and Physical Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. B. Clapp, Meadmoor, Brighton Road, Purley.

The first meeting of the 1921-22 session of the Croydon Wireless and Physical Society, was held at the Central Polytechnic, Croydon, on October 1st, 1921, Dr. H. A. Eccles in the chair.

Captain Donisthorpe gave a very interesting lecture, accompanied by demonstrations on "The Application of a Magnetic Field to Thermionic Valves."

The lecture was enthusiastically received by the members present and was followed by a keen discussion. A hearty vote of thanks was then accorded the lecturer.

Glasgow and District Radio Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. Robert Carlisle, 40, Walton Street, Shawlands, Glasgow.

The annual general meeting was held on Wednesday, September 28th, and there was a good attendance of members.

The Hon. Secretary presented the annual report and financial statement. The former showed a record of 23 ordinary meetings, and one out-door meeting, held during the session just closed, while the latter disclosed, after meeting all expenses, a substantial balance. This was considered satisfactory in view of the expenditure incurred in connection with the trans-Atlantic tests in the early part of the year, and the fact that the source of income was derived solely from members' subscriptions.

Officers were elected for the ensuing session.

Before vacating the chair Mr. Dewar paid a handsome tribute to the retiring President, Mr. Robert Watson, Jnr., for his past services to the Club, and expressed the regret and disappointment of the members that business arrangements prevented Mr. Watson from offering himself for re-election. It was unanimously resolved that the Secretary write accordingly to Mr. Watson, who is the founder of the Glasgow and District Radio Club.

Mr. E. Snodgrass then took the chair and made remarks suitable to the occasion

Appointments to the Committee were then made.

It was decided to continue the fortnightly meetings, and the opening night of the session will be held at the Club-room, 206, Bath Street, commencing 8.0 p.m. At this meeting Mr. E. Snodgrass will give a lecture on "The Theory of the Thermionic Valve." Part I. Part II of the same subject will be given at the following meeting, on October 26th.

The forthcoming trans-Atlantic Amateur Test was under consideration, but as it was felt that participation in these tests would be prejudicial to the best interests of the Club, it was decided not to enter. Nevertheless, if any individual member wishes to enter, the Club will give him all possible assistance by loaning apparatus, etc.

A syllabus is being prepared, and will be issued to members shortly.

Members are reminded of their annual subscription of 10s., which fell due on October 1st.

The Secretary feels certain there is still a number of "negative electrons" in Glasgow and district, and he will be glad to get into touch with them with the view of making them "positive" members of the Club.

Birmingham Experimental Wireless Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. Frank S. Adams, 110, Ivor Road, Sparkhill, Birmingham.

The first annual general meeting was held on August 19th, at Digbeth Institute, Birmingham, 25 members were present.

The chair was taken at 7.30 p.m. by the retiring President, Mr. A. L. Lancaster. The Chairman called upon the Hon. Treasurer (Mr. A. Woodcock) to read the statement of accounts for the preceding year. Mr. Woodcock informed the meeting of the Club's financial position, and, replying to the Chairman intimated that the accounts would be available for inspection by members at the conclusion of the meeting. Mr. Lancaster moved an adoption of the Hon. Treasurer's Report and balance sheet, the motion being carried unanimously.

The Chairman, in a short address to the meeting, outlined the activities of the past year. The Club had, he said, grown in a remarkably short space of time, from a small Club to a large and responsible organisation. In arranging the affiliation with the Wireless Society of London the Committee had shown that their responsibilities to the wireless community were appreciated. They had been very fortunate in securing such excellent headquarters, and owed much to the generosity of Mr. Woodcock for his kindness in placing at the disposal of the Club a room at his chambers, which was used as a committee room, also for storing the Club's instruments. He would ask the Hon. Secretary to read the proposed new rules, which had been approved by the Committee after much careful consideration.

The Hon. Secretary then read out the draft rules as they appear in the minutes of the Committee meeting of August 17th. After a short discussion the Chairman moved the adoption of the rules in the amended form. The motion was carried unanimously. The officers were then elected.

The President then declared the meeting closed,

reminding members that subscriptions were now due for the New Year.

Woolwich Radio Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. H. J. South, B.Sc., 42, Greenvale Road, Eltham, S.E.9.

The opening monthly meeting of the above Society, for the winter session, took place at Woolwich Polytechnic, on September 30th, at 8 p.m.

Mr. W. L. McPherson, B.Sc., Vice-President, took the chair, and in a few well chosen words introduced the lecturer.

Captain W. R. H. Tingey had brought with him a large and well-chosen array of wireless instruments, including a 3-valve receiver, a 4-valve amplifier, a Brown loud-speaker, a Morse printer with valve relay, a frame aerial, several special inductances, and numerous other accessories: a sight calculated to make most of our eyes sparkle. Step by step Capt. Tingey went through all the chief points in the erection and putting together of a station which require attention: the aerial; the lead in; the earth; the inductances; the condensers; the best use of valves and the advantages of crystal rectification. He pointed out and illustrated practically the advantage of the three separate circuit arrangements in selectivity and close tuning. He also showed the advantages of very loose coupling. Most amateurs have their sets far too tightly coupled. Then he gave us a practical demonstration of—

(1) How to separate and hear 600 metre ship stations.
(2) The advantage of three separate inductances for large range of wavelengths.
(3) Direction finding with a loop aerial.
(4) The printing of wireless signals—Bordeaux Press being used for the experiment.

At 8.45 he tuned up a musical concert which was being sent out for our especial benefit from his transmitting station at Hammersmith; but this was spoilt by a very persistent local amateur who was "tuning up" on the same wavelength.

Lastly, he made a living aerial. Several of our members having joined hands, and the aerial being disconnected, signals were received loudly through us. At the close of this exceedingly interesting lecture demonstration, Captain Tingey answered several questions put to him by members.

Some members of the Woolwich Radio Society listening to the Dutch Concerts.

The evening passed all too quickly, and at 9.30 our Chairman had to put in the closure after passing a very hearty vote of thanks to Captain Tingey for his kindness in giving us such an interesting lecture.

Weekly meetings of the Club take place at the Old Mill, Plumstead Common, on Thursdays at 7.30, where we shall be pleased to welcome visitors and intending members. We have been having great success with the Dutch concerts lately. Our Mr. Beeson has wound a special set, and with the help of a Brown relay and a Brown loud-speaker, we can hear the Dutch concert all round the room. When Mr. Burnham obliges us with a little music, it is so loud that it could be heard half-way across Plumstead Common. The other evening one of our members, Mr. Brennerman, took a flashlight photograph of some of us listening to the Dutch concert.

Borough of Tynemouth Y.M.C.A. Amateur Wireless Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. L. L. Sims, "Eynesbury," Cleveland Road, North Shields.

At a meeting of the above Society held on September 26th, Mr. Geo. Littlefield delivered the second part of his paper upon "The Construction of a Single-Valve Receiver." The paper proved to be very helpful and, judging by the open discussion which followed this series of lectures, are being keenly followed by the members.

A hearty vote of thanks to the speaker was proposed by Mr. H. Hutchinson, who, on behalf of the members and himself thanked Mr. Littlefield for all the time he had spent to provide such an interesting set of lectures.

Mr. J. Ernest Emery ably seconded the motion.

After the lecture the members adjourned to the wireless room for the formal opening of the Society's new valve set.

The opening ceremony was performed by Mr. R. Lishman, a Vice-President of the Society.

On Thursday, September 29th, through the kindness of the authorities, a number of the members paid a visit to Carville Power Station, where a very enjoyable and instructive evening was spent. The Committee are endeavouring to arrange a number of these visits for the winter session.

It has been decided to hold the second annual exhibition of wireless telegraph and telephone apparatus on November 30th and December 1st in the Y.M.C.A. Buildings, North Shields.

Brighton Radio Society.

(Affiliated with the Wireless Society of London.)

A meeting of this Society was held at 7.30 p.m. on September 29th, when it was very pleasing to see such a large number of members present.

The possibility of obtaining a transmitting set for the Society was discussed at some length, and in conclusion it was pointed out by the President that before anything could be done in this direction

the P.M.G. should be approached, with a view to obtaining the necessary license.

The Hon. Secretary was accordingly requested to co-operate with the Technical Committee to ascertain exactly what would be required in the shape of apparatus, etc., and write to the P.M.G. in an endeavour to secure the transmitting licenses.

A gift of apparatus in the form of a first-class variable condenser of his own manufacture was made to the Society by Mr. M. G. Foster.

It is with much regret that the Society loses one of its keenest officers in the resignation of Mr. C. H. Bingham, who, unfortunately, has been called away from the locality.

At the conclusion of the usual business an exceedingly interesting demonstration of his 5-valve amplifying receiver was given by Mr. A. Blackburn.

The first Morse class of the session will be held on October 7th in the Lecture Room at 7.30 p.m.

This Society is becoming very popular indeed, several new members having joined during the past three months.

Any gentlemen interested are invited to communicated with the Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton, who will be pleased to furnish full particulars as to membership, etc.

Sussex Wireless Research Society.

(*Affiliated with the Wireless Society of London.*)

This Society commenced its new session on the 5th inst., with a general meeting held at "Cottesmore," Upper Drive, Hove, when Capt. Hoghton, F.P.S.L., was re-elected President, and Mr. Edward Hughes, B.S.c (Eng.), A.M.I.E.E., Hon. Secretary and Treasurer. Major Davidson Brown, Messrs. W. Bennett, B.Sc., A.R.C.S., and J. Cowie, A.M.I.E.E., were appointed as Committee. Also there were three applications accepted for membership. The flourishing condition of the Society was reflected by the very substantial balance in the Treasurer's hand.

It was decided to hold meetings at 7.45 p.m. on alternate Wednesdays during the coming session. Various matters concerning the welfare of the Society were discussed, and a programme of the meetings up to the end of February was submitted for the members' approval.

The Secretary will be very pleased to give information as to conditions of membership, and also of the programme of meetings on receipt of enquiries addressed to him at the Technical College, Brighton.

Wireless and Experimental Association.

At the annual general meeting held at the Central Hall, Peckham, on Wednesday, October 5th, the Secretary read as follows: –

"Since the last annual general meeting on August 4th, 1920, the Association has made undoubted progress. Thirty-eight new members have joined, though we regret to have to chronicle that we see less of some of the old faces than we should like to.

Your Committee have done all in their power to make the meetings bright and profitable, and the average attendance has been undoubtedly higher. Our Society is a mutual aid society, and not only have we to voice our needs in the matter of instruction and help, but we have also to supply them ourselves. That we have been able to do so successfully speaks volumes for the high and varied general and specialised knowledge possessed by our members, as well as the free way in which they place this knowledge at the disposal of one another. To have run weekly meetings so successfully speaks well for all concerned, from the Chairman downwards, to the latest new member.

The officers and members of the Committees have now ceased to hold office, and their re-election or replacement is now in the hands of the members."

Mr. A. W. Knight and Mr. Geo. Sutton were elected Chairman and Secretary respectively, *nem. con.* Mr. G. Horwood, General Manager; Mr. Hunter, his assistant; Mr. Carroll, Treasurer; Mr. P. Voigt, Installation Engineer; Mr. Kloots, Librarian, and Mr. Nicholson his assistant. Messrs. Childs, Goldsmith, Foord and Noakes, General and Agenda Committee.

At the Peckham Rye Tabernacle, on Saturday, October 1st, Mr. A. W. Knight, assisted by other members, gave a demonstration of wireless to a large and appreciative audience.

The instruments, by Messrs. Mitchells, of Rye Lane, gave every satisfaction, and rendered possible a faultless exposition of the science.

Hon. Secretary, Mr. Geo. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

Portsmouth and District Wireless Association.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

The above Association is making much progress. With funds received from displays at bazaars, etc., a Brown loud speaker has been purchased, and a license for transmitting C.W. and telephony has been applied for.

A list has been opened for the Dutch concert fund, and the money will be forwarded in due course.

At the three last meetings, papers have been read by Mr. Gall, on "Direction Finders"; Mr. Priest, on "Modern Valves"; and by the Secretary, on "The Poulsen Arc."

We also had a "wireless tent" at a local scout jamboree, and did a roaring trade. It was quite exciting when the tent and aerial were being erected. For the latter we "lassoed" the grand stand, and hooked up to that.

Officers of the Association have been elected as follows: President, Mr. A. G. Priest; Treasurer, Mr. W. C. Gall; Committee, Messrs. C. Bridge, Lawrence, and E. Smith.

Cambridge and District Wireless Society.

The first meeting of the season was held at the large room of the Photographic Ram Yard, on Wednesday evening, September 28th, at 7.30 p.m. Mr. Farren in the chair, firstly mapped out the doings of the Society since it was founded in April. Mr. Farren then asked a member to propose that the joint secretary and treasurer should be relieved of the position of treasurer. Mr. Diver accordingly proposed this, and Mr. Butterfield seconded that Mr. Banyard should be the Treasurer. This was unanimously carried. It was next agreed that ladies should be admitted to the Society. The

Chairman proposed that the *Cambridge Daily News* should be asked to be the official organ of the Society. This was seconded by Mr. Butterfield and carried unanimously. The Secretary was instructed to act accordingly.

The new aerial was then dealt with, and the Chairman was pleased to announce that the Photographic Society would allow the members of the Wireless Society to use the room in which the lead-in of the aerial is situated, with the reservation that it was not in use, and that it should be used in daylight, Sundays included. He also instructed the Chairman to put a book in the reading room of the Photographic Society for members to sign when they used the aerial. The forthcoming programme was then discussed, and it should prove very interesting.

Mr. Butterfield here took the chair, and called upon the Chairman to deliver his paper on "Aerials."

Mr. Farren then dealt extensively with all kinds of aerials, dealing first with their theory, then with the practice in erecting aerials. Dealing with the theory of aerials he showed the amount of efficiency of one, two, three, up to ten wires, all spaced the same width apart. The practice of erecting the mast, was next dealt with, also the halyards, and finally the earth connection. The Society's aerial was next dealt with, describing in some detail the adventures that were encountered in erecting it.

At the close of the lecture Mr. Butterfield proposed a hearty vote of thanks to the lecturer, and this was demonstrated in the usual way. The meeting was here declared informal, and Mr. Butterfield demonstrated a portable crystal set with valve reaction. The next meeting is to be held at the large room of the Photographic Society, Ram Yard, at 7.30 on October 12th, when Mr. Butterfield will read a paper on "Coil Winding." Mr. Culpan will also demonstrate a 3-valve set.

The Stockport Wireless Society.

An extraordinary general meeting was held on September 14th, and the whole of the Society's rules were reviewed and some additions and amendments made. A letter was read from Mr. H. Pickford tendering his resignation of the office of Hon. Treasurer. The Chairman, Mr. Roberts, remarked that in losing the services of Mr. Pickford the Society was losing one of its most valuable assets. Mr. C. Froggatt was elected to the office in Mr. Pickford's place.

On September 18th a number of members gathered together in order to listen to the Halifax Wireless Club's concert. Owing to the absence of an amplifier, however, the music was very faint, but at 12 noon the members received a message of greeting from our Halifax friends the C.W. signals coming in very loud.

On September 21st Mr. S. Corner gave a very interesting paper on "Simple Magnetism," and on September 28th Mr. P. E. Leaver gave a lecture on "Electro Magnetism."

The Society's syllabus of lectures provides 26 elementary lectures based on the requirements for the P.O. examination, and already a deal of benefit has been obtained from these simple lectures which will give the necessary grounding in theory to all members.

Every Friday buzzer practice is held, and a deal of progress has been made in this direction. During the last month 14 new members have been enrolled. Anyone desiring to join the Society should apply to the Hon. Secretary, Mr. R. H. Jackson, 54, Prince's Street, Stockport.

Luton Wireless Society.

The Society's winter session promises to be most successful. There are now 80 members, senior and junior. With permission of the P.M.G. the Society's aerial has been extended to 200 ft.

Application has been made to the London Wireless Society for affiliation. Membership cards and a syllabus of the usual fortnightly meetings and special scientific lectures held monthly, have been issued, and a weekly Morse class has been instituted, giving good practice for the proficient members and instruction for beginners.

The opening meeting held on September 14th, was highly successful. The Mayor of Luton, Alderman H. Arnold, was chairman, and the demonstration by Mr. W. R. Tingey was highly appreciated. Music was successfully transmitted, and excellent signals on long and short wavelengths were received, using outdoor, indoor and frame aerials, and made audible to a large attendance by means of an amplifier and loud speaker.

Mr. Tingey gave many useful hints to those building sets and demonstrated in a remarkable manner magnetic coupling of circuits, using his well-known and excellent tuning coils.

A hearty vote of thanks to Mr. Tingey concluded the meeting.

On Wednesday, September 28th, a lecture was given by the President, Mr. W. H. Cooke, A.M.I.E.E. His subject was, "Electricity Supply in the Town." Being borough electrical engineer the lecturer was able to give a detailed description of the means used to generate and distribute current, and a party of members will visit the local power station during the session. The means of using the local supply of D.C. for use as H.T. and L.T. for wireless apparatus was discussed, and questions were ably answered.

Ilford and District Radio Society.

This Society now boasts of well over 40 members, and on Wednesday, September 28th, at our fortnightly meeting, most of them turned up.

The chair was taken by the Vice-President, Mr. Welch, who has just come back from his holiday, and all were very pleased to see him back again.

The evening commenced with the usual buzzer practice, Mr. J. Thompson manipulating the key. The buzzer practice finished, Mr. Welch continued his interesting course of lectures, taking for his subject the theory of magnetism. He ably demonstrated his lecture by means of many pieces of apparatus strewn about the table, and during one of the experiments with a powerful magnet and a needle, someone laughingly suggested he should pull the needle through a newspaper. This he proceeded to do, much to everybody's amusement.

A hearty vote of thanks was accorded to Mr. Welch, and we are all looking forward to the next lecture.

Since the last meeting, great strides have been

made with the set for the Society. The Secretary and a few other members have been working on it, and it is now completed, and the last half-an-hour of the meeting was devoted to listening in. Signals came in everywhere, but at 9.30 p.m. everyone was waiting anxiously for some real good stuff and sure enough it came.

"Hello! Ilford Wireless Society—2FQ calling," etc., etc., and Mr. Burnham then gave us a good half-hour transmission of music, which was heartily appreciated by all members. Our thanks are due to Mr. Burnham—he has christened our set with some waves which will be always welcome. The Society's aerial is not yet up, and Mr. Burnham's music was received on a single wire only 15 ft. high and about 40 ft. long, and we are all satisfied with the working of the set.

After a thoroughly enjoyable evening the meeting broke up at 10.10 p.m. The Secretary, Mr. L. Vizard, 12, Seymour Gardens, Ilford, will be pleased to welcome new members.

Coventry Wireless Association.

A very successful meeting of the above Association was held on the evening of September 28th, 1921.

The Club now has its own receiving set, thanks to the energies of Mr. Eggleston, who has devoted considerable time and skill to the manufacture of this complete single valve set. Tests of this apparatus were carried out, and the whole set proved to be most satisfactory. A portable 3-valve short wave set, made by one of the members, gave very good results.

A discussion of various matters relating to "wireless" was held. It is hoped that these discussions of a technical character will take place at each meeting of the Association, as they are found to be most useful in imparting information to members.

A very pleasant surprise was created when Mr. Eggleston brought in his 4-valve set. Demonstrations were given and signals came in remarkably loud and clear. This ended a very successful and entertaining evening.

The next meeting will be held on Wednesday evening, October 26th, 1921, at 7.30, in the Club-room at St. Paul's Schools, Foleshill Road.

Secretary, Mr. J. E. Bolus, 14, Coundon Road, Coventry.

Ipswich and District Wireless Society.

Hon. Secretary, Mr. F. T. G. Townsend, 46, Grove Lane, Ipswich.

A very successful inaugural meeting of the above Society was held at the Municipal Technical School, Ipswich, on Thursday, September 22nd. A working set composed of apparatus loaned by local amateurs was connected to the school aerial and excellent results obtained for an hour before the meeting, which began at 8 p.m.

After the Chairman, Mr. F. Mellor, A.M.I.E.E., had opened the meeting by outlining the agenda and a few other remarks, the Hon. Secretary gave a detailed summary of the events, culminating in the present meeting, and also gave details of what it was hoped to do. A good Club-room was essential, especially as it was proposed to open the room every evening. An annual subscription of 10s. was proposed, and those present were invited to enrol on this basis pending a definite settlement. Upon passing papers round it was found about 40 persons of the 100 present desired to become members. A temporary committee, consisting of Mr. Mellor (Chairman), Messrs. Boddey, Alger, Adcock, Firman, Townsend (Secretary), was elected to form rules and submit to a further meeting to be convened later. An effort was then made to intercept the Dutch concert, but owing to local interference and static this could only be discerned faintly. Messrs. British Thomson-Houston & Co., of Rugby, very kindly loaned one of their portable receiving sets, and a 2-valve amplifier, by which excellent results were obtained. It was generally acknowledged that the B.T.H. Co. have succeeded in producing a high-class article in their portable set, as it left nothing to be desired in any way.

The Committee wish to thank the following gentlemen for kindly loaning apparatus:—Messrs. B.T.H. Co.; H. C. Gooding, Stowmarket (Morse inker, wavemeter, converted Mk. III); C. Chevallier, Rushmere (Brown loud speaker); A. Southgate, Tattingstone (new Mark III); F. Boddey, Ipswich (2-valve amplifier); S. Lewis, Ipswich (original Marconi silver coherer).

South Woodford Radio Society.

Hon. Secretary, Mr. L. R. Gaywood, "Eastholme," 190, Hermon Hill, South Woodford, Essex.

The first annual meeting of the above Society was held at Headquarters on Tuesday, October 4th, at 8.30 p.m., the chair being taken by Mr. E. J. Turbyfield.

The following officers were elected:—President, Mr. E. J. Turbyfield; Vice-President, Dr. J. Craig-Crawford; Treasurer, Mr. E. J. Turbyfield; Secretary, Mr. L. R. Gaywood; Committee, Messrs. S. Carr, V. Johnston, and C. Carr. The Society at present numbers 20 members, and already possesses a 2-valve receiving set from which excellent results are being obtained.

It has been arranged to hold "buzzer" classes from 8.30 p.m. to 9.30 p.m. on Tuesday and Fridays, and a complete syllabus for the coming season will be arranged shortly.

The Secretary will be pleased to forward particulars to, or meet by appointment any persons in the district who are interested in wireless and desirous of becoming members.

Newark-on-Trent and District Wireless Society.

Hon. Secretary, Mr. G. T. Sindall, 6, Beech Avenue, Hawtonville, Newark-on-Trent.

Owing to a fair response to the recent paragraph in *The Wireless World*, *re* the reforming of the above Society, which fell through last winter, a meeting was held on September 28th, at the Magnus Grammar School (by kind permission of the Headmaster, Rev. H. Gorse). A fair number of amateurs were present, and it was resolved to reform the Society at once.

It is hoped that more success will attend the Society's work this winter, and as the room has been placed at our disposal, and also the fine aerial which is led into the room, there is no reason why this should not be so. It was decided to meet each Wednesday evening at 7.30. Buzzer practice

for the first half-hour and the remainder of the evening devoted to lecture or discussions.

The Rev. H. Gorse, M.A., has kindly consented to become the President, and Mr. G. T. Sindall was elected Hon. Secretary, and Mr. Edmonds Hon. Treasurer. The subscription has been fixed at 1s. per month for the time being. The Society welcome the attendance of anyone interested in wireless.

Blackpool and Fylde Wireless Club.

The above Club has made the suggestion that a conference of the various wireless societies of the North might be arranged to take place at Blackpool some time in the near future. Those interested should communicate with the Secretary, 8, Park Street, Lytham, Lancs.

The Greenwich Wireless Society.

Hon. Secretaries, Mr. Arthur F. Bartle, 27, Kidbrooke Park Road, Blackheath, S.E.3, and Mr. W. Witt Burnham, 18, Blackheath Rise, Lewisham, S.E.13.

The first meeting of the new session was held at Headquarters on October 4th. After formal business was completed Mr. S. Ward presented a most interesting and instructive paper on "Capacity and Inductance." The chair during proceedings was taken by Mr. Hubert Fergsuson. Next formal meeting Tuesday, November 1st, at 8.30 p.m.

More papers are required and help from other societies in this respect would be very much appreciated. Visitors from other societies heartily welcome.

Headquarters, Ranger's Lodge, Greenwich Park.

Manchester (Y.M.C.A.) Wireless Society.

A general meeting was held of the above Society on Wednesday, August 24th last. It was resolved unanimously to amalgamate with the Manchester Wireless Society, and Headquarters will be in future at the Albion Hotel, Piccadilly, Manchester. All further communications shall be addressed to Mr. Y. W. P. Evans, Secretary, Manchester Wireless Society.

The Margate and District Wireless Club.

The above Club which was formed on April 29th, 1921, is still going strong; members continue to increase, and also the Club apparatus. A crystal set is fitted and a valve set is in the course of construction.

The meetings take place at 119, Northdown Road, Margate, at 7.30 p.m. every Tuesday, when lectures are given, Morse practice indulged in, and numerous questions asked and answered. All new members will be made welcome.

Further information can be had from the Secretary, Mr. J. Byers, 33, Richmond Avenue, Margate, or from the President, Mr. G. W. May, 75a, Trinity Square, Margate.

Epsom and District Amateur Radio Society.

The first meeting of the above Society was held on Wednesday last, at the Cinema Royal, Epsom, when a record attendance was made. Quite a large variety of apparatus was displayed, and tested on the Club's aerial.

Good signals were received on a Mark III. tuner, converted for use as a 2-valve set. Horsea and other stations were very clear.

A twin wire aerial is in the course of construction, and will be completed early. Four new members were elected. Owing to vacancies on the Committee it was found necessary to fill the places, and the names of members are given below.

President, H. G. Gardner; Chairman, W. J. Clark; Secretary, H. N. Penfold; Treasurer, J. B. Plenty; Messrs. C. Campbell, Atkinson, Gravett and S. Brown.

Arrangements are being made to organise a series of dances in Epsom to swell the funds, and in all probability £20 will be reached very soon. As a novelty for this district music will be received by wireless on a temporary aerial erected in the room where the dances will be held. Buzzer practice will be held each Wednesday at 7.30 p.m., and lectures, demonstrations, etc., will be held after 8 p.m.

Gentlemen desirous of becoming members are asked to write to Mr. H. N. Penfold, Hon. Secretary, or Mr. J. B. Plenty, Hon. Treasurer, at Cinema Royal, Epsom.

CORRESPONDENCE

To the Editor of *The Wireless World*.

Sir,—The Portsmouth and District Wireless Association have asked me to communicate with you with reference to transmission of telephony from an English station, in a similar manner to that of the Dutch concert from Holland.

We think, in common we feel sure with other Societies, that a short transmission of telephony, if only for a few minutes daily, from such a station as Chelmsford, would be greatly appreciated and would, undoubtedly, do much to further amateur work, and increase enthusiasm in the wireless hobby. Trusting you would publish this for us,

R. G. H. COLE.

6th October, 1921.

To the Editor of *The Wireless World*.

Sir,—May I be permitted, through the columns of *The Wireless World*, to make an appeal to amateurs transmitting telephony. It is often, owing to jamming or bad articulation, impossible to catch the exact call letters of the station sending, and at times a great deal of the interest is lost to the hearer and valuable reports fr ı different parts of the country to the sender. If all amateurs would repeat their call letters several times, both before and after their transmission, this difficulty would be overcome. In this connection I would suggest that speakers should adopt the "ack," "beer," "don," or "a" for Arthur, "b" for Bertie, "d" for David method to avoid mistakes. A careful study of the methods adopted by Croydon would repay the trouble.

A. S. BRERETON.

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 work. 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.**

A.B.C. (Gosport).—(1) The formula on page 302 of August 6th issue, in reply to "**Quaere,**" will enable you to make the correct calculation.

(2) The relative amounts of A.T.I. and reaction inductance are best determined experimentally. The inductance of your basket coils will be approximately 5,000 mhys. For the reaction make a coil similar to the A.T.I. to commence with, and experiment with it.

(3) The maximum wavelength will be about 3,500 ms.

(4) The wiring diagram was correct.

J.G.B. (Fife).—If the M panel has a grid leak and condenser, a crystal will not do much good. If it has not, the reaction coil may be tuned by means of a condenser and the crystal connected across this condenser. Short circuit the telephone terminals and place the telephones in series with the crystal in the usual way.

G.C.L. (Cardiff).—(1) Yes; a good arrangement.

(2) Yes. Connect it across the L.T. terminals, and not as shown.

(3) Earth to the negative of the 6-volt battery the cores of the L.F. transformers and telephone transformers to prevent howling.

AMATEUR (S.E.).—(1) and (2) We regret we have no detailed information regarding this set. If it is a military trench set, it will probably only be suitable for short waves, of the order of 300 to 1,000 ms.

(2) Yes.

(4) Either 4 or 6 volts, with a resistance either in the set or external to it.

S.J.R.B. (Ringwood).—(1) The weak incoming currents are passed through either one of the D.U. windings, sometimes through both, and cause a movement of the tongue or armature against one of the contacts. The recording or indicating device connected to the tongue and one of the contacts S or M is thus operated.

(2) These letters stand for "Down" and "Up," referring, of course, to the telegraph line.

(3) The current charge necessary to operate this relay is about 1 milliamp, to obtain which several valves in cascade are required. To make it suitable as a wireless relay, rewind the coils full of No. 47 wire.

(4) There are not a sufficient number of types of relay used in wireless work to justify a book on the subject. Relays of the G.P.O. type are described in books relating to cable telegraphy, such as that by Herbert.

A.F. (Stone).—(1) A diagram of the French 6-valve amplifier, with triple pole switch, is given in Fig. 1. With receiver connected to L_1 L_2, and switch at HF, the first valve acts as a rectifier with grid condenser. With telephone terminals of a receiver connected to L_1L_2 and the switch at BF, the set acts as a low-frequency amplifier. The additional tapping on the primary of the first transformer was provided to give a low resistance primary for use with earth telegraphy systems, in which case the current to be magnified was put into the transformer at L_1L_2. This is not needed for wireless. What you call a reactance is probably the grid leak.

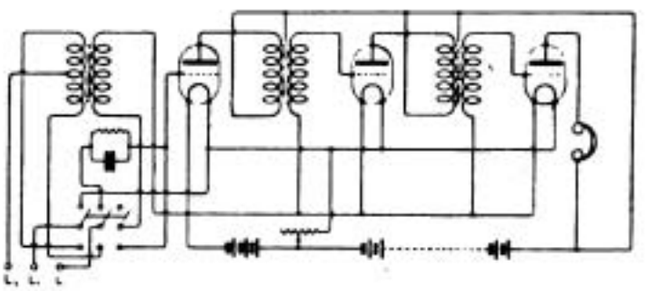


Fig 1.

MAC SMYTH (Castlebar).—The relay requires about 1 milliamp. of current to operate it. It requires the magnification of several valves to give this current charge. To operate it from a single valve receiver is out of the question.

G.O.A. (Pinner).—(1) Cleethorpes is, we believe, on private Admiralty service; no working times are publishable. You should be able to get the station.

(2) Maximum, 0·00055; minimum, indeterminate; very likely about 0·00001 mfds.

(3) This station may possibly be Gibraltar, but we are doubtful about this.

(4) Yes.

ANTENNA (Liverpool).—We are glad our previous advice was of use. The present set seems O.K. The down lead would be better taken to the end of the aerial nearest to the window; you could stay it out a little from the wall. The suggested addition of an A.T.I. should considerably improve the set; but the crystal and telephones should be tapped right across both coils—not the small one only, which gives too weak current, as you suppose. Crackling noises are almost certainly X's. The set seems to give results, as good as can be expected; now proceed to improve it by elaborating the design, *e.g.*, introduce a tuning condenser to improve the selectivity.

K.U. (Leytonstone).—(1) An additional permit to cover the proposed alteration would be necessary.

(2) The proposed circuit would be very inefficient. Take any good crystal circuit and, in place of the telephones—or telephone transformer, if fitted—put an H.R. iron-cored step-up intervalve transformer, connecting the grid and filament of the valve across the higher resistance winding.

(3) The open-ended arrangement, if preferable; but in the case of two wires only, it is almost immaterial.

C.M.H. (Canterbury).—(1) and (2) Yes, either add an additional coil for the reactance, or make one of the original coils the reactance coil, putting the other in the appropriate receiver circuit.

(3) See Fig. 9, page 368, September 3rd.

(4) No, thoroughly bad. See various crystal circuits in recent issues.

F.G.N. (Tonbridge).—(1) For 0·002 mfds. a single pair of foils with an overlap of 1¼" by 2" will be sufficient. For 0·0015 mfds., as above, but with ¾" of the above overlap.

(2) A reaction coil is of no use with a crystal set.

(3) Fourteen fixed, 13 variable.

(4) About 0·002 mfds. variable.

SEA SCOUT (Isle of Bute).—(1) The aerial should be quite efficient, if satisfactorily insulated from the tree and all its branches.

(2) Yes.

W.H.B. (Castleford).—(1) According to the old-established convention current flows in a circuit from a point at positive potential to a point at negative potential. According to the modern electron theory, the current, consisting of a stream of negatively charged particles of electricity, or electrons, flows in the opposite direction. This is the more exact view of the matter, though the older convention is still useful and used in many cases.

(2) Various proprietary mixtures of a secret nature are used. They probably consist of an intimate mixture of a fairly good conductor, such as graphite, with a suitable proportion of some non-conducting substances.

(3) Almost immaterial: the best position depends on the valve employed.

(4) There is no way possible without the use of special apparatus. The best method of making such resistances is by trial and error, *i.e.*, altering the resistance until it works well. The exact value is not critical.

S.H. (Tunbridge Wells).—See Fig. 4, page 186, June 11th, with the data there given—in which, however, the transformer marked "1/1" should preferably have a ratio of about 1/2, and should, of course, be shown iron cored.

"NEST" (Lowestoft).—(1) and (2) Circuit is quite correct and rather ingenious.

(3) Probably, but not certainly, whenever the H.T. is switched on, and also when the L.T. is switched on, if the H.T. is also on at the time.

? (Brighton).—(1) Make coil L 4" diameter, 10" long, wound with No. 26, and L_1 3" diameter, 8" long, also of No. 26; 4 oz. will probably be sufficient.

(2) Either H.R. or L.R. with a transformer would give best results; but a medium resistance of 2,800 ohms. should give good signals.

(3) 300 to 3,000 ms. The Dutch Concerts (1,050 ms.) will be weak.

(4) The valve probably requires 6 volts with a variable resistance for the filament and about 50 volts for the plate.

"ACK ACK" (Greenwich).—(1) 0·0017 and 0·0021 mfds. approximately.

(2) Yes, although 0·0021 mfds. is rather low for the 0·003 mfds. condenser.

(3) The number—10—is correct for this condenser.

(4) No.

G.H.P. (Stalybridge).—(1) Wind several feet of No. 22 bare Eureka wire round a pencil and draw out the sprind so formed so that the adjacent turns do not touch. Screw it at the ends to a piece of wood and make a sliding contact arrangement.

(2) Maximum wavelength about 2,500 ms.

(3) Use either a V24 or an R valve, the former with about 30 volts and the latter with about 50. The grid condenser must have a leak of about 2 megohms connected across it.

G.A.H. (Farnborough).—(1) Value suggested is O.K., but a somewhat larger value would be useful.

(2) Use a small coil sliding in and out of the secondary, wound with about No. 28 wire.

(3) These expressions are used rather loosely. Generally a pancake coil is one containing a single layer of wire, and the term "slab" is used for a thin honeycomb, or other coil containing rather more than a single layer of wire in its thickness.

(4) Yes. Connect a 0·001 mfd. condenser across the primary of the intervalve transformer.

CORRECTIONS.

October 15th issue. On page 433, col. 2, formula should read:—

$$R \Big/ \left(1 + \frac{600 \pi RC}{\lambda}\right)$$

On page 437, col. 1, for 60,000 watts read 60,000 ohms, and for 80,000 watts read 80,000 ohms.

SHARE MARKET REPORT.

There has been no business done with Wireless Shares during the fortnight, and the prices have been affected accordingly.

Prices as we go to press, October 21st, are:—

Marconi Ordinary	£1	11	3
,, Preference	£1	10	0
,, Inter. Marine		17	6
,, Canadian		5	6
Radio Corporation of America:—			
Ordinary		10	3
Preference		9	0