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CONTENTS

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EXPERIMENTAL DIRECTION FINDING SETS.

By THE EDITOR.

IT is surprising that more attention has not been paid by the amateur and experimenter to directional wireless. The subject is one which holds peculiar fascination, and there is undoubtedly a very great deal of important development work yet to be done.

Wherever the amateur has devoted his attention to a particular line of research we have seen that important progress has been made. High frequency amplification and short wave transmission and reception both owe much to the amateur for their present stage of development, and there are many other channels of progress to which the amateur has contributed largely. In the case of directional wireless, however, the amateur has very little, if anything, to his credit, probably for the reason that he has not so far turned his attention to the subject seriously.

Many people who have not taken up D.F. work seem to be of the opinion that no satisfactory results are possible where the apparatus cannot be installed at a location free from shielding effects. This, however, is not the case, since provided the shielding effects remain constant they can in most cases be compensated for. The compensation will hold good over a fair wavelength band, but will have to be modified where a considerable change in wavelength is made. These circumstances only add to the interest which experiments with direction finding apparatus provide.

A point in favour of direction finding experiments being taken up by local wireless societies is that it is in a way a sociable occupation since two or more stations must be engaged for location to be established.

This reminds me of a fallacy which ought to be exposed. References have been made recently to the use of D.F. stations as a means of locating "oscillators" and bringing them to book. Anyone who has had any practical experience of D.F. work knows at once what an almost impossible task it would be to endeavour to take D.F. bearings on spasmodic bursts of local oscillation where no distinguishing signal is transmitted, and it is not possible to differentiate between one "squeal" and the next when they may originate from different sources. It would be like the novice who argued that he could always recognise the same C.W. station by the pitch of the note transmitted! Another objection to the use of D.F. apparatus for this purpose is that even if we suppose that such accuracy is obtainable as to locate the aerial from which oscillation emanates, the individual "detective" still has no right to intrude upon his neighbour and accuse him of interfering with the reception of others.

THE MEASUREMENT OF LOW-FREQUENCY AMPLIFICATION.

In this paper is described a method of measuring low frequency amplification. The results of tests with resistance capacity, reactance capacity and transformer couplings are given.

By R. L. SMITH-ROSE, Ph.D.

I.—INTRODUCTION.

IN the above title the term "low frequency" is used in its generally accepted meaning in connection with wireless reception as indicating the band of frequencies from about 100 up to 3,000 cycles per second, these being the audible frequencies which are important from the point of view of the transmission of the human voice. This audio or low frequency amplification is carried out with the usual types of three-electrode valves coupled in cascade by some standard form of connection such as resistance-capacity, reactance-capacity or transformer. Of these the last is probably the most popular since it provides the possibility of obtaining a step-up of the effective voltage transferred from one valve to the next. The history of the development of amplifiers is largely an account of progress by the trial-and-error method, although in many cases this has been guided by sound scientific principles. Several workers have attempted a theoretical treatment of the design of the transformer, but the difficulty has always been found of including appropriate numerical values for the many and variable factors which contribute to the practical operation of an amplifier. Landline and submarine cable telephone experience have shown that it is very difficult to design from theoretical considerations the various iron-cored induction coils, repeating coils and other transformers which are required to function on alternating currents of speech frequencies, often in the presence of a steady magnetising current. In the amplifier case full account must also be taken of the three-electrode valve, an instrument which is still somewhat difficult to treat in a quantitative manner. Even with an intervalve coupling transformer already constructed it is extremely difficult to measure the electrical constants—inductance, resistance, self-capacity—of its windings in a manner which conveys any material information from the practical point of view, as the measurements made are subject to relatively large changes with any alteration of the circuit arrangements.

For practical purposes the most useful and important fact to know concerning an amplifier is what is the actual increase in voltage or power obtained by the inclusion of the amplifier in the circuit. The next section describes the arrangements which are in use at the National Physical Laboratory for this purpose, being available and used for tests on standard manufactured types of intervalve transformers.

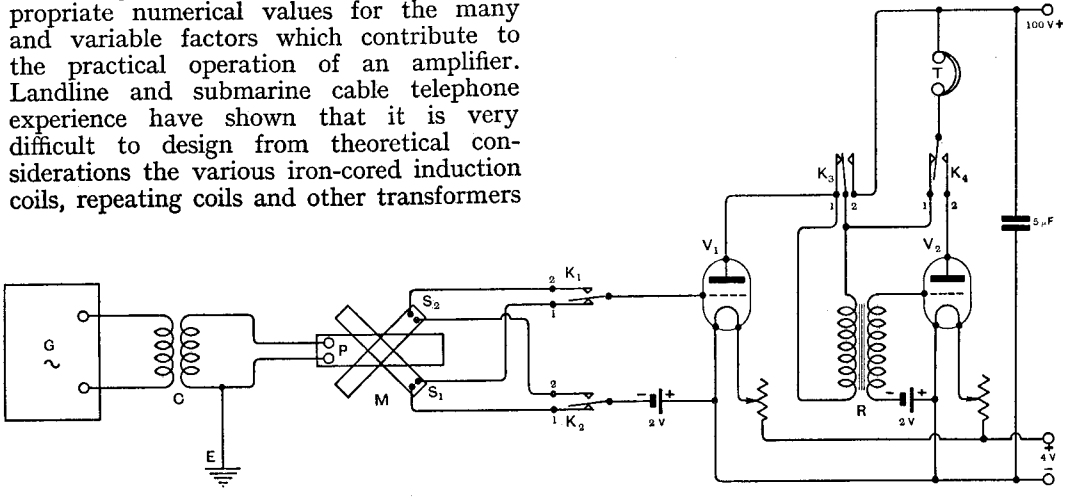


Fig. 1. *Connections of apparatus used in the measurement of low frequency amplification.*

2.—METHOD OF MEASUREMENT.

The method of measurement was devised in about 1918, by Mr. F. E. Smith, F.R.S., and the late Mr. H. C. Napier.*

The principle of the method may be explained with the aid of the schematic diagram of connections given in Fig. 1. G represents a source of alternating current of audible frequency which through the coupling C supplies the primary coil P, of the mutual variometer, M. This latter instrument comprises a fixed primary coil P, inside which rotates a system of two secondary coils S_1S_2 fixed together at right angles, a pointer and scale being provided on the axis of these coils. By means of the switches K_1 and K_2 either of the secondary coils may be connected to the grid-filament circuit of the first valve V_1. The E.M.F. which is thus applied to the first valve is dependent upon the frequency, the current in the primary coil, and the mutual inductance between the primary and the appropriate secondary coil.

A second valve V_2 is connected to the anode circuit of V_1 by any of the standard intervalve connections which may be employed for audible frequencies. In Fig. 1 this is shown as the usual iron-core transformer. By means of the switches K3 and K4, the telephone receivers may be connected in the anode circuit of either V_1 or V_2. When connected to V_1 the primary of the coupling transformer is short-circuited as shown.

In the actual apparatus the switches K1-K4 are interlinked so that they may all be put simultaneously into positions 1 or 2. In position 1, the E.M.F. from the coil S1 causes a signal current in the telephones via the valve V_1. In position 2, the E.M.F. from S2 results in telephone current via the valves $V_1 + V_2$ coupled by the transformer. If the coils S_1 and S_2 are set to give the same E.M.F. then the current through the telephones will be greater in position 2 than in 1, by the increase which is obtainable by the transformer plus the valve V_2, the valve V_1 being common to the two cases. Instead of attempting to measure the ratio of the outputs so obtained, however, the E.M.F. from the coil S_2 is made less than that from S_1, by simply rotating the secondary coils within the primary, until the output current in the telephones is the same in both cases. It is then known that the reduced E.M.F. applied by S2 is exactly compensated for by the amplification introduced by the valve V_2 and the coupling transformer. Now, for a given frequency and primary current, the E.M.F. in either secondary coil is proportional to its mutual inductance with the primary. The ratio of the E.M.F.'s in the two secondaries is therefore equal to the ratio of the mutual inductances of the secondaries with the primary. In setting up the apparatus these mutual inductances are carefully measured by means of a standard inductometer, and the above ratio can then be calculated. A curve showing the ratio of the mutual inductances for various scale readings on the instrument is given in Fig. 2.

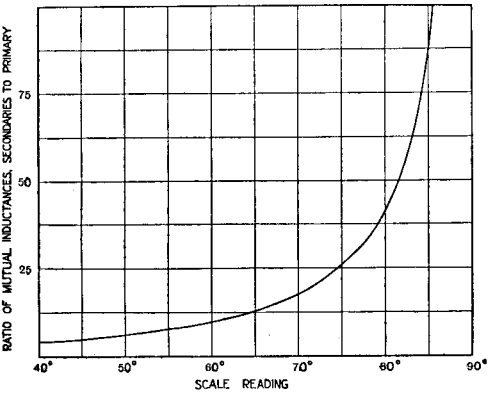


Fig. 2.

The practical operation of making a measurement of amplification is therefore briefly as follows. The source G, is set accurately to the frequency required for the test, and the potentials applied to the filament, anode and grid are set to their specified values. Switches K1-K4 are then quickly alternated between positions 1 and 2, while listening to the signal in the telephones T, and the secondary coils S1 and S2 are rotated until the signal strength is judged to be the same in either position of the switches. The scale reading is then observed and by reference to the appropriate calibration such as in Fig. 2, the amplification is read off. Among the precautions to be observed are the entire elimination of stray induction into the coils S_1 and S_2 from either

* F. E. Smith, and H. C. Napier: "On the Measurement of Amplification given by Triode Amplifiers at Audible and at Radio Frequencies."—*Proc. Phys. Soc.* 1920, *Vol.* 32, *p.* 116.

the source G, with its coupling C, or the intervalve transformer R. Up to the present comparative freedom from this trouble has

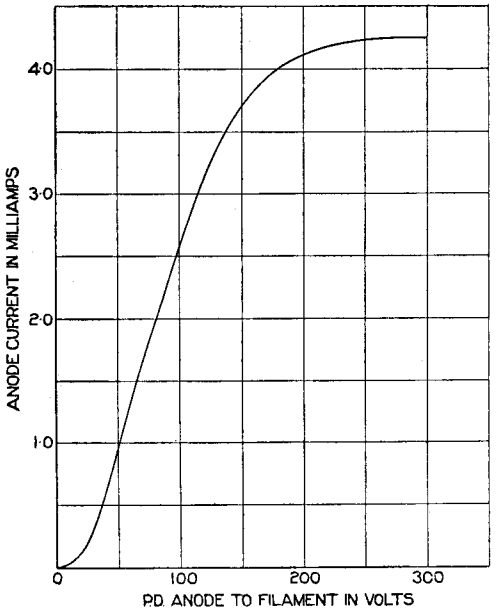


Fig. 3A. *Showing the relationship between the valve anode voltage and anode current of an "R" valve.*

been obtained by adequate spacing of the individual components of the apparatus and by earthing one side of the coupling C at E, although in later developments somewhat elaborate screening arrangements are contemplated.

The source G is a simple valve oscillator operated at comparatively low efficiency to ensure the production of a current of pure fundamental frequency free from harmonics. This freedom is necessary since certain types of intervalve coupling may give totally different amplifications at different frequencies. Concerning the accuracy to which the measurements are possible, this is dependent upon the frequency and strength of telephone signal obtained. Long experience on this and other measurements involving the balance of two signals in telephone receivers has shown that an optimum sensitivity is obtained for a medium frequency of about 1,000 cycles per second, and a signal of good readable strength, when a want of balance of about 5 per cent. can be detected by a trained observer. By taking several check observations a mean result can be obtained which is somewhat more accurate than the above figure. In testing certain types of iron core transformer and choke-coil coupling, which distort the applied audio frequency oscillations in one position of the switches, the accuracy is lowered by the difficulty of balancing the intensity of two signals of different qualities.

3.—THE SELECTION OF THE VALVES AND THE CONDITIONS OF THEIR USE.

One of the difficulties experienced in the setting up and development of any valve apparatus used for measuring purposes is the choice of the valves to be used. With all due respect to the manufacturers of modern valves it has to be admitted that for quantitative purposes it is rare that a batch of valves can be obtained, all specimens of which have anything like identical properties. Also when satisfactory valves are obtained they vary with time unless they can be employed with very low filament temperatures. On the latter point it is possible that modern dull emitter valves will have some advantage, although the "doctoring"

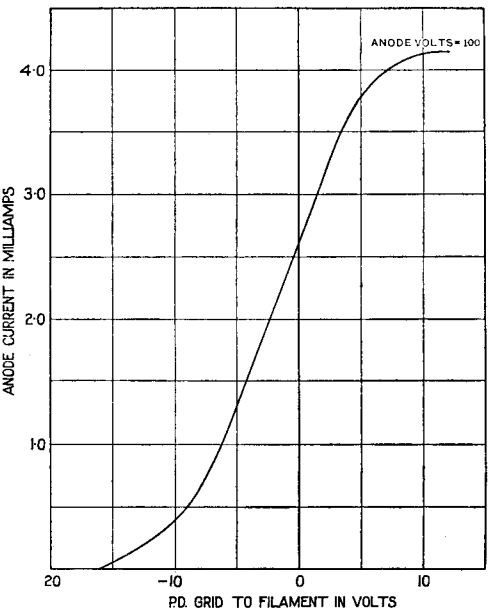


Fig. 3B. *Characteristic curve, showing the relationship between the grid volts and anode current when the anode voltage is fixed at* 100 *volts, of an "R" valve.*

of the filament probably does not conduce to stability and constancy of emission over long periods.

The method of selection of suitable valves for measurement purposes presupposes a fairly large representative batch from which a number may be chosen by a suitable

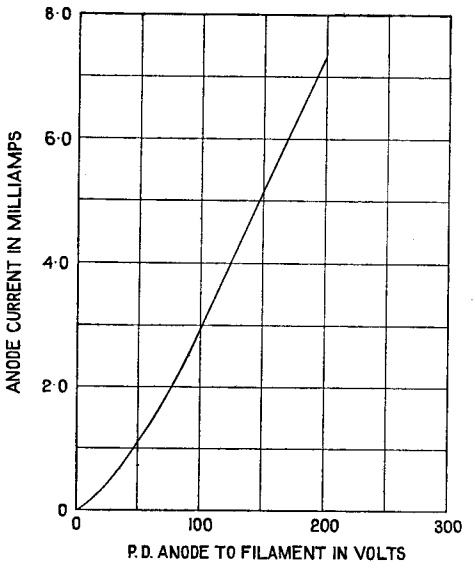


Fig. 4A. *Showing relationship between the anode voltage and anode current of a D.E.R. valve.*

preliminary test. These valves are then subjected to a complete characteristic test using direct current supply. In order that the conditions may be reproduced it is necessary that the filament supply should be specified. As this is usually an arbitrary quantity, a value of the filament voltage is selected which general experience has shown to be suitable for the valves employed.

The results of these tests are then plotted in the form of the usual curves, from which the valves are selected in pairs, having as nearly as possible identical characteristics, and thus similar " constants." By examining a number of valves in this manner, a selection can be made of a pair of valves representative of the type to be employed in the amplification test. These valves are then carefully preserved and used exclusively for test purposes.

The characteristic curves of the selected valves are also employed in the selection of the steady values of the anode and grid potentials to be used. Specimen characteristic curves of valves of the " R " and dull-emitter " R " type respectively are shown in Figs. 3 and 4.

In order to reduce the grid current to the minimum to avoid distortion and loss of amplification it is necessary to ensure that the grid is always at a negative potential relative to the negative end of the filament. To avoid distortion due to curvature of the characteristic it is also necessary that the working conditions are confined to the " straight " portion of the characteristics. From Fig. 3 it is seen that an anode potential of + 100 volts and grid potential of — 2 volts secures the fulfilment of these conditions for small oscillating grid potentials such as are used in the amplification test. If, however, large amplitudes of alternating current are required in the anode circuit, both the positive potential of the anode and the negative potential of the grid must be increased. For example, for the D.E.R. valve, of which the characteristics are shown in Fig. 4, an anode of + 150 volts and a grid potential of — 4 volts permit an amplitude of the alternating component of the anode current of over one milliampere

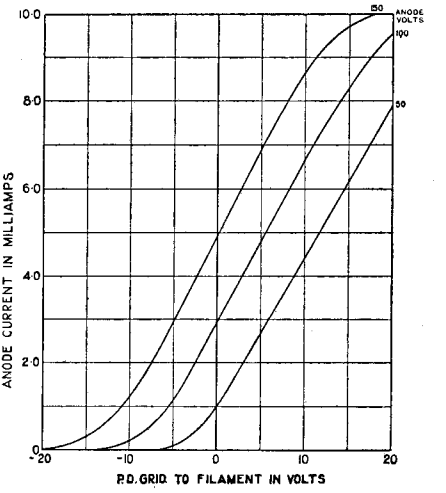


Fig. 4B. *Characteristic curves of a D.E.R. valve, with various anode voltages.*

(peak value) while still operating on the straight part of the characteristic. A current of this magnitude is ample for good reproduction from the smaller types of loud speaker used nowadays.

(*To be concluded.*)

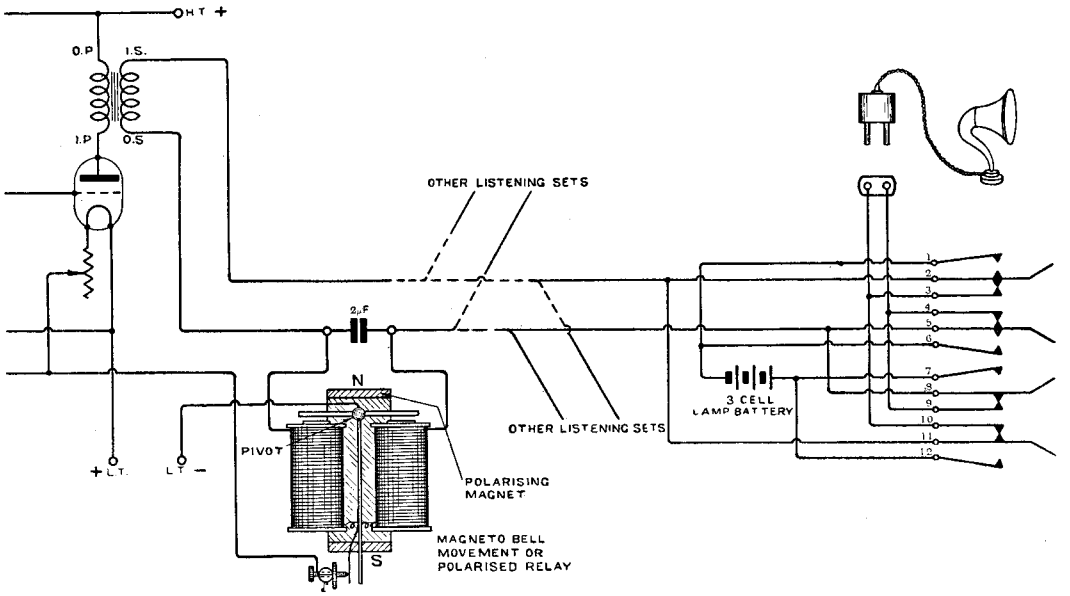
HOUSE WIRING FOR LOUD SPEAKERS.

TWO LEADS FOR TELEPHONY DISTRIBUTION AND BATTERY SWITCHING.

By F. H. HAYNES.

FREQUENT reference has been made recently to the distribution of telephony to various rooms throughout the house where receiving apparatus is installed. In working out the scheme of distribution provision must not only be made for plugging the telephones or loud speaker on to a pair of leads emanating from the output terminals of the receiver-aerial to earth provided some suitable lightning protector is permanently fitted.

There is no difficulty in devising a remote control system when three or more leads are in use for distribution. The use of more than two leads, however, is to be deprecated, and the system here described has been worked out so that pairs of wires may be paralleled across and distributed throughout



Wiring system for remote filament switching of the receiving set. The listening point on the right controls the operation of the set. A special feature of the method shown is that no current is passed through the loud speaker for operating the relay, and that no current is applied to the lines while the loud speaker is in circuit. All listening points can control the switching on or off of the valve filaments of the receiver.

amplifier, but control of the valve filaments must also be arranged so that the receiver can be brought into operation from any point in the system.

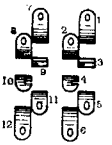
At the onset it might be pointed out that there is no necessity to interrupt any other leads than those of the filament circuit, and no purpose is served in breaking the H.T. battery leads or switching the whole building, and the filaments switched from any point in the circuit. Another condition, and one of great importance, is that no constant current which may be used for operating the valve switching relay shall pass through telephones or loud speaker when thrown on to the circuit. Thus, when once the receiving set is switched on, the key operating equipment must be

entirely disconnected from the leads carrying the telephony and no apparatus must be left across the lines. To accomplish these requirements it is necessary to make use of a telephone transformer to feed the system and so obviate distribution of high potentials from the H.T. battery. The other apparatus required is a 2 microfarad condenser, a polarised relay which can easily be constructed, if necessary, from the movement of a magneto bell, and for every control point a twelve-point Dewar switch, a three-cell pocket battery, and a two-point plug and socket for connecting up the listening apparatus.

Referring to the diagram, the action of the circuit can readily be followed. It will be seen that when the switch is in the central position, the loud speaker is connected directly across the lines, whilst by throwing the key to either the up or down positions, substitutes the battery on the lines. In the up and down positions, however, the battery connections are reversed so that the current sent out on the lines depends for its direction on the position of the switch. Interposed in the circuit and located near the receiver is the polarised relay and the direction of movement of its armature depends upon the direction of the current passed through it, and hence on the position to which the key switch is moved. If the movement of a G.P.O. pattern magneto bell is employed as a relay it will be necessary to rewind the bobbins with No. 26 S.C.C. wire, as bells of this type are normally wound to a resistance of 500 ohms per bobbin. The arm which is to act as a contact should be short and light, and must not upset the even balance of the armature. When connecting up the windings of the two bobbins one must be careful to produce unlike poles at the armature end and the usual connections for making a horseshoe electromagnet must be carried out. There are many simple polarised relays on the market which can be obtained quite cheaply, as they are not required to possess great sensitiveness. The bobbins will probably be wound to a high resistance and will need rewinding with No. 26 S.C.C. The windings of the relay are shunted with a large capacity condenser which will offer a negligible impedance to the speech currents.

With regard to the telephone transformer in the plate circuit of the last amplifying valve, this need not have a step-down ratio and an ordinary 1 to 1 open core power transformer can be employed with advantage in conjunction with high resistance listening apparatus at the points of distribution.

In operation, keys at listening points are normally left in the central position and the batteries are connected up so that the relay is pulled in the direction of making contact when a key is moved downwards. Hence, a listener, to bring his loud speaker or telephones into operation, would merely press the key and restore it, thus causing the contact of the relay to move over and remain there. In switching off it is only necessary to raise the key for a second when the relay will be pulled off and the listener will leave the key in the central position. The writer has made use of Sterling



An end view of one of the switches. Each tag is numbered so that the actual circuit wiring can be carried out from the diagram on the previous page.

keys, which are heavily built and make good contact for the battery currents, and the type employed remains in any of the three positions in which it is placed. It might be convenient, however, to select a type of switch which is not fitted with stops in either the up or down position, so that it will always restore to the central setting, for it will be seen that a switch left in either the up or down position will exhaust the local battery, produce a low resistance shunt across the entire listening circuits and render the operation of all other manipulating keys ineffective.

To guard against the possibility of leaving the valves of the receiving set switched on when no transmission is taking place, a slotted sliding leaf fitted over the face of the key will indicate the position of its last setting before restoring to the central setting.

The purpose of providing the plug and socket connectors for loud speakers and telephones is to permit of listening apparatus being removed from the circuit when the receiving set is switched on by another listener. The listening units on which the distributing lines terminate can take the form of small polished boxes of almost a three-inch cube in dimensions with the battery enclosed and switch and socket carried on the front or top face.

A PRACTICAL DEMONSTRATION OF SOME APPLICATIONS OF THE CATHODE RAY OSCILLOGRAPH.*

By N. V. KIPPING.

ONLY the difficulties attached to the operation of the old type Braun tube have prevented its general use in the past. The wide field of use which it presents has been fully appreciated by earlier experimenters, but the high costs of operation have led, in many instances, to the adoption of cheaper and less effective methods of conducting certain experiments. Quite recently, however, the low voltage type of cathode ray oscillograph has been developed, and its simplicity has made possible its full use for a multiplicity of purposes. Before describing the constructions of the Braun tube and also of the new type of oscillograph, it will be well to make a few remarks as to their general principles of operation.

The main difference between these tubes and the familiar vibrating strip type, lies in the fact that in the former the moving part consists of a beam of electrons instead of a vibrating strip of wire. This beam, being practically without inertia, is capable of dealing with frequencies at least equal to those of the upper radio frequencies. The beam of electrons, however produced, may be deflected in any direction by applying an electric or magnetic field across the beam near its source. Deflection occurs in the same direction as the electric field, and at right angles to the direction of the magnetic field.

If two fields are applied in two directions at right angles, then the path traced by the end of the beam is the curve in rectangular co-ordinates of the relation between the two fields at any time. Two fields which are cyclic and synchronous result in the ray tracing out the same pattern repeatedly, with the result that an apparently stationary curve is obtained. With the vibrating strip or galvanometer types of oscillograph, the chief use has been found in the examination of wave forms, the spreading out of the wave proportionally with time having been achieved with rotating mirrors, or falling or projected photographic plates. With the cathode ray types the availability of a means of plotting curves in rectangular co-ordinates, has widened the scope of the oscillograph, the special case of wave form examination being dealt with by arranging for one of the varying electric fields itself to vary proportionally with time, either sinusoidally or lineally.

Like the galvanometer forms of oscillograph, the Braun types are best suited for studying cyclic or recurring phenomena, though the approximate form of transient phenomena may also be indicated, if the frequency is low enough to enable a single sweep of the ray across the screen to be seen.

The principles set out above apply both to the original Braun tubes and to the new cathode ray tubes.

The former derives its electron beam from a high voltage gas discharge. Fig. 1 shows diagrammatically the arrangement of the gas discharge

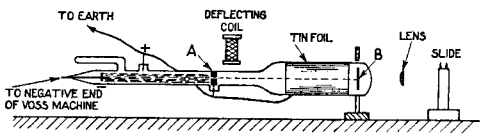
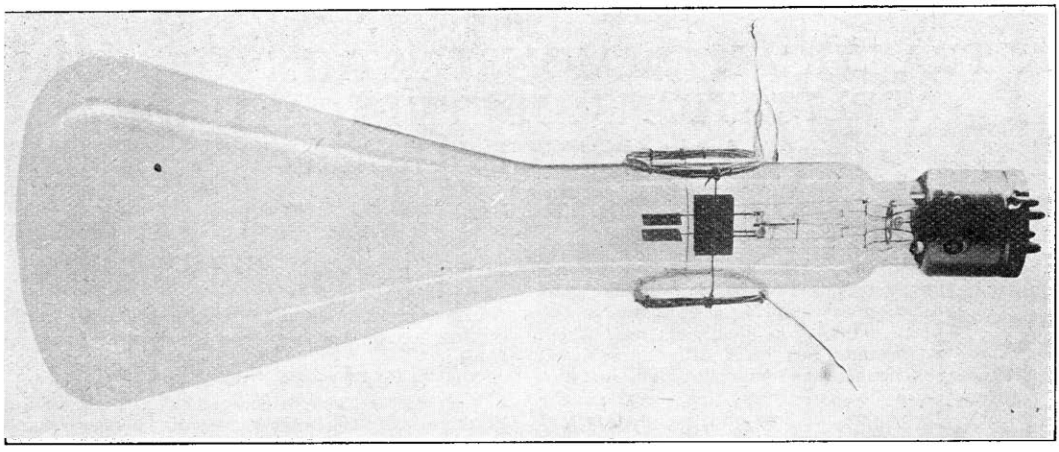


Fig. 1.

type, which is a form of high vacuum tube having at one end a cathode from which the cathode beam is projected. Two baffle screens A are provided with small holes in them, and on an enlarged end, a screen B of fluorescent material. The projection of cathode particles was brought about by the unidirectional and continuous discharge from some electrostatical electrical machine, such as a Voss or Wimshurst. The ray showed as a bright spot on the fluorescent screen. Deflection was obtained by placing on either side of the neck of the tube a pair of coils traversed by an electrical oscillatory current. The line of light so produced was examined with some such device as a rotating mirror. The tube required constant voltage of from 10,000 to 50,000, resulting in an expensive, cumbersome, and somewhat dangerous installation, which placed it beyond the means of most experimenters. The focussing of the ray was brought about by the use of "striction" coils, or some other producer of a powerful field, which press together the negative electrons forming the cathode ray, thus acting as a device for focussing the spot on the fluorescent screen. Without some such device the mutual repulsion of the negative elec trons would result in the spreading out of the beam, even though its velocity be largely increased by such high potentials as were used in the Braun tube, and very little definition of any figure could then be obtained on the fluorescent screen.

The cathode ray oscillograph to be described here differs from the original form of Braun tube in that the source of electrons is a hot filament instead of a gas discharge. This makes it possible to operate the tube on a comparatively low anode potential of 250 to 400 volts, the sensitiveness being correspondingly greater, and the auxiliary apparatus very simple.

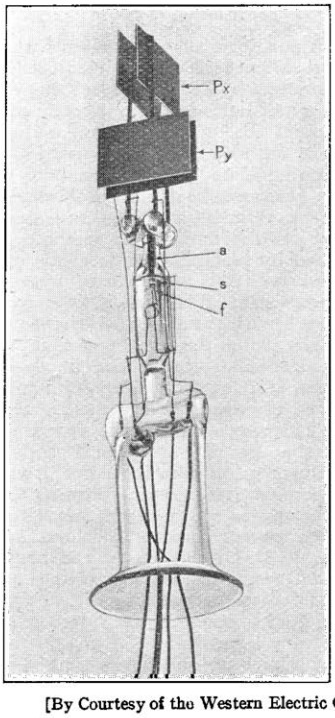
* A paper read before the Radio Society of Great Britain at a meeting held on February 27th, at the Institution of Electrical Engineers.



[By Courtesy of the Western Electric Co., Ltd.

Fig. 2.

A general idea of the apparatus of the tube may be obtained from Fig. 2, and the internal construction is shown more clearly in Fig. 3. The small internal glass tube seen in Fig. 3 contains a length of oxide coated filament f, heated when in use



[By Courtesy of the Western Electric Co., Ltd.

Fig. 3.

by a 4 or 6-volt accumulator. From 1·3 to 1·5 amperes are consumed by the filament when the beam of electrons is correctly adjusted, and the current to the tubular anode a, from which the beam issues, is about half a milliampere. A shield, s, is inserted between anode and filament, and has a small hole in the centre. The end of the filament is bent round into a nearly complete circle, of diameter just greater than that of the hole in the screen. The back bombardment on to the filament of positive electrons is thus largely overcome, and the filament has a correspondingly longer life—about 200 hours. A detailed drawing of the filament is shown in Fig. 4.

The external pair of deflecting coils used in the Braun tube are here replaced by two pairs of deflecting plates Px and Py, mounted at right angles to each other above the anode inside the tube, one plate of each pair being connected to the anode. The potentials to be studied are connected between the anode and the other plate of each pair. Thus the cathode ray oscillograph is self-contained, all the necessary connections being made from a socket into which it fits.

Fig. 4.

The large end of the tube is coated on the inside with a fluorescent substance, which becomes luminous at the spot where the electrons strike it. The coating is a mixture of calcium tungstate and zinc silicate, which results in a spot sufficiently bright for visual observations, yet containing enough blueness to be fairly active photographically. The tube contains a small amount of gas, which prevents charges from accumulating on the walls of the tube, and also assists in the focussing of the ray as will be explained later.

A diagram of the connections for the operation of the oscillograph is shown in Fig. 5. The internal deflecting plates are connected conductively to the anode in order to avoid a charge collecting on them, which would cause the spot to drift.

The brightness of the spot increases rapidly as the anode voltage is raised, but a certain amount of sensitivity is lost. The anode voltage should therefore be governed by the nature of the experiment—whether sensitivity or quick visibility

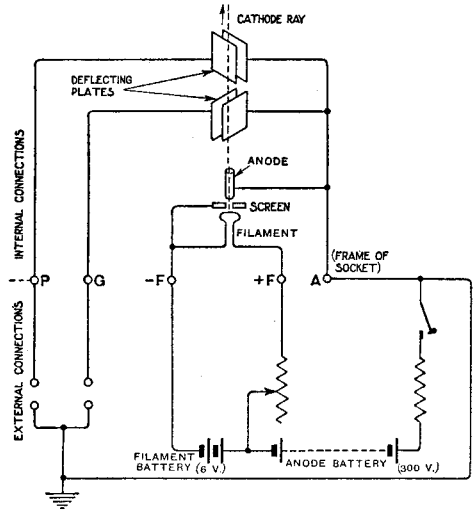


Fig. 5.

is of greater importance—but 300 volts is generally the best value.

When current deflection rather than voltage deflection is required, the current may be passed through a pair of small coils of wire placed outside the tube, such as those in Fig. 2. The beam is deflected by the magnetic field from the coils, which are usually connected in series, and set of course, in a plane parallel to the plane of one of the pairs of deflecting plates.

The deflecting plates are made of a high resistance non-magnetic material, so as not to cause distortion when using the magnetic field.

The focussing of the rays to a spot on the fluorescent screen, one of the most important steps in the designing of this type of oscillograph, was, as mentioned above, brought about by the introduction into the tube of a small amount of gas. The suggestion was due to Dr. H. J. van der Bijl, who, with J. B. Johnson, was responsible for most of the work on the tube's development.

The part which the gas plays depends upon the difference in the mobilities of electrons and positive ions.

Some of the electrons in the stream forming the "cathode ray" in passing through the gas in the tube, collide with gas molecules and ionize them. Both the colliding electrons and the secondary electrons leave the beam, but the heavy positive ions receive very little velocity, as a result of the impact, and drift out of the beam with only their comparatively low thermal velocity. It therefore happens that positive ions accumulate down the length of the stream, so that there is a field surrounding the "cathode ray" which tends to pull the electrons inwards. There is, however, a mutual repulsion between the electrons constituting the beam, which has to be overcome before the ray is properly focussed. If there were only the mutual repulsion between the electrons to overcome, this would be done when the number of positive ions in the stream equals the number of electrons. If the original divergence in the beam is taken to be one degree from the axis, and the electron current 2×10^{-5} amp., then a simple calculation shows that the radial field required to pull the beam to a focus at a distance equal to the length of the stream in the tube is about one volt per cm. This field strength is produced, with beams of ordinary intensity, if there are four positive ions for each electron in the stream.

When the current is increased, the total positive ionization of the beam increases, the field around the beam becomes stronger, and the electrons are brought to a focus in a shorter distance. This has been proved to be true by using a movable fluorescent screen with the tube.

The focussing of the beam therefore is brought about merely by adjustment of the filament current.

In general, visual examination of the curves, etc., obtained is all that is required, though stationary curves may be photographed.

A difference of potential of 1 volt across a pair of deflecting plates, with 300 volts anode potential, results in a deflection of the luminous spot of about 1 mm. The deflection due to one ampere turn in the external coils of Fig. 2 is about 1 mm.

It is intended below briefly to describe those experiments which it is intended to demonstrate, without showing also the resulting curves, as it is hoped these will be obtained on the occasion of the demonstration.

It will be appreciated also that it is only possible to select certain experiments which are likely to be of general interest, as to cover the whole field of use of the oscillograph would be impossible.

1. VALVE CHARACTERISTICS AND INVESTIGATIONS IN OSCILLATORY AND MODULATING CIRCUITS.

Under this heading three investigations have been selected, namely :—

(*a*) The production of the grid voltage—plate current characteristic of a thermionic valve.

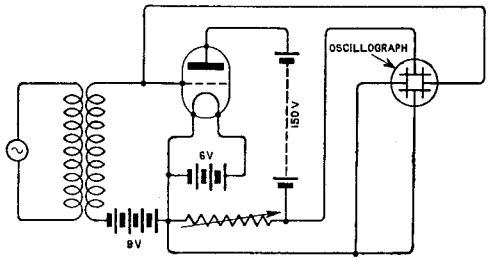


Fig. 6.

(*b*) The variations between grid and filament and between anode and filament in a simple oscillatory circuit.

(*c*) The measurement of modulation of high frequency currents.

For (*a*) the circuit is shown in Fig. 6. It will be seen that the alternating potential applied to the grid is connected across one of the pairs of the oscillograph deflecting plates, while the resulting variations in anode current are obtained by connecting the second pair of deflecting plates across a series resistance in the anode filament circuit of the valve. The curve charted by the oscillograph spot in rectangular co-ordinates is then the curve of anode current variations with changing grid potential.

For (*b*) the circuit which may be used is shown in Fig. 7, the connections to the oscillograph being similar in character to those in experiment (*a*).

For (*c*) the circuit is shown in Fig. 8, in which the horizontal deflection of the beam is made proportional to the low frequency modulation, and the vertical deflection to the radio frequency output.

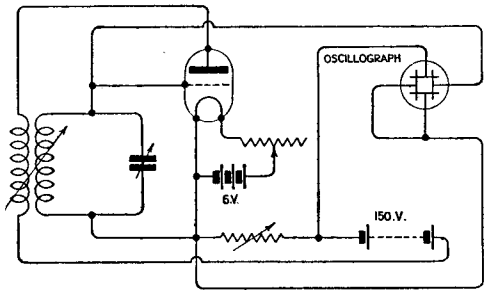


Fig. 7.

2. THE EXAMINATION OF WAVE FORMS.

For this series of experiments it is necessary to arrange that the vertical line obtained by the repeated potential variations whose wave shape is to be examined shall be spread out horizontally proportionally with time. A circuit which is arranged to achieve this on a linear basis (as opposed to sinusoidal or other basis) is shown in Fig. 9.

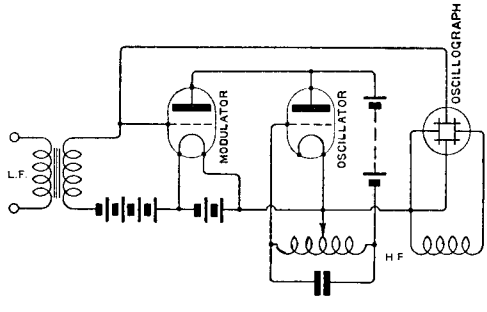


Fig. 8.

In this familiar circuit when the voltage is switched on, the neon lamp may be said to be on open circuit, the potential difference V across the condenser, and therefore across the lamp at any time T will be given by

$$V = B\,(1 - e^{-t/rc})$$

where B, r and c having the meanings given in Fig. 9.

As the potential reaches the value at which the discharge strikes, the condenser discharges until the P.D. has dropped sufficiently for the discharge to

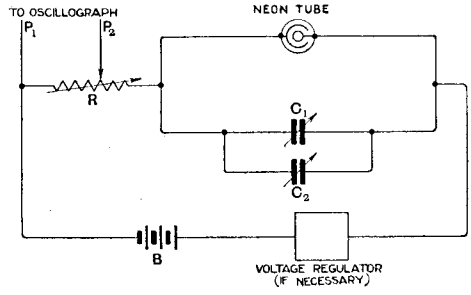


Fig. 9.

fail again. Adjustment of the values of r and c varies the frequency at which the blinking effect takes place.

If now the pair of plates on the cathode ray oscillograph which govern horizontal deflection are connected across a suitable portion of the resistance r in Fig. 9, the spot is deflected proportionally with

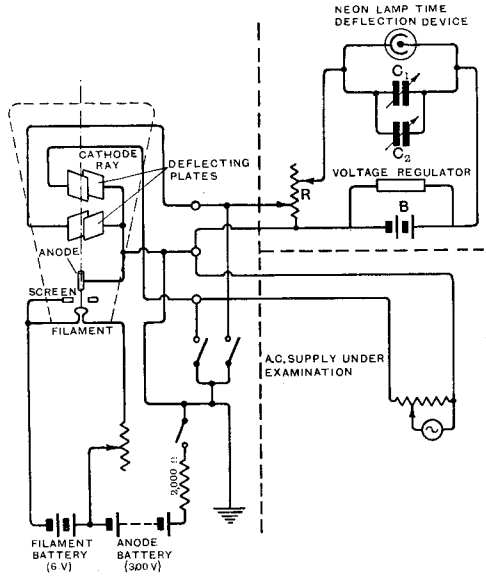


Fig. 10.

the potential variations occurring in this resistance. These variations have a wave form approximating to the saw-tooth shape, so that the spot is deflected horizontally across the screen in a manner depending upon the A.C. wave form (connected to the vertically deflecting pair of plates), after which the spot flashes back to the starting point and again traces out the A.C. wave. If the two deflections are synchronous, or if any integral multiple of the

"time" deflection is equal to the A.C. frequency, the A.C. wave form is traced out into a stationary pattern, the length of one wave and the number of complete waves shown on the screen depending on the value of the above integral multiple. When this is one, one complete wave is traced.

It is intended to demonstrate the examination of the wave shapes of some valve oscillators with the help of this circuit, the complete wiring to the oscillograph for such an experiment being shown in Fig. 10.

3. ACCURATE FREQUENCY CALIBRATION.

Two methods will be demonstrated, the first being by the production of Lissajou's figures, the second by the means of a "rotator" circuit. For the first of these methods an accurately known low frequency oscillation of fairly good wave shape is connected across one pair of the deflecting plates, the unknown frequency oscillation across the other pair. When the ratio of these two frequencies can be expressed as the ratio of two whole numbers the deflection of the spot follows the shape of the appropriate Lissajou figure, which is stationary if the ratio is exact, but which appears to revolve at the rate of once per second for each cycle which the frequencies are away from the exact ratio. Thus a high frequency may be accurately determined, in several steps if necessary, from the accurately known low frequency.

In the second method a circle is obtained on the screen by means of the circuit shown in Fig. 11, in which R is made equal to $\frac{1}{\omega C}$, so that equal deflections, 180 degrees apart in phase, produce the circular trace. The variations in sensitivity of the oscillograph with anode potential are now made use of by applying the alternating potential of unknown frequency in series with the fixed anode battery. Thus the diameter of the circular trace is varied according to the total anode potential at any moment.

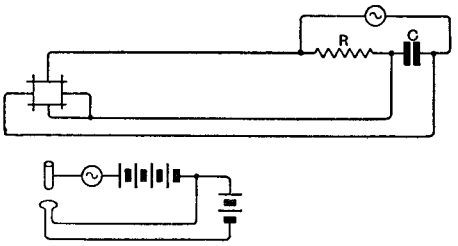


Fig. 11.

If, therefore, the frequency of the alternations applied in series with the anode is any integral multiple of the frequency at which the spot traces a circle on the screen, then the diameter of the circle will be at its largest and at its smallest each the same number of times per revolution, according to the above integral multiple. Furthermore, these maxima and minima will recur at the same place in each revolution, so that the resulting trace will be a type of tooth wheel, the number of teeth corresponding to the integral multiple. Various less simple frequency ratios will result in more complicated forms of wheel, in all of which, however, the ratio of the frequencies is easily observed. It may be mentioned that a cursory examination of the wave shape of the applied alternating potential may be made by observing the shape of the teeth in the wheel, as, of course, the diameter of the circle at any moment directly follows the applied potential.

It is intended to demonstrate both these methods of frequency calibration for several ratios.

4. HYSTERESIS STUDY.

For this Fig. 12 shows the electrical connections. A magnetising current is passed through two coils

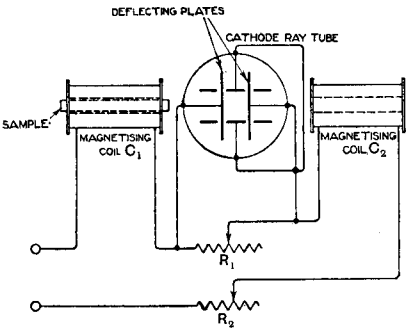


Fig. 12.

arranged on either side of the oscillograph in such a way that the effects of the currents passing through them exactly counter-balance one another, and no deflection of the spot from this source results.

One of the pairs of deflecting plates is connected across a suitable amount of resistance in series with these coils. The other pair of plates is short-circuited, as it is not required for the experiment, and would otherwise accumulate a charge and so cause deflection. The vertical deflection is obtained by placing in the middle of one of the coils a bar of the metal to be examined so that a vertical deflection proportional to the magnetisation in the bar is produced, while the horizontal deflection is proportional to the magnetising force.

In conclusion it may be remarked that although the oscillograph is only ideal for visual examination of results, it will be appreciated after the demonstration that this sets no severe limitations on the use of the oscillograph, and does in fact enhance its value for most types of experiments. Nevertheless, for recurrent phenomena, other than transients, the actual photographing of results is possible and some such will be shown.

No mention has been made above of a very large section of experiments which have been performed with the greatest satisfaction with the oscillograph, but it is intended to mention some of those on the occasion of the lecture, more particularly the work on transients which is now being done by the Radio Research Board of Great Britain, as well as some further experiments of less importance, which are not included above.

THE THREE-ELECTRODE VALVE.

BY W. SYDNEY BARRELL

THE VALVE AS A DETECTOR.

IN earlier numbers of *The Wireless World and Radio Review*, we have briefly outlined some of the physical properties of the valve, and have shown the effects produced by altering the filament and anode potentials, and in more recent articles we have broadly described the effects on the characteristics by structural changes in the valve itself. Having thus, in a simple and general way, shown how a valve functions, it is now proposed to describe some of its several uses. It is not, however, our intention to discuss the many circuit arrangements which have been devised but to confine ourselves to the operation of the valve *per se*.

Now in order that the signal carried by the radio waves be made audible, it is necessary to transform these waves in such a way that they will operate a pair of telephones, and this is the work of the detector in any wireless receiving circuit. True, the incoming waves may be first amplified by one or more stages before detection, but as most beginners commence (perhaps we should say, ought to commence) with a plain detector, it is proposed to deal first of all with the valve in this capacity.

It may however be well if we digress for a moment in order to be quite clear of the conditions a detector must fulfil in order that it may make these incoming waves audible. The frequency of the oscillations used in wireless work is so extremely high that neither the ear nor the telephone itself can respond to them; but if in some way we can transform each wave train into a slow variation of current through the telephones we shall get an audible sound. The detector performs this duty by fulfilling two conditions. Firstly, it must rectify; that is to say, it must cut off, or at any rate reduce, one half of the oscillations in order that they will not neutralize each other in their effect on the telephone diaphragm.

Secondly, the detector must transform the radio frequency impulses into pulses of a lower frequency so that they may become audible.

The valve is capable of operating as a detector of radio frequency oscillations in two distinct ways: one, making use of a series grid condenser, and the other without. These two methods are quite distinct and operation takes place at quite different parts of the characteristic. See Fig. 1.

Taking the second method first, rectification is due to the fact that over a certain region, the anode current-grid volts

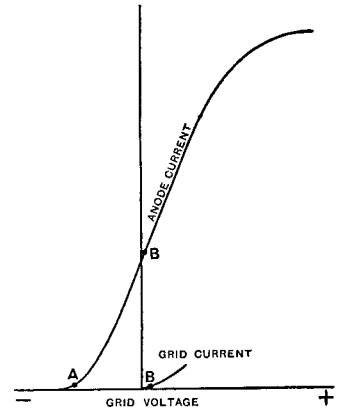


Fig. 1. A is the point of operation without a grid condenser. B is point of operation with grid condenser and leak.

characteristic is curved, and if operated at this point equal but opposite variations in grid potential will cause unequal variations in anode current, resulting in the mean anode current being varied.

Let us study this a little closer.

ANODE DETECTING.

In Fig. 2, we show the lower portion of a typical characteristic curve of a three-electrode valve obtained by plotting anode current against grid voltage, and it will be observed that the characteristic is markedly curved over this portion. Suppose the valve to be adjusted by some means to work at the point x, then normally a certain current I_p will flow in the anode circuit. Now the incoming oscillations will give an

increment + e to the normal grid potential followed by an equal one of opposite sign — e and the anode current will rise and fall proportionately according to and along the characteristic. That is the anode current

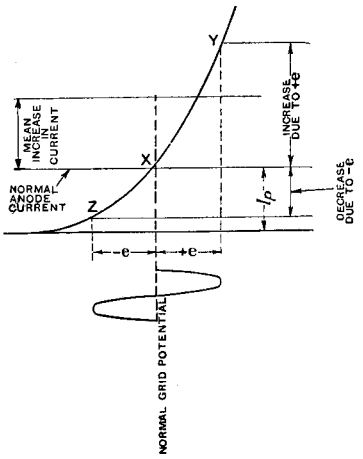


Fig. 2.

will swing between the limits Y and Z, and we get an alternating current in phase with the incoming oscillations superimposed on the normal steady anode current. Due, however, to the fact that the point of operation is at the bend of the curve, equal grid voltage variations above and below the normal do not produce equal changes in anode current, but as shown in Fig. 1, the anode current variation due to the positive grid increment is greater than that due to the negative one, and as a result the mean anode current is increased.

It will be obvious that the rectifying action of this method is due to the fact that the curve of Fig. 2 is asymmetrical around the point x, and further, the greater the asymmetry the better the rectification. This means that for rectification without a grid condenser, we require a valve which gives a characteristic having a sharp bend, and indeed, the curvature of the characteristic at the operating point is a direct index of the detecting merit of the valve. There is a second essential in that we must have some means at our disposal to enable us to adjust the grid potential to the point where the bend is most pronounced. This is generally carried out by means of a potentiometer so arranged as to give the desired steady potential to the grid. With certain valves such as the Q and Qx, which have been specially designed as detectors, this grid potentiometer may be dispensed with and the grid connected direct to the — terminal of the filament battery which, generally speaking, means that the grid will have a small negative potential. See Fig. 3.

Adjustment should then be made on the anode battery for the best results, the reason for which it is not far to seek. The effect of changing the anode voltage is to move the characteristic bodily to the left or right according to whether the anode voltage is increased or decreased, and by so doing we can arrange the position of the curve so that the operating point is at the bend. For "anode rectification," then, we require a valve such that its characteristic exhibits a sharp bend, and this usually means the valve must be specially designed. These valves have a close grid mesh, and the nearer this is placed to the filament the sharper the bend. All valves must, by reason of the space charge, have a bend in the characteristic, but it is usually not very pronounced, and valves of the so-called general purpose type are generally very inefficient if used in this way. They are, however, used with success in conjunction with a grid condenser and leak.

This grid rectification, as it is called, is so named because the currents are now rectified on the grid instead of on the anode, as in the previous method.

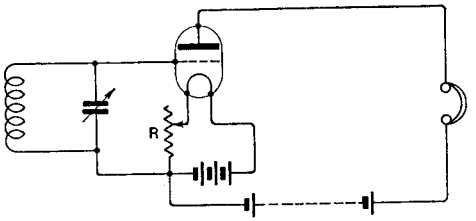


Fig. 3.

GRID DETECTING.

When operating with a grid condenser, there are two changes to be considered. Firstly, the rectification which takes place on the grid, and secondly, the steepness of the anode current curve, the merit of the valve when operating in this manner being proportional to both these factors. Let

us see what happens when incoming waves are impressed on the grid circuit of Fig. 4. The positive half wave will give the grid a + potential, and therefore electrons will be attracted to it. These electrons accumulate on the grid, thus giving it a negative potential causing a consequent decrease in the anode current. The negative half

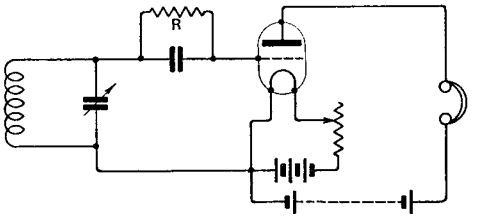


Fig. 4.

wave applies a negative potential to the grid which prevents the flow of further electrons to it. The net result of one complete oscillation is therefore that the grid is left with a negative charge. Successive oscillations in the wave train increase this negative charge thus still further decreasing the mean anode current. This action is graphically represented in Fig. 5, from which it is seen that the radio frequency voltage is superimposed on a *changing* mean grid potential, and the point of operation slides down the curve instead of remaining fixed as in the case of the anode detecting methods previously described.

Now it will be seen from the foregoing that at the end of a wave train the grid condenser is negatively charged, and the anode current consequently reduced. In order that the valve may re-assume its normal condition it is necessary for this condenser charge to leak away, and in practice this is arranged for by providing a high resistance R, Fig. 4, across the condenser. The value of this resistance or grid leak as it is called, next requires consideration. If its resistance is too low the rectified charge on the condenser will leak away almost as fast as it collects, and signals will be weak. On the other hand, if its resistance is too high, strong signals will probably produce a " wipe-out."

Generally speaking a 2 megohm resistance is a suitable value with a condenser of 0·00025 mfd. capacity.

To get the best results with this method of rectification it is necessary that the valve should work on that part of the grid current curve where the curvature is greatest. It is also necessary to simultaneously adjust the plate potential to such a value that the operating point lies on the steepest part of the anode current characteristic. Experience shows that as a rule the best results are obtained when the grid is given a slight positive potential which can be easily secured by connecting the grid return lead to the terminal of the filament battery.

This is very important when using many of the new dull emitting valves as detectors. The reason is, that no current whatever flows to the grid until it is made positive with respect to the filament, and since, with the method of detection under review, we are working on the grid current curve the necessity of connecting up the circuit as suggested will be realised. It is quite probable that much of the trouble experienced by amateurs when using these

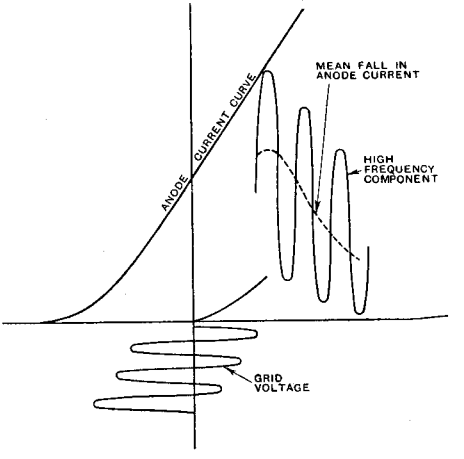


Fig. 5.

valves is due to the grid return lead being connected to the negative instead of the positive terminal of the filament battery.

It is further an advantage to make the final adjustments on the filament resistance, this often greatly helping the signal strength.

THE 1,600 METRE BROADCASTING STATION.

THE POINT OF VIEW OF THE B.B.C.

In the following article the chief engineer of the B.B.C. states the case of the Company for the erection of a high power station to work on 1,600 metres. It will be remembered that the announcement of this project met with some criticism (see in particular the Editorial of the *Wireless World and Radio Review* p. 638, February 20th, 1924).

By P. P. ECKERSLEY.

THERE is undoubtedly a good deal of misconception about the high powered station, and whereas it was expected that this new departure on the part of the B.B.C. would be hailed with acclamation, and while this has been so in most quarters, there has also been a certain amount of criticism about the station. Let us take these criticisms under their various heads and let us examine as far as we can what ground there is for complaint.

The first criticism and the most obvious one is that it may be difficult for users of crystal and other sets to convert such sets so that they can hear the 1,600 metre transmissions. Let us suppose for a moment that it is difficult to convert sets. It should be pointed out here and now that conversion is not absolutely necessary, because listeners will get exactly the same service from the existing stations as they had before, and it is only a universal Oliver Twist feeling in all listeners that will cause them to worry about conversion. The new station, if it comes about, is additional to the present service. It is not replacing any existing service.

But, now let us examine in more detail whether it is so amazingly difficult to convert a set to listen to the new high powered station. We will take the ordinary crystal set that has been used with a local station. If the user is more than 100 miles from the high-powered station it is useless to talk of conversion, because the crystal set will not receive the new station at over 100 miles, but those crystal users in London who may wish to receive the high-powered station can convert their sets at a cost, which I hesitate to name, but which will be very small, by simply adding a loading coil, or more simply still, a variable condenser to be connected between aerial and earth. The cost of such a variable condenser will be very small, but once more, if the user cannot afford to buy such an attachment he will have the same service as he had formerly. The whole point is that, thanks to the enormous power of the new station, the apparatus to detect it need be of the very simplest character, and need not be so sensitive as heretofore; thus the conversion is made even easier than it might appear at first sight. Surely then, this criticism is dealt with at once.

There has been some talk in the Press and elsewhere saying a conversion will be a most costly and difficult matter, but the critics have not realised the enormous power of the station, which makes all conversion so vastly more simple than they had comtemplated. It is true that there may be sets which are not susceptible of conversion very easily, but I am convinced that these represent a very small proportion of the total number.

There is another criticism that people will hold off and not buy sets now, but will await the high powered station. Supposing these people are potential users of the present scheme, seeing that conversion is so easy, and seeing that such things as replaceable coils are incorporated in a majority of designs, why should such people deny themselves the present service when they can enjoy it now and only await the addition of another service? They will be no better off with the new high-powered station, except that they will have two services to choose from. Why should they be so timorous as to hold off until they can get two services?

Another criticism has been raised which says that many people have heretofore listened to the concerts from Continental stations at 1,700 metres, and that these transmissions will be now denied them. In some places this may be true, but I think everyone will realise that we must study the majority and because 0·00001 per cent. of the population may be denied certain services they have

enjoyed beforehand, are we to hold up the whole progress of broadcast on account of them, and are we to deny vast areas the advantages they will enjoy on account of this tiny minority? I am sure the first people to agree with these sentiments will be the minority. British people are normally fairly sporting, and they do give way to the claims of the majority. If anyone lives over 30 miles away from the contemplated station they should be able to still hear Paris.

Now let us come to the advantages of the new high-powered station, having, I hope, dealt fairly adequately with the criticisms. In the first place I think it is axiomatic to say that broadcasting as broadcasting cannot be enjoyed much more than 30 miles from a main station. It may be very interesting to listen to Aberdeen in Cornwall or Sheffield in the Orkneys, but it is not broadcasting as such, and it is a very small minority of the population who have deep enough pockets to afford the apparatus necessary.

Broadcasting as broadcasting can, I think, be only really appreciated if the listener is within 30 miles of a main station. I live to be corrected, and I am sure that this will raise a great deal of controversy, but with oscillation, interference, electric light noises of all sorts, a factor of safety is no longer present if the signal is weak compared to these extraneous noises. It is a nice hobby, but it is not broadcasting as such. Take then a map of England and draw round our main stations circles of 30 miles radius. Draw round relay stations circles of five miles radius. Has the whole of England been covered with broadcast? Is it possible for the majority of people to receive broadcast on simple sets? The answer obviously is "No!" and only those privileged by chance to live within a certain distance of a certain point can enjoy broadcast to the full. Why, because of trivial disadvantages should dwellers in other areas be denied broadcasting? Why should all our programmes be jammed and interfered with, simply because there may be some difficulty, and I submit a very small difficulty, inherent to the scheme? Obviously, we must study the majority, and this high-powered station will open up on the one hand to the manufacturers and traders a vast amount of virgin soil untouched before, and on the other hand to the public, wherever they may live, an almost equal chance to receive broadcast. Why will the trader complain because we are going to give him an increased market for his wares? It would seem surely unreasonable.

Many complain to us not only of interference, which in one fell swoop we would overcome, but they complain that simultaneous broadcast is not all that can be desired because of induction and cross-talk on the lines.

We further submit that relay stations are very well in their way, but are dependent to an extent upon the weather and the conditions obtaining on the land lines. In one stroke, by erecting this high-powered station, we have overcome all those troubles because every relay station can be worked off the high-powered station, and relay stations can be given the London programme, which I submit, with all deference, is probably through force of circumstances the best programme. Thus the present disadvantage of simultaneous is done away with and all the advantages secured.

Lastly it is a question of national pride. France will be erecting such a station; are we to be behind? If we are successful in our experiments, British broadcasting will stand supreme and unique throughout the world, and even the most captious critic will find little to complain of. This indeed is looking ahead, for the high-powered station is not yet, not a single turn of inductance has been wound, not a valve has been bought, not an aerial erected; the whole scheme depends entirely upon the success or otherwise of the experiments.

We are hoping to have the co-operation of all wireless amateurs in our experiments, and we are hoping that they will give us data to enable us to determine the all-important question as to whether this contemplated addition to our service will interfere with the present service. If it can be proved and substantiated that whatever we may do to eliminate harmonics and so on that the powerful station we have in contemplation will interfere with or upset the present station in any way, we shall be the first to condemn the scheme as impracticable, and we shall have to think over other methods of overcoming the bugbear of interference, cross-talk and induction on simultaneous, the difficulties of feeding

relay stations and the claims of the majority in England who have not yet been adequately served with broadcast. Dwellers in the towns have infinite distractions for the evenings, and broadcast for them is supplementary to all these. Perhaps your readers have not realised what an incalculable boon broadcasting may convey to those who are condemned to spend long dreary evenings in the country without the possibility of distraction of any sort. The high-powered station is additional to the present service, and will bring in all those not adequately served at present. Must it be said that those who are satisfied at present have for purely theoretical and recondite reasons denied to others their right to enjoy broadcasting? Must it also be said that a few manufacturers, traders and others are evidencing short-sightedness in any uneasiness they may have, cutting their noses to spite their face. We are opening up to them, if and when this high-powered station gets going, a market greater than they have ever had before.

Remember, it is all problematical as to whether the station will be built. We are only going to experiment, and much will still have to be done, even if these are successful, before the actual scheme is approved.

INSTITUTION OF ELECTRICAL ENGINEERS.

Further Discussion on Loud Speakers.

At a joint meeting of the Institution of Electrical Engineers and the Physical Society on Thursday, February 14th, there was a resumption of the discussion on loud speakers, which was commenced on Thursday, November 29th.

The resumed discussion was opened by **Sir Richard Paget**, who said that the ideal reproducer of sound must be sensitive to frequency changes, and it must be free from any resonance caused by this or that component. The vice of the horn was not the fact that the horn has resonance of its own but that when resonances come along the horn makes such a fuss about them. The ideal reproducer must also faithfully repeat rapid changes in amplitude as well as rapid changes in frequency. Audibility was almost entirely a matter of diction, that is to say, faithfulness in reproduction of the higher frequencies.

Mr. B. S. Cohen, who spoke next, said that many of those present would probably remember an experiment by Sir Oliver Lodge in the early 1900's, in which excellent results were obtained with what was probably the first loud speaker. Although certain changes had been made in more modern loud speakers, for commercial purposes, they had not been particularly advantageous from the point of view of efficiency. His own definition of a perfect loud speaker was one in which the ratio of acoustic input to acoustic output is 1 at all frequencies and amplitudes and all combinations of frequencies. He then demonstrated an apparatus which he has devised for measuring frequency and for indicating resonance peaks in the receiver circuit.

Mr. G. H. Nash put in a strong plea for the horn receiver. He commented upon the fact that Prof. Rankine had said, on the occasion of the previous meeting, that we should avoid the horn because of its resonance, and Capt. Eckersley had also said that the hornless receiver had certain important advantages, chief of which was that it brings out a low frequency, but he also mentioned that it is extremely inefficient. If efficiency was to be obtained it was necessary to put in more valves. On the other hand, he contended that the horn type of loud speaker is a perfectly natural amplifier. He showed a curve illustrating the permissible distortion on loud speakers to obtain good speech, and added that many of the horn types operated with much less distortion than this permissible amount shown.

Captain H. J. Round said that if one takes arbitrarily any microphone and attempts to magnify the resulting currents from that instrument, one is led to recognise very quickly the limitations of one's amplifying apparatus. A valve amplifier could be said to have certain peak voltage limits. By increasing the size and power of valves this voltage limitation could be increased, but there was one place in the system where this cannot be done economically, and that was the place where the maximum power is used, *i.e.*, in the wireless transmitter. The consideration of this effect was exceedingly complex. The natural sounds which it was desired to transmit had all sorts of peak amplitudes at all sorts of frequencies, and the question was the basis which should be adopted for transmitting these different frequencies. On the microphones and amplifiers now in use it was possible to make a very large number of changes in the way the frequencies are represented. Probably before long it would be possible for the N.P.L., or the B.B.C. to give us some frequency strength standard, and then the difficulties would be less. This subject had an important bearing upon the loud speaker problem.

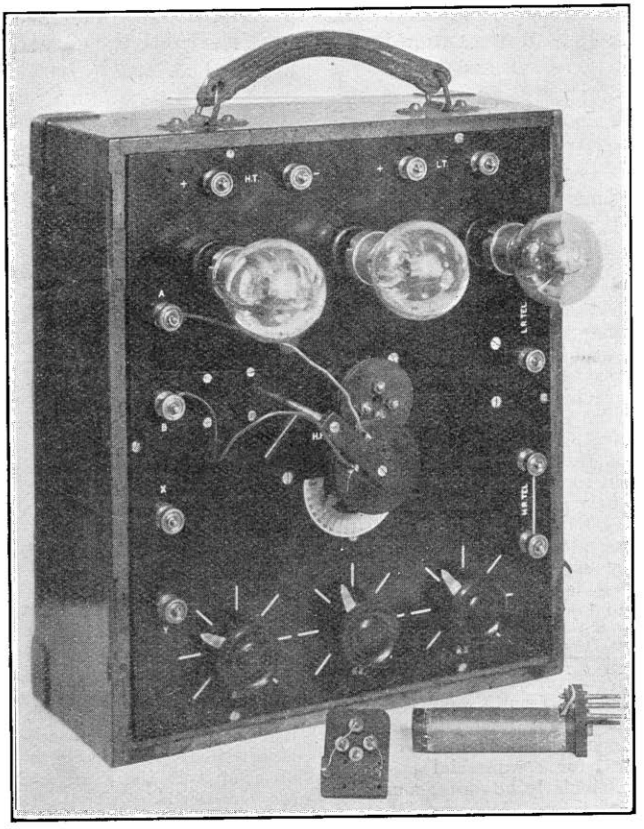
Other speakers devoted attention to the type of valve suitable for loud speaker reproduction, and discussed whether it was better to employ sufficient energy to operate a less sensitive but more faithful loud speaker, or to limit the electrical amplification and make up for this by the mechanical amplification to be obtained by the employment of a horn.

A UNIVERSAL RECEIVER.

(*Continued from page* 685 *of previous issue.*)

To turn to the amplifier. The three valve sockets are seen at the top of the panel, and the controlling filament rheostats at the bottom. It is, of course, essential for the valves to be fitted with separate filament control, as each valve may require a particular filament current.

The valve holder seen in the centre of the panel receives the plug-in type of transformer, and the condenser immediately below it, has a value 0·00015 mfd., which tunes the primary of the transformer. The value of this condenser may be up to 0·0002, but not larger. A larger value will cover a wider band of wavelengths at the expense of signal strength. Various transformers can be made up and plugged in to suit any wavelength band. The circular type of intervalve transformer is still very popular, but if built by the experimenter, a good deal of testing and readjusting may be necessary in order to obtain the best result over the required range of wavelengths. A really efficient transformer for short-waves (350 to 570 metres) can be made up by winding a $1\frac{1}{8}$ in. ebonite former with a single layer of 300 turns of No. 38 S.S.C., and overwinding this with a second similar single layer separated with a piece of insulating empire cloth.

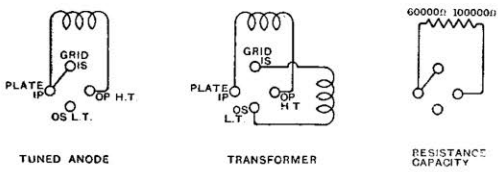


The H.F. and L.F. amplifying and detecting unit for use with the tuner already described. Another H.F. transformer and the long wave resistance H.F. amplifier are also shown.

On no account should the windings be treated with paraffin wax or shellac, as this will considerably increase the self-capacity of the windings, thereby altering the tuning range and reducing signal strength. The ends of the turns can be brought out to a suitable base on which four valve legs are mounted. The connections for the transformer are taken to the valve pins as shown in an accompanying figure.

For substituting the tuned anode method of coupling, a suitable base must be made up with four valve legs and a coil holder and the connections picked up as indicated. The anode coil when in this position is tuned by the transformer condenser. For long wavelengths (2,000 metres and upwards) it is quite unnecessary to make use of the transformers or anode inductances, for good amplification can be obtained by the resistance capacity method of high frequency intervalve coupling. The

connections necessary for a plug-in unit used to replace the transformers are also given. The transformer and anode tuning condenser should be set at the minimum position when the resistance coupling unit is made use of. The anode resistance varies from 60,000 to 100,000,



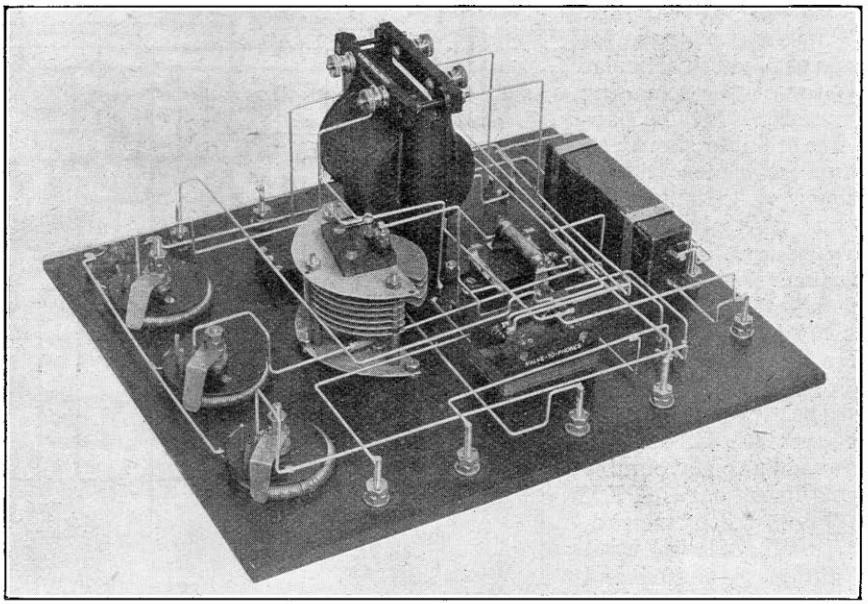
Connections of plug-in units for interchanging tuned anode, transformer and resistance capacity H.F. amplification.

depending on the type of valve and the value of the H.T. battery employed. The resistance unit may consist of a small ebonite panel just a few square inches in area and carrying the valve legs and clip in anode resistance of the type which is specially manufactured for this purpose. Alternatively a pencil line made in a groove in the ebonite will serve as a suitable leak. The pencil line can be rubbed away until the maximum signal strength is obtained.

Reaction for short waves is obtained by coupling a coil of say 30 turns to the transformer or anode coil. The writer uses transformers and the reaction coil is wound in a circular slotted ebonite former mounted on a spindle with handle and the requisite coupling is obtained by moving the coil over the transformer. This method makes tuning sharp, and together with loose coupling of the aerial and closed circuit coils, interference can usually be eliminated. An instance of this can be given. The writer's station is situated within a mile of **2 LO**, and yet Birmingham or Newcastle can be tuned in and distinguished, whilst the nearby station is transmitting, although the same of course cannot be entirely cut out.

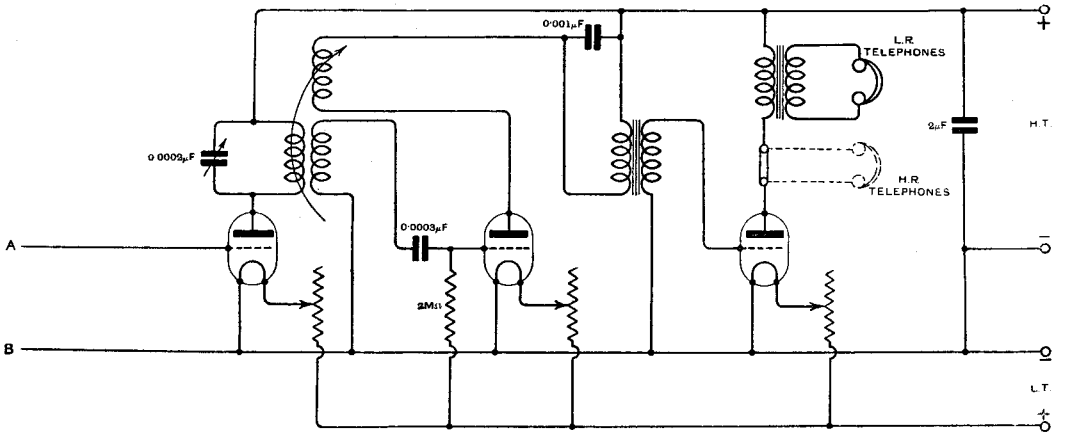
The grid leak is connected to L.T.+, which allows the resistance capacity and tuned anode couplings being used without further altering the circuit.

The H.T. bypass condenser is of 2 mfds. capacity, and in general should not be less than 0·5 mfds.



Underside view of panel. It is interesting to note that even the plates of the variable condenser are home-made.

The wiring of the amplifier must be carefully carried out, and in particular grid leads and all other leads in the high frequency side should be short and kept as far away as possible from others. It is better

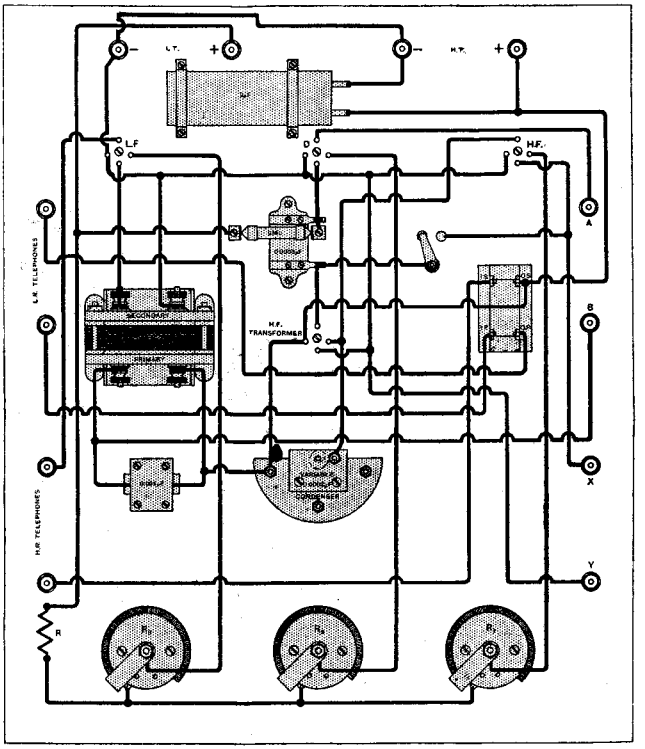


Circuit of amplifying and detecting unit.

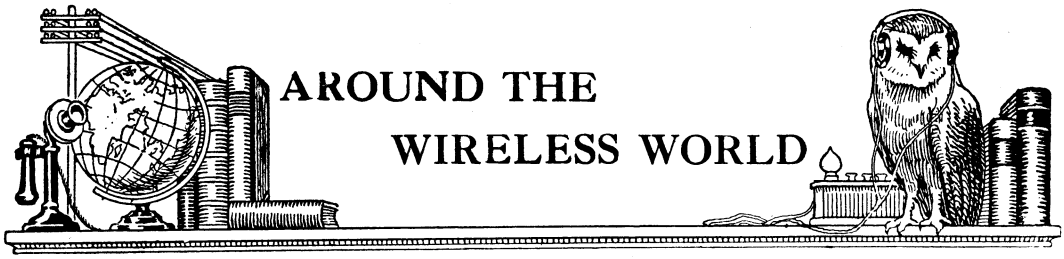
to use a stiff wire such as No. 16, as this does not sag and requires no insulating sleeving.

Mention might be made of the necessity of paying particular attention to the insulating materials used in valve apparatus. The ebonite should be of the very best grade and well rubbed down. Cheap valve sockets may also be looked upon with suspicion.

In conclusion the writer would add that a well-made three-valve set is quite powerful enough for all experimenters who wish to get long distance stations. The set herein described receives all B.B.C. and American broadcast on favourable nights. On long waves **PKX** (Malabar, Java, 8,800 metres), as well as the long wave American stations Arlington and Annapolis can be tuned in.



Practical wiring as viewed from the underside of the panel.



Broadcasting in Ceylon was inaugurated on February 22nd, when a programme was transmitted from Colombo.

* * * *

Wireless receiving apparatus is being installed at the Lancashire Constabulary headquarters at Preston.

* * * *

H.R.H. The Prince of Wales is to broadcast a speech from **2 LO** at nine o'clock on March 18th, on behalf of the British Empire Exhibition.

* * * *

The question of an International Wireless Conference is to be discussed at the 28th session of the League of Nations, which will probably be held at Geneva on March 10th.

* * * *

The B.B.C. has decided to re-transmit programmes from **KDKA** every Saturday night at 11 o'clock until further notice.

* * * *

Transmitting Records.

Mr. Gerald Marcuse **(2 MN)**, referring to his letter in our last issue, in which were given particulars of the number of American and Canadian amateurs worked by members of the Committee of the Radio Transmitters' Society, states that further successes have now been obtained. **2 OD** has now worked 24 Americans and Canadians; **2 KF**, 21; **2 SH**, 14; and **2 MN**, 12.

During the last ten months Mr. W. E. F. Corsham **(2 UV)** of Harlesden, N.W.10, has worked with 175 amateur transmitters. This number is made up of 135 British (85 beyond a 20 miles radius), 14 foreign and 26 British (unlisted).

Having no mains or generator supply, **2 UV** relies on H.T. dry cells, obtaining antenna currents from 0·1 to 0·15 amperes.

Two-Way Working with Denmark.

In addition to working with **7 EC** (Copenhagen) on January 6th, Mr. James Croysdale **(5 US)**, of Burley-in-Wharfedale, Yorks, has effected two-way communication with the Danish stations **7 QF** and **7 ZM**. The latter has been worked in broad daylight with an antenna current of 0·4 amperes.

Glasgow's Educational Broadcasting Scheme.

The Glasgow Education Authority has almost unanimously approved of a scheme of educational broadcasting, and for the benefit of schools in the Glasgow area, lectures are to be transmitted on such subjects as musical appreciation, Scottish history, science and French. The proposal is that lectures will be broadcast only one day per week between 3 p.m. and 4 p.m. The cost of installing receiving equipment will be borne for the most part by the schools and it is understood that the sets will be constructed or assembled by the pupils themselves.

This admirable scheme, which promises every success, might well be adopted by education authorities throughout the land. The experiment will be watched with great interest.

Two-Way Communication with the Continent.

With the small transmitting power of 3.5 watts, Mr. Alfred D. Gay **(6 NF)** of West Norwood, has successfully worked **8 CT** of Bordeaux. **8 CT** was received at a strength of R7 on a two-valve set.

6 NF has also worked with Luxembourg, **1 JW**, who reported his signals weak but readable.

New Radio Society

A new society for the study of wireless problems has been formed under the name of "The Board of Radio and Scientific Research." The Hon. Secretary's address is 132, Handcroft Road, West Croydon, Surrey.

Broadcast Reception on Trains.

Another successful experiment in receiving broadcasting on an express train has been carried out, this time by the Great Western Railway.

A six-valve set was installed in a brake-van of the 4.10 p.m. Paddington to Birmingham express on February 21st, and the programme from **2 LO** was clearly received 60 miles from London. Birmingham was then tuned in with equal success. The tests were continued on the 8.10 express from Birmingham to Paddington, and Bournemouth's programme was received with perfect clarity on the telephones, without interference from external noises.

Signals from the McMillan Arctic Expedition.

In our issue of February 20th it was stated that no British amateur had received signals from the *Bowdoin* **(WNP)**, the ship of the McMillan Arctic Expedition. We are interested to learn, however, that Mr. J. H. Ridley, of Messrs. Burndept, Ltd., succeeded in tuning in **WNP** on 218 metres in November last.

The Ideal Home Exhibition.

Demonstrations by the British Broadcasting Co. are a regular feature at the *Daily Mail* Ideal Home Exhibition, now being held at Olympia, London, W. In order to give visitors an insight into the methods of broadcasting, a special series of short, popular lectures is being provided in the Demonstration Hall.

The wireless trade is represented by four well-known firms, whose stands should not be overlooked by wireless amateurs and broadcast listeners.

A New Wireless Film.

For the purpose of educating the public in the manipulation of valve receiving apparatus and the operations involved in the transmission and reception of broadcasting, a rather clever film has recently been introduced by the General Electric Company.

After showing how the sound waves at the transmitter create modulated ether waves, and how these ether waves are converted to sound waves by the receiving apparatus, the film depicts the announcer and artists at **2 LO** carrying out their duties, and indicates the great pleasure which the family circle can obtain by the installation of suitable receiving apparatus. Of interest in the film also are views of the General Electric Company's works at Coventry. The method of assembly of the receiver and its wiring is very interesting, and the wireless amateur will no doubt very closely watch the method by which jigs are used for shaping wire for the internal connections.

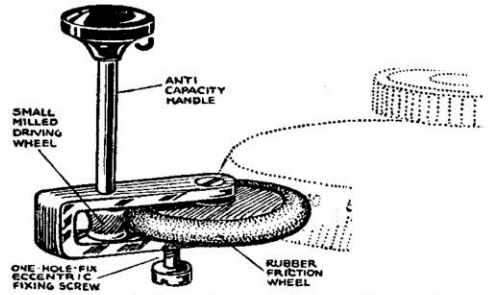
We understand that the film will shortly be released for public exhibition.

A Manchester Transmitters' Society.

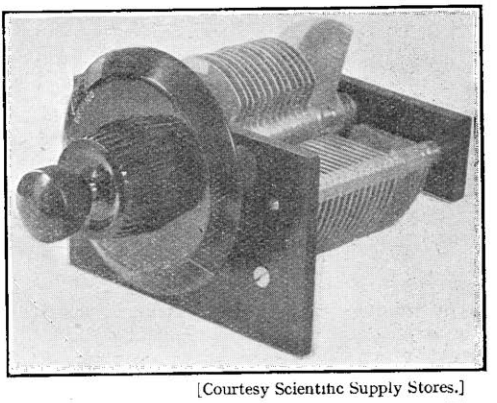
Amateur transmitters in the Manchester area are invited to join the Radio Transmitters' Society, which has just been formed in that city. The membership already numbers nearly 50, and it is hoped that this figure will be considerably augmented at the next extraordinary general meeting, which is to be held at 7.30 p.m. on March 11th, at the Grand Hall, Aytoun Street, Piccadilly, Manchester. The Hon. Secretary is Mr. W. R. Burne **(2 KW)** of Springfield, Thorold Grove, Sale. It is understood that the Society will work in close touch with the Radio Society of Great Britain.

Transatlantic Amateur Working.

Mr. H. L. Bowen **(6 RY)** of Bath, reports that he successfully established communication with **1 XAR** on the night of February 15th, and with **1 CMP** in the early morning of the 19th. The latter station is situated at Bridgewater, Mass.



A new and useful vernier attachment for condensers, known as the "Fynetune" micro-adjuster.



[Courtesy Scientific Supply Stores.]

The use of square law condensers is rapidly gaining favour among experimenters, and to meet the present demand the condenser shown above has recently come on to the market. It is fitted with a vernier, which is a useful refinement.

R.A.F. Seeks Wireless Operators.

In spite of the popularity of amateur radio, the Royal Air Force is experiencing difficulty in obtaining skilled operators. During the present year a special effort is being made to recruit 250 operators who will be given the rank of Leading Aircraftman or Aircraftman (First Class) according to the skill shown. Full particulars, including information concerning marriage allowances, can be obtained from the Air Ministry.

Forthcoming Events.

WEDNESDAY, MARCH 5th.

Institution of Electrical Engineers (Wireless Section). At 6 p.m. (light refreshments at 5.30). At Savoy Place, Victoria Embankment, W.C.2. Lecture: "Development of the Bellini-Tosi System of Direction-Finding in the British Mercantile Marine." By Commander J. A. Slee, C.B.E., R.N.(Ret.), Member.

Edinburgh and District Radio Society. At 8 p.m. At 117, George Street. Business meeting.

Golders Green Radio Society. At 8.30 p.m. At the Club House, Willifield Way, N.W.11. Exchange and Mart of Surplus Apparatus.

Clapham Park Wireless and Scientific Society. Lecture, "Wave Motion." By Mr. J. G. Hurst.

Hampton and District Radio Society. Lecture: "Wavelength Measurement." By Mr. Dye, B.Sc.

Tottenham Wireless Society. At 8 p.m. At 10, Bruce Grove, N.17. Monthly Business Meeting. Lecture: "Elimination of Interference in Wireless Reception." By Mr. F. E. R. Neale.

North Middlesex Wireless Club. At Shaftesbury Hall, Bowes Park, N. Exhibition and Sale of Instruments.

THURSDAY, MARCH 6th.

Sale and District Radio Society. At 37, School Road. Lecture by Mr. G. R. Lewis.

FRIDAY, MARCH 7th.

Radio Society of Highgate. At 8 p.m. At Edco Hall, Archway Road. Lecture: "Television." By Mr. A. N. Browning.

Sheffield and District Wireless Society. At 7.30 p.m. At the Department of Applied Science, St. George's Square. Elementary Class.

Wimbledon Radio Society. Lecture: "Reflex Circuits." By Mr. Milton Ayres, A.M.I.E.E.

MONDAY, MARCH 10th.

Ipswich and District Radio Society. At 55, Fonnereau Road. Open Night.

Dulwich and District Wireless and Experimental Association. Lecture: "Construction of the Thermionic Valve."

Sale and District Radio Society. At 37, School Road. Open Discussion and Experimental Work.

Calls Heard.

Contributors to this Section are requested to limit the number of calls sent in to those heard within the previous three weeks, these being of greater interest and value to transmitters than earlier records. The repetition of the same call sign in consecutive lists is not recommended. Contributors will also assist by kindly arranging their reports in alphabetical order.

Arundel, Sussex.
2 AA(?), **2 BZ, 2 IL, 2 KA, 2 KS, 2 OM, 2 QL, 2 SZ, 2 XL, 2 WZ, 2 XX, 5 AK, 5 BT, 5 CC, 5 CS, 5 IO, 5 KO, 5 HL, 5 MC, 5 OK, 5 SL, 5 SZ, 5 SU, 5 UA, 6 AO, 6 BF, 6 FF, 6 HS, 6 NH, 6 ON.** (1—v—1.) (J. B. Robertson.)

Margate.
2 AC, 2 JF, 2 JX, 2 MC, 2 PZ, 2 UV, 5 BT, 5 GT, 5 HI. French—8 AÉ, 8 BP. Dutch—**0 KX.** Italian—**1 MT.** (Arthur O. Milne, **2 AIF.**)

Reading.
2 AO, 2 BM, 2 DY, 2 FB, 2 GG, 2 HS, 2 IO, 2 IV, 2 KG, 2 LX, 2 NP, 2 OM, 2 ON, 2 RR, 2 RY, 2 SD, 2 SH, 2 VK, 2 VN, 2 VY, 2 WD, 2 WT, 2 YR, 2 ZO, 5 BM, 5 CP, 5 FL, 5 GQ, 5 IO, 5 LF, 5 LP, 5 LT, 5 PU, 5 UA, 5 TX, 5 TI, 5 VF, 5 VL, 5 VP, 5 VR, 5 XS, 6 AW, 6 IM, 6 PF, 6 SO, 6 VO, 6 WX. (1 to 4 valves.) (Michael I. Evans.)

Louvain, Belgium.
0 FL, 0 KX, 0 MT, 0 XO, 1 MT, 4 ZZ, 5 BT, 5 MO, 8 AQ, 8 AZ, 8 BN, 8 DU, 8 DY, 8 GU(?), **8 ZA.** (o—v—o.) (A. L. Stainier.)

Belfast.
2 AO, 2 BQH, 2 DR, 2 FQ, 2 HG, 2 IL, 2 JO, *2 KT, 2 LZ, 2 MM, *2 OM, *2 ON, * 2 PX, 2 SH, 2 UV, 2 VS, 2 YQ, 2 ZT, 5 AT, 5 BT, *5 BV, 5 DN, * 5 HI, 5 HN, 5 IK, 5 JT, 5 LF, *5 LH, 5 MO, 5 NN, *5 PU, 5 SI, 5 SZ, 5 US, 6 EA, 6 NH, 6 NO, 8 AE, 8 AQ, 8 AU, 8 CF, 8 CT, 8 DK, 8 DX, 8 JL, 8 R2, 8 ZA, 0 AB, 0 KX, 0 XP, PA 9. * Heard on telephony. (3 valves.) (F. R. Neill.)

Reading, Berks.
British: **2 AH, 2 BY, 2 BZ, 2 CW, 2 DX, 2 DY, 2 FN, 2 GG, 2 GZ, 2 HC, 2 HF, 2 IJ, 2 IL, 2 IN, 2 JF, 2 JO, 2 JP, 2 JU, 2 KF, 2 KT, 2 KW, 2 LZ, 2 MM, 2 NM, 2 NP, 2 OD, 2 ON, 2 OS, 2 PG, 2 PY, 2 SQ, 2 SX, 2 TF, 2 TQ, 2 TV, 2 UV, 2 VS, 2 WK, 2 XI, 2 XR, 2 XZ, 2 YQ, 2 ZG, 2 ZS, 5 AT, 5 BA, 5 BV, 5 DT, 5 DU, 5 FD, 5 GL, 5 HI, 5 IO, 5 IP, 5 JX, 5 KO, 5 KZ, 5 LP, 5 LU, 5 MO, 5 OT, 5 OX, 5 PS, 5 RB, 5 RZ, 5 SD, 5 TZ, 5 UC, 5 US, 6 BV, 6 DO, 6 JX, 6 NF, 6 NI, 6 OM, 6 OY, 6 RX**(?), **6 RY, 6 SO, 6 TM, 6 QZ, 6 UC, 6 WX, 6 XX, RMC.** French: **8 AB** (130 metres), **8 AE1, 8 AE2, 8 AÉ, 8 AP, 8 AU, 8 AW, 8 AZ, 8 BF, 8 BM, 8 BN, 8 BP, 8 BV, 8 CF, 8 CH, 8 CJ, 8 CM, 8 CS, 8 CT, 8 CY, 8 CZ, 8 DA, 8 DU, 8 DY, 8 ÉB, 8 JL.** Dutch: **0 AB, 0 BQ, 0 DV, 0 FN, 0 GS, 0 KX, 0 MX, 0 NY, 0 XF, 0 XP, 0 XL, 0 YS, PA 9, PCII.** Danish: **7 EC, 7 GS, 7 ZM.** Belgian: **1 RC** (Brussels). Italian: **1 MT.** American: **1 MO, 1 RR**(?), **1 ALW, 1 BDI, 1 BKG, 1 CMP, 2 AL, 2 BLP, 2 CXL, 3 TE, 3 AJL, 3 BGJ, 4 FT, 5 EV, 8 APT, 8 DA**(E?), **8 DCB, 8 CJQ.** (1—v—1.) (N. L. Yates-Fish, **5 CA**).

London, N.W.
Heard between 5 a.m. and midnight, January 6th.
British: ('phone), **2 AH, 2 DY, 2 GO, 2 KF, 2 KT, 2 ID, 2 LI, 2 LP, 2 LX, 2 MK, 2 MO, 2 NP, 2 OM, 2 PY, 2 SF, 2 SL, 2 TQ, 2 TX, 2 UU, 2 UV, 2 VH, 2 WD, 2 XZ, 2 YK, 2 YR, 2 ZK, 2 ZO, 2 ABR, 2 ABZ, 5 AR, 5 AS, 5 BT, 5 CF, 5 DK, 5 FL, 5 FN, 5 HI, 5 HY, 5 IX, 5 LP, 5 OX, 5 PD, 5 PS, 5 WN, 5 WR, 6 GT, 6 IM, 6 IV, 6 KI, 6 NF, 6 NH, 6 PF, 6 QM, 6 QV, 6 RF, 6 WF.** (Morse) **2 IX, 2 JF, 2 JP, 2 KW, 2 TB, 2 WJ, 2 ZT, 2 ZU, 2 ZX, 5 CO, 5 DB, 5 ID, 5 LZ, 5 MO, 5 OL, 5 OT, 5 UF, 5 US, 5 WM, 6 EA, 6 IZ, 6 JX, 6 OZ, 6 QZ, 6 WX, 6 XG, 6 XX.** French: **8 AZ, 8 BA, 7 BC, 8 CC, 8 CJ, 8 CS, 8 CZ.** Dutch: **0 AB, 0 BQ, 0 BS, 0 FN, 0 KX, 0 XO, 0 XP, 0 XW.** Italian: **1 MT** (strength—R.6). American: **1 ARK, 1 BDT, 1 FE, 1 MV, 1 AJT, 1 BDI, 1 CSW, 1 ATB, 1 CMP, 1 TX, 1 KC, 1 AJP, 1 AS, 2 BY, 2 CUA, 2 BXW, 3 CV, 3 BG, 3 WF, 4 FS, 4 FT, 4 TU, 4 ZBQ**(?), **6 AWT, 6 XAD, 6 LJ, 6 BR, 8 BDI, 8 BLV, 8 UF, 8 ADG, 8 DG, 8 CA, 8 CO, 8 CEI, 8 TC, 9 BP, 9 BOF, 9 DOP, 9 BAK, 9 VC.** (o—v—1.) (S. K. Lewer, **6 LJ**).

Tulse Hill, London, S.W.2.
American: **1 AA, 1 AGB, 1 AHZ, 1 AKK, 1 ALL, 1 ALW, 1 AMF, 1 ANQ, 1 AO, 1 BDT, 1 BGG, 1 BQC**(?), **1 BDI, 1 CKP, 1 CMP, 1 CPO, 1 CRB, 1 CU, 1 DQ, 1 KA, 1 LC, 1 XM, 1 YK, 1 YB,** Can. **1 BQ, 2 AAT, 2 AGB, 2 AJF, 2 ANA, 2 AOL, 2 AWF, 2 BM, 2 BSC, 2 BUQ, 2 BXP, 2 CC, 2 CPA, 2 CPD, 2 CUL, 2 CWJ, 2 DX, 2 KS, 2 NC, 3 ADB, 3 BV, 3 CY**(?), **3 MB, 3 OT, 3 PZ,** Can. **3 PG, 5 EZ, 8 ACM, 8 AFY, 8 AVL, 8 BJ, 8 BO, 8 CSE, 8 CVC, 8 DKJ, 8 FM, 8 NB, 8 DU, 9 AMP, 9 CYP, 9 ELD.** (Single-valve Reinartz.) (A. G. Wood.)

Cobham, Surrey.
British: **2 AAH, 2 AG, 2 AO, 2 CF, 2 CW, 2 DF, 2 DU, 2 GG, 2 IN, 2 IT, 2 JF, 2 KA, 2 KF, 2 KW, 2 NM, 2 OD, 2 OG, 2 CN, 2 PY, 2 SH, 2 SZ, 2 UV, 2 VS, 2 VW, 2 WJ, 5 AT, 5 BV, 5 DN, 5 DT, 5 GX, 5 KO, 5 LD, 5 LP, 5 NN, 5 PU, 5 SW, 5 SZ, 5 TO, 6 EA, 6 JF, 6 JX, 6 MO, 6 NF, 6 NH, 6 NI, 6 QB, 6 TM, 6 UF, 6 XX.** French: **8 AA, 8 AÉ, 8 AQ, 8 ARA, 8 AS, 8 AU, 8 AZ, 8 BV, 8 CD, 8 CJ, 8 CS, 8 CT, 8 CZ, 8 DU, 8 JL, PAR 14**(?). Dutch: **, FN, 0 KX, 0 MX.** Danish: **7 ZM.** Italian: **1 MT.** American: **1 AUR, 1 CMP, 1 YBM, 2 AL, 2 BLP, 2 BSC, 2 BQS, 2 EL, 3 AC**(?), **3 CO, 4 CT, 4 IO, 8 CO**(?), **8 CXX** (?), **9 BED, 9 CET, 9 COL, 9 DZY, 9 UZ.** (2 valves.) (E. J. Martin.)

Heswall, nr. Birkenhead.
2 DF, 2 FN, 2 GF, 2 HF, 2 IL, 2 IJ, 2 JP, 2 MG. 2 OM, 2 OS, 2 PP, 2 RH, 2 SB, 2 UF, 2 VU, 2 WN, 2 YX, 5 AY, 5 BF, 5 BV, 5 CX, 5 FD, 5 FW, 5 GB, 5 IK, 5 KC, 5 LO, 5 MO, 5 MU, 5 NN, 5 OT, 5 PK, 5 PQ, 5 SI, 5 SW, 5 UU, 5 XI, 6 BY, 6 HS, 6 IL, 6 JQ, 6 KB, 6 KK, 6 LC, 6 LF, 6 LR, 6 LY, 6 OB, 6 RF, 6 RW, 6 RY, 6 TD, 6 UC, 6 XG, 8 AD, 8 AG, 8 AZ, 8 BP, 8 BU, 8 CD, 8 CF, 8 CJ, 8 CM, 8 CT, 8 CZ, 8 DA, 8 ÉB, 8 JP, 8 JL, 8 LY, 8 RJ, 8 US(?), **0 MX, 0 KS, 0 YS, 0 BS, 0 ZZ, 1 MT.** (1—v—1 or 1—v—o.) (I. Auchterlonie, **6 OM.**)

Brixton Hill, London, S.W.2.
2 AU, 2 AH, 2 CU, 2 IJ, 2 RB, 2 RT, 2 TM, 2 TR, 2 TT, 2 TZ, 2 ZE, 2 ZM, 2 ZU, 5 BK, 5 CS, 5 DN, 5 GX, 5 HA, 5 HI, 5 ID, 5 MJ, 5 OT, 5 OX, 5 PD, 5 RF, 5 RZ, 5 UC, 6 BQ, 6 DS, 6 EA, 6 GO, 6 IH, 6 MZ, 6 NF, 6 OM, 6 QA, 6 QB, 6 QV, 6 RS, 6 TM, 6 TS, 6 UD, 8 AQ, 8 AW, 8 AZ, 8 BF, 8 BE, 7 BU, 8 BV, 8 CF, 8 CH, 8 CD, 8 CE, 8 CZ, 8 CS, 8 DD, 8 DY, 8 DA, 8 DZ, 8 EB, 8 ED, 8 R2, 8 YD, 8 ZS, 8 ZM, 2 AAZ, 2 OJA, 2 CFN, 0 FN, 0 NY, 0 AB, 7 MO, FGH. (o—v—o) (A. Richardson.)

Ascot, Berks.
British: **2 AZ, 2 BT, 2 BZ, 2 DL, 2 DX, 2 FN, 2 GG, 2 GL, 2 GO, 2 GZ, 2 HS, 2 ID, 2 IN, 2 JA, 2 JF, 2 JL, 2 JM, 2 JO, 2 KS, 2 KT, 2 KV, 2 KW, 2 LW, 2 LZ, 2 MF, 2 MK, 2 NM, 2 OD, 2 OJ, 2 OM, 2 ON, 2 OS, 2 PR, 2 PY, 2 QL, 2 QM, 2 QQ, 2 SH, 2 SI, 2 SL, 2 SM, 2 SQ, 2 ST, 2 SX, 2 SZ, 2 TQ, 2 UV, 2 VH, 2 VJ, 2 VN, 2 VT, 2 WJ, 2 WK, 2 WW, 2 XB, 2 XC, 2 XH, 2 XI, 2 XL, 2 XO, 2 XR, 2 XZ, 2 YM, 2 YR, 2 YX, 2 ZK, 2 ZL, 2 ZO, 2 ZZ, 5 AT, 5 BS, 5 BV, 5 BW, 5 CB, 5 CO, 5 CP, 5 CQ, 5 DK**(?), **5 DM, 5 DN, 5 DT, 5 GA, 5 GP, 5 GS, 5 HW, 5 HY, 5 II, 5 IO, 5 IS, 5 IX**(?), **5 KI, 5 KO, 5 KS, 5 LF, 5 LP, 5 NN, 5 OP, 5 OX, 5 PS, 5 PU, 5 PX, 5 QV, 5 RB, 5 RZ, 5 SU, 5 TB, 5 UL, 5 VD, 5 VH, 5 VI, 5 VM, 5 VO, 5 VR, 5 VT, 5 WR, 5 XC, 5 XR, 5 XY, 5 YX, 6 AH, 6 BV, 6 BX, 6 GB, 6 GZ, 6 IM, 6 IY, 6 KI, 6 KO, 6 NI, 6 OD, 6 PD, 6 PS, 6 PT, 6 PX, 6 QZ, 6 WM, 6 WX, 6 XX.** French: **8 AÉ, 8 AH, 8 AS, 8 AQ, 8 AZ, 8 BÉ, 8 BF, 8 BM, 8 CS, 8 CK, 8 CT, 8 ÉB, 8 ES, 8 LS, 8 LY, 8 RD.** Dutch: **9 PA, 0 AB, 0 AR, 0 BQ, 0 KB, 0 MX, 0 YS.** Italian: **1 MT.** American: **1 CMP, 1CX, 1 JW.** (1 to 4 valves, 1 H.F.). (F. Charman.)

Djarsholm, near Stockholm, Sweden.
1 MT, 2 FN, 2 IN, 2 NM, 2 ON, 2 RB, 5 AT, 5 CC, 5 KO, 5 NN, 5 PU, 6 NH, 6 NI, 6 RY, 6 XX, 7 EC, 7 GF, 7 ZM, 8 AU, 8 ARA, 8 AZ, 8 BE, 8 BF, 8 CC, 8 CH, 8 CZ, 8 ÉB, 8 YL, 8 LY, 0 BS, 0 DV, 0 YS, ACD. (1 valve Reinartz.) (Goeran Krase.)

40 miles N.W. of Barcelona (January 24th).
2 AC (Metropolitan Vickers, Altrincham). (Burndept Home-constructor Receiver.) (B. Hastings.)

Cambridge.
English: **2 AR, 2 AW, 2 CQ, 2 CX, 2 CW, 2 CO, 2 CH, 2 DX, 2 DY, 2 DR, 2 DV, 2 FK, 2 FL, 2 FF, 2 HF, 2 IN, 2 JF, 2 KF, 2 KO, 2 KT, 2 KQ, 2 LV, 2 MG, 2 MM, 2 MZK, 2 NA, 2 NAB, 2 OK, 2 OX, 2 OG, 2 PF, 2PY, 2 QN, 2 SA, 2 SF, 2 SH, 2 SB, 2 SM, 2 TF, 2 TH, 2 TW, 2 TA, 2 UV, 2 UI, 2 UF, 2 VF, 2 VO, 2 VS, 2 VD, 2 XD, 2 XP, 2 XS, 2 XR, 2 YQ, 2 ZT, 2 ZU, 5 AQ, 5 AT, 5 BS, 5 BV, 5 CQ, 5 CW, 5 CS, 5 CP, 5 DT, 5 FD, 5 FS, 5 GJ, 5 GR, 5 HL, 5 IC, 5 ID, 5 JX, 5 JP, 5 KD, 5 KO, 5 LF, 5 LT, 5 MO, 5 MJ, 5 NN, 5 OP, 5 OW, 5 OK, 5 PD, 5 PG, 5 PU, 5 PS, 5 QM, 5 SZ, 5 SI, 5 TG, 5 US, 5 WD, 5 XH, 6 AK, 6 BA, 6 BM, 6 BT, 6 DW, 6 DT, 6 EA, 6 IM, 6 PS, 6 RY, 6 SO, 6 UD, 6 XU, 6 XX, ACD.** French: **8 AA, 8 AE, 8 AS, 8 AÉ, 8 AU, 8 AQ, 8 AB, 8 AP, 8 AA, 8 ARA, 8 AZ, 8 AE1, 8 AE2, 8 BF, 8 BK, 8 BN, 8 BU, 8 BV, 8 CD, 8 CF, 8 CH, 8 CM, 8 CZ, 8 CB, 8 CO, 8 CJ, 8 CY, 8 CK, 8 CT, 8 CC, 8 DK, 8 DO, 8 DX, 8 DY, 8 DA, 8 DU, 8 DN, 8 DT, 8 EB, 8 FF, 8 JL, 8 LY, 8 LP, 8 LS, 8 LD, 8 NK, 8 PA, 8 RD, 8 R, 8 S2, 8WS, 8 WX, 8 WV, 8 YY.** Dutch: **0 AB, 0 BS, 0 CP, 0 DX, 0 FL, 0 IX, 0 KX, 0 MX, 0 MR, 0 NY, 0 PM, 0 PZ, 0 SA, 0 WS, 0 XO, 0 XW, 0 XJ, 0 YS, 0 YP, PCII, PA 9, OXA, PAOCS.** Danish: **7 EC, 7 QF, 7 QZ.** Italian: **1 JW, 1 MT.** German(?): **M 3.** American: **1 AV, 1 BDI, 1 CMP, 2 RS, 2 KQO, 2 AH, 2 GK, 2 BKW, 2 BY, 4 QF, 4 FT, 6 TE, 7 BU, 8 GZ, 9 CS.** (1—v—o.) (G. W. Thomas.)

Saint Gilles, Brussels.
2 AO, 2 AW, 2 CW, 2 DA, 2 DF, 2 DJ, 2 FN, 2 FU, 2 GG, 2 HF, 2 JF, 2 JO, 2 JZ, 2 KF, 2 KP, 2 KX, 2 LM, 2 NA, 2 ND, 2 NM, 2 OD, 2 OM, 2 ON, 2 SH, 2 TB, 2 VS, 2 WA, 2 WJ, 2 XU, 2 YK, 2 ZS, 5 BV, 5 DN, 5 JS, 5 KO, 5 MO, 5 NN, 5 SZ, 6 AA, 6 CN, 6 RY, 8 AA, 8 AB, 8 AD, 8 AE, 8 AG, 8AQ, 8 AS, 8 BC, 8 BE, 8 BL, 8 BM, 8 N, 8 BV, 8 BW, 8 CF, 8 CJ, 8 XY, 8 CT, 8 DO, 8 DU, 8 DY, 8 EA, 8 IC, 8 MX, 8 ON, 8 RCD (Grenoble), **8 TT, 8 XX, 0 BQ, 0 CN, 0 FN, 0 KX, 0 MX, 0 MY, 0 MZ, 0 NS, 0 NY, 0 PZ, 0 YS, PCII.** Italian: **1 MT, (S)MX.** (1—v—o.) (Robert Deloor.)

INTERFERENCE DURING BROADCASTING.

Below is published correspondence forwarded to us by the Radio Society of Great Britain with the comment :—

"It is customary for a great number of 'listeners-in' to blame the amateur wireless experimenter whenever they are troubled by interference with the B.B.C.'s wireless programmes. The attached correspondence published in the *Southern Daily Echo* is forwarded in the hope that it will relieve, to a certain extent, the heavy burden of blame which the experimenter is compelled to bear.

"In addition to throwing a little light where there is much darkness, the correspondence also has its humorous side."

6-2-24.

To the Editor of the *Southern Daily Echo*.

SIR,—Hundreds of listeners-in of wireless programmes in Southampton and district must have been annoyed beyond endurance last night by a would-be transmitter of Morse code, who kept up a terrible din by repeating the same two letters with a "buzzer" for at least an hour. The noise was so intense in this district that on a three-valve set working a loud speaker it could be heard distinctly several rooms away, and same in at about the same volume as the Savoy bands on the Bournemouth wavelength. This must be either the work of an amateur at close quarters, or if broadcast all over the town, must be from a very powerful set. If the owner is so ignorant of the rudiments of wireless that he is unaware of spoiling other people's reception for miles around, then he is obviously unfit to hold a transmitting licence, if he has one. Catcalls owing to oscillation have been very common of late, and have been generally regarded as the result of carelessness, but this last effort seems to prove the existence of the kind of "fiend" who delights in spoiling other people's pleasures out of pure mischief. If those who were affected last night will kindly drop me a P.C. stating the intensity with which they received the signals as compared with the Bournemouth station's output, it will be possible at least to localise the offender, and having done this, will allow the B.B.C. to deal with him as they think fit. Yours faithfully, (Signed) D. S. BAKER.

"West Brook," Millbrook Road.

7-2-24.

DEAR SIR,—I note your correspondent, Mr. Baker, has been disturbed by some powerful station sending the same two letters with a "buzzer" for at least an hour, and that he wishes to locate the offender, with a view to his being reported to the B.B.C. Well sir, the "buzzer" is a high power transmitter of probably 125 kw. (some "buzzer"), and the offender an Admiralty station. In some cases other such stations create the same so-called terrible din. They did so before broadcasting became a hobby. Probably this will save many P.C.s.

Yours faithfully, (Signed) ALBERT PARSONS.

65, Cromwell Road, Winchester.

SIR,—Re the letter in last night's *Echo*, may I be allowed to enlighten the author on a few points ?

1. The "Buzzer" was C.W. from a powerful station.
2. The two letters were P 1.
3. The Morse did not emanate from a local amateur transmitter, as they are forbidden to send during broadcasting hours.
4. The signals were received with great volume all over the town.
5. The same station was working yesterday evening (Wednesday) sending P 1, changing to P 2, and then a jumble of letters and figures, finishing with A R (end of message). No call sign given.
6. The signals were heard on every wavelength of the B.B.C.
7. When B.B.C. closed down signals ceased, and could only be received by making receiving set oscillate.

Trusting this will clear the air somewhat for Mr. Baker's enquiries. Yours faithfully, **6JW**.

SIR,—Will you permit me to thank the numerous users of wireless who sent me their experiences yesterday. Dozens of letters arrived from all parts of the town and suburbs, Totton, Hamble, Westend, etc., all giving practically the same account, that they had to close down on Tuesday night after 10 o'clock, and on Wednesday in the "Children's Hour," and after ten o'clock again. It seems pretty evident therefore, that the trouble came from outside the town on the high-power set.

Your correspondent, Mr. Parsons, of Winchester, judging by the tone of his letter, is either a transmitter, or has some technical knowledge of these matters, and seems to be uncannily certain of his own deductions. He seems to have overlooked enlightening us as to the main factor in the situation, however, viz., why, if the signals came from an Admiralty station, no call sign was used, and under what conceivable circumstances an Admiralty station would send out a repetition of 1 P's for hours at a stretch.

However, having focussed attention on this matter the full weight of the evidence has been transmitted to Bournemouth for the B.B.C.'s perusal, together with the suggestion that some unauthorised person may have gained access to a high-powered set between hours. They will no doubt take such action as they think fit to prevent a repetition of the nuisance if they have not already done so, as I note there was no interference yesterday.

Thanking you for your valuable help in this matter.

Yours faithfully, (Signed) D. S. BAKER.

"West Brook," Millbrook Road. 9-2-24

SIR,—May I again beg space to enlighten numerous amateurs with regard to the interference they have had to contend with within the last few days.

It is the custom of high power stations to measure "field strength" etc., at certain periods with a view to gaining further knowledge of the behaviour of waves radiated, absorption factors, harmonic phenomena and the like. This, of course, needs more than one station, the chief of which is the transmitter. It may be also that a new type of transmitter required testing. This necessitates the station sending for a given period. For different wavelengths and powers different symbols are used, the one we have heard being P 1 (P one).

This symbol was sent out by a station which did give a call sign namely, "**BYC**," hence "**BYC**" has been experimenting again, and we, through being in close proximity to such a high powered station, have been the victims of harmonic interference. As an experimenter I find great pleasure in trying to devise some means whereby these harmonic effects may be eliminated during such tests as we have just experienced.

Who knows but what these experiments were being carried out for the benefit of amateurs in the future ?

Yours etc., (Signed) ALBERT PARSONS.

65, Cromwell Road, Winchester.

11-2-24.

SIR,—The thanks of all wireless enthusiasts are due to Mr. Baker for focussing and consolidating attention in the proper quarter to the recent disturbances. It is only by prompt and energetic action that this sort of thing can ever be eradicated and wireless made enjoyably possible. If an Admiralty station was at the bottom of the trouble as per Mr. Carter's suggestion, the B.B.C. will no doubt arrange with them in future to try new apparatus at some other time than during the few hours that thousands, probably millions, of people are enjoying a harmless amusement.

Yours etc., R. M. Bassett.

Radio Society of Great Britain.

An Ordinary General Meeting of the Society was held (in conjunction with the Students' Section of the Institution of Electrical Engineers), at 6.30 p.m. on Wednesday, February 27th, at Savoy Place, W.C 2.

The chair was first occupied by Dr. W. H. Eccles, F.R.S., and subsequently by Dr. H. M. Barlow.

A practical demonstration of the applications of the "Cathode Ray Oscillograph" was given by Mr. N. V. Kipping.

At the conclusion of the demonstration and discussion the following were elected to membership of the Society :—

W. H. Reading, B. G. Bird, Associate Member I.R.E., H. J. Cooper, S. H. Batho, A.M.I.E.E., E. C. Atkinson, M.A., F.R.A.S., P. B. Holdsworth, Lt.-Col. H. McK. Kirkby, M.C., D.C.M., A.C.G.I., M.I.E.E.

ASSOCIATE MEMBER :—J. E. Simpson.

ASSOCIATE :—V. S. Dolby.

The following Societies were accepted for affiliation :—

Yiewsley and District Radio Society, The Isle of Sheppey Radio Society, Maidstone and District Radio Society, and Dirksworth and District Radio Society.

WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary.
Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

Sheffield and District Wireless Society.*

On February 15th, Professor S. R. Milner, D.Sc., F.R.S., lectured on "Electrons and Protons—the Constituents of Matter." Professor Milner explained how many branches of physics, but especially radioactivity, and the study of radiation and of spectra, had increased our knowledge of the fine structure of matter. The lecturer then outlined some of the recent atomic theories, special attention being paid to that associated with the names of Rutherford and Bohr. The lecture was illustrated by a large number of apt and fascinating experiments.

Hon. Sec., R. Jakeman, "Woodville," Hope, Sheffield.

Barnet and District Radio Society.*

"Distortion in Valve Sets" was the subject of a helpful address given by Mr. J. F. Stanley, A.C.G.I., B.Sc., Hon. Sec. of the Radio Society of Highgate, on Wednesday, February 20th. Mr. Stanley dealt with the various causes of distortion when the valve is used as a high frequency amplifier, a rectifier, or as a low frequency amplifier, illustrating his remarks with diagrams on the blackboard. He emphasised the need for care in the construction of a set, and insisted that the constructor should have a good knowledge of the characteristics of the valve in operation.

Recently, numerous Barnet listeners-in have been complaining of persistent interference by a "reactance fiend" in the district who has, on several occasions, completely ruined the broadcast concerts by allowing his set to oscillate furiously. So bad has the interference become that a local wireless licence holder has written to the Post Office on the matter. At the meeting of the Society, the Secretary read a letter from the Superintendent of the Engineering Department of the Post Office, who called attention to the complaint, and invited the Society to co-operate with the Post Office in the detection of the offender. Several members spoke strongly on the matter and, by a unanimous vote, it was decided that the Society should give every possible assistance to the authorities. The members have completed a scheme whereby they may detect the position of the offending station.

Hon. Sec., J. Nokes, "Sunnyside," Stapylton Road, Barnet.

The Ilford and District Radio Society.*

On February 7th, Mr. Phelps described and demonstrated the "Neon Tester." This is a device making use of the characteristics of the well-known neon tube. Many condensers, grid leaks and anode resistances were tested, yielding some most alarming results. Grid leaks which were reputed to have a value of 2 megohms, were, when compared against a standard, found to have a resistance in the neighbourhood of 12 megohms. Small fixed receiving condensers were found to differ by 500 per cent. from their stated capacity.

On the whole, the impression gained was that some of the manufacturers whom amateurs have been prone to rely upon for products of unquestionable accuracy, would do well, even in these days of "broadcasting booms," to pay more attention to quality than to quantity!

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

The Northampton and District Amateur Radio Society.*

A most interesting lecture on "Wireless Transmission" was given by Mr. A. J. Smith, on January 18th.

The lecturer gave a brief account of the evolution of Wireless transmissions from the spark system to the first generation of continuous waves by the Poulsen arc.

It was interesting to hear that Northampton was the scene of one of the early attempts of speech transmission by wireless before the war.

His claims for the very great mechanical perfection reached by the Alexanderson high frequency generator caused much discussion at question time. It was explained how this type of generator was restricted to the production of relatively long wavelengths.

The transmitting set constructed and used by the chairman of the Society, Mr. A. E. Turville (**2 XG**), was on view and evoked much interest and admiration.

Any information required concerning membership of the Society can be had from the Secretary, S. H. Barber, 51, College Street.

Golders Green Radio Society.*

On Wednesday, February 20th, the Society was honoured with a visit from Mr. J. H. Reeves, M.B.E., who spoke at some length on the subject of "Fine Wire Coils as an Aid to Definition," and drove home his points very forcibly to a keenly interested audience by a practical demonstration.

He tuned in several of the Broadcasting stations (separating them perfectly with a rejector circuit), and the difference in definition was most noticeable as Mr. Reeves changed from 22 G in steps down to 36 G wound coils. It was also noticed that, on the finest coils, there was a marked falling off in volume.

The President, in introducing the lecturer, reminded those present that Mr. Reeves had been instrumental in getting the Society into working order, thus crowning the pioneer efforts of the Secretary and the little band of workers who laboured so valiantly to bring the Society into being.

It is interesting to note that, at an early date, it is possible that representatives of the British Broadcasting Company will pay a visit to the Golders Green Radio Society. Full particulars will be announced in due course.

Any listener who is experiencing difficulty in the operation of his or her set should get into touch with the Hon. Secretary, who will be pleased to arrange for a qualified member of the Society to give free advice and practical help.

It is hoped that every person in Golders Green and district who is enjoying the benefits of Radio will support the Society, which exists to protect their interests and to secure for them the best results of which their set is capable. The annual subscription is quite a nominal one (equalling that of a receiving licence) and full particulars of the work and policy of the Society can be obtained from the Hon. Secretary, W. J. T. Crewe, "The Dawn," 111, Prince's Park Avenue, N.W.11. (Telephone: Hampstead 3792.)

Wimbledon Radio Society.*

A very successful meeting of this Society was held on Friday, February 22nd. A member very kindly brought along a portable transmitting set, and the circuit employed and other details were fully explained.

An attempt was made to establish communication with a neighbouring station, but, owing to the fact that it was absolutely impossible to work to the time previously fixed, and also to the apparent inefficiency of the aerial-earth system available (which gave very little radiation indeed), the attempt was unsuccessful.

Forthcoming events are:—On March 7th next, a lecture on "Reflex Circuits," by Milton Ayres, Esq., A.M.I.E.E., and on March 14th next a lecture by a member of the staff of the Igranic Electric Co., Ltd., the subject and lecturer to be announced in due course.

The Hon. Sec., Mr. C. G. Stokes, is leaving London on business for the next month or so, so that all communications with regard to membership of the Society, etc., should be addressed to the Assistant Hon. Sec., P. G. West, of 4, Ryfold Road Wimbledon Park, S.W.19.

Fulham and Putney Radio Society.*

A short talk on the Flewelling circuit was given on Friday, February 15th, by the Chairman, Mr. Scanlon, whose remarks had reference to the prize competition to be held on March 14th.

Mr. Wooding afterwards gave a demonstration on a home-made block set, which was wired in about 15 minutes.

Three new members were enrolled at the close of the meeting.

Hon. Sec., B. L. Houston, 125, Hurlingham Road, S.W.

Bromley Radio and Experimental Society.

A demonstration was given by Mr. Farrance on the N.S. (non-sulphating) accumulator, on Monday, February 4th.

To demonstrate the robustness of this make of accumulator, a 90-ampere (actual) accumulator was short-circuited for three-quarters of an hour, and then recharged at 85 amps for another three-quarters of an

hour. It was then shorted again and afterwards taken apart for inspection. The plates even after this drastic treatment were in quite sound condition without any signs of buckling.

The Secretary, Mr. L. R. Stephens, 73, Mason's Hill, Bromley, will be pleased to hear from any one interested in the neighbourhood.

The South London League of Radio Societies.

At a meeting held at headquarters on February 9th, attended by the representatives of twelve of the League Societies, a long programme, dealing with finance, distribution of lecturers, and several other items was discussed.

It was decided to hold an exhibition of wireless apparatus at the South London Art Gallery, Peckham Road, on March 27th, 28th, 29th, with free admission. Details will be published later.

Hon. Sec., G. J. Price, 22, Honor Oak Park, S.E.23.

Liverpool Co-operative Radio Association.

At the meeting of the Association on Friday, February 15th, Mr. S. Frith, submitted a home-constructed portable receiving set—crystal and two valves (pre-war construction), which, including headphones, batteries, aerial wire, etc., might be carried in one half of an ordinary-sized attache case.

He explained the ingenious circuit in detail and the members exhibited keen interest in the apparatus, which has now been modernised.

Hon. Secretary, Jas. Kearns, 107, Walton Breck Road, Anfield, Liverpool.

Battersea and District Radio Society.

On January 30th Mr. Welch, technical adviser of the Fuller United Electric Co., gave an interesting lantern lecture on the Company's products. This was followed by an instructive discussion on general wireless matters.

Lecturers attend every fortnight, and all interested are invited to attend. Particulars of membership can be had from Hon. Sec., T. M. Norris, 39, Warriner Gardens, Battersea.

Honor Oak Park Radio Society.

On Friday evening, Mr. Beadle, who is an ex naval wireless operator, gave an interesting lecture on "Experimenting with One Valve," demonstrating his remarks with an ordinary one-valve set which, by means of three additional terminals could employ a great number of different circuits. The lecturer gave some valuable hints on learning Morse, and supplied details of a simple but efficient tape machine, with which the learner could read matter in Morse code at his leisure. After dealing at some length with "Transmitting on Low Power," the lecturer concluded with a demonstration of the Armstrong circuit.

Hon. Asst. Sec., H. Norris, 54, Bovill Road, Forest Hill, S.E.23.

The Radio Research Society.

At a meeting of the Society held on Wednesday, February 6th, Mr. J. V. Newson (**2 GF**) gave an interesting lecture on "Transmission," dealing with reverse feed-back, Colpitt and Hartley circuits and the ways of keying and modulating them, and concluded with an explanation of the methods adopted for utilising A.C. A large number of questions were fully dealt with, and the meeting was carried on long after normal "close-down" by an animated discussion on the subject of telephones.

Hon. Sec., Arthur H. Bird, 35, Bellwood Road, Waverley Park, Nunhead, S.E.15.

Altrincham and District Radio Society.

A meeting of this newly-formed Society was held at the headquarters (British Schools, Oxford Road, Altrincham), on February 6th. There should be ample scope for a live Society in this district, and it is hoped all interested in radio will join. The subscription is 10s. per annum and application should be made in person at the above address any Wednesday evening or in writing to the Hon. Sec., H. Daltry, 69, Sinderland Road, Broadheath.

A visit to the local station (**2 ZY**) on February 9th, was much enjoyed by all.

Stoke-on-Trent Wireless and Experimental Society.

An interesting paper, entitled "Constructional Hints," was given on Thursday, January 31st, by Mr. T. R. Clarke, who dealt mainly with the winding of multi-layer coils and the assembling of condensers. He described the best methods of winding coils to obtain the maximum efficiency, dealing with the duolateral, slab, honeycomb and pile-wound types.

Mr. Clarke gave useful data for the assembling of condensers of any capacity required, and also gave formulae for calculating the capacity.

Hon. Sec., F. J. Goodson, B.Sc., Tontine Square, Hanley.

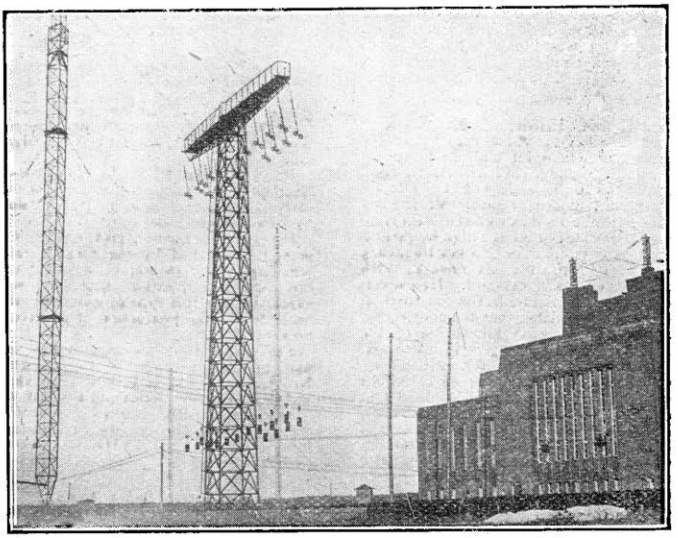
Mr. Stevenson (**5 IK**), Mr. Cross (**2 RM**), Mr. Davies (**2 PC**), Mr. Sparrow (**2 TR**), Mr. Cash (**2 GW**), Mr. Chadwick (**2 WT**) Mr. Bailey (**2 UF**), Mr. Cropper (**6 XY**), Mr. Bolt (**6 BB**).

The Hon. Secretary will be pleased to hear from all who, possessing transmitting permits, would care to join the Society, if they would write to "Springfield," Thorold Grove, Sale. The committee would especially welcome newcomers at the next extraordinary general meeting which commences at 7.30 p.m. prompt on Tuesday, March 11th, 1924, at the Grand Hotel, Aytoun Street, Piccadilly, Manchester.

It is intended to hold the meetings about once a month, when speakers will be asked to deliver lectures on subjects dear to the hearts of the transmitting amateur.

Bradford Wireless Society.

At the annual general meeting of the Society, held on January 10th, it was decided that the sum of £40 be allocated for the purchase of instruments for use of the members.



A recent photograph of Nauen, claimed to be the largest broadcasting station in the world. A new aerial has been specially erected for broadcasting purposes.

Manchester and District Radio Transmitters' Society.

The inaugural meeting of the Society was held recently at the Grand Hotel, Aytoun Street, Manchester. There was an attendance of 25. Between 15 and 20 gentlemen were unable to attend the meeting but expressed their willingness to join the Society. This gives a membership of nearly fifty, and it is hoped that all who hold transmitting permits will avail themselves of this opportunity afforded them for forming one strong Society for Transmitting Amateurs in the Manchester district.

The following officers were appointed: Hon. Sec., Mr. W. R. Burne (**2 KW**); Assist. Hon. Sec., Mr. A. Rainford (**6 IK**); while the duties of the Hon. Treasurer and Chairman were entrusted to the able care of Mr. W. C. Barraclough (**5 AJ**).

The following gentlemen were asked to serve on a temporary committee:—

The election of the officers and committee for 1924 was carried out, and the meeting closed with a vote of thanks to the retiring officers.

On January 24th considerable discussion took place with regard to the provision of new premises for the Society.

This was followed by a very interesting lecture on "Frame Aerials," given by Mr. L. C. Watson, in the course of which the design and construction of these aerials were ably dealt with.

At a meeting of the Society held on February 7th, Lieut. Burbury, R.N., described the apparatus used at Station **2 AW**. The interesting details of the supersonic receiver used for short wave work, and the Colpitts transmitter were made extremely clear by means of blue-prints, which were distributed to the members.

Hon. Sec., S. R. Wright, 14, Bankfield Drive, Shipley, Yorks.

Questions & Answers
Solutions of Readers' Difficulties

1. *All questions are answered through the post. A selection of those of general interest is published.*
2. *Not more than four questions may be sent in at any one time.*
3. *Every question should be accompanied by a postal order for* **1/-**, *or* **3/6** *for four questions, and by a coupon taken from the current issue.*
4. *A free coupon appears in the first issue of each month, and if this is sent in together with coupons from the three previous issues, the reader is entitled to have one question answered free of charge.*

"*E.J.M.*" (*Grimsby*) **refers to the diagram of the resistance capacity coupled L.F. amplifier given on page 37 of the issue of October 10th, 1923, and asks if the voltage applied to the detector valve will not be excessive.**

The D.C. voltage applied to the detector valve will depend on the ratio of the filament-plate resistance of the valve to the resistance in the external plate circuit. Assuming that these two resistances are equal, the voltage applied to the detector valve will be half the voltage of the amplifier H.T. battery.

"*E.J.W.*" (*London, S.E.*10) **asks for a diagram of a three-valve receiver with one stage of H.F. amplification, tuned anode coupled to a valve detector, and one stage of L.F. amplification.**

The circuit is given in Fig. 1. The aerial circuit is tuned by a 0·001 μF. condenser in series, and is inductively coupled to the receiver. It is recommended that the 2 MΩ grid leak be connected to + L.T., as better rectification is often obtained by this means.

"*F.N.C.*" (*London, S.W.*2), **having rewired his receiver, is troubled with interference from A.C. mains which did not cause trouble when the original set was in use. He also finds that the aerial circuit will not tune properly, and that signals from 2 LO are received just as well without an aerial coil. The wiring has been checked and found to be correct.**

We recommend that you examine the internal connections of the tuning condensers, coil plugs etc., as there is obviously a break somewhere in the aerial circuit. The interference now experienced from the A.C. lighting mains, if not actually due to the break in the aerial circuit, may be due to the stray field picked up by the cores of the intervalve transformers if the receiver happens to be placed near wires running behind the wall.

"*R.G.L.*" (*Whitley Bay*), **asks whether it would be possible to construct a frame aerial of metal if the turns were carefully insulated from the frame.**

Metal should not be used for the frame, as

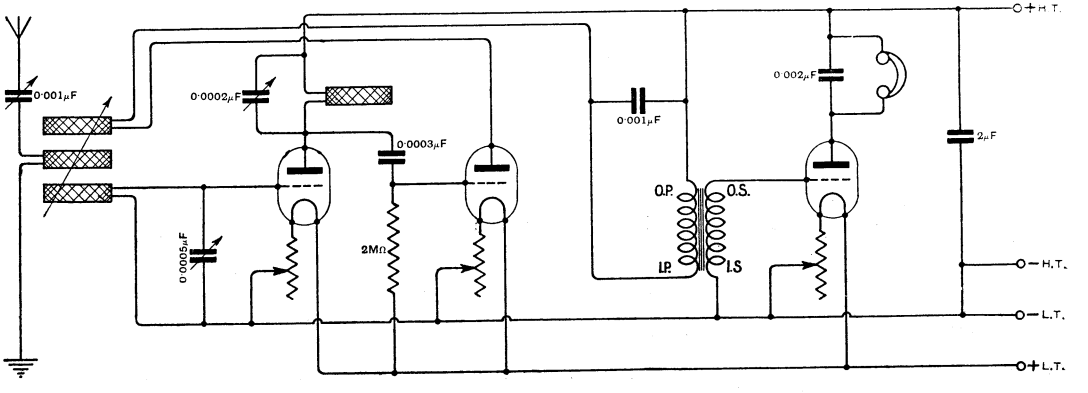


Fig. 1. "*E.J.W.*" (*London, S.E.*10). *A simple three-valve receiver with H.F., Det., and L.F.*

considerable damping is likely to occur through the setting up of eddy currents. The least possible quantity of insulating material consistent with mechanical strength should be used in the construction of the frame.

"E.S.J." (*Bentley*), asks what degree of low frequency amplification is obtained with resistance capacity coupling, compared with iron core transformer coupling.

When the anode resistances are adjusted so that

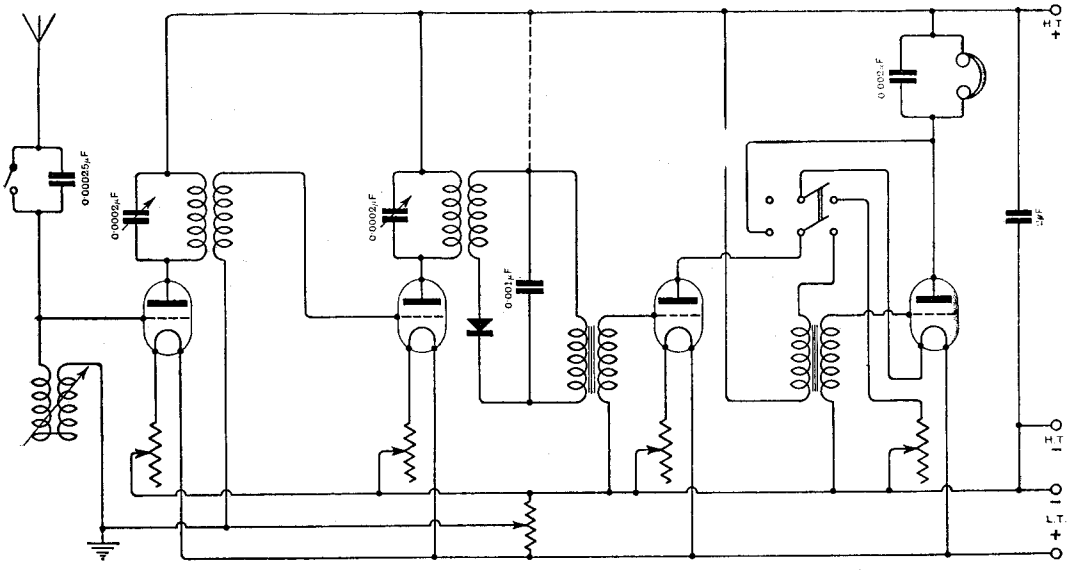


Fig. 2. "*J.H.Y.*" (*London, S.W.*19). *A receiver with two transformer coupled H.F., crystal detector and two note magnifiers.*

"J.W.M." (*Edinburgh*) asks for particulars of an H.F. transformer suitable for broadcast reception.

The primary winding should consist of 75 turns of No. 26 D.C.C. wire wound on an ebonite former 2½" in diameter. After insulating with several layers of waxed paper the secondary winding is wound over the primary, and may consist of the same number of turns of No. 26 D.C.C. wire. Double cotton covering is recommended, since it automatically provides an adequate spacing between turns. The primary should be tuned by a 0·0002 μF condenser.

"J.H.Y." (*London, S.W.*19) asks for a diagram of a four-valve receiver, with two stages of transformer coupled H.F. amplification, crystal rectification, and two stages of L.F. amplification, the aerial circuit to be variometer tuned, and a switch to be provided to cut out the last L.F. valve.

The diagram is given in Fig. 2. A potentiometer is recommended to control the grid potential of the H.F. valves, and you will find it an advantage to connect a fixed condenser in series with the aerial circuit, if the aerial capacity is abnormally high. A switch is provided to short-circuit this condenser when not required. If the receiver is unstable in operation it may be found necessary to join one side of the primary winding of the first L.F. transformer to + H.T., as shown by the dotted line in the diagram.

the H.T. voltage required is approximately twice that of the normal plate voltage of the valves, the amplification given by three resistance capacity coupled valves is about equal to that given by two transformer coupled valves operated with their normal plate voltage.

"W.F.R." (*Leamington*) has an inverted "L" type aerial which is higher at one end than at the other. He asks from which end the lead-in should be taken.

In general it is found that best results are obtained when the lead-in is taken from the lower end, but in any case the down lead should be taken from the end nearest to the receiving apparatus, and should on no account be brought underneath the aerial from the remote end.

"J.Y." (*North Berwick*) asks what is the best method of storing a lead plate accumulator.

The accumulator should first be given a full charge at a slow rate. The acid should then be emptied out and the plates rinsed once or twice with distilled water. When it is required to put the accumulator into service again, the cells should be filled with fresh acid of a specific gravity corresponding with the fully charged condition. After allowing to stand for a few hours the cells should receive a short charge, and are then ready for use. On no account should the plates be allowed to stand in contact with acid, as sulphating is almost certain to occur.

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 239. (No. 24. Vol. XIII.) MARCH 12th, 1924. WEEKLY

CONTENTS

THE EDITOR will be glad to consider articles and illustrations dealing with subjects within the scope of the Journal. Illustrations should preferably be confined to photographs and rough drawings. The greatest care will be taken to return all illustrations and manuscripts not required for publication if these are accompanied by stamps to pay return postage. All manuscripts and illustrations are sent at the Author's risk and the Editor cannot accept responsibility for their safe custody or return. Contributions should be addressed to the Editor, "The Wireless World and Radio Review," 12 and 13, Henrietta Street, Strand, London, W.C.2.

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THE TESTING OF L.F. TRANSFORMER WINDINGS.

A SIMPLE METHOD OF DETECTING SHORT-CIRCUITED TURNS.

By F. L. DEVEREUX, B.Sc.

THE losses caused by short-circuited turns are a frequent cause of inefficiency in intervalve transformers. The pressure exerted upon the inner layers of the windings is considerable, and any movement of the turns is almost certain to result in a breakdown of the insulation. When enamelled or silk-covered enamelled wire is used and layers are spaced with insulating material the risk of short-circuited turns is reduced to a negligible quantity. On the other hand experience shows that it is difficult to wind a transformer free from short-circuits when single silk-covered wire is used, and wound on to the former at random without spacing between layers.

It therefore becomes a matter of first importance to provide some means of detecting the presence in transformer windings of short-circuited turns or layers. The first method which suggests itself is to measure the direct current resistance of the windings and observe the reduction in resistance brought about by any sections of the winding that may have become short-circuited. Unfortunately the effect of short-circuited turns on the resistance is masked by variations usually met with in the thickness and conductivity of the wire as well as by changes in the mean diameter of the turns. For a similar reason the measurement of the inductance of the windings does not furnish reliable evidence, though the effect of shorted turns is in this instance more marked. Moreover, the apparatus necessary for the accurate measurement of inductance is not always available, and the time taken for an accurate determination would prevent the use of this method for routine testing.

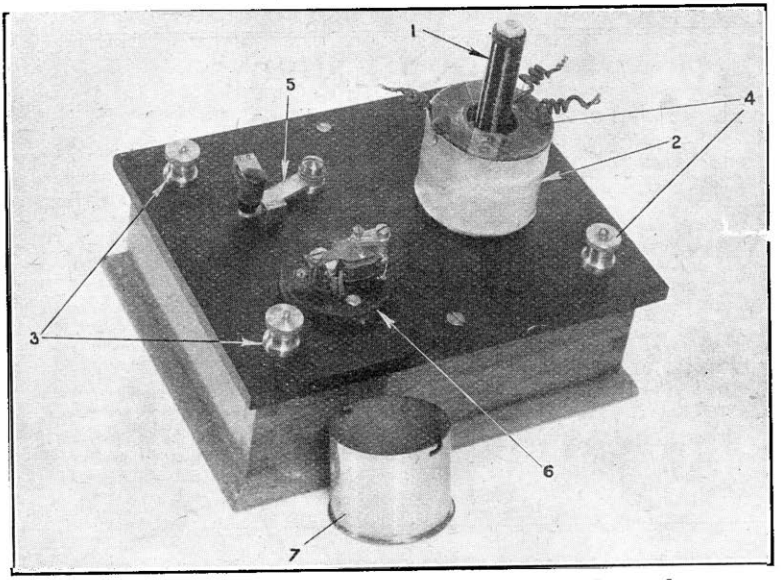


Fig. 1. The complete instrument. The parts referred to by numbers are as follows: 1, search coils; 2, transformer winding under test; 3, telephone terminals; 4, battery terminals; 5, battery switch; 6, high tone buzzer; 7, cover for buzzer.

In the instrument described below the effect produced by the short-circuited turns is independent of the relation in number between these turns and the remainder of winding. Further, tests can be carried out at the rate of about one per second, so that the method is suitable for works use.

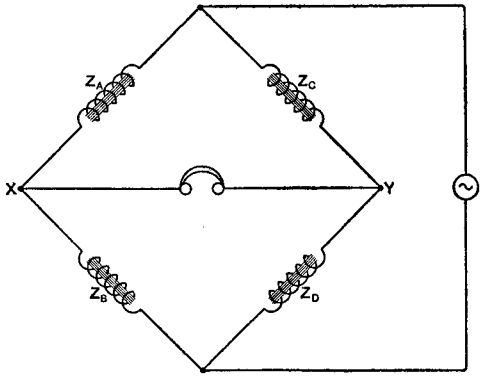


Fig. 2. Theoretical circuit. No current flows in the telephones when $\frac{Z_A}{Z_B} = \frac{Z_C}{C_D}$.

The operation of the instrument depends upon the change which the shorted turns produce in the inductance of two concentric search coils placed inside the central hole in the transformer windings. These coils, ZA and ZD in Fig. 2, form a bridge with two similar coils ZB and ZC. An interrupted current is supplied to the bridge from a buzzer and battery, and the balance of the bridge is tested by connecting a pair of telephones between X and Y. The effect on the telephone current produced by lowering the inductances ZA and ZD is cumulative, since these form diagonally opposite arms of the bridge. The two coils are therefore wound together on the same former and subjected simultaneously to the influence of the transformer windings. In practice, best results are obtained with the use of iron core inductance coils.

A diagram of the practical arrangement of the instrument is given in Fig. 3, which clearly shows the method of connecting the four impedance coils. The commencement and end of each winding are indicated by the figures 1 and 2 respectively. If the resistance of the bridge is low compared with that of the buzzer winding, a series resistance R_1 may be inserted to reduce the current in the bridge. A short potentiometer wire R_2 may be used as a refinement to obtain an exact balance in the bridge. These variable resistances are not included in the instrument illustrated in Fig. 1, and need not be used if the bridge coils are accurately constructed and wound to a suitable resistance.

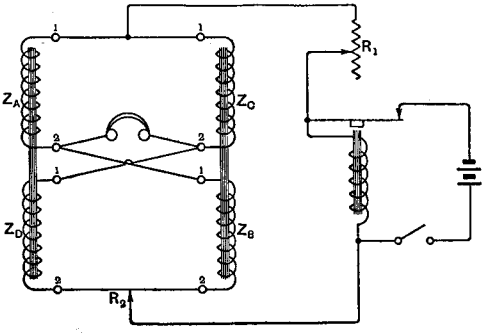


Fig. 3. Practical wiring diagram. Low resistance telephones should be used.

Details of the ebonite formers used in this instrument to carry the bridge coils are given in Fig. 4. Each search coil consists of two layers of No. 32 D.S.C. or No. 28 enamelled copper wire, coil ZA being wound on first and then ZD after insulating with a layer of thin waxed paper. The use of two-layer windings enables the ends of the coils to be brought out at one end of the

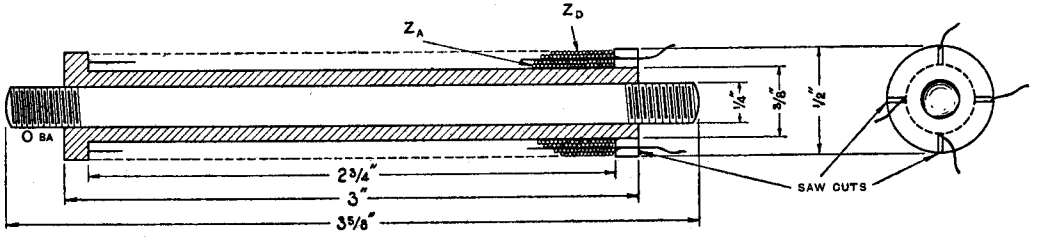


Fig. 4. Details of search coils. The formers are turned from $\frac{1}{2}$*" ebonite tube and the core consists of a length of* $\frac{1}{4}$*" annealed steel rod.*

former; an arrangement which greatly facilitates wiring when the search coils are mounted vertically as in Fig. 1. The balance coils ZB and ZC are wound in exactly the same way, and are mounted horizontally underneath the panel in order that there may be the minimum amount of interference between the magnetic fields produced by each pair of coils.

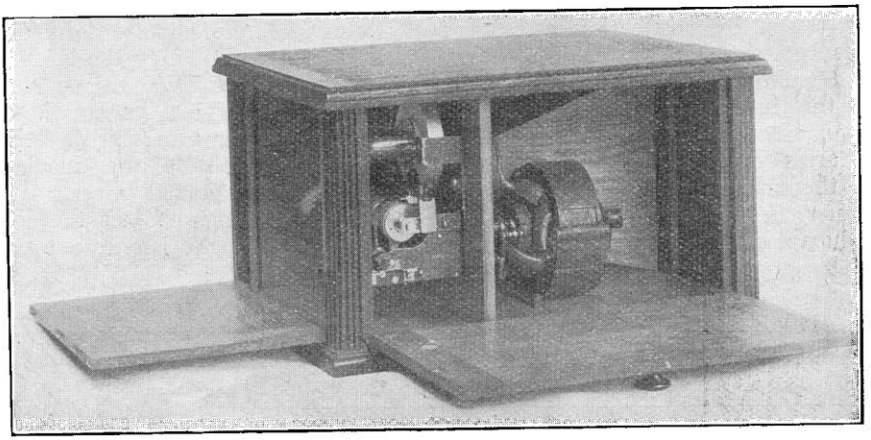
The iron cores of both coils must be of exactly the same dimensions and material. Soft iron or annealed silver steel rod will be found quite satisfactory. The use of soft iron wire cores is not recommended as it is difficult to balance the volume of iron in each core.

The foregoing particulars will serve as an indication of the type of bridge coils required. The actual dimensions can, of course, be varied to suit the shape of the particular transformer coils to be tested. The remainder of the instrument does not call for further comment, the arrangement of the components being largely a matter of individual taste.

On first switching on the instrument the buzzer will probably he heard very faintly in the telephones owing to slight lack of symmetry in the bridge. The transformer winding to be tested should first be examined to see that the ends of the windings are not touching and then dropped over the search coils. If any turns are shorted the buzzer note will be heard very loudly in the telephones. If the transformer is perfect there will still be a change in the telephone current, but in this case of quite a different character, being more in the nature of a subdued hiss. The transformer windings possess an appreciable self capacity, and small charging currents are induced by the fluctuating field from the search coils. In practice there is no difficulty in differentiating between the sound produced by capacity effects and that produced by shorted turns.

A rough estimate of the number of turns shorted in a faulty winding may be obtained by comparison with a series of test coils wound with a known number of turns of a diameter equal to the mean diameter of the transformer windings. The instrument will detect a closed circuit of five turns about 1 in. in diameter.

A JOHNSEN RAHBEK LOUD SPEAKER.



Making use of the adhesive action between surfaces across which a potential exists, this loud speaker produces very considerable amplification. A cylinder of hard semi-conducting material with a rubbing metal band brings the potentials together. The cylinder revolves, and as the friction fluctuates a varying pull is produced on a diaphragm to which the metal band is attached.

THE MEASUREMENT OF LOW-FREQUENCY AMPLIFICATION.

In this paper is described a method of measuring low frequency amplification. The results of tests with resistance capacity, reactance capacity and transformer couplings are given.

By R. L. SMITH-ROSE, Ph.D.

(*Continued from page 702 of previous issue.*)

4.—SOME RESULTS OBTAINED ON AMPLIFICATION MEASUREMENTS.

(*a*) *Resistance-capacity coupling.*

This well-known type of valve coupling is useful for measurement purposes, since the effective amplification can be calculated from the valve constants and the value of the resistance; and so it affords a good check on the measuring apparatus. If R is the value of the resistance, B the effective internal impedance of the anode-filament circuit of the valve, and μ the voltage factor of the tube, then the voltage amplification obtained or the step-up in alternating potential applied to the grid of the second valve relative to that on the grid of the first valve is

$$M = \frac{\mu R}{B + R}$$

Now for the valve whose characteristics are shown in Fig. 3, $B = 32{,}000$ ohms, and $\mu = 9{\cdot}6$; at the conditions $V_a = +100$ $V_G = -2$. Hence with an anode resistance of 66,000 ohms the value of M should be 6·5. Actually this resistance was very variable in use so that the calculated value of M is necessarily only approximate. The value obtained from measurement was 6·0, this being independent of frequency over the range 500-2,000 cycles per second.

To fulfil the conditions of 100 volts on the anode it was necessary to have nearly 300 volts H.T. battery to obtain the corresponding current of 2·4 milliamps since this current involves a voltage drop in the anode resistance of about 160 volts, a value of useless "H.T." supply which is not always appreciated by advocates of the resistance-coupling in their enthusiasm over its distortionless properties. Various measurements have been made with other values of anode resistances with corresponding agreement, and the amplification measured was found to be independent of the value of the grid leak resistance between 1·3 and 3·3 megohms. If the above conditions of adequate anode potential are not fulfilled, the amplifier will immediately give rise to distortion with varying amplitude owing to curvature of the characteristics. A further point on this form of valve coupling is that when carrying a steady current of the order of 2 milliamps, the values of the usual type of anode resistance do not remain constant with time, the more rapid changes giving rise to disturbing noises in the amplifier, and the slow changes resulting in alterations in the operating points on the valve characteristics.

It will thus be seen that with the resistance-capacity coupling the absolute maximum of voltage amplification is that of the voltage factor of the valve, which for the usual receiving valve is about 10. For practical purposes it is difficult to obtain more than two-thirds this value, and even this involves a wasteful drop of several hundred volts in the anode resistance if distortion is to be avoided.

(*b*) *Choke-capacity coupling.*

The choke—or reactance-capacity coupling employs an anode circuit having a low direct current resistance with a high impedance to alternating current. The high order of the impedance required for use with the usual type of receiving valve almost invariably necessitates an iron-cored type of coil for audible frequencies. It is probable therefore that the reactance of such a coil will vary with frequency and unless the total impedance can be made very large, the amplification will be affected by this change, and distortion will result. A convenient form

of reactance to employ is the primary or secondary winding of an iron-cored inter-valve transformer, and the following table gives the results of some measurements made with a few of such reactances. The same standard valves were used as before, and under the same conditions, *i.e.*, filament volts = 4, anode volts + 100, grid volts − 2; while the grid leak resistance was 2·93 megohms.

In the majority of cases the D.C. resistance of the windings was low enough to cause only a small drop in the voltage applied to the anode.

TABLE I.

Voltage amplification measured for reactance-capacity coupling.

Transformer No.	Winding used as Reactance	Frequency	Voltage Amplification Measured.
a	Primary	500	5·2
a	Primary	1,000	6·0
a	Primary	2,000	6·7
a	Secondary	500	6·8
a	Secondary	1,000	6·5
a	Secondary	2,000	6·0
b	Primary	500	2·8
b	Primary	1,000	5·0
b	Primary	2,000	6·5
b	Secondary	500	5·6
b	Secondary	1,000	7·0
b	Secondary	2,000	7·0
e	Primary	500	1·1
e	Primary	1,000	1·9
e	Primary	2,000	4·3
e	Secondary	500	6·0
e	Secondary	1,000	6·0
e	Secondary	2,000	7·0
h	Primary	500	4·6
h	Primary	1,000	5·8
h	Primary	2,000	6·2
h	Secondary	500	6·0
h	Secondary	1,000	8·0
h	Secondary	2,000	7·5

In every case it will be seen that the secondary winding gives a higher amplification than the primary, when used as a reactance, due to its much higher impedance. The results also show that, due to the comparatively low direct current resistance of the winding, it is possible to obtain amplifications approaching more closely to the valve constant (9·6) than with the non-inductive resistance coupling, without employing unreasonably high voltages in the H.T. supply. Furthermore, the amplification varies with frequency to an extent which decreases as the impedance of the coil is increased.

It would appear to be quite practicable therefore to design an anode reactance or choke-coil which possesses a low direct current resistance and also such a high impedance to alternating currents that the variation of amplification with frequency, which is one cause of distortion, is negligible. It must be remembered, however, that the voltage amplification obtainable by this means is limited to the voltage factor of the valve.

(*c*) *Transformer coupling.*

The iron-cored transformer method of coupling two valves has always appeared to be a very hopeful line for the development of amplifiers since it should give the combination of a low-resistance winding in the anode circuit with a step-up in the voltage transferred to the grid of the next valve. This increase of voltage is apparently not always obtained in practice, since some types of manufactured transformers give an amplification less than that obtainable with the reactance coupling discussed in the previous section. In general, however, this point is realised, and as indicating the possibilities of a transformer coupled amplifier, the curves given in Fig. 5 show the results of measurements made on six different types of transformers at various frequencies from 300 to 3,000 cycles per second.

The curves all refer to the voltage amplification obtained from a single stage comprising one valve plus one transformer, the valve being operated under the standard conditions previously indicated.

It will be observed from these curves that in every case the amplification diminishes as the frequency is reduced below 800 cycles per second, while in the case of types b, d and e, the falling off occurs at a higher frequency and to a much greater extent. This variation in amplification with frequency naturally indicates that distortion will be present in the use of such transformers for speech amplifiers. In the case of transformer "e," for example, the voltage amplifications obtained at the frequencies of 3,000 and 300 are in the ratio of 10 : 1. When it is observed

that this corresponds to a power ratio of 100 : 1 it will be realised that the distortion so introduced into an amplifying system is very serious. Although this is possibly an extreme case, it is certain that the low frequency transformer-coupled amplifier is the source of a large amount of the distortion which is present in broadcasting receivers and which is frequently attributed to other portions of the apparatus. That it is possible to design and manufacture transformers which are practically free from distortion is evidenced by the curve for type " c," in which the extreme variation of amplification is in the ratio of 1·17 : 1. It is doubtful if such a variation in amplitude of 17 per cent. at the different frequencies is detectable by the human ear in the ordinary reception of speech and music. The above transformer (type c) gave an average effective voltage amplification of 22 per stage. A greater value, reaching 30 at the higher frequencies, is obtainable from type " a " at the expense of a slightly greater variation with frequency. As to how much variation is permissible without impairing the successful reproduction of music, the writer is not in a position to say, but it is obviously desirable to make the amplification as independent of frequency as possible.

A feature which has been noticed in the carrying out of the above measurements is that some of the transformers show a large variation of amplification when the connections of transformer to valve are altered. In Table II the results of such alteration of the connections are shown for several of the transformers, employing the same valves and conditions, at the frequency of 2,000 cycles per second. The " normal " connections adopted in this test are those with the inner end of the primary winding connected to the anode of the first valve, and the outer end of the secondary winding connected to the grid of the second valve.

TABLE II.

Showing variation of amplification with the connections of transformer to valves.

Transformer	Voltage Amplification with Connections indicated.			
	Normal	Primary reversed	Primary and Secondary reversed	Secondary reversed
b	20·0	15·5	27·0	27·0
c	23·0	23·0	23·0	23·0
d	20·5	19·0	19·0	20·0
e	12·5	17·5	28·5	30·0

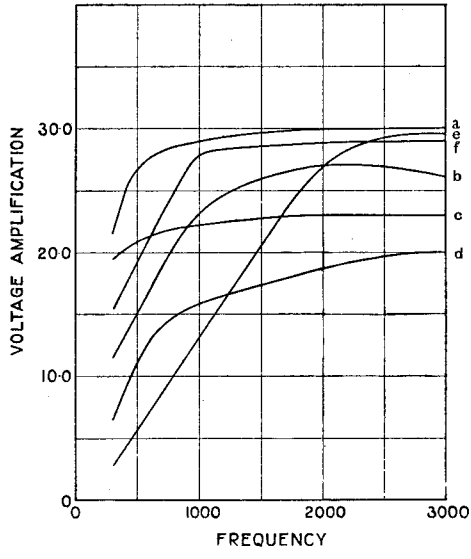


Fig. 5.

This peculiarity is probably the result of the transfer of E.M.F. from primary to secondary by a combination of capacity and inductive coupling, between the windings.

A comparison of the measurements given in Table I with those for the same transformers in Table II and Fig. 5 shows that there is a definite step-up in voltage obtained with the use of the transformer in place of the reactance-coupling, the increase in some cases being as high as 7 : 1.

The general conclusion to be drawn from these measurements is that it is possible to design a transformer coupling for low frequency amplifiers which is distortionless for all practical purposes, in so far as variation of amplification with frequency is concerned, and which gives an effective voltage amplification of from four to seven times as great as that obtainable by any other method of valve coupling.

5.—CONCLUDING REMARKS.

Another manner in which distortion may occur is from a variation in amplification with the amplitude of the input signal voltage. While a detailed investigation of

this matter has not so far been carried out, a few measurements have been made with the best types of transformers, which show that over a range of output varying from that required for faint telephone signals up to the amount necessary to operate a smaller type of loud speaker, the amplification is subject to only slight variation.

From this it may be deduced that the amplification for two stages is approximately equal to the square of that given by a single stage, but here again insufficient measurements are available as yet to confirm the deduction. It appears probable however, that a two-stage low-frequency amplifier can be constructed and operated under conditions giving an effective voltage amplification which may approach 900 as an optimum value. Since it is the practice in some quarters to speak in terms of power amplification, which quantity is obtained not by measurement, but by the simple process of squaring the voltage or current amplification, it may be as well to point out that the above figure for two stages corresponds to a power amplification of 810,000. If, as is frequently done, the figures be extrapolated to the case of three stages, the values of voltage and power amplification become 27,000 and 729,000,000 respectively! The conditions necessary to maintain stability of such an amplifier would form an interesting field for research for the enthusiastic experimenter.

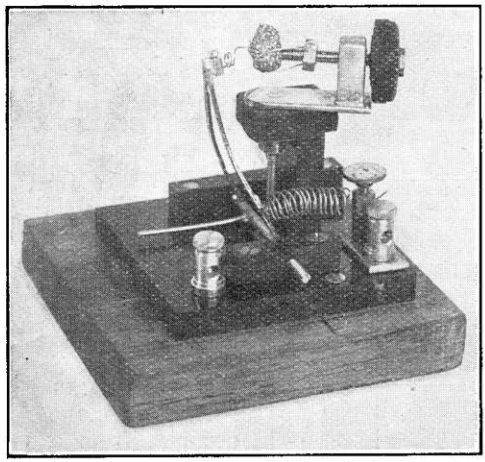
Finally, the writer would like to state that from his own bitter experience he considers that robustness and long life are properties of a transformer which are quite as important as good amplification and absence of distortion. The maintenance of twelve receiving sets, each employing two or three stages of low frequency amplification, is well remembered as being a very tedious business when transformers broke down at the rate of about one a week. In every instance, and there have been about 30 in all of various makes of transformer, it is the primary winding which breaks down, and since this is inside it is impossible to effect a repair without completely dismantling the transformer. The defect is shared with the high resistance telephone receiver when used in the anode circuit of the last valve, and is probably due to the persistent use of No. 47 S.W.G. copper wire, together with defective materials and manufacture.

INGENIOUS CRYSTAL DETECTOR DESIGN.

The detector shown in the accompanying illustration embodies several unique features. In the first place the method of securing the piece of crystal permits of almost any portion of it being brought into action, while the actual mechanical details are quite simple.

It will be noticed in the illustration that a loop of wire is placed over the crystal, and its ends terminate on either side of the hexagon nut. As the nut is run down on to the threaded spindle the wire tightens, whilst the spindle presses hard on the back of the crystal.

On examining this method of crystal fixing it was found that the piece of crystal was very securely held, whilst it could easily be loosened and turned over to make use of the other face if required. The threading on the spindle is to drive the crystal forward and to rotate it, whilst the support which holds the threaded stem is made rotatable by means of a brass arm.



[Courtesy Sir Henry Cuninghame.
The Crystal Detector.

The wire point which is used to make contact with the crystal is pulled up into position by means of a spring, and the tension can be regulated to alter the pressure of contact between the wire and the crystal. By means of the lever projecting on the left the wire point can be dropped out of contact when the crystal is being rotated, whilst when the lever is released the point springs up in contact with the crystal with the same pressure as previously.

MULTI-CIRCUIT EXPERIMENTAL VALVE PANEL.

Various circuit arrangements are sometimes provided in receiving sets by the use of switches. Wiring is simplified, however, by the adoption of plug connectors, and constructional details are given in this article of an interesting set with which many simple circuits can easily be brought into operation.

By R. H. COOK.

HAVING experimented with a number of sets, making use sometimes of a crystal and sometimes of a valve detector, and wishing to incorporate in the receiving circuit all available apparatus, it occurred to the writer that a receiver panel might be built up permitting of any circuit combination of valve and crystal. With the instrument changing out the circuit, several of which form part of the high frequency system of the set. Considerable falling off in efficiency will be observed when any attempt is made to provide for every circuit arrangement by merely terminating all the component instruments on terminals. Apart from all the leads to these terminals the entire wiring would have to be carried out with

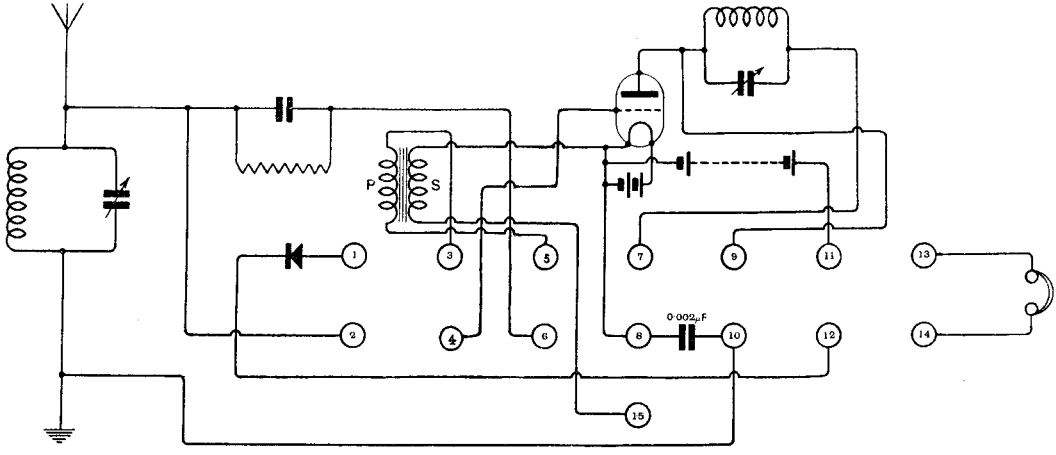


Fig. 1. The general arrangement of the sockets, showing how they become connected in the external circuit when apparatus is joined to the terminals.

under description it is possible to use it either as a crystal detector or valve detector with reaction, whilst by an easy rearrangement of the connecting plugs the circuit may be changed to the usual dual arrangement with crystal detector or to a crystal with the valve as a low frequency amplifier.

In designing apparatus of this sort there must of course be a limit to the number of circuit arrangements which can be provided for, even with such a simple receiver as this. There are, of necessity, many bridging wires between the plugs and sockets used for leads across the face of the terminal board, and there is scarcely space enough to efficiently arrange the large number of leads thus required, especially as all these leads will be congested into one plane, and unless stiff wiring is undertaken between the terminal points, stray capacities will be set up which will render the set useless.

The single-valve dual arrangement with crystal detector is quite popular at the present time because it is thought that one valve is made to perform the function of two. Whether or not this is the case is

a matter for the experimenter to determine by test, and provision is made on this receiver for connecting up such a circuit.

The writer, being doubtful of the merits of the various circuit arrangements, thought of building a receiver in which switches would alter the circuit arrangements, but this was soon put aside when it occurred to him that plugs and sockets would do the job so much better, particularly as with the type of plug chosen, a number of connections

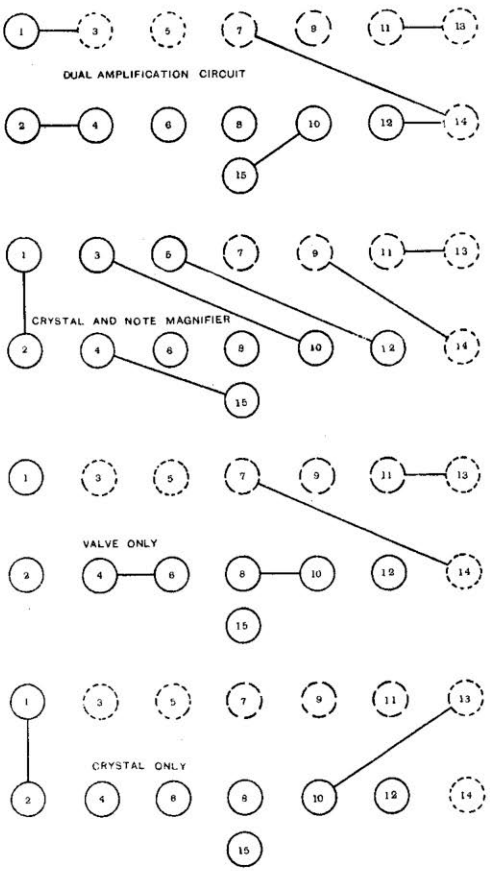
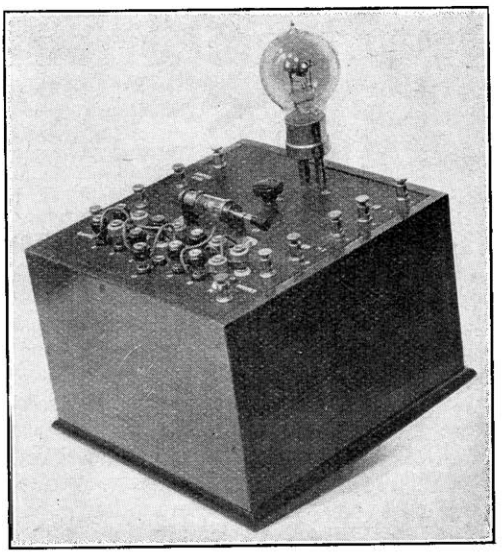


Fig. 2. Method of joining up the plug ended leads to produce various circuit arrangements.

could be made to one point, and when two plugs reach to the same socket the leads are lifted away from one another by the height of the second plug.

Fig. 1 shows the internal connections of the instrument, and an examination of the leads will indicate how the various circuit combinations are arrived at.



The complete instrument.

In Fig. 2 the plugs and connectors are shown for producing four different receiving circuits, and careful consideration of the connections shown in conjunction with the wiring shown in Fig. 1 will reveal the actual circuits arrived at. These are shown in Figs. 3, 4, 5 and 6.

Turning to construction details the materials required are as follows:—

A piece of ebonite $\frac{1}{4}$ in. in thickness from which a panel 7 by $7\frac{1}{2}$ ins. can be prepared.

A crystal detector complete.

Ten terminals.

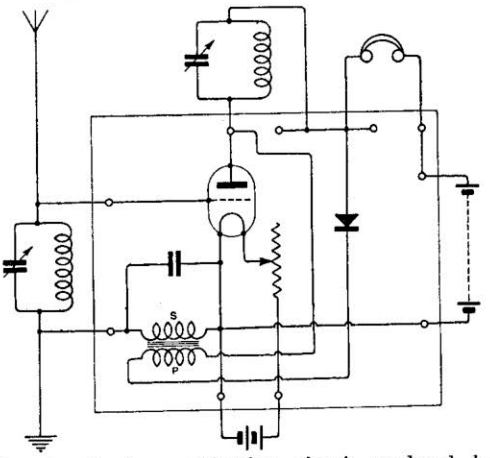


Fig. 3. Dual amplification circuit produced by plugging in as shown in Fig. 2.

Four valve legs.
An intervalve transformer.
Grid condenser and leak.
One fixed value condenser 0·001 mfds.

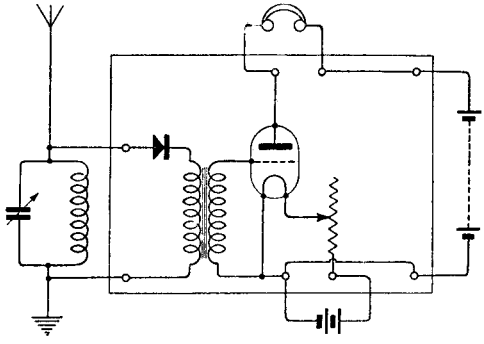


Fig. 4. Crystal detector with note magnifier.

Filament resistance.
Suitable box with inside measurements of 7 by 7½ by 5 ins.
Various nuts and screws, 2 and 4B.A.
Half pound No. 16 tinned copper wire.
Fifteen plug and socket connectors (if of the "Clix" type, 29 sockets will

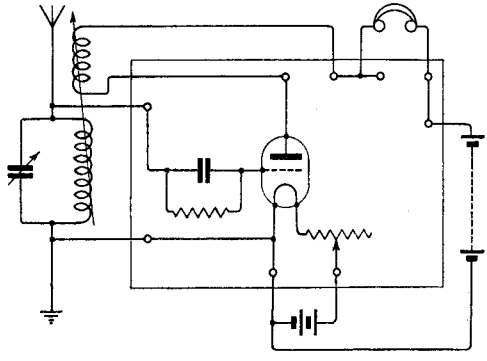


Fig. 5. Reacting valve receiver.

be needed, some of these serving as connector plugs. Fourteen knobs, suitable for use with these sockets, will be needed, say 6 red and 8 black, also 8 black bushes, 4 white ones and 3 red.)

To proceed with the construction of the set one should first true up the panel to the required dimensions. One edge should be filed true and straight, after which the ends can be sawn off exactly at right angles to the first finished edge, having the box ready so that slight adjustments can be made in order that the panel will exactly fit. The other edge can next be trued up at right angles to either of the two sides, again making necessary corrections to fit the box. Nothing looks worse than a panel that fits loosely in the cabinet.

Bear in mind that the cabinet maker working in wood, which is a comparatively soft material, may have made slight errors, and these must be allowed for when fitting the panel.

Both faces of the panel may be given a matt finish by rubbing down with carborundum cloth. The carborundum cloth may be attached to a small block of wood and used with a circular motion. The setting out of the positions of the holes is shown in Fig. 7, and this should be done with a fairly sharp pointed pencil.

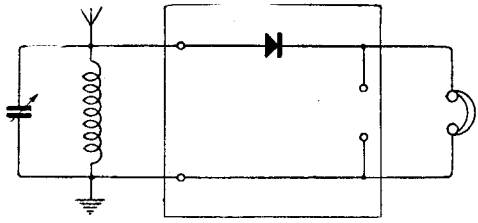


Fig. 6. Simple crystal receiver.

The centres for the holes should be centre-punched, taking care that the ebonite is lying in a hard flat surface, or otherwise there is a danger of breaking the panel. When drilling, do not press too hard on the hand brace or there may be a danger of fracturing the ebonite as the drill passes through. Little need be said with regard to assembling the apparatus on the panel, but with regard to wiring it might be

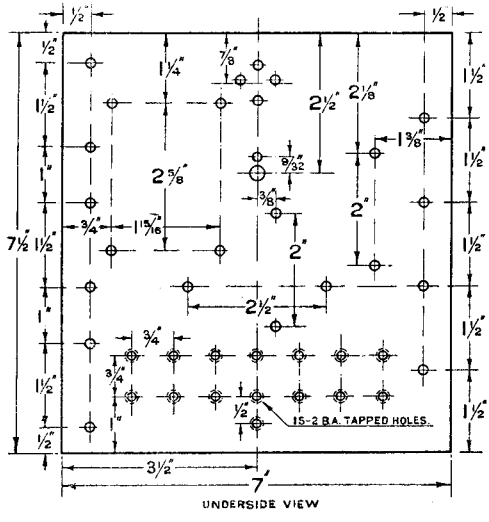


Fig. 7. The drilling of the panel.

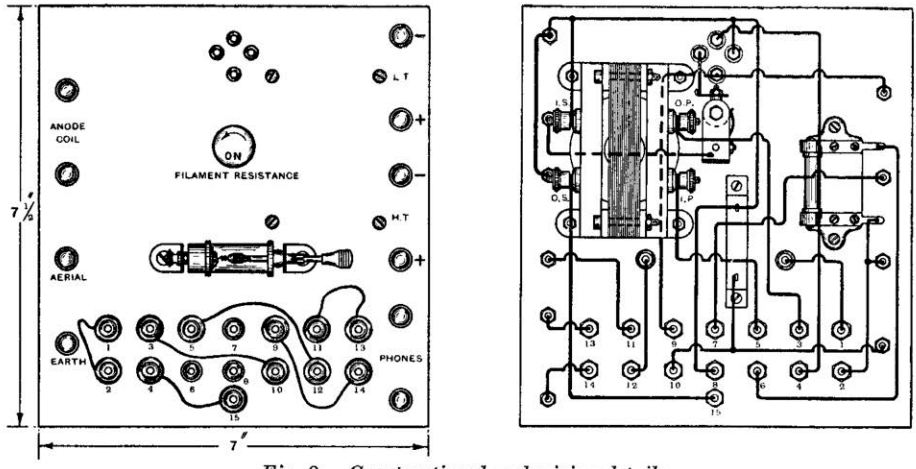


Fig. 8. Constructional and wiring details.

mentioned that the wire may be strained by stretching prior to clipping off and shaping it into suitable lengths.

Views of the back of the panel are given in Figs. 8 and 9, and the actual leads are shown so that the practical wiring can be undertaken from this diagram.

The actual socket connections are as follows :—

1. Crystal Detector. 2. Aerial. 3. O.P. Transformer. 4. Grid. 5. I.P. Transformer. 6. Grid Condenser. 7. Anode Coil. 8. Negative L.T. Battery. 9. Plate. 10. Earth. 11. Positive H.T. Battery. 12. Crystal Detector. 13 and 14. Telephones. 15. O.S. Transformer.

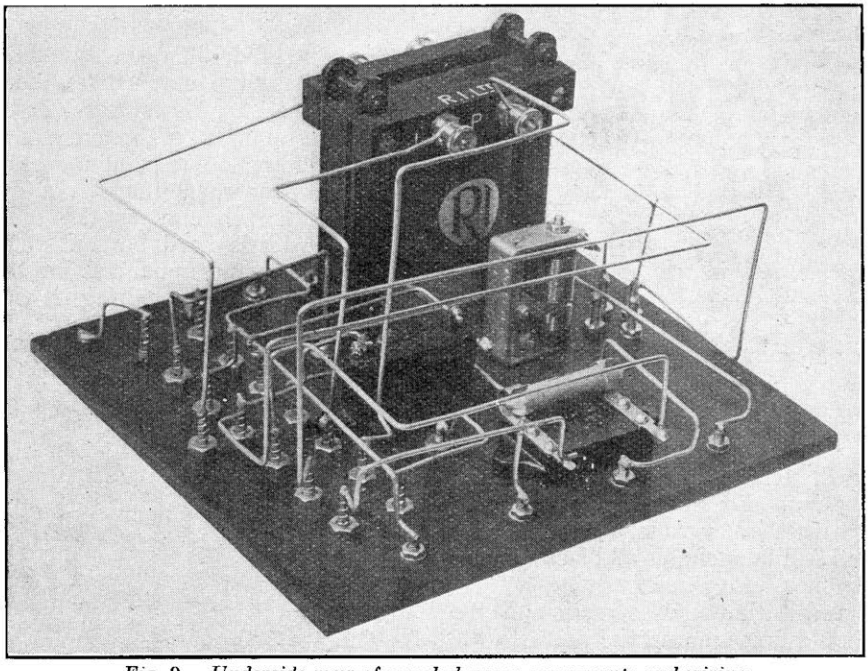


Fig. 9. Underside view of panel showing components and wiring.

It is not thought that any advice is necessary here on the operation of this set, as the circuits produced are so well known, and I think that experimenters will agree that there is no loss in efficiency in the system here described.

THE CONFERENCE OF RADIO SOCIETIES.

THE postponed Conference of Radio Societies was held as previously announced on Saturday, March 1st, at 2 p.m., at the Institution of Electrical Engineers. The chair was taken by Dr. W. H. Eccles, President of the Radio Society of Great Britain, and the meeting was well attended by delegates from Affiliated Societies in all parts of the country. The agenda for the meeting was as follows :—

1. To discuss the principles of the alterations proposed by the Radio Society in its constitution, as follows :—
   (A) A General Committee should be formed for the discussion of national wireless affairs affecting amateurs.
   (B) This General Committee should be elected mainly by the Affiliated Societies.
   (C) Communications with public bodies on national affairs should be made by the Council on the advice of the General Committee, provided that
      (i) The Affiliated Societies have representation on the Council.
      (ii) All administrative expenses of the General Committee be defrayed by the Radio Society.
   (D) For the purpose of electing the General Committee the Affiliated Societies should be divided into groups which shall each elect one or more members.
   (E) The division of the Affiliated Societies into groups should be left to the General Committee and revised frequently.
   (F) The General Committee should from time to time fix the fees of affiliation, but no lower than those existing at present.
2. To discuss clauses 87 to 100 of the Memorandum and Articles of Association in the light of the foregoing principles.
3. To elect the first General Committee and the Officers.
4. To discuss facilities for obtaining amateur transmitting licences.
5. To discuss the proposal of the Derby Wireless Club to establish an Amateur Research Fund.
6. To discuss steps taken regarding Standardisation of Wireless Apparatus and Parts.
7. To discuss other items submitted by Societies or Delegates.

In opening the Conference the Chairman explained that the principal business of the Conference would be to discuss the alterations proposed by the Radio Society to its present constitution in so far as these rules affected the management of Affiliated Societies.

The draft rules affecting the Affiliated Societies were accepted by the meeting after being discussed one by one. Certain modifications were introduced, and these will be set out in a more complete report of the meeting to be published in a later issue.

The next item on the agenda was the election of members and Officers for the General Committee. Mr. Thomas Hesketh was elected to the office of Vice-Chairman of the General Committee, there being no other nominations.

Mr. F. J. Stanley was elected Hon. Secretary.

Some nominations to the Committee from Societies and groups of Societies were made at the meeting, whilst a number of others were left to be decided at an early date.

A representative from the Derby Wireless Club next put forward a proposal with regard to raising an Amateur Research Fund to be put in the hands of competent research workers to be expended at their discretion. There was discussion on the proposal, some delegates considering that a Research Fund raised by amateurs should be devoted to furthering research work amongst amateurs. Eventually a motion was agreed to by the meeting approving cordially the aims of the Derby Wireless Club and wishing them every success.

General Holden, Vice-Chairman of the Radio Society, next spoke on the subject of standardisation of wireless apparatus and parts, a sub-committee for which subject had been set up by the Radio Society.

Amateur transmitting licences and the position with regard to obtaining these from the Post Office was the subject of a short talk by Dr. Eccles to the delegates, in which he explained the present position and the steps which have been taken by the Radio Society of Great Britain.

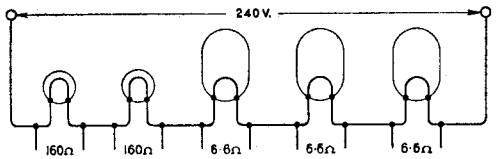
Other matters referred to by the Chairman were the problems of interference with the broadcast transmissions and an analysis was given of a number of complaints received by the British Broadcasting Company and passed on to the Radio Society. It was shown how, after an analysis of these complaints, definite percentages were arrived at indicating that 78 per cent. of the interference was attributable to unintentional oscillation due to broadcast and other apparatus capable of causing interference through the ignorance of beginners using it. About 3 per cent. was due to intentional oscillation, 12 per cent. interference from transmitting stations, including Government and commercial stations, and 1 per cent. appeared to be due to intentional interference by amateur transmitters. Finally, 6 per cent. was attributable to various causes not wholly connected with wireless.

One or two miscellaneous subjects were next discussed, and the meeting closed with a very hearty vote of thanks to the Chairman.

FILAMENT CURRENT FROM THE MAINS.

When direct current mains are available, it is now customary to charge accumulators for filament heating. The problem of directly operating the filaments from the mains is dealt with in this article.

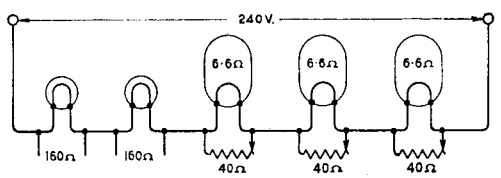
ONE of the drawbacks of modern wireless apparatus from the point of view of the amateur with comparatively small means and little or no workshop facilities or experience is the four or six-volt accumulator necessary for his valve set. These are both costly to purchase and quick to deteriorate in unskilled hands, and in spite of the fact that to charge them oneself from the mains is not a difficult accomplishment they will have to be constantly "observed" both while on charge and off if they are to be kept in good condition.



Voltage distribution when suitable lamps are connected in series with the valve filaments

In this article a method is given of getting over the accumulator problem by utilising the house mains, when available, as a source of low tension supply, and at the same time doing so without using more current than is necessary to light one valve. The mains will also be used as a source of H.T.

The circuit chosen is one which appears to be popular among amateurs, having one H.F., one rectifier and one L.F. valve—at all events it has one of each type of amplification, additional valves, either H.F. or L.F., merely necessitating a little more calculation in arriving at the values of the resistances, etc.

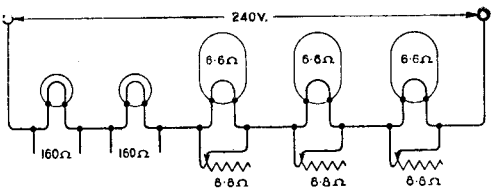


Arrangement of valve filament resistances in shunt.

From a glance at the circuit it will be seen that the H.T. leads—plate and filament—are connected across a 120-volt lamp, and that another such lamp is between the plate lead and the positive of the 240-volt supply. This method of employing lamps to regulate, within certain limits, the H.T. voltage, has previously been explained in an article in *The Wireless World and Radio Review*,* and fuller details are unnecessary here.

The negative side of the H.T. instead of being taken straight to the negative main, is led through each of the valve filaments in series, and thence to the negative of the mains. That is to say, the small current necessary to light the two lamps flows through the valve filaments and also acts as a source of H.T.

Suppose, now, that the voltage of the mains is 240, and that the two lamps used are for a 120-volt circuit, and normally pass 0·75 amps of current. Their resistances will be $\frac{120}{0{\cdot}75} = 160$ ohms each. Assume that the valves normally work on 4 volts and pass a maximum of 0·6 amps, then their resistance will be $\frac{4}{0{\cdot}6} = 6{\cdot}6$ ohms each, the total resistance of the three in series being 19·8, say 20 ohms.



Filament current is decreased by reducing the value of the shunt resistance.

The 240-volt circuit now contains two 120-volt lamps (resistance 320 ohms) and three valves (resistance 20 ohms), with a total resistance of 340 ohms. The current which will flow round the circuit will be, therefore $\frac{240}{340}$, or approximately 0·7 amps. The circuit is connected as in the accompanying diagram, and 0·7 amps of current will flow through the filaments.

* Page 343, June 17th, 1922.

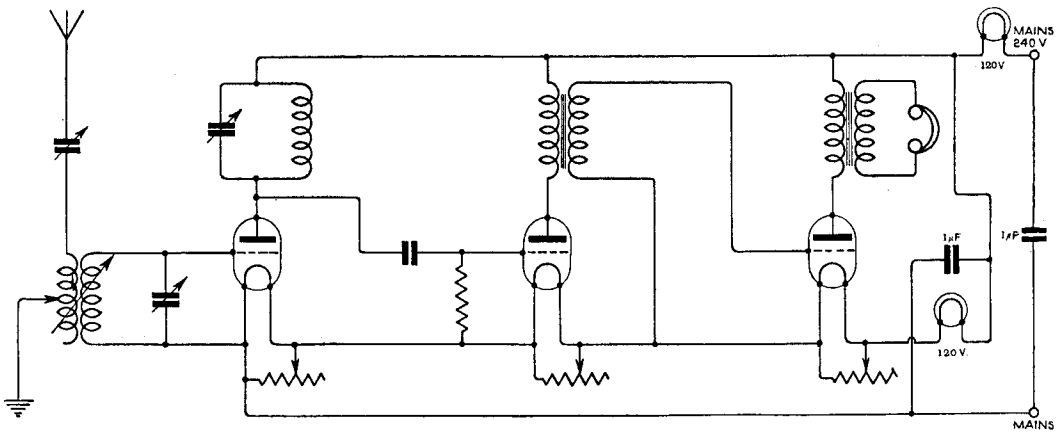
Most experimenters prefer to have a separate resistance for each filament of their valve sets, and the same principle can be adopted here, but, in this particular case, the resistances will have to be shunted across the filaments in such a way that they rob the filaments of more or less current according to whether there is little or much resistance in parallel.

It has been seen that the amount of current flowing through the circuit is 0·7 amps, and it has been assumed that the maximum amount required by the valve is 0·6 amps, so that, with the rheostat at its maximum resistance 1 amp. will have to flow through it and 0·6 amps. through the filament. That is to say, the resistance of the rheostat carry 0·3 amps. As it is always advisable to allow a small margin of safety, however, the figure 0·5 amps should be taken.

In looking for the disadvantages of utilising this method of L.T., the two which probably strike one at once are (1) the rheostats to be wound to a higher resistance than normal, and (2) the H.T. across the three valves differs by the drop of potential across their filaments.

That the resistances of the rheostats will have to be higher than usual does not mean that they will be cumbersome things, as the wire has only to carry 0·3 of an ampere instead of the usual 0·6 or more.

The difference of the H.T. values is slight enough to cause no inconvenience, and the



Three-valve receiver deriving both L.T. and H.T. from direct current mains.

will be $6 \times 6{\cdot}6$ (6·6 being the resistance of the filament) = 39·6, say 40 ohms. Thus the maximum resistance of one of these rheostats will be 40 ohms.

Before these 40 ohm rheostats can be built up there is one thing more to ascertain, and that is the size of the wire necessary. Assuming that the maximum variation necessary in the filament amperes is from 0·6 to 0·4, the rheostats will, at the lower figure, be carrying 0·3 amps, and their resistance will be

$$\frac{0{\cdot}4}{0{\cdot}3} \times 6{\cdot}6 = 8{\cdot}8 \text{ ohms.}$$

The rheostats should be provided with a stop to prevent the resistance dropping below 8·8, and can be wound with wire to working position of each valve on its curve can be regulated by its filament rheostat.

There are two more points to be noted. Firstly, the condenser in the tuned anode circuit is at high potential, and a shock may be experienced if any of its metal parts are touched. Secondly, a large capacity condenser, 2 mfd. or upwards, connected across the mains, will probably be necessary to eliminate ripple, and a second across the H.T. terminals to short circuit the resistance of the lamp to the oscillations in the anode circuit.

The necessary fuses and switches should be added, and the lamps can be utilised for lighting the wireless room.

R. N. H.

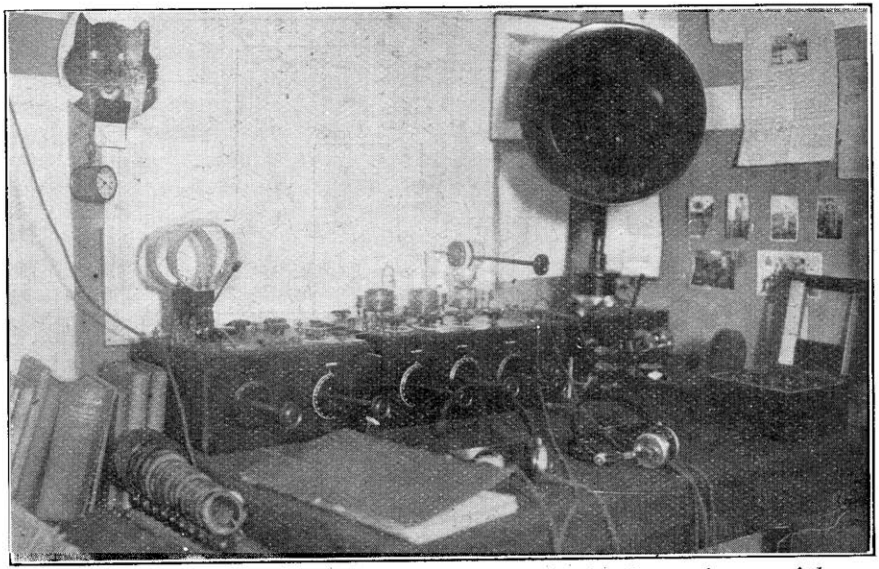
A BELFAST STATION.

DESCRIPTION OF THE SET WHICH RECEIVES MANY BRITISH AMATEUR STATIONS.

IT is unfortunate that there are so few receiving stations at present in Ireland, but there is at least one experimenter who is actively interesting himself in the reception of English amateur signals and, in many cases, telephony. This station is owned by Mr. F. R. Neill and his station is situated at Belfast.

He employs a 6-valve receiver, embodying three stages of transformer coupled, high-frequency amplification, a valve detector and two note magnifiers. His receiver is built as two units, one of which includes the tuning equipment and the other the amplifying apparatus. Switches are introduced everywhere into the circuit, so that any combination of circuit arrangement can be obtained and the requisite degree of amplification produced. The wiring of the tuner is carried out with No. 16 bare tinned copper wire, all wires being suitably spaced and the distances between the points of connection as short as possible. It is stated that the tuner operates over a waveband of 60-20,000 metres and for wavelengths over 2,800 metres resistance capacity, high-frequency intervalve coupling is adopted. On wavelengths below 170 metres high-frequency amplification is not employed. On the amateur band of wavelengths (150-200 metres) on which Mr. Neill has done so much useful work, an aerial tuning inductance consisting of 18 turns of No. 18 S.W.G. on a 4 in. former, and a secondary having 21 turns of the same diameter are employed, while the reaction coil has 14 turns. A local oscillator is also made use of.

Possibly the first English station to establish communication with Mr. Neill was **5 TR,** situated at Ilford, Essex, and this is of particular interest, when one considers that this station uses very low power. At **5 TR,** high-tension for the transmitter is derived from the 230-volt street mains, and he obtains an aerial current reading of 0·4 to 0·5 amperes. **6 NG** has also worked with Belfast, using an aerial current of 0·8 amperes. Many other stations have been received on telephony, including **2 KT, 2 ON, 2 NM** and **5 DT,** but with these stations more power is probably employed than in the case mentioned above.



Mr. Neill's receiving equipment. Vernier condensers and extension handles are features of the apparatus.

A USEFUL INSTRUMENT BOARD.

METERS CONVENIENTLY ARRANGED FOR SIMPLE WIRELESS DETERMINATIONS.

By H. E. ADSHEAD, B.A.

THE panel described was made up some time ago now out of a collection of disposals apparatus in order that the various components might be ready to hand when required. According to American photographs it seems the fashion there to mount as many meters on the receiving panel itself as can be accommodated. I have put mine on a board which hangs against the wall so that they can be introduced into a circuit as required.

(*a*) GALVANOMETER.

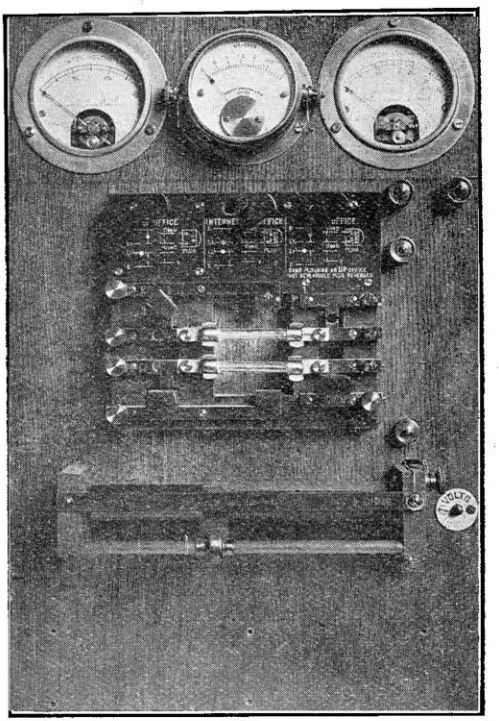
It would appear from the illustration that two Weston voltmeters are made use of but that on the left has had a Student's No. 375 movement fitted. The galvanometer is exceedingly sensitive, and goes across the scale for only 1·8 milliamps, or a millimetre deflection for about 20 microamps. I have tried it in the telephone circuit of a crystal set, but this was asking rather too much.

(*b*) AMMETER.

This is also a sensitive instrument reading up to 3 amps. The current goes through a shunt, and only a small portion is used for the field coil, so that it does not cause a drop in the filament brightness when plugged into the accumulator circuit.

(*c*) VOLTMETER.

The Weston voltmeter is a well-designed instrument. If the action is examined with a magnifying glass the nuts will be seen to be accurate hexagons with chamfered edges, and also that the pointer is not solid, but is a tube. Besides being accurate the instrument is dead-beat, that is, the pointer does not "waggle." It is interesting to note that any degree of dead-beatness can be introduced, so that the pointer might come slowly up to the mark and stop. In order to increase the range for use with the whole H.T. battery, series resistance bobbins should be wound. The internal resistance of a Weston voltmeter is about 2,100 ohms; and hence to increase the range three times a 4,200 ohms coil can be wound with the aid of a wire table, say 1,100 yds., or 1 oz. of 40 S.W.G. Eureka. When this is wound on do not cut the wire, but proceed in this manner. Get a combination of cells reading 30 volts. Attach one end of the bobbin in the circuit, and the battery lead to the blade of a knife. Pass the blade through the insulation of the wire and the voltmeter should read 10 volts. If it is less or more, try less or more wire until you get it exact. (Fig. 1).



The Instrument Board, with meters suitable for carrying out simple resistance determinations.

There is, of course, no essential difference between a voltmeter and an ammeter except the resistance of the winding. This instrument will serve as a milliammeter if required. From Ohms's law $C = \frac{E}{R} = \frac{1}{2100}$, and so for a reading of 1 volt, there is only 0·5 milliamps passing. Thus the meter can be inserted in the plate circuit of a valve and indicates the current flowing by two scale

divisions to the milliampere. The cheap pocket voltmeters will not do this, however, because they require larger currents to shift the pointer.

(*d*) PLUG DISTRIBUTOR.

This complicated looking contrivance came out of one of those field service separators, and at first sight appeared pretty useless, but I found a job for it here instead of buying a number of tumbler switches. The current from the accumulator can be plugged to the voltmeter and ammeter, passing through the fuse tubes (shorted in my case), and can then be plugged to either of two circuits. Fig. 2 gives the wiring and Fig. 3 the scheme of connections.

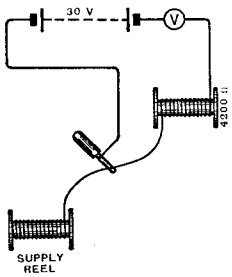


Fig. 1. Method of adjusting the resistance of the spool used for extending the voltmeter range.

(*e*) POTENTIOMETER.

This is used in conjunction with the galvanometer to obtain the tiny current to deflect it when employed in low resistance circuits such as testing for continuity of wiring or shorts. An old flash-lamp battery is fixed behind the panel and the resistance of the potentiometer is about 600 ohms. The circuit to be tested is joined across the terminals G_1 and G_2 (Fig. 2), and the little switch pressed to insert the battery. When comparing grid leaks extra voltage is required, and an increasing number of cells from the H.T. battery can be cautiously added until a sufficient deflection is obtained. The relative resistances can be calculated because the current passed will be proportional. The galvanometer can be put in the plate circuit of the valve and the current noted. Knowing the H.T. voltage the equivalent resistance of the valve can be determined by Ohm's law. The effect on the current of varying the brightness of the filament and putting the grid bias cells can be seen.

After this the reader should make or procure a resistance box and do some

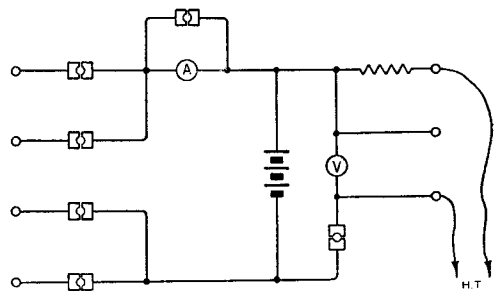


Fig. 3. Schematic diagram of connections.

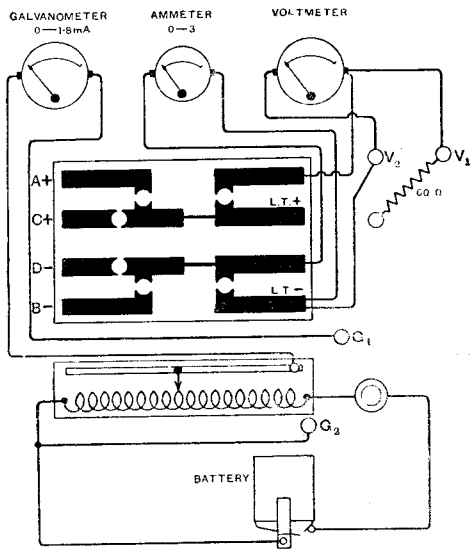


Fig. 2. Wiring of switchboard.

Wheatstone bridge or metre bridge calibrations. The galvanometer will indicate the point of balance. Provided with a resistance box and a variable condenser of known value, the capacities of all the condensers in his possession can be determined. A sort of Wheatstone bridge circuit is set up, and De Sauty's double click method or Kelvin's buzzer method employed. I will not go into the actual circuit now. On the whole I preferred the former method, as the buzzer silent point is not very defined.

All these determinations of quantities only involve a multiplication sum at the end. These can be solved in half a minute on the slide rule. Those readers who cannot use one should lose no time in attaining proficiency with this method. It is not at all difficult for the simpler calculations.

THE THORPE VALVE.

IT is a hard and fast rule with us when testing any type of valve to adjust it, at any rate for the initial tests, exactly in accordance with the maker's instructions, because it is only by so doing that one is able to prove whether the claims put forward are substantiated under working conditions. Moreover, when the maker stipulates certain data it is only fair to him to make use of it.

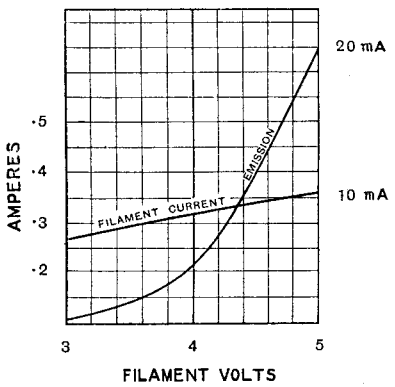


Fig. 1.

For this reason, therefore, the filament voltage of the Thorpe valve under test was set at 5·0, which gave a filament current of 0·355 ampere. At this brilliancy the most liberal emission of 21 milliamperes was obtained, which rather suggests that in the single specimen available the filament is being over-run. Reducing the filament voltage to 4·5 resulted in cutting down the emission to 12 milliamperes, which is still more than ample for ordinary needs. The relation between filament volts and emission is given in Fig. 1.

The static characteristic (anode current-grid volts) with 5 volts across the filament is given in Fig. 2, from which we get a magnification of 8 and a plate impedance of roughly 40,000 ohms. The working anode voltage is given as 50 to 100 and at the latter figure the maximum reverse grid current (sometimes called "backlash") was 0·25 microampere, which merits the tube being placed under the heading of hard valves.

The anode current curves of Fig. 2, and in particular those at the higher anode voltages are wonderfully straight over quite a considerable range of negative grid voltage, thus giving promise of good quality low frequency amplification.

On test in actual reception the valve was first used as a low frequency amplifier following a plain crystal receiver, and gave excellent results using either 80 or 100 volts on the plate. As a high frequency amplifier, and as a detector, the valve was equally good, but in all cases we were able to dull down the filament quite appreciably and still maintain satisfactory reception. The Thorpe valve can therefore be described as a general purpose valve, and is good for all-round work.

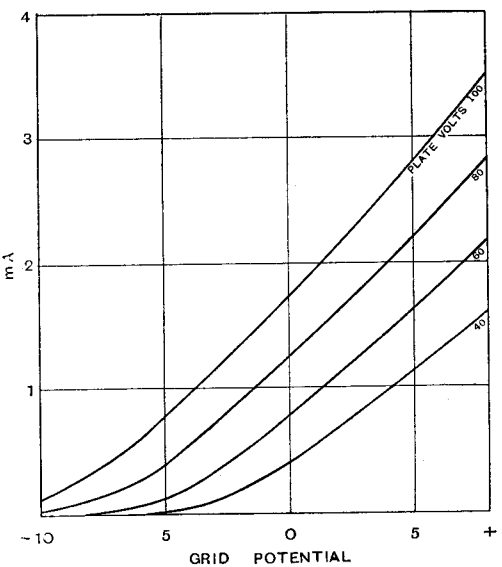
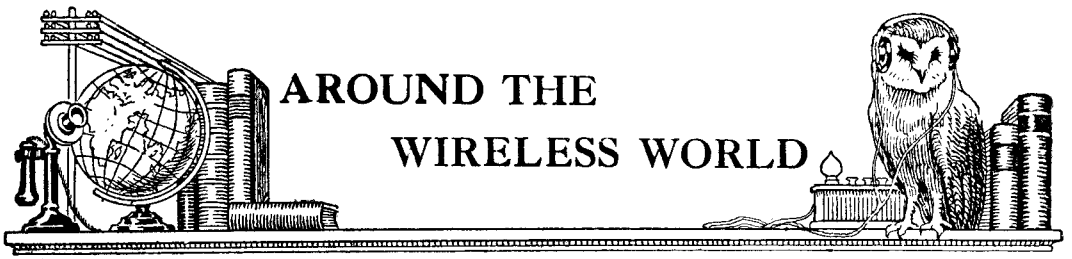


Fig. 2.

In design it is somewhat out of the ordinary in that the anode is made in the form of a spiral of thick wire. This form of construction we believe has certain manufacturing advantages, but we do not quite understand why the spiral type of anode can provide a more efficient "electron trap" than the more usual cylindrical arrangement.



A meeting of the Newcastle Rural Deanery Chapter has heartily approved of the broadcasting of church services.

* * * *

The Committee appointed to consider Imperial Wireless problems advocates an increase in power of the Leafield station.

* * * *

On January 31st, states the Postmaster-General, 636,000 wireless receiving licences were in force.

* * * *

The Brighton Corporation has been urged to approach the B.B.C. with a view to the establishment of a broadcasting station in Brighton.

* * * *

Tenants of West Bromwich Corporation houses are resisting a demand for the payment of 12s. 6d. in respect of wireless sets installed. Ten shillings of the amount is claimed as a deposit to cover possible damage to property, and each agreement is to cost 2s. 6d.

* * * *

Transatlantic Reception.

Using a two-valve receiver (0-v-1), Mr. S. K. Lewer **(6 LJ)** of London, N.W., has logged 297 Americans and Canadians. The average rate at which these have been received is ten per hour, but on one morning Mr. Lewer secured 46, the last one coming in at 9.30 a.m.

A Word to Transmitters.

Mr. T. W. Higgs **(5 KO)** of Bristol, draws attention to the practice of many transmitters of "calling" for long periods without "signing." Our correspondent suggests that it would save listeners the boredom of waiting many minutes for the transmitter's call sign if the rule were observed of announcing both the transmitter's and the receiver's call three times alternately.

Broadcasting for the Blacks.

A proposal to erect broadcasting stations for the edification of ten million natives in Central and East Africa is discussed in an interesting article appearing in *The Observer.*

One of the prime movers in the scheme is Mr. R. St. Barbe Baker, late Assistant Conservator of Forests in Kenya Colony. The programmes would consist of bulletins to the Forest Scouts, folk lore, musical selections, news, and the messages of the Administrators which now have to be sent by runners.

The hope is expressed that it would be possible for the British Government to co-operate in the scheme so that transmitting stations may be established in three or four centres and loud speakers set up in every village.

The Marconiphone Company.

The Marconiphone Co., Ltd., announce that Marconi's Wireless Telegraph Co., Ltd., have agreed to transfer to them as from December 31st last their business in connection with the sale and distribution of "Marconiphone" wireless receiving apparatus and accessories.

American 9 AN.

We regret that owing to a correspondent's mistake our recent note concerning the reception of American **9 AN** was misleading. This station is not situated in San Francisco, as was stated, but is located at St. Paul, Minnesota.

Reception of WGY on 100 Metres.

Several readers report the reception of **WGY** on 100 metres during February, in two cases with a single valve. Signals are stated to be stronger and freer from distortion than those of **KDKA** on the same wavelength.

Wireless versus Chronometer.

At the recent annual convention of the Dominion Land Surveyors' Association at Ottawa it was stated that radio is revolutionising exploration and survey work in the Far North of Canada. Where formerly the surveyors had to rely upon a chronomoter to get the correct time for astronomical observations, they now carry a radio set, with which they receive the time signals from Arlington, Annapolis, Suez Canal, Bordeaux, Santiago, Tokio or Nauen.

A Correction.

Doubtless many readers of the article in our issue of February 27th, entitled "An Improvement in Frame Aerial Connections" will have observed that Figs. 8 and 9 were erroneously reversed. The captions were correct.

Empire Wireless.

Up to the time of writing, the Government have not taken a decision on the report of the Committee appointed to inquire into the subject of Imperial Wireless Control. The report advocates that all wireless stations for communication with overseas Dominions, Colonies, Protectorates and territories should be owned by the State and operated by the Post Office, other services being left to private enterprise.

In a statement on the report, Mr. Godfrey Isaacs, Managing Director of Marconi's Wireless Telegraph Co., Ltd., says that the proposals with regard to

the Empire wireless chain must inevitably involve considerable delay. He draws attention to the fact that Mr. Marconi has invented a new system that will revolutionise the practice of wireless telegraphy, and will be essential to the success of the Empire scheme. Technical efficiency can only be obtained by the adoption of a common interest in operation, to attain which all stations should include the latest developments in wireless practice.

The Supply of Wireless Operators.

In reply to a question as to the supply of qualified operators for ship installations, the Managing Director of the London Telegraph Training College has received a letter from the Mercantile Marine Department of the Board of Trade, from which the following is an extract :—

"The Board consider that the real solution of this difficulty lies not in reducing the qualifications which they are sure are necessary, but in shipowners and others interested taking steps to train a sufficient number of men to make good the normal wastage in the service. They (the Board) are informed that at the present time, a considerable number of shipowners are carrying operators for training purposes in addition to those required by the statutory rules."

The word "training" in the last sentence refers, not to technical instruction, but to sea experience.

THE RADIO SOCIETY OF GREAT BRITAIN AND RADIO TRANSMITTERS' SOCIETY.

ON Tuesday, February 26th, at the Headquarters of the Radio Society of Great Britain, at 53, Victoria Street, London, S.W., a Joint Meeting between the members of the Committees of the Radio Transmitters' Society and of the Transmitting and Relay Section of the Radio Society of Great Britain was held. This meeting arose out of the resolution recently passed by the members of the Radio Transmitters' Society in General Meeting, when the principle of amalgamation with the Transmitting and Relay Section was approved. The business done at the meeting was of a preliminary nature, the main object being to settle the officers and devise the machinery for the carrying on jointly of the work which hitherto had been done by the two bodies.

On the proposition of Dr. W. H. Eccles, Captain Ian Fraser was appointed Chairman of the Amalgamated Committee, and Mr. Gerald Marcuse was appointed Honorary Secretary. Mr. W. Corsham and Mr. W. K. Alford accepted the office of Joint Traffic Managers, and were asked to prepare a scheme for consideration at the next committee meeting to be held on Tuesday, March 11th, for the carrying on and development of transmission tests, calibration signals, etc. It was agreed that the Committee should continue the series of successful lectures which under the auspices of the Radio Transmitters' Society had been regularly held, and the Secretary was asked to book a room at the Institute of Electrical Engineers for March 14th and 28th, and April 25th. It is not possible to announce in time for publication the name of the lecturers on these occasions, but notices will be served upon members in due course.

As regards finance, it was reported that the Radio Transmitters' Society had a substantial balance to hand over for the use of the new Committee, and a Sub-Committee, consisting of Messrs. Maurice Child, E. J. Simmonds and H. S. Walker (Honorary Treasurer of the R.T.S.) was appointed to advise the Committee as to the best method of adjusting all outstanding matters relating to subscriptions, etc.

General satisfaction was expressed at the prospect of future harmonious working under the auspices of the R.S.G.B., and the Committee were confident that after a brief delay to allow all matters under negotiation to be properly settled, the new and enlarged Transmitting and Relay Section of the R.S.G.B. would be able to offer its members more adequate facilities and stronger representation than had hitherto been available.

Radio Society of Great Britain.

At the next Ordinary General Meeting of the Society, to be held at 6 p.m. on Wednesday, March 26th, at the Institution of Electrical Engineers, Mr. A. A. Campbell Swinton, F.R.S., will deliver a lecture on "The Possibility of Electrical Television, both with and without wires."

An informal meeting of the Society will be held at the Institution of Electrical Engineers at 6 p.m. on Wednesday March 12th, at which Mr. F. Phillips will open a discussion upon "Amplifiers for Short Wave Reception."

Calls Heard.

Contributors to this section are requested to limit the number of calls sent in to those heard within the previous three weeks, these being of greater interest and value to transmitters than earlier records. The repetition of the same call sign in consecutive lists is not recommended. Contributors will also assist by kindly arranging their reports in alphabetical order.

Ilford, Essex.
2 AC, 2 DY, 2 LI, 2 MC, 2 SZ, 2 VT, 2 YZ, 2 ZO, 5 AS, 5 HN, 5 LN, 5 RZ, 5 XN, 6 JM. French: **8 ÉB.** (1—c—o.) American: **7 OF.** (C. E. Largen.)

Hammersmith, London, W.6. (Heard during last 12 months.)
2 AA, 2 AJ, 2 AM, 2 AN, 2 AQ, 2 BM, 2 BV, 2 BZ, 2 CP, 2 DC, 2 DP, 2 DT, 2 DV, 2 DZ, 2 FG, 2 FQ, 2 FV, 2 GL, 2 GP, 2 HT, 2 ID, 2 IF, 2 KF, 2 KM, 2 KT, 2 KV, 2 LG, 2 LU, 2 LV, 2 LW, 2 MF, 2 MI, 2 MK, 2 MR, 2 MO, 2 MT, 2 NH, 2 NM, 2 NO, 2 NQ, 2 OD, 2 OM, 2 ON, 2 PA, 2 PY, 2 QI, 2 QQ, 2 QS, 2 SF, 2 SH, 2 SI, 2 SN, 2 SQ, 2 SS, 2 SX, 2 SZ, 2 TA, 2 TQ, 2 UC, 2 UV, 2 VJ, 2 VP, 2 VR, 2 VW, 2 WD, 2 WJ, 2 WZ, 2 XL, 2 XO, 2 XQ, 2 XT, 2 XZ, 2 YH, 2 YN, 2 YX, 2 ZO, 2 ZZ, 5 AC, 5 AG, 5 AP, 5 AR, 5 BT, 5 BV, 5 CB, 5 CP, 5 DC, 5 DK, 5 DM, 5 HK, 5 HY, 5 IO, 5 KS, 5 LF, 5 LP, 5 OB, 5 OG, 5 OP, 5 OQ, 5 OX, 5 PD, 5 PU, 5 QO, 5 SU, 5 UO, 5 VD, 5 VM, 5 VK, 5 VP, 5 VR, 5 WS, 6 BS, 6 HD, 6 HY, 6 IM, 6 KI, 6 PS, 6 QZ, 6 WX. (H. Eade, jnr.)

Mablethorpe, Lincs. (February 25th, 1923, to February 6th, 1924.)
1 AB, 2 AC, 2 AM, 2 AO, 2 AP, 2 BM, 2 BW, 2 BY, 2 CA, 2 CW, 2 DF, 2 DJ, 2 DR, 2 DU, 2 DX, 2 DY, 2 DZ, 2 FF, 2 FG, 2 FL, 2 FN, 2 FQ, 2 FR, 2 FU, 2 FZ, 2 GG, 2 GJ, 2 GQ, 2 HF, 2 IN, 2 IQ, 2 JF, 2 JO, 2 JP, 2 JR, 2 KF, 2 KM, 2 KO, 2 KQ, 2 KW, 2 KX, 2 KZ, 2 LF, 2 LM, 2 LT, 2 LX, 2 LZ, 2 MC, 2 MF, 2 MG, 2 ML, 2 MM, 2 MS, 2 NA, 2 NB, 2 NK, 2 NM, 2 OD, 2 OF, 2 OG, 2 OM, 2 ON, 2 OP, 2 OS, 2 OZ, 2 PD, 2 PP, 2 PV, 2 PX, 2 QH, 2 QN, 2 RM, 2 RS, 2 SH, 2 SL, 2 SM, 2 SQ, 2 SX, 2 SY, 2 SZ, 2 TB, 2 TF, 2 TO, 2 TT, 2 TY, 2 UG, 2 UL, 2 UV, 2 VJ, 2 VO, 2 VQ, 2 VS, 2 WA, 2 WD, 2 WJ, 2 WK, 2 XB, 2 XR, 2 XY, 2 XZ, 2 YQ, 2 YR, 2 YT, 2 ZS, 2 ZT, 2 ZU, 2 ZZ, 5 AS, 5 AT, 5 BA, 5 BG, 5 BM, 5 BS, 5 BV, 5 CC, 5 CT, 5 CX, 5 DK, 5 DN, 5 DT, 5 FD, 5 FS, 5 FU, 5 FZ, 5 GJ, 5 GL, 5 GS, 5 GX, 5 HI, 5 HN, 5 HR, 5 IC, 5 IK, 5 IO, 5 JH, 5 JJ, 5 JX, 5 KF, 5 KO, 5 KZ, 5 LP, 5 LR, 5 LT, 5 MO, 5 NN, 5 NT, 5 ON, 5 OW, 5 PU, 5 QM, 5 QV, 5 RB, 5 RI, 5 RS, 5 RZ, 5 SD, 5 SI, 5 ST, 5 SU, 5 SY, 5 SZ, 5 TG, 5 UF, 5 UM, 5 US, 5 WR, 5 XC, 5 XF, 5 YI, 5 ZV, 6 AL, 6 AN, 6 BT, 6 BV, 6 GO, 6 KI, 6 KR, 6 LO, 6 NF, 6 NI, 6 NO, 6 OY, 6 RY, 6 ST, 6 UC, 6 XX. French: **8 AA, 8 AB, 8 AF, 8 AQ, 8 AS, 8 AU, 8 AW, 8 AZ, 8 BA, 8 BÉ, 8 BF, 8 BM, 8 BP, 8 BV, 8 CC, 8 GG, 8 CH, 8 CJ, 8 CM, 8 CS, 8 CT, 8 CZ, 8 DU, 8 DX, 8 ÉB, 8 GS, 8 JL, 8 LS, 8 LY, 8 OK, 8 RI, 8 SS, 8 WV, 8 ZZ.** Dutch: **0 AA, 0 AB, 0 AW, 0 BN, 0 BQ, 0 BV, 0 CT, 0 DV, 0 DX, 0 FN, 0 FZ, 0 GS, 0 KB, 0 KX, 0 MX, 0 NY, 0 PK, 0 RZ, 0 SA, 0 ST, 0 WS, 0 WX, 0 XO, 0 XP, 0 XQ, 0 XR, 0 XW, 0 XY, 0 ZZ, P 2, PA 9, PC 11, PCM, 0 YG, 0 YN, 0 YS, 0 PZ.** American (all November 26th, 1923): **2 EL, 2 CXL, 8 MZ, 8 TR, 8 UF, 8 AGO, 8 AMM, 8 CPD, 8 CPO, 8 XAN, 9 CR, 9 AMK.** Miscellaneous: **7 EC, 7 MX, 7 ZM, 1 JW, 1 MT, 1 TT, 3 TT, 4 AA, 6 EA, XY, GG.** (1—v—1 or o—v—1.) (A. C. Simons.)

Moulins (Allier).
2 CA, 2 CK, 2 CW, 2 DF, 2 DP, 2 DX, 2 FN, 2 FQ, 2 GG, 2 HF, 2 HN, 2 HZ, 2 IN, 2 IP, 2 JF, 2 KF, 2KW, 2 NM, 2 OD, 2 OG, 2 ON, 2 PC, 2 PF, 2 PR, 2 RB, 2 RS, 2 VF, 2 VS, 2 VU, 2 WA, 2 WE, 2 WJ, 2 WK, 2 YH, 2 ZD, 2 ZG, 2 ZS, 2 ZK, 2 ZT, 2 ZU, 5 AR, 5 BA, 5 BV, 5 CS, 5 DN, 5 DO, 5 FS, 5 GJ, 5 HI, 5 ID, 5 JU, 5 KO, 5 MO, 5 MT, 5 NN, 5 OT, 5 OL. 5 PS, 5 PU, 5QV, 5 RQ, 5 SI, 5 SZ, 5 TG, 5 US, 5 WR, 5 WM, 5 WW, 6 JX, 6 NF, 6 NI, 6 OY, 6 RY, 6 UC, 6 XX, 7 QF, 7 ZM. (Aimé Clayeux.)

2 FM.
The call sign **2 FM**, originally allotted to Mr. V. Corelli, of Eastbourne, has now been transfered to the experimental station of Mr. F. C. McMurray, of Burnage, Beechwood Road, Sanderstead. Reports on **2 FM's** transmissions would be welcomed.

Mr. Alfred D. Gay (**6 NF**), 49, Thornlaw Road, West Norwood, S.E.27, would be pleased to receive reports on his transmissions.

Are There Two 5 CW's?
Mr. A. H. S. Colebrooke (**5 CW**), of Birmingham, suspects that his call sign is being used by another transmitter, reception having been reported in the Sidcup district. **5 CW** has been dismantled for four months.

Long Distance Transmission Tests.
The Transmitting Section of the Glevum (Gloucester) Radio and Scientific Society will be pleased to arrange long-distance tests on low power with any other society. The Hon. Secretary is Mr. A. R. E. Jennings (**6 HH**), Caxton House, Gloucester.

Broadcasting.

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:—

GREAT BRITAIN.

ABERDEEN 2 BD, 495 metres; **BIRMINGHAM 5 IT,** 475 metres; **GLASGOW 5 SC,** 420 metres; **NEWCASTLE 2 NO,** 400 metres; **BOURNEMOUTH 6 BM,** 385 metres; **MANCHESTER 2 ZY,** 375 metres; **LONDON 2 LO,** 365 metres; **CARDIFF 5 WA,** 353 metres; **SHEFFIELD** (Relay), 303 metres. Tuesdays, Thursdays and Fridays, 1 p.m. to 2 p.m. (**2 LO** only). Regular daily programmes, 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), FL, 2,600 metres. Daily, 6.40 to 7 a.m. Weather Forecasts; 10.50 a.m. (Thursday and Friday), 11.15 to 11.30 a.m., Time Signal and Weather Forecast; 12.0 noon, Live-stock prices; 3.40 p.m. (Saturday excepted); Financial report, 5.30 p.m. (Saturday excepted) Bourse Closing Prices; 6.10 p.m., Concert or Address; 7 p.m., Weather Forecast; 7.20 p.m. (Sunday), Concert and Address; 10.10 p.m., General Weather Forecast.

PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), SFR, 1,780 metres. Daily, 12.30 p.m., Cotton Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9 p.m., News; 9 p.m., Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

ECOLE SUPERIEURE des Postes et Télégraphes, 450 metres. 9 p.m. (Sunday, Wednesday, Thursday, Friday and Saturday), Talk on Literature. Dramatic and Musical Selections. 8.15 p.m. to 9.25 p.m. (Tuesday), Morse Practice, English Lesson, Lecture and Concert.

LYONS, YN, 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m., Gramophone Records.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. At 1 p.m. and 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

BRUSSELS ("Radio Electrique"), 410 metres. Daily, 5 to 6 p.m., 8.30 p.m. to 9.30 p.m., Concert.

HOLLAND.

THE HAGUE, PCGG. 1,070 metres. 3 to 5 p.m. (Sunday), 8.40 to 10.40 p.m. (Monday and Thursday), Concerts.

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 8.40 to 9.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

THE HAGUE (Velthuisen), PCKK, 1,050 metres, 8.40 to 9.40 p.m. (Friday), Concert.

HILVERSUM, 1,050 metres. 8.10 to 10.10 p.m. (Sunday), Concert and News.

IJMUIDEN (Middelraad), PCMM, 1,050 metres. Saturday 8.10 to 9.40 p.m., Concert.

AMSTERDAM, PA 5, 1,050 metres (Irregular). 7.40 to 9.10 p.m., Concert.

AMSTERDAM (Vas Diaz), PCFF, 2,200 metres. 8 a.m. and 4 p.m., Share Market Report, Exchange Rates and News.

DENMARK.

LYNGBY, OXE, 2,400 metres. 7.30 to 8.45 p.m., Concert (Sunday excepted).

GERMANY.

BERLIN (Koenigswusterhausen), LP, 2,800 metres (Sunday), 10.50 a.m. to 11.50 a.m., Orchestral Concert; 650 metres, 4.30 p.m. to 6 p.m. (Weekdays), 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 to 12.30 p.m., Music and Speech; 4.0 to 4.30 p.m., News; 650 metres, 8.30 to 9.30 p.m., Concert.

EBERSWALDE, 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 7 to 8 p.m., Concert.

BERLIN (Vox Haus), 400 metres. 8 to 9 p.m. Concert.

CZECHO-SLOVAKIA.

PRAGUE, PRG, 1,800 metres. 7 a.m., 11 a.m. and 3 p.m., Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m., and 9 p.m., Concert.

KBEL (near Prague), 1,000 metres. Daily, 6,20 p.m., Concert, Meteorological Report and News.

SWITZERLAND.

GENEVA, 1,100 metres (Weekdays). At 2.15 p.m. Concert or lecture.

LAUSANNE, HB 2, 1,100 metres (Monday and Wednesday), 4 p.m., Concert; 1,000 metres (Friday and Saturday), Concert.

SPAIN.

MADRID, 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests.
MADRID, PTT, 400 to 700 metres. 4 to 5 p.m., Tests.

ITALY.

ROME, ICD, 3,200 metres. Weekdays, 11 a.m., Gramophone Records.

INVENTIONS AND NOVEL IDEAS.

Transformers for Audio Amplifiers.

Transformers for use in high impedance circuits require high impedance windings in order to obtain maximum efficiency, and it is also essential that over the whole frequency range for which these transformers are designed, the distortion of the wave form must be eliminated as far as possible. Under usual conditions, speech and music, for example, will be faithfully transmitted by the transformer.

The use of high impedance windings introduces difficulties on account of the self-capacity of these windings. This is inevitable, and is due to the large number of turns of small gauge wire which must be used in order to keep the transformer within reasonable dimensions.

Self-capacity and its effects may be minimised (*a*) by increasing the separation between individual wires and layers; (*b*) by reducing the induced voltages between adjacent layers of the windings, or (*c*) by reducing the effective transverse length of the windings. Method (*a*) used alone leads to a comparatively large transformer. Method (*b*) may be effected in several ways, such as by sectional windings or special arrangement of the windings, but these involve manufacturing inconveniences.

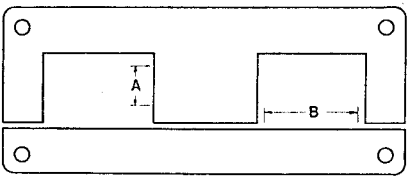


Fig. 1.

The present invention* relates to transformers in which the desired results are obtained by method (*c*) and a combination of methods (*b*) and (*c*). The results are obtained by limiting the length of the winding space on the spool, and the invention consists in an iron core transformer in which the winding space is not greater than one-half its depth. With such an arrangement it is possible to wind with small gauge wire with the minimum permissible insulation in a straightforward manner, and to keep the self-capacity so low that the efficiency of the transformer is not appreciably impaired, and that the distortion of the waveform is negligible.

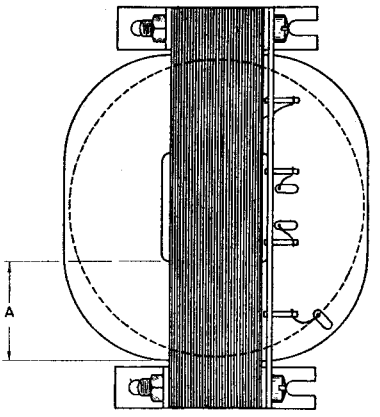


Fig. 2.

The advantages of such a narrow spool may be stated to be, firstly, that it reduces the self-capacity of the windings to such an extent that the losses due to capacity currents are negligible, and the high efficiency of the transformer is maintained. Secondly, by reducing the self-capacity of the transformer windings as above, the impedance-frequency and transformation ratio frequency characteristics are practically unaffected, with the result that distortion of the waveform due to transmission by the transformer is negligible. This renders the transformer very satisfactory for the faithful reproduction of, for example, speech or music. Thirdly, it enables the above characteristics to be

* British Patent 209,345 by Western Electric Co., C. P. Smith and W. L. McPherson.

obtained by the use of small gauge enamelled wire wound in the simplest manner, thus reducing manufacturing difficulties to the minimum.

Referring to the drawings, Fig. 1 shows a pair of core plates, Fig. 2 shows in plan view a transformer built in accordance with this invention, and Fig. 3 shows a side elevation of the same transformer.

It will be noticed that the length of winding space A is small compared with its depth B. It has been found convenient to arrange the primary and secondary windings concentrically, one above the other, the outer winding being that which is to be connected to the circuit of higher impedance.

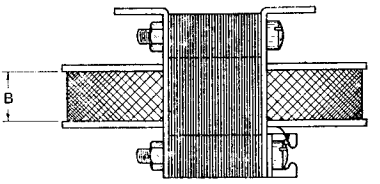


Fig. 3.

THE TRANSMITTING AMATEUR.

By CAPTAIN IAN FRASER, C.B.E.

(*Broadcast from* **2 LO** *Thursday, March 6th,* 1924.)

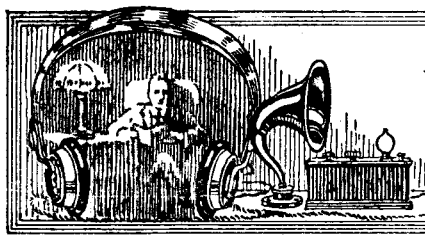
I DIVIDE the persons who hold licences from the Postmaster-General for the Transmission of Telephony and Telegraphy by wireless into four groups. (1) Those who operate small transmitters for commercial reasons, who may be regarded as professionals; (2) Those who engage in pure research, mainly for the love of it; (3) Those who frankly recognise wireless as a splendid hobby, with a scientific interest attaching to it; and (4) Those who think they are furthering the interests of science, but who stand alone in this opinion.

It will be generally agreed that the first two groups should be encouraged in every possible way, and doubtless it is for them that the Post Office is mainly concerned when it offers them licensing facilities. Those who interest themselves in the building and operating of a transmitter purely as a scientific hobby or pastime, should also, I think, receive consideration, for beyond ensuring that their transmissions do not interfere with commercial stations, or with broadcasting, I see no reason why the liberty of these individuals should be curtailed. It does everyone good to indulge in a hobby, and apart from this, it is a great advantage to a country in case of war to be able to call upon the services of a considerable number of people who have a working knowledge of such a highly specialised subject, and one of such military importance.

When you hear a voice calling out of the aether after Broadcasting saying, "Hullo, old man, I am now going to carry out some important experiments, please stand by," and this is followed by a series of gramophone records, you can be quite certain you are listening to a transmitter in group No. (4), that is to say, one who thinks and very often claims that he is doing important research work, but who is in fact doing no more than demonstrating to his friends the strength of his transmitter, and the variety of his selection of records. He is not to be encouraged, and I think I can say quite frankly on behalf of the Radio Society of Great Britain that the Transmitting Section of this Society will not concern itself very greatly to obtain further facilities for him.

The average listener's idea of amateur transmitters and their value to the community is probably a wrong one, for his opportunities of hearing them work are limited, and as a rule are confined to a few examples of bad gramophone transmission such as I have referred to. I beg listeners not to judge the work of transmitters as a whole by the activities of those I have placed in group No. (4). They are in fact the smallest and least important section of the transmitting licence holders. For every one of them there are probably ten whom you never hear at all, who are engaged upon serious research work, whose transmissions are infrequent—for it is not necessary when carrying out proper experiments to shake the aether for hours at a time—and whose efforts are, except when they are engaged in Transatlantic work, generally confined to low powers and low wavelengths, not usually within the range of broadcast receivers.

Recently the Radio Transmitters' Society and the Transmitting and Relay Section of the Radio Society of Great Britain have been amalgamated. Prior to this the British Relay League had been absorbed by the parent society, and now the happy state has been reached in which the amateur transmitter is represented by one organisation and one only, under the auspices of the parent body, the Radio Society of Great Britain. It will be the aim of this Society to do what it can to ensure reasonable conditions for its members, for the pursuit of their research and their recreation, as well as to carry on and develop long-distance tests and other methods of co-operate working both within and without the United Kingdom. Transmitting amateurs who desire to join should send their names to the Secretary at 53, Victoria Street, London, S.W.



WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary. Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

Tottenham Wireless Society.*

"The Constitution of Matter" was the subject of an instructive and interesting lecture given by Mr. Holness on February 20th. After dealing with the early conception of matter, the lecturer explained the significance of the Crooke's tube discharge. Radium and uranium and their disintegration were discussed in sufficient detail to give a grasp of the main discoveries. Investigations of these elements confirmed the theory that atoms are probably comparable to the solar system in construction, particles of positive and negative electricity taking the place of the sun and its planets.

On Wednesday, February 27th, Mr. F. H. Haynes, Assistant Editor of *The Wireless World and Radio Review*, lectured on "Receiver Design." It was a talk on the many details of standard circuits which still promote discussion. In a short report it is impossible to do justice to the informative side of the lecture.

From discussing the positions of A.T. condenser and filament resistance respectively, and the sizes of grid leaks and condensers, the lecturer passed to H.F. amplification and the production of self oscillation.

Speaking of low frequency amplification, Mr. Haynes said that L.F. transformers had not yet been reduced to a formula and generally a hit-or-miss method of design is employed in the endeavour to improve things. It is hardly necessary to add that Mr. Haynes' visit was heartily appreciated, and he was sincerely thanked for his kindness in visiting us.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

The Radio Society of Highgate.*

An interesting debate took place on Friday, February 22nd, on the motion that "In the opinion of this Society the whole of the proceedings of Parliament should be broadcast."

Mr. G. H. Eade and Mr. J. D. Steele proposed the motion, which was opposed by Messrs. J. F. Stanley and G. A. V. Sowter.

The main point in the argument of the proposers was that there are at present no reliable sources of information on parliamentary proceedings readily available to the general public. Newspaper reports are abbreviated and biassed, and Hansard is not readily accessible to the public. Further, the proposers maintained that broadcasting would tend to raise the level of the debates, since all M.P.'s would realise that their words were being heard by thousands of people. The opposers of the motion suggested that M.P.'s would be so anxious to make themselves heard that they would get up and speak without really having anything to say. It was admitted that special events in Parliament should be broadcast, but it was contended that to broadcast the whole of the proceedings would be sheer waste of power, since nobody could afford the time to wear the headphones all day long and far into the night.

After the motion had been fully discussed by the Society, a division was taken, as a result of which the motion was lost by 17 votes to 4.

On February 29th, a Question Night was held, when a very interesting exchange of ideas took place. One member raised a discussion on frame aerials and power amplifiers, and Mr. Stanley gave an account of his recent visit to the **2 LO** studio. The technical difficulties involved in the use of long wavelengths for telephonic transmission was discussed, and some useful information was given concerning the position of the grid leak and filament rheostat.

The Society has pleasure in reporting that the Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., has been elected Hon. Secretary to the General Committee of Affiliated Societies, which Committee is composed of representatives of Societies all over Great Britain.

Hon. Sec., J. F.Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

Kensington Radio Society.*

At the February meeting, Lt.-Col. Hall delivered a most interesting lecture on his "Neon Tube, Capacity and Resistance Measurer."

At the end of the lecture he measured several so-called grid leaks and condensers, and the results provided an explanation as to why many amateurs cannot receive any station except their own local one.

The Hon. Sec., J. Murchie, 33, Elm Bank Gardens, Barnes will be pleased to answer any enquiries regarding the Society.

Glevum (Gloucester) Radio and Scientific Society.*

A single-valve set which operated a loud speaker on **5 WA** and **5 IT** was demonstrated on February 22nd by Mr. Charles H. Box, and with the addition of the Secretary's power amplifier, signals were received in great volume.

The Transmitting Section of the Society is now active, and members will be pleased to arrange any long distance tests on low power with other Societies.

There are still a few vacancies in the Society for experimenters in the Gloucester district, and particulars of membership can be obtained from the Hon. Sec., A. R. E. Jennings, Caxton House, Gloucester.

North Middlesex Wireless Club.

A lecture and demonstration on "Types of Broadcast Receivers," was given on February 20th. The lecturer was Mr. Frank Hickley, of the Edison-Swan Electric Co., Ltd.

Mr. Hickley soon revealed himself as an enthusiastic experimenter, his practical advice regarding aerials and earths winning the cordial approval of a rather critical audience.

Beginning with a simple crystal circuit, the lecturer described and illustrated by blackboard diagrams numerous circuits, containing more and more refinements as he proceeded, until he arrived at the typical dual amplification circuit now in use. The next circuit to be dealt with was the rather complicated arrangement used in the special demonstration set which Mr. Hickley had brought with him. The receiver was very compact and convenient to handle, but unfortunately the questions with which the lecturer was plied left little time for demonstrating its capabilities and the hope was expressed that this could be done on a future occasion.

The Hon. Secretary will be pleased to forward particulars of membership to any one interested in the experimental side of wireless.

Hon. Sec., H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

The Manchester Radio Scientific Society.*

Several interesting lectures have been delivered before the Society during the past month.

On February 6th an instructive lecture on "Valves," with lantern illustrations, was given by Mr. Wade, of the Marconi-Osram Valve Company. The Cossor valve was similarly dealt with on February 13th, the lecturer being Mr. Darbyshire.

On February 20th, Mr. Percy Harris lectured before an interested audience on the subject of "Dual Amplification," demonstrating with one and two-valve dual circuits.

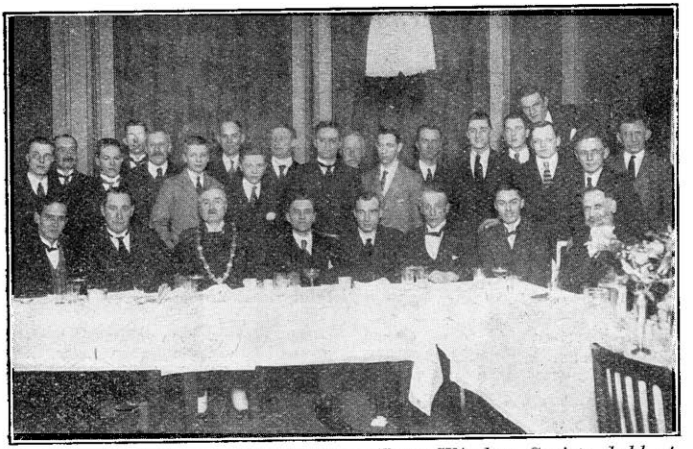
Hon. Sec., G. A. F. Mercer, 116, Burton Road, Withington, Manchester.

The West London Wireless and Experimental Association.*

At the meeting held on Tuesday, February 26th, great interest was centred on a one-valve circuit capable of receiving **KOKA** telephony direct. The Vice-President, Mr. J. F. Bruce, illustrated the circuit by the aid of the blackboard, and during his remarks gave full data for the construction of the set, detailing the sizes of the special coils and the value of the various variable and fixed condensers used.

Mr. R. T. Wright gave a two-valve circuit, which he also use for 100 metre stations. He described it as a mysterious circuit, as no matter what capacity coil he used as A.T.I. his results were equally good. Mr. A. P. Dobson also assembled a three-valve, tuned anode circuit for receiving all broadcasting stations, on the Club experimental units.

Full information respecting membership will be gladly supplied by the Hon. Sec., Horace W. Cotton, 19, Bushey Road Hayes, Middlesex.



At the annual dinner of the Stoke-on-Trent Wireless Society, held at Hanley recently. In the front row (left to right) are seen Mr. T. R. Clark (Vice-Chairman), Col. W. J. Kent (President), Alderman F. Collis (Mayor of Stoke), Messrs. F. Jenkinson (Chairman), F. J. Goodson (Hon. Sec.) L. F. Fogarty (Vice-President of the R.S.G.B.), and E. A. Halliburton (Asst. Hon. Sec.).

Oldham Wireless Society.*

The Society has taken new headquarters at Greenacres Congregational School. The new room is situated at about 800 ft. above sea level, and is consequently ideal for experimental work. Several test transmissions have been carried out.

Regular meetings are held on Thursdays at 8 p.m., and the Club Room is also open on Monday evenings. The membership of the Society is now 60.

Hon. Sec., *pro tem.*, H. W. Moorsland.

Finsbury Technical College Wireless Society.

The Society held its 7th general meeting for the present session on February 14th, 1924, when Capt. P. P. Eckersley, Chief Engineer of the B.B.C., addressed the Society.

Capt. Eckersley dealt with broadcasting and its reception in a very interesting and humorous manner. He pointed out many of the difficulties he had had to meet, and cited as an instance that he had desired to build two high power stations—one in London and the other in Manchester. Owing, however, to lack of Post Office permission, the desired 492 kw. had to be reduced to 1½ kw. which necessitated the use of numerous sub-stations. Wireless broadcast has to be sufficiently powerful to be heard practically anywhere by what Capt. Eckersley called "the optimist with his penknife, a piece of cheese and a wet clothes line."

Capt. Eckersley gave a very clear explanation of the now generally accepted Heaviside layer theory of fading.

Having given a general outline of the almost perfect microphone now in extensive use, Captain Eckersley suggested that the majority of the spurious noises now heard in "simultaneous" would be overcome by the use of wired wireless.

Capt. Eckersley concluded by comparing the well-organised developments of broadcasting in this country with the chaos existing in America.

Hon. Sec., F. W. Dawe, Finsbury Technical College, Leonard Street, E.C.2.

Honor Oak Park Radio Society.

On February 15th Mr. Willis (of Messrs. Peto Scott) gave a very clear explanation of the straight circuit receiver, going very fully into the subjects of tuning, reaction, detecting, low and high frequency amplification. The evening closed with questions, and a general discussion by members.

Hon. Sec., J. McVey, 10, Hengrave Road, S.E.23.

Glasgow and District Radio Society.

The Society met on February 13th at 207, Bath Street, where a lecture was delivered by Mr. Stick, B.Sc., on the subject of "Tuning, Resonance, and Coupling."

By the help of ingenious models the different phenomena were clearly illustrated and some very close analogies were obtained showing what actually takes place in an oscillatory electrical circuit under varying conditions.

The Society is now arranging a series of "free and easy" evenings at the workshop when members will bring up various interesting pieces of apparatus for demonstration.

Assistant Hon. Sec., Wm. K. Fulton, 148, Kenmure Street, Pollokshields, Glasgow.

The Clapham Park Wireless and Scientific Society.

Mr. R. J. Stanley gave an instructive lecture on the fundamental principles of capacity and inductance, on February 6th.

At the following meeting Mr. Pope, representing Messrs. S. G. Brown & Co., Ltd., gave a good demonstration of the "Crystavox," and the "Frenophone," both of his firm's manufacture, and explained in detail their construction and the principles by which they operated.

On February 20th, Mr. Abbot gave an account of his experiences of short wave reception from 50 to 100 metres, and drew attention to the circuits used, and the main points observed for efficiency on these wavelengths. Mr. Richardson, Chairman of the South London League of Radio Societies, drew attention to the forthcoming Exhibition to be held by the League, and urged members to contribute to the exhibits in the portion devoted to amateur constructed apparatus.

Hon. Sec., H. C. Exell, B.Sc., 41, Cautley Avenue, S.W.4.

FORTHCOMING EVENTS.

WEDNESDAY, MARCH 12th.

Radio Society of Great Britain. At 6 p.m. At the Institution of Electrical Engineers Savoy Place, W.C.2. Informal Meeting. Discussion, "Amplifiers for Short Wav Reception." To be opened by Mr. F. Phillips.

Edinburgh and District Radio Society. At 8 p.m. At 117, George Street. Lecture: "Alternating Currents" (Illustrated). By Mr. M. G. Scroggie, B.Sc.

Clapham Park Wireless and Scientific Society. Lecture: "Long Distance Transmission." By Mr. F. L. Hogg.

Tottenham Wireless Society. At 8 p.m. At 10, Bruce Grove, N.17. Lectures: "Testing of Grid Leaks and Condensers." By Mr. T. Vickery. "Cabinet Making." By Mr. A. D. Kilbey.

THURSDAY, MARCH 13th.

Liverpool Wireless Society. At 7.30 p.m. At the Royal Institution, Colquhitt Street. Address by Mr. Dan Godfrey, Jun., A.R.A.M. (Director of Manchester Broadcasting Station). Open to Public.

Hendon Radio Society. At 8.30 p.m. At the Town Hall, The Burroughs, Hendon. Lectures by Mr. D. Kilburn (**5 VR**) and Capt. P. P. Eckersley on "Wireless Telephony from Amateur and Broadcasting Standpoints." Followed by demonstration at **5 VR**.

Sale and District Radio Society. At 37, School Road. Lecture by Mr. D. F. Owen.

Hounslow and District Wireless Society. At 8 p.m. At the Council House, Treaty Road. Lecture "Dual Amplification." By Mr. Percy Harris.

FRIDAY, MARCH 14th.

Sheffield and District Wireless Society. At 7.30 p.m. At the Department of Applied Science, St. George's Square. Practical Work.

Wimbledon Radio Society. Lecture by Representative of Igranic Electric Co., Ltd.

Leeds Radio Society. At 7.30 p.m. Special General Meeting. Important Society Business only.

MONDAY, MARCH 17th.

Ipswich and District Radio Society. At 55, Fonnereau Road. Lecture: "Wireless Experiments on Wave Motion." By Mr. R. Stanley Lewis.

Dulwich and District Wireless and Experimental Association. Lecturer from the South London League of Radio Societies.

Sale and District Radio Society. At 37, School Road. Workshop Practice.

Kingston and District Radio Society. Lantern Lecture: "Construction and Application of Honeycomb Coils." By Representative of Igranic Co., Ltd.

Hornsey and District Wireless Society. At Queen's Hotel, Broadway, Crouch End, N.8. Lecture: "Wireless Telephones and Loud Speakers." By Mr. H. W. Pope. (By arrangement with Messrs. S. G. Brown, Ltd.).

Questions & Answers
Solutions of Readers' Difficulties

1. *All questions are answered through the post. A selection of those of general interest is published.*
2. *Not more than four questions may be sent in at any one time.*
3. *Every question should be accompanied by a postal order for* **1/-**, *or* **3/6** *for four questions, and by a coupon taken from the current issue.*
4. *A free coupon appears in the first issue of each month, and if this is sent in together with coupons from the three previous issues, the reader is entitled to have one question answered free of charge.*

"*R.C.*" (*Cardiff*) **asks for a diagram of a four-valve receiver for general reception, incorporating any refinements that may be conducive to efficiency.**

The diagram is given in Fig. 1. A coupled tuning circuit is employed in order to obtain selectivity, and the A.T.C. may be connected either in series or in parallel. A vernier condenser has been connected across the 0·001 μF. aerial condenser, since the tuning by means of so large a capacity is somewhat critical when connected in parallel with the A.T.I. A potentiometer is provided to control the grid potential of the H.F. valve, and a similar function is performed by means of grid cells in the case of the L.F. valves. The telephones are supplied through a filter circuit, which not only protects the telephone windings from the steady anode current of the last L.F. valve, but often improves the quality of telephony received. Switches are provided to control the number of valves in use, and to reverse the reaction coil when the H.F. valve is switched in or out of circuit. The H.T. battery should be shunted by a reservoir condenser of not less than 2 μF.

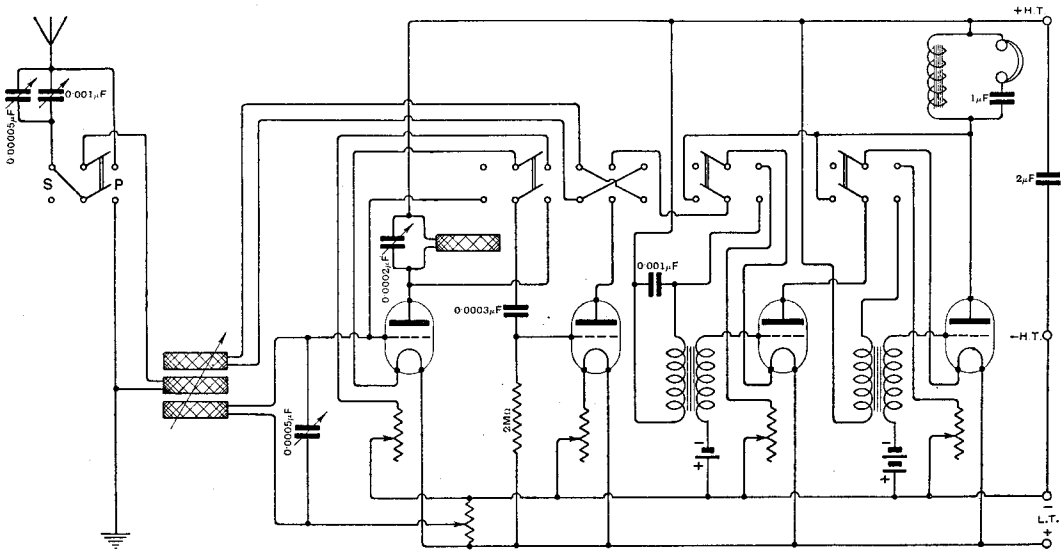


Fig. 1. "*R.C.*" (*Cardiff.*) *A four-valve receiver with* 1 *H.F., detector and* 2 *L.F. The switches are connected so that the receiver may be used with from one to four valves.*

"*N.R.F.*" (*London*), **wishes to use a local oscillator in conjunction with a short wave receiver, and asks how the oscillator should be adjusted and whether it should be switched off when receiving telephony.**

The local oscillator should not be used when receiving telephony, as serious distortion may be caused by the heterodyning of the telephony carrier wave. When receiving C.W. signals, it is generally unnecessary to couple the oscillator to the receiver by means of an auxiliary coil, as sufficient energy is usually picked up by the coils and wiring when the oscillator is placed on the table near to the receiving apparatus. It is often found when the oscillator is tightly coupled to the receiver, that radiation from the aerial is as great as when the receiver itself is oscillating. When receiving C.W. signals by the "autodyne" method with a self-oscillating receiver, it is necessary to de-tune slightly from the wavelength of the signal in order to produce an audible note in the telephones. With the separate heterodyne, the receiver is tuned exactly to the wavelength of the signal and the heterodyne beat note is produced by de-tuning the local oscillator. It will be seen, therefore, that the increase in signal strength obtained with a local oscillator is really due to the fact that the receiver can always be tuned to resonance with the incoming signal.

"*C.B.*" (*Didcot*), **asks what is the simplest form of receiver that could be used to receive broadcasting at a distance of 50 miles from 2 LO, in order to operate head telephones or a small loud speaker.**

Assuming that a good outdoor aerial is available, a three-valve receiver would be required, in which the first valve operates as a high-frequency amplifier, the second as a detector, and the third as a low frequency amplifier. The H.F. valve should be coupled to the detector by the tuned anode method, when it will be possible to increase the range of the set by coupling a reaction coil with the tuned anode circuit.

"*I.F.*" (*London*, E.15), **asks for particulars of a semi-aperiodic anode reactance unit to cover a wavelength range of 300 to 20,000 metres.**

The inductance should be wound in 12 sections in slots cut in a cylindrical ebonite former 2″ in diameter. The slots should be $\frac{5}{8}$″ deep and $\frac{1}{8}$″ wide, spaced $\frac{1}{8}$″ apart. The first six slots should contain 100 turns of No. 44 enamelled and single silk covered copper wire. The next four slots should each contain 200 turns, and the last two, 500 turns. The sections should be connected in series, with tappings taken from the junction between each section to a 12-point distributing switch. This switch should be connected in such a way that turns not in use are short-circuited.

"*S.E.B.*" (*Leamington*) **asks (1) What determines the correct value of the filament current required by a receiving valve. (2) Why the value of H.T. should be increased for the last stage of L.F. amplification.**

(1) The filament current must be adjusted to give an electron emission to correspond with the particular value of H.T. applied to the plate of the valve. The filament current should be reduced until the point is reached where any further reduction in the filament current causes distortion. To run the filament any brighter is only a wastage of filament current, and will result in reduction of the life of the valve. (2) The H.T. voltage and filament current are increased in order to extend the straight portion of the grid voltage — plate current characteristic of the valve, in order that the amplified voltage variations applied to the grid shall not extend as far as the bends in the characteristic curve.

"*G.E.H.*" (*Coalville*) **asks for particulars of (1) An A.T.I. for a transmitter to work on 200 metres (2) A radio frequency choke for 200 metres (3) Windings of a suitable microphone transformer.**

(1) The A.T.I. should consist of 35 turns of No. 16 bare copper wire on a former 5″ in diameter, the turns being spaced $\frac{1}{4}$″ apart. (2) The choke coil may consist of a single layer of 200 turns of No. 30 D.S.C. on a cylindrical former 2″ in diameter. (3) The primary winding should consist of 200 turns of No. 34 D.S.C., and the secondary 20,000 turns of No. 44 enamelled and single silk covered copper wire. The primary winding should be put on first.

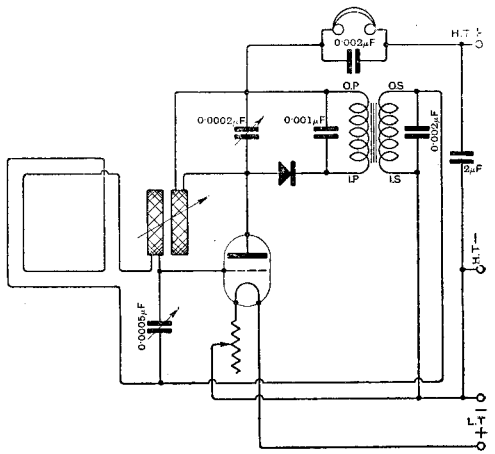


Fig. 2. "R.C.R." (London, S.E.5). A single valve crystal dual amplification receiver connected to a frame aerial.

"*R.C.R.*" (*London, S.E.5*) **asks for a diagram of a sensitive single valve and crystal receiver to work in conjunction with a frame aerial.**

In order to use the valve to best advantage, a dual magnification circuit is given. Referring to Fig. 2, it will be seen that after rectification by the crystal detector, the signals are passed back to the grid of the valve through the intervalve transformer for L.F. amplification. The tuned anode coil is coupled with a small plug-in coil connected in series with the frame aerial, in order to obtain reaction effects. The 0·0005μF tuning condenser should be connected across the frame and coupling coil, as shown in the diagram. A common mistake in circuits of this type is to tune the frame aerial only, leaving the coupling coil outside the oscillatory circuit.

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 240. (No. 25. Vol. XIII.) MARCH 19th, 1924. WEEKLY

CONTENTS

THE EDITOR will be glad to consider articles and illustrations dealing with subjects within the scope of the Journal. Illustrations should preferably be confined to photographs and rough drawings. The greatest care will be taken to return all illustrations and manuscripts not required for publication if these are accompanied by stamps to pay return postage. All manuscripts and illustrations are sent at the Author's risk and the Editor cannot accept responsibility for their safe custody or return. Contributions should be addressed to the Editor, "The Wireless World and Radio Review," 12 and 13, Henrietta Street, Strand, London, W.C.2.

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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AMATEUR INTERNATIONAL WORKING.

SOME SURPRISING LONG DISTANCE SUCCESSES.

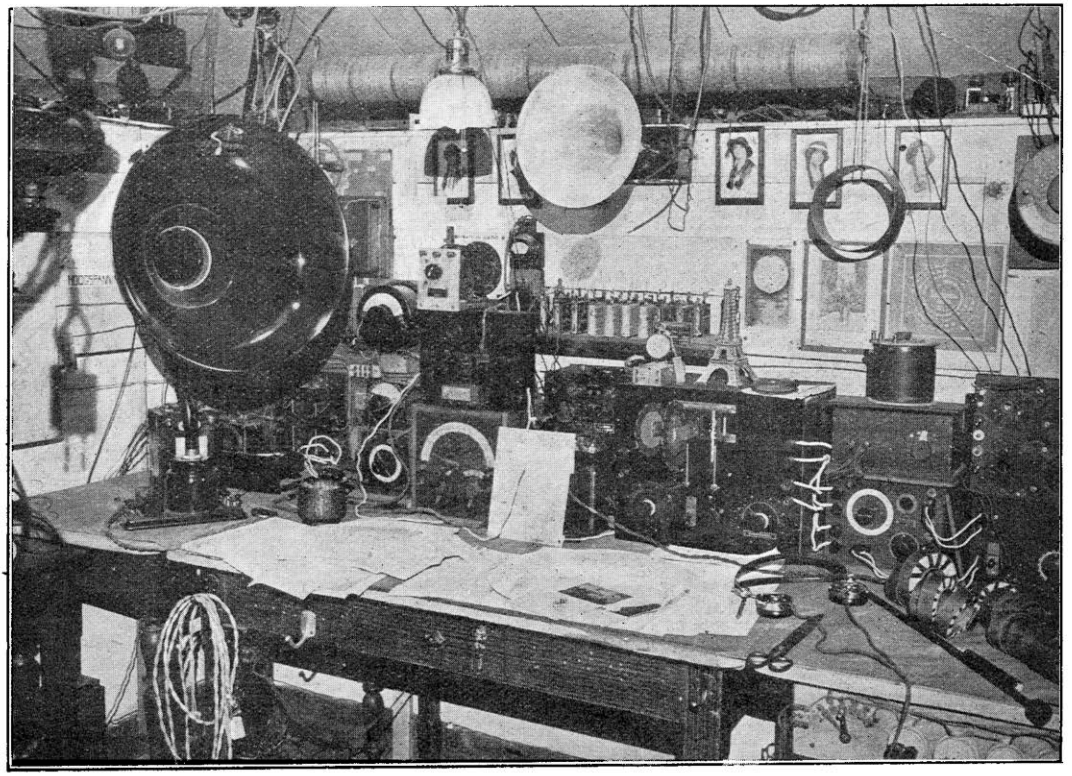
TRANS-OCEAN amateur communication is now well established, and each week brings to light new and remarkable achievements. There are now many British and Continental amateur stations working to regular schedules with stations in U.S.A. and Canada, and these tests result in the collection of much useful data on fading effects and variation of strengths under different atmospheric conditions, on both sides of the ocean.

The fourth district of U.S.A. is already in contact with England, and the first station to effect two-way working was **4 BZ** (now **4 XC**) of Atlanta, Georgia, who has worked at least two London stations.

The strength of signals from this station and the regularity with which communication can be effected is remarkable, considering the distance from London, some 4,500 miles. The aerial current at this station is at present in the region of 3 amperes, and the power is to be increased still further.

7 ZU at Montana reports having logged **G 2 KF** on February 11th, and from these results it appears that we shall soon be in direct contact with stations on the U.S.A. Pacific coast.

G 5 LF has succeeded in reaching Maine, where his signals were heard by **1 BDI** (now **1 XAH**), who was heard calling **G 2 MJ** probably mistaken for **2 WJ**, who was working a few minutes previously.



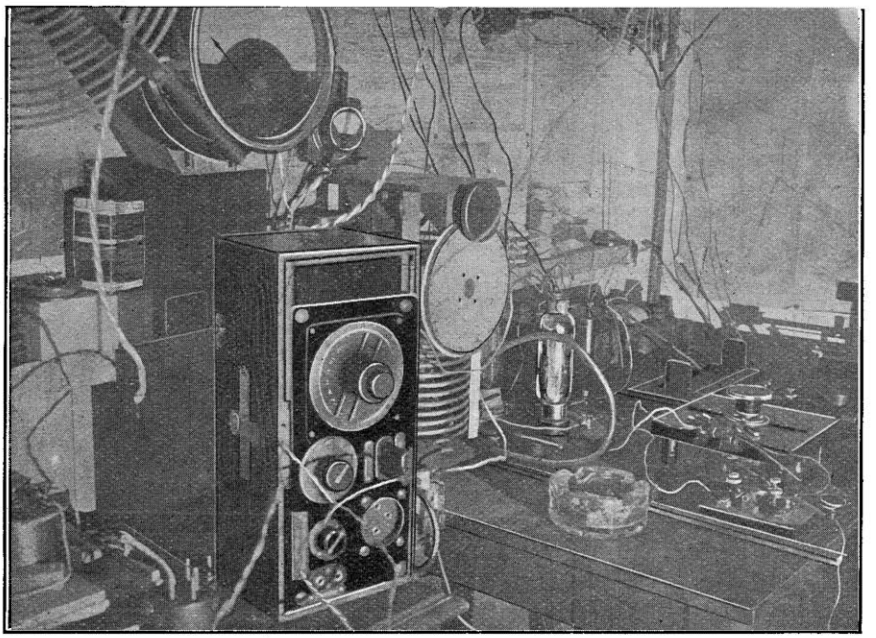
The Dutch amateur station **PCTT** *which communicates with a number of American and Canadian Stations.*

5 KO of Bristol is now regularly working with the other side, and his signals have reached Chicago.

The untiring efforts of **2 OD**, **2 SH**, **2 SZ** and **2 KF** have resulted in each of these stations having worked with stations in U.S.A. and Canada, whose numbers run into two figures.

The remarkable feature of the tests is the great difference in the powers employed by the stations engaged on each side. Whereas the American stations seldom use less than 250 watts input, our own men are working with powers of 50 to 250 watts, a very peculiar occurrence indeed. **U 1 XW** (ex **1 MO**) has increased his power, and is at times quite uncomfortable on two valves in London. Many special permits for low wave working are being issued to the American stations, and in each case the first letter of the sign after the figure is an "X," which denotes that the station is entitled to work on waves below 150 metres only. **1 BDI** has recently changed to **1 XAH**, and with **1 XAM** and **1 XW** rank amongst the strongest of the U.S.A. stations heard in England at present.

British stations have now communicated



Another view of the apparatus at **PCTT**, *showing some of the transmitting gear.*

and the maximum only in a very few cases. The note of the Yankee stations is with very few exceptions of similar character, produced by the extensively used self-rectification circuit, designed by one of their own men, and the tone is unmistakable. An exception to the above rule is **1 CMP** (Bridgewater, Mass), who apparently uses a spacing and marking wave with a view no doubt to eliminating local interference to broadcast listeners. This station, whose signals are very consistent, has also an "extra wave" some ten metres above the intended wavelength, and he can be read easily on this "upper wave," with stations in most U.S.A districts, only the fifth, sixth and seventh remaining, and the reason for this is probably due to the fact that the inland stations are awaiting their special "X" permits before attempting communication with Europe.

On the other side it appears that there is no definite code for signal strengths similar to our own "R" or "A" codes, and the reports from U.S.A. usually give our signals as QRZ (weak), QRK (fair), QSA (loud), very QSA (strong). The abbreviations employed by the Yankee stations are many and various, but a few of the most used are NM (no more), NW (now), YSTDY

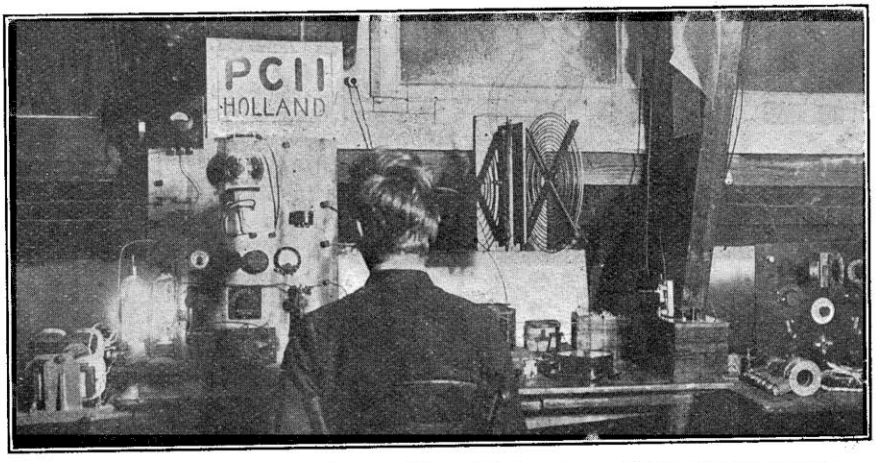
(yesterday), MNG (morning), FB (fine business), GLD (glad), CUL (will see you later), RADN (radiation), HR (here), WX (weather), GUD (good), and so on, and this habit is fast growing upon our own men for much time and current can be saved in this way.

Another very excellent idea has been adopted by their stations and it is hoped that the various licensing authorities throughout Europe will approve of the arrangement, and that is the use of the "International Intermediate" in lieu of the cumbersome and confusing "A" and "G" prefix now in use by British stations, on instructions given in the special permits.*

A. Australia
C. Canada
F. France
G. Great Britain
I. Italy.
M. Mexico.
N. Netherlands
O. South Africa (the one exception.
P. Portugal.
Q. Cuba (phonetic).
R. Argentine (do.).
S. Spain.
U. United States.
Z. New Zealand.

The procedure is as follows:—

A British station, say **2 AA**, when calling an American station, say **1 DDX**, calls: **1 DDX** ug **2 AA**, and if the American stations receive the call he replies with **2 AA** gu **1 DDX**. The "ug" and "gu" here indicate the nationalities. It will be seen that it is not possible to confuse the



Another well-known Dutch station, working with American and Canadian amateurs.

The Americans have not been slow in realising that much confusion is liable to arise when the prefix method is used, and now that three-letter calls are being issued in more than one country, confusion is occurring. A station for example in Central U.S.A. hears a call **G 2 AA** repeated many times, and with a little bad spacing the call is logged as **2 AAG**. The signal probably fades out, and the listener of course logs the station as American **2 AAG**. Incidents of this nature have actually taken place, and must be avoided if possible.

The Americans suggest that each country shall be denoted by the initial letter, and have drawn up the following list:—

actual call signs in any way for they remain unaltered, and only the break sign is changed. In practice this method is found to work exceptionally well and it is hoped that permission will be given to British amateur stations to adopt this method when working foreign amateur stations.

A late report shows that still another "4" is in touch with England, and **4 BY** (Savannah, Georgia) has worked **G 2 OD** and **2 KF**, whilst **4 IO** and **4 HS** have been heard here. **4 EB** is also making special arrangements to "get across."

The reception of American stations in England at the present time is quite an easy matter, and there is not a morning that they are unable to get their signals across, even if they cannot effect two-way working.

*This matter is dealt with on p. 767 "International Amateur Radio Call Signs."

Saturday evenings and Sunday mornings seem to be the most popular times for our men, and the QRM on 100-130 metres is becoming almost as bad as the 200 metre band. The same thing applies on the U.S.A. side, and they have also two broadcasting stations working between 100 and 110 metres—**KDKA** and **WGY**, the latter station producing some really good transmissions which are received on this side very clearly, and at times very strongly.

A station **P 2** at Brussels has worked with several British amateurs and also **8 SSU**, whose location is given as Bonn, Rhineland, has carried out several tests with our men.

The Dutch amateurs **PCII** and **PCTT** are going strong, the former having worked many stations in U.S.A. and Canada, and this station has a schedule of transmissions to the station of an amateur in Japan. Photographs of these stations are given in these pages, and it will be seen that in each case the stations are very well equipped, and give the appearance of having high powers available.

ACD at Bologna, has now exchanged signals with several more British stations, also two or three on the Atlantic Coast of U.S.A. He has now closed down for a few days in order to make preparations for a high power set for transatlantic communication. The layout of his station is very neat indeed, and gives the impression of efficiency. A reversed feedback circuit is used for transmission.

Danish amateurs are now endeavouring to reach the States, and **7 QF** may be heard almost any morning with an A.C. note. This station has so far exchanged signals with England, Holland, France and Italy, also with **P 2** and **8 SSU**.

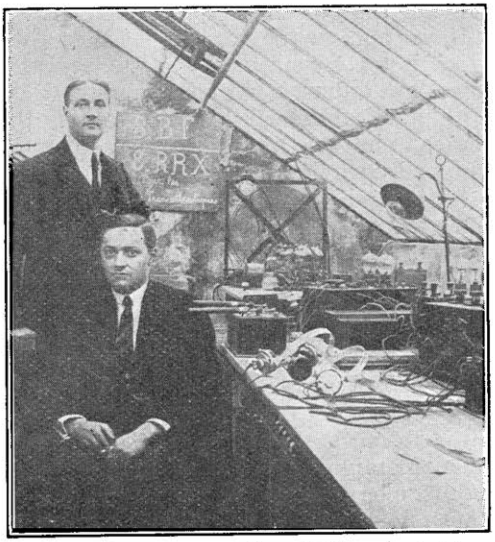
7 EC is another Copenhagen station who has been heard by Mr. J. Renshaw of Blackburn and many other listeners throughout the country, and the same can be said of **1 JW**, who is located at Luxemburg.

6 RY of Bath has recently made rapid strides, and we have now the report of his two-way working with two American stations.

5 LF, previously mentioned as having been received in U.S.A., has now exchanged signals with **1 XJ** and **1 XAH (1 BDI)**, both stations reporting his signals as being very good. This station has recently experimented with quite small powers and succeeded in working **P 2** and **8 AQ** near Paris on 5 watts in daylight. **4 IO** of Atlanta, Georgia, has also heard **5 LF**.

Reception by British amateurs of American and Canadian signals using single and two-valve receivers improves every day, and Mr. D. A. Broun, of Birmingham, has logged about 35 stations in four nights.

2 OD, of Gerrard's Cross, heads the list for stations worked with something over 30 U.S.A. and Canadians to his credit, whilst **2 KF** has a total of 28, and is closely followed by **2 SH** and **2 MN**.



The French amateur station, **8 BF**, *operated by M. Pierre Louis, This was the second French station to work with America.*

The introduction of "Summer Time" will give us another hour of working with our American cousins, and most of our men are asking each other, "how long shall we be able to keep in touch with the U.S.A.?"

At the present time reliable two-way working ceases about 7 a.m., when our signals become very weak to the listeners on the other side, but on several mornings quite recently the "boiled owls" on the other side have been heard working with stations inland until 9 a.m. G.M.T.

An attempt by **2 KF** to establish contact with **6 BCL** in California a few mornings ago was unsuccessful, although Mr. Handy (**1 BDI**) tried hard to join these two stations up.

J. A. P.

TELEVISION.

AN ACCOUNT OF THE WORK OF D. MIHALY.

BY NICHOLAS LANGER.

I.—GENERAL CONDITIONS.

THE word Television, in the sense we intend to use it, means to be able to see distant objects by means of special apparatus without any regard to optical hindrances between the objects and the observer.

If we make a photograph of the object which is to be rendered visible at a distant place by ordinary telephotography, there is no practical difficulty in transmitting this photograph to a distant station either by wire or by wireless, and to reproduce there a photograph quite like the original. We know many excellent methods of telephotography, for example, those of Belin, Korn and of some others. In these methods a rather considerable interval of time is needed for the transmission (five to twenty minutes for a photograph of the size 6 by 9 centimetres). An elaboration of this principle consists in taking a series of photographs of the object in a similar manner to ordinary cinematography, and after transmitting these photographs one after another by telephotography to the receiver station, to reproduce them as a motion picture. The series of photographs can serve to make the object in question visible at the receiving station, although with some delay.

The present methods of telephotography are working at a far too low speed to enable the process to be carried out in the described manner. In addition the light sensitive films must be developed and fixed, a process which takes up more time, and thus television carried out in this manner would prove an impossibility. The problem of television is thus reduced to the method of increasing the speed of transmitting photographs, and no one will doubt that advance can be made in this direction. Considering the problem from this point of view, it would appear that a form of television is within reach of present science.

Some five years ago I conducted a number of experiments concerning some details of the problem. Meeting later Dionys Mihaly (Budapest), who was then making rapid progress towards the solution of the problem, I gladly undertook to assist him in his experiments. In the year 1922 a short *résumé* of my theoretical and experimental investigations was published in *The Wireless World*.*

Disregarding colour, the picture of an object, moving or stationary, can be considered as consisting of many very small areas of varying brightness, which, for the sake of simplicity, are called "picture elements." These picture elements can be regarded as being so small that their corresponding brightness is uniform over their whole area.

Instruments with which differences of illumination are converted into fluctuations of an electric current are well known, for example, the various types of selenium cell and other light-sensitive devices. The properties of selenium cells are too complicated to be treated here at full length, but it might be mentioned that the cells used have a section sufficiently large and a length small enough to produce a maximum variation in the very high specific resistance. One simple type of selenium cell has a support of two thin parallel wires of 600-800 millimetres length wound round a porcelain plate so that the distance between the two wires is about 0·5 mm. A fine layer of amorphous selenium is put on the support, and by means of a heating process is turned into the grey crystalline modification which is so sensitive to light. An average selenium cell of this type has an electric resistance of 60-100,000 ohms, which diminishes by illuminating it with an incandescent lamp of 16 candle power from a distance of 1 metre to 30-50,000 ohms, that is, to about one half of the "dark-resistance." One of the drawbacks to the use of selenium is, that in

* *Wireless World and Radio Review*, Nov. 11th, 1922.

consequence of its high resistance the currents passing through it are very small, generally of the order of a microampere. Another and still more important drawback is that selenium takes some time after the illumination has ceased to regain its original (dark) resistance. This phenomenon is called the "lag" of selenium cells, and many methods have been worked out for compensating its effects.

The principle of modern attempts to solve the problem of television is as follows:—

The picture to be transmitted is taken to pieces (to so-called picture elements) which are of the same size, but in general, of different brightness. These picture elements are projected one after the other upon the selenium cell which converts the differences in illumination into fluctuations of an electric current which are transmitted to the receiving end either by wire or by wireless. At the receiving station the current fluctuations are converted into fluctuations of a light source and distributed on a screen in the same order as they were at the transmitting station. The transmitted picture appears in extremely small parts (in its picture-elements), which exist one after the other for a very short time. Because of the lag of the eye, however, the impression made by each of these picture elements will last for about 1/10th of a second, so that if all the picture elements are transmitted within 1/10th of a second, they appear to exist at the same time and produce the impression of a complete picture.

There are the following special problems:—

1. Taking to pieces (picture elements) the picture to be transmitted.
2. Converting the differences of brightness between the picture elements into changes in amplitude of an electric current.
3. Transmitting these fluctuations to the receiver either by wire or by wireless.
4. Rearranging the fluctuations into picture elements of different brightness.
5. Projecting the picture elements on a screen in the same order as they were in the transmitted picture, which also includes the problem of synchronisation.

The most difficult of all these problems is perhaps how to convert the extremely small differences of brightness between the single picture elements into current fluctuations. Until recent years the very small current fluctuations caused by varying the illumination of selenium cells could be scarcely registered. By means of the valve amplifier, however, these minute currents may be amplified to any extent necessary, and only this has made it possible to obtain practical television.

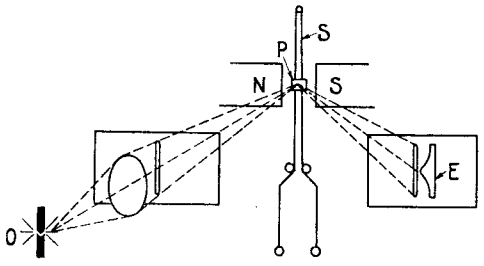


Fig. 1. Explaining the "Telehor."

II.—THE "TELEHOR" OF D. MIHALY.

The chief feature of the Telehor is the use of very small oscillating mirrors of an area of only 1 mm.^{2} (one square millimetre) or less, for the purpose of splitting the picture into picture elements, and for rearranging the current fluctuations into picture elements of different brightness. The small mirror (Fig. 1) P is pasted to a loop of an extremely thin platinum wire S (about 0·01 mm. in thickness) stretched between the poles of a powerful electromagnet (N.S.) representing a similar arrangement to the well-known oscillograph of the Siemens type.

Two special devices have been used to synchronise the transmitter and the receiver in the construction of the Telehor: the tuning-fork interrupter and the "phonic drum" of La Cour.

The tuning-fork interrupter (Fig. 2) is in principle quite analogous to an ordinary interrupter (buzzer). A carefully made tuning-fork which has been magnetised is placed between the poles of an electromagnet so that they draw the two legs of the tuning-fork apart. In this position, however, the current from the battery will be interrupted at the contact

C, and so the legs of the tuning-fork return into their original position, when

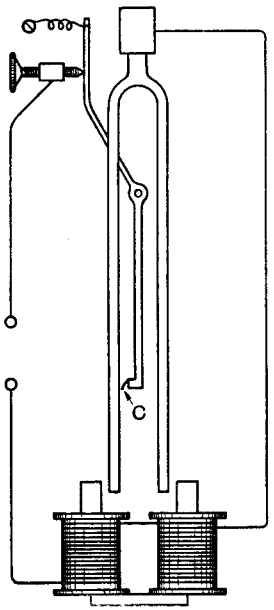


Fig. 2. The tuning fork interrupter.

the movement continues. The tuning-fork is thus oscillating, and can be used for producing alternating currents of very constant frequency.

The " phonic drum " of La Cour (Fig. 3), which represents the simplest possible type of synchronous motor, consists of a hollow drum G made of wood, copper, aluminium or of any anti-magnetic material, which may be partly filled with mercury and on the outside of which are thin iron bars, I_1, I_2, etc., at equal distances apart. The drum is pivoted, and an electromagnet

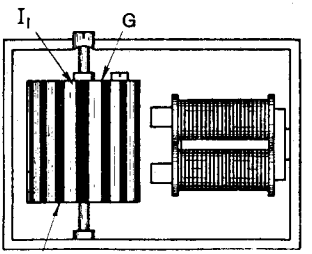


Fig. 3. The " phonic-drum " of La Cour.

is mounted close to the drum, so that its poles are at a distance of about 0·5 mm. from the iron bars. This electromagnet is connected with an alternating current supply or supplied with interrupted direct current, and if the drum is caused to rotate at a speed such that the number of iron bars passing the poles of the electromagnet per second is equal with the frequency of

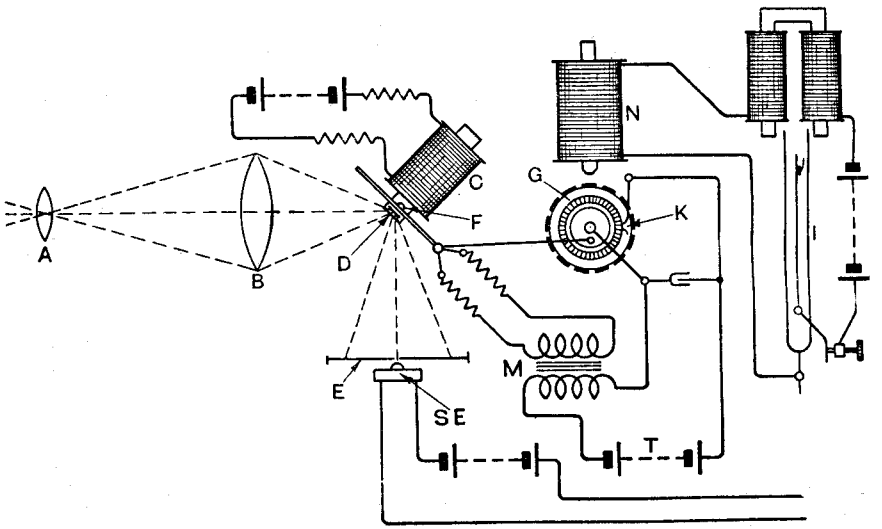


Fig. 4. The transmitter.

the A.C. (or the number of interruptions of the intermittent D.C.), the drum rotates at a speed depending only on the frequency of the A.C. in question. The phonic drum, of course, can be used in connection with the tuning-fork interrupter described; the electromagnets of both being connected in series. This arrangement can be advantageously used, if we wish to obtain complete synchronism between the motion of two separate phonic drums located at two distant stations. If the two tuning forks are carefully tuned to the same pitch, which project it upon the small oscillating mirror D of the oscillograph C. The mirror D is caused to oscillate at a rate of 500 oscillations a second by feeding the platinum wire loop with an alternating current of 500 cycles. The mirror D, however, has also another much slower oscillation to fulfil in a horizontal plane. The former consists of a metal frame holding the platinum wire loop, pivoted in its middle at F and connected through a lever to an eccentric point on the phonic drum G. The phonic drum is caused to rotate by

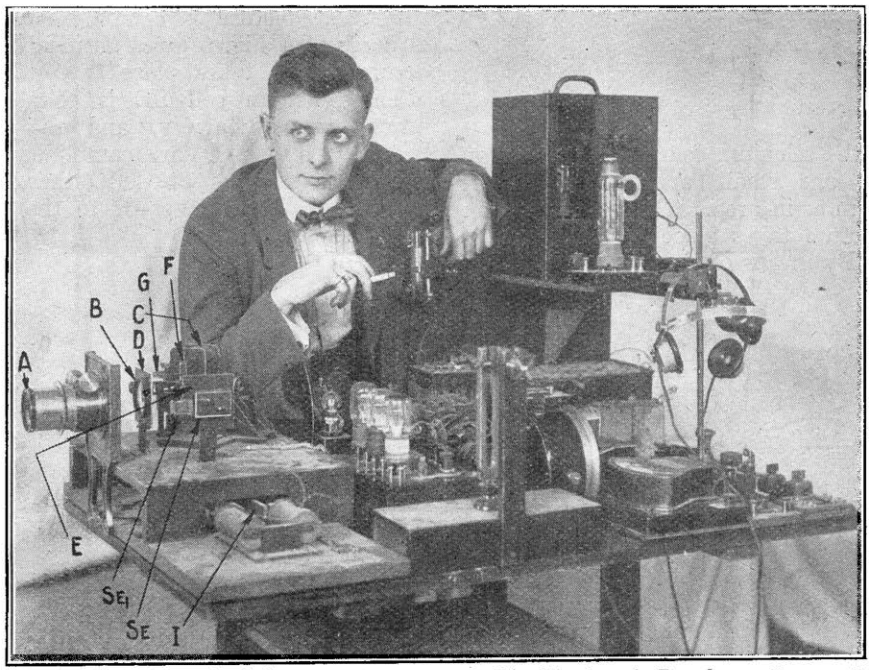


Fig. 5. A photograph of the apparatus represented in Fig. 4. A, B = lens; D = oscillating mirror; E = diaphragm; G = phonic drum; I = tuning fork interrupter; SE = selenium cell holder; SE_1 = the small selenium cell of special design taken from the holder SE.

is easily done, the two drums will rotate at the same speed, and they will remain in phase for hours without any regulation. La Cour and Mercadier used such arrangements with great success for synchronising multiplex and high-speed telegraph apparatus.

The complete transmitter (except the camera obscura inside which it is placed) is represented in Fig. 4 and the photograph of Fig. 5.

The lens A and B reduce the picture to be transmitted to a very small area and means of the electromagnet, being connected in series with the tuning-fork interrupter I with a frequency of 100 oscillations a second, which means that there are 20 iron bars on the surface of the drum, and five revolutions a second, producing five complete oscillations of the mirror D in the horizontal plane. The alternating current of 500 cycles necessary for feeding the platinum wire loop of the oscillograph C is obtained by interrupting the current of the battery T through a small interrupter K consisting of 100 insulated segments

mounted on the phonic drum. Consequently the current is broken 500 times a second, and this intermittent D.C. is converted by means of the transformer M into A.C.

The rays from the oscillating mirror D now diverge, projecting a picture of about original size upon the diaphragm E, behind

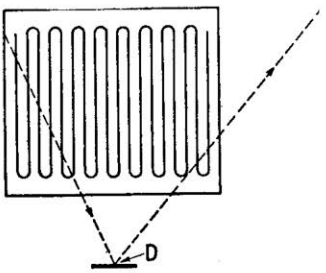


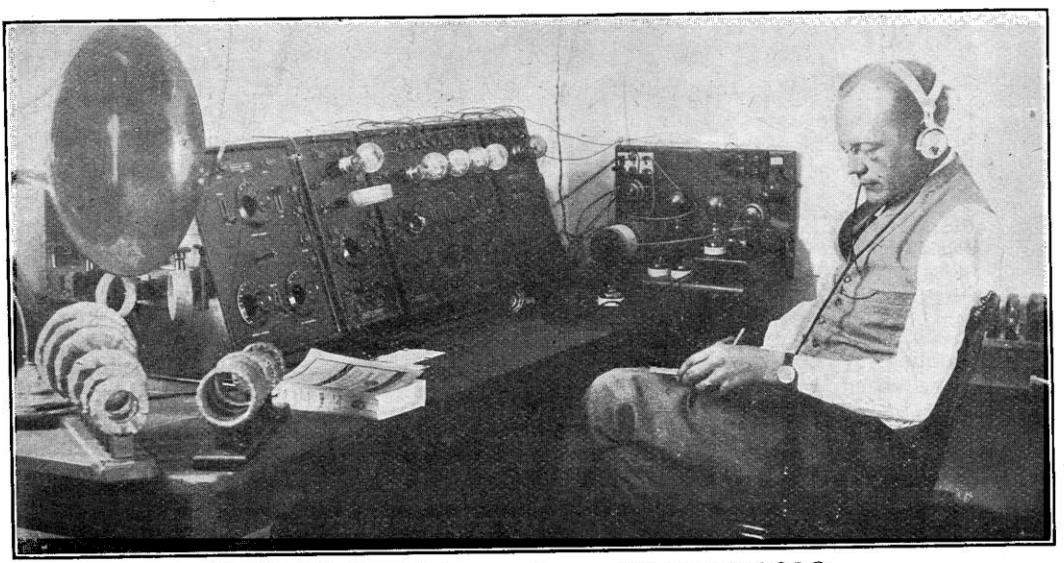
Fig. 6.

which is the selenium cell. The diaphragm has only one small aperture of about 1 square mm. in area. The decomposition of the picture takes place in the following manner. By means of the rapid oscillations of the mirror D in the vertical plane the picture is caused to move up and down on the diaphragm 500 times a second, so that there is always a picture element of a narrow strip of the picture projected upon the selenium cell. The mirror D, however, also oscillates in a horizontal plane at a rate of five oscillations a second, which means that during 1/10th of a second while the mirror D makes 50 oscillations in the vertical plane it makes 0·5, that is, one half oscillation in the horizontal plane. This is the way the picture elements reach the selenium cell; the decomposition of the whole picture is completed in 1/10th of a second. Fig. 6 gives an idea how this decomposition takes place.

The selenium cell SE is connected in series with a battery, and the current fluctuations which are amplified by a two-valve amplifier are led either directly by wire to the receiver or to the wireless transmitter.

(*To be concluded.*)

RECEIVING 2 LO IN SOUTH AFRICA.



Mr. H. G. Becker with the apparatus on which he received **2 LO.**

The reception of the London Broadcasting Station in South Africa has already been reported in these pages and we are now able to reproduce a photograph of the apparatus employed. The set is operated by Mr. H. G. Becker, seen in the illustration, and is situated at Port Elizabeth.

Signals from **2 LO** were first heard at 1 a.m. local time, which is about 9.30 p.m. G.M.T.

THE THREE-ELECTRODE VALVE.

By W. SYDNEY BARRELL.

THE VALVE AS AN AMPLIFIER.

PROBABLY the most important function of the three-electrode valve is that of amplification, and in this respect the valve may be said to occupy a field of its own, for, while in the case of rectification, there are other alternatives which may be substituted, as an amplifier it stands without rival.

Amplification may be divided under two headings :—

(1) Radio or high frequency amplification, and
(2) Audio, note or low frequency amplification.

Either of these two methods has its own particular merit and its own sphere of application, and, according to the results required so will one or the other or even both of these methods be employed. It is therefore necessary to understand the *raison d'être* of high and low frequency amplification and to appreciate their respective advantages and limitations.

Now the currents flowing in the aerial of our receiving sets are at radio frequency, whereas those which flow through the telephone winding are at audio frequency, and we may either amplify these tiny aerial currents before they are detected or we may amplify the already audible signal after detection. In the former case we are using high or radio frequency amplification, and in the latter case we are using audio or low frequency amplification, but while the circuit details to give the best results under these two conditions are somewhat different, yet the action of the valve itself remains the same.

By amplifying a signal after it is detected (L.F. amplification) we are merely making the already audible signal louder, that is, we are increasing the volume of sound. L.F. amplification is therefore used when the telephone signals are weak or when it is required to increase the volume of the signal so that it can be heard throughout a room. It does not, however, materially increase the range of a receiver for the reason that it only deals with that energy passed on to it from the detector. This will become more apparent when we have considered the sphere of application of high frequency amplification.

High frequency amplification is used to increase the range of a receiver, and therefore brings in signals which with a plain detector would not be heard. One of the reasons for this is due to the peculiarity of the detector in that its efficiency as such is proportional to the square of the voltage impressed between its grid and filament. Thus for example, if the radio frequency signal is doubled in intensity the efficiency of the detector will be increased four times. So that the greater the radio frequency signal applied to the detector the stronger the sound in the telephones. On the other hand it is to be noted that, due to this "square law" effect, the efficiency rapidly falls off with weakening signals and below a certain critical value the detector ceases to function. High frequency amplification can therefore be said to increase the efficiency of the detector.

All present-day methods of amplification are based on the fact that the valve is itself an amplifier ; that is to say small variations of grid potential will cause comparatively large variations in anode current.

HIGH FREQUENCY AMPLIFICATION.

There are a number of ways in which the incoming radio frequency oscillations may be amplified, and many variations in circuit arrangements have from time to time been proposed. There are, however, three basic methods of high frequency coupling in general use :—

(1) Transformer coupled.
(2) Resistance coupled.
(3) Tuned anode coupling.

Certain advantages and disadvantages accrue to these methods, but we shall not discuss

them as it is our purpose to describe merely the function of the valve and its adjustment.

Fig. 1 represents the anode current grid volts characteristic of a certain valve, that is, it shows how the anode current varies according to the voltage applied to the grid. It will be seen from this figure that if we can arrange the valve in a circuit in such a way that its operating point is at X, then normally there will be a current I_p flowing in the anode circuit. It will further be seen that by varying the grid volts we shall vary the anode current, and this is the fundamental action underlying the operation of the valve.

Now if we apply an alternating voltage of, let us say, 0·5 volt about the point X, we get an equal variation of anode current above and below the normal value. This is shown in Fig. 1. Working in this way, we keep the anode current within the limits of the characteristic which is a straight line and under these conditions the changes in anode current follow exactly the changes in grid voltage. This then gives us true amplification without distortion.

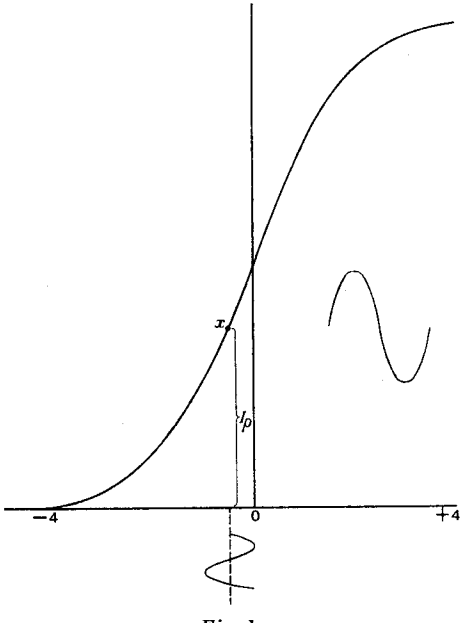


Fig. 1.

It will of course be obvious that the steeper the straight part of the characteristic of Fig. 1 (*i.e.*, the greater the angle which the straight portion makes with the base line) the greater the amplification, because the steeper the characteristic the greater the change in anode current for a given change

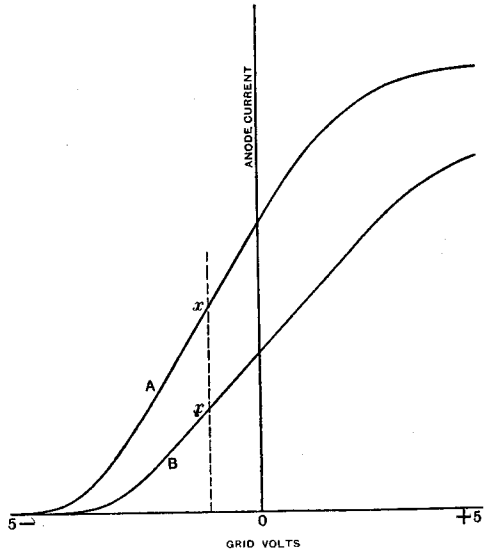


Fig. 2.

in grid volts. In this connection compare Fig. 2, curves A and B.

For true amplification, that is to say, for amplification without distortion, it is required that the oscillations in the plate circuit of the amplifier valve be of exactly the same form as those which are applied to its grid. Theory would therefore indicate that the valve should be adjusted to work around the middle of the straight part of the characteristic and with a sufficient negative grid bias to prevent grid current flowing. Unfortunately, however, in practice a high frequency valve can seldom be made to operate at this point owing to its liability to self-oscillate.

H.F. amplifiers have a tendency to self-oscillation, and the greater the number of stages the greater this tendency becomes. Provided the coupling between anode and grid is large enough, any circuit will oscillate and in high frequency amplifiers there is generally a strong coupling present, particularly if the circuits are tuned. In addition to this it must be remembered that there is always some internal coupling in the valve itself, and this is why valves having a small internal capacity are to be preferred for high frequency amplification. Due to this coupling effect there is always present

a tendency for the amplifier to oscillate or "howl" and to prevent this it is usual to arrange for the grids to be connected to the slider of a potentiometer connected as shown in Fig. 3, and by adjustment of the slider a position can be found where the amplifier just does not oscillate. What actually happens when we move this potentiometer slider is that we alter the potential of the grid and therefore the point of operation on the curve, and we shall find that it will generally be necessary to make the grid slightly positive, which will cause a current to flow to the grid and thus produce a damping effect. So that we see in actual practice we have to compromise between distortion due to grid current and self-oscillations. It is to be noted further that self oscillation will be aggravated if the H.F. valve is somewhat soft. The amplitude of these incoming oscillations are small so that at any rate for a one-stage H.F. amplifier the straight part of the characteristic need not be long.

High frequency amplification is not intended for strong signals, its purpose is to amplify weak signals so that the detector may operate efficiently. High frequency amplification is therefore quite unnecessary for near-by stations when an outdoor aerial is used.

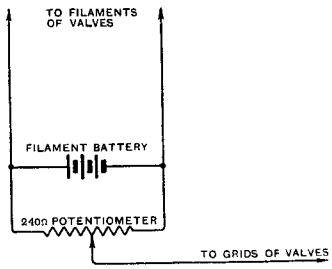


Fig. 3.

INTERNATIONAL AMATEUR RADIO CALL SIGNS.

A RESUME OF PROPOSALS FOR AVOIDING CONFUSION, WITH PARTICULARS OF OFFICIAL RECOMMENDATIONS.

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

LAST year's Transatlantic Tests (Christmas, 1922) first showed up to British radio experimenters the possibility of confusion arising between the call signs officially allotted to radio amateurs in different countries. During those tests, in which we were listening for signals from America, it was found several times that two stations using the same call sign could be heard working at the same time, one being located in the United States (second district) and the other in this country.

In the American continent the difficulty arising through the absence of international agreement in the allocation of amateur call signs had been met at an earlier date, as many U.S. call signs have duplicates in Canada. A working arrangement between radio amateurs in these two countries had been arrived at so as to provide a means of indicating whether two American amateurs or two Canadians were in communication with each other, or whether an American was calling a Canadian or *vice versa*. This distinction was made by modifying the "intermediate" signal separating the call signs of the called and the calling stations. The official intermediate signal laid down by international agreement is "DE," this signal being of course used in all commercial transmissions. The arrangement unofficially adopted between Americans and Canadians was to retain this "DE" signal for transmissions between the American amateurs, and to replace it by other letters for Canadian transmissions, and for transmissions between America and Canada. Two Canadians working together would use "V" to separate the call signs in similar manner to the separative signal frequently used in British Naval radio transmissions. An American amateur station calling a Canadian used "AA" instead of "DE," and a Canadian calling an American used "FM" for the same purpose.

This scheme worked very well while only two countries were concerned, but the extension of the signalling range of amateur

stations over the Atlantic and Pacific Oceans, meant either that there had to be a large increase made in the number of such arbitrary intermediate signals, or an entirely new scheme had to be prepared.

Some months prior to this year's Transatlantic Tests the American Radio Relay League circulated the amateur radio organisations in all the various countries where such organisations or societies exist, putting forward a suggested scheme for a uniform method of designating the country of origin of all calls from amateur radio stations, by appropriate modifications of the intermediate or " DE " signal. About this time M. Léon Deloy, of Nice, France, well known as **8 AB**, put forward another scheme for designating the nationality of the call signs. He proposed to prefix all call signs by a letter indicative of the country to which the call belongs. Thus, to designate that his is a French station he proposed to prefix his call with the letter " F," and his method became well known to many by the frequent use of the call **F 8 AB** for his station.

Space will not permit of a detailed account of all the other proposals which have been made for overcoming the confusion of duplicate call signs, as although all of them have some points in their favour, their disadvantages have so far outweighed their advantages as to result in their rejection by the majority of the countries concerned.

In this country it was of course strongly felt by the Radio Society of Great Britain that uniformity of method was of the utmost importance, but at the same time it was not considered desirable to modify the intermediate " DE " signal if at all possible to avoid doing so, since not only is that signal an officially allocated one by international agreement, but it is also so well known and recognised that its replacement might lead to confusion. Coupled to this too the General Post Office have placed a definite ban on the adoption by British amateurs of any scheme which involves interference with the international " DE " signal. Subsequent to this the Post Office has authorised British amateurs to utilise a system analogous to that proposed by M. Deloy consisting of the use of a prefix letter or letters to designate the country to which the calls belong. They stipulated that the prefix must be taken from the initial letters of the series of calls allocated by the Berne Bureau for the commercial call signs of the countries concerned. In cases where the commercial calls of any country commence with more than one letter of the alphabet (as for Great Britain, United States, France and some other countries) one of those initial letters only should be chosen as prefix for the amateur call signs; and in cases where one initial letter has been allocated by Berne to more than one country, the two prefix letters are to be used. This last applies to the British Colonies and some other countries.

Acting on these lines a list of prefix letters has been prepared, and has been approved by the Post Office for use by British amateurs in all cases when calling an amateur radio station in another country, the appropriate prefix being chosen in accordance with the country of the called station. In all such cases their own call sign should be prefixed with the letter G, which is the appropriate prefix for Great Britain.*

The officially approved list of prefixes for use by British amateurs is as set out in Table I.

It will be noted that this list includes many double letter prefixes, but this apparently is unavoidable under this scheme, which has received the Post Office approval.

The use of these prefixes is now fairly general in Europe, and during this year's first Transatlantic transmission schedules between December 22nd and January 10th the double letter prefix of Holland apparently caused no difficulty. Several Dutch amateurs using the **0** initial figure received transmission schedules from this country and used the **PA** prefix in accordance with the above table, while another Dutch amateur who received a special licence from the Dutch government for the Tests was given a call letter **PA9**, which itself involved these prefix letters, thus also definitely establishing the nationality of the station.

Unfortunately from the point of view of uniformity of action in these matters,

* In cases where special permits have been granted by the Post Office for the Transatlantic Tests, mention has been made in the permit of the use of this " G " prefix in all cases when communicating with a station outside this country. The Post Office has also emphasised the need for obtaining special permission in all cases when it is desired to communicate with foreign amateurs.

the American Radio Relay League have maintained their championship of their original proposal involving a modification of the "DE" separative signal. Some other countries have also supported them in this matter. Hence in deference to the Post Office views against the use of this method by British amateurs, and the similar views which have been set out by other prominent European amateurs—notably by M. Deloy (**F8AB**), as has already been pointed out—it seems obvious that for the time being at least both methods must be recognised.

The Americans and Canadians, and some European amateurs, employ the A.R.R.L. method and replace the "DE" by another pair of letters to designate the nationalities of the two stations, the first letter of the pair being indicative of the nationality of the called station, and the second that of the calling station; while the British and many French and Dutch amateurs use the prefixes given in Table I.

Unfortunately, too, some of the letters chosen for the various countries by the A.R.R.L. are not quite the same as those in the list set out above, so that the American list is appended here for the information of any who hear the method in use.

TABLE I.

NATIONALITY PREFIX LETTERS OFFICIALLY APPROVED FOR USE BY BRITISH AMATEURS.

Prefix Letters.	Country.
EA	Spain.
F	France.
G	Great Britain.
HB	Switzerland.
I	Italy.
J	Japan.
KB	Germany.
LA	Norway.
N	United States of America.
ON	Belgium.
OU	Denmark.
PA	Holland.
SA	Sweden.
VA	Canada.
VH	Australian Commonwealth.
VL	New Zealand.
VN	South Africa.
VO	Newfoundland.
VT	India.

TABLE II.

LIST OF NATIONALITY INDICATING LETTERS USED BY U.S. AND CANADIAN AMATEUR STATIONS TO REPLACE THE "DE" SIGNAL.

(SPECIAL NOTE: These letters should not be used by British Amateurs.)

Country.	Designating letter.
Australia	**A**
Canada	**C**
France	**F**
Great Britain	**G**
Italy	**I**
Mexico	**M**
Netherlands	**N**
South Africa	**O**
Portugal	**P**
Cuba	**Q**
Argentine	**R**
Spain	**S**
United States	**U**
New Zealand	**Z**

The main disadvantage of the use of the American scheme is the difficulty of overcoming the habit of listening for the "DE" signal, as it is not merely a matter of remembering that the "DE" is replaced by two other arbitrary letters, but those letters differ on different occasions.

Anyone not familiar with the scheme—such possibly as Government or commercial station operators—would not necessarily be in a position to know what stations were in communication, and if necessity arose for communicating with those stations, as in cases of interference, confusion might result.

With the British arrangement whereby the "DE" is retained, such confusion could not arise, while the possibility of errors arising from reading a repeated call such as **G6XX** in the incorrect form of **6XXG** would soon disappear if the system were universally adopted and everyone expected a prefix before the figure in the call sign.

It is to be hoped that in the not too distant future, these and similar international amateur arrangements will be placed upon a more stable basis, and official agreement arrived at not only between the various amateur radio organisations, but also between the respective Governments of the countries where such organisations exist. In the mean-

time, however, we would urge all British radio amateurs to stick to the scheme which has been approved by the Post Office for their use, and so to give it a thorough trial. At the same time a watch can be kept upon the working of both systems by the interception of European and American transmissions, so that the matter can again be brought up for discussion if occasion should arise in the future.

As a guide to the use and interpretation of the two methods a few examples are appended of calls between various countries set out according to the two methods in Table III. It should be specially noted that in the British method the prefix letter is (naturally) always attached to the call itself, whereas with the A.R.R.L. method the indicative letters which replace the "DE" indicate by their order only the countries to which the two stations belong. Reversing the order of these intermediate letters is understood as meaning that the direction of transmission between the two countries is reversed. The first letter of the pair indicates the nationality of the *called* station, while the second refers to the *calling* station. This point is particularly shown in the first two examples in the Table.

The outstanding advantage of the British method seems to be that the designation of nationality is tied up with call itself, and is not separated from it as in the American method. Thus in cases where the call letters are repeated over and over again (as is frequently the case) instead of confining them merely to three repetitions, the nationality of the called station becomes at once obvious without waiting for the separative signal.

The views of individual transmitting amateurs in this connection would doubtless be of much value if such information could be collected, particularly with a view to an analysis of the results obtained in the practical working of the two systems.

TABLE III.

COMPARISON OF BRITISH AND AMERICAN METHODS.

British Method.	A.R.R.L. Method.
N1XW N1XW N1XW DE G6XX G6XX G6XX	1XW 1XW 1XW UG 6XX 6XX 6XX
G6XX G6XX G6XX DE N1XW N1XW N1XW	6XX 6XX 6XX GU 1XW 1XW 1XW
F8AB F8AB F8AB DE N1XW N1XW N1XW	8AB 8AB 8AB FU 1XW 1XW 1XW
G2KF G2KF G2KF DE F8AB F8AB F8AB	2KF 2KF 2KF GF 8AB 8AB 8AB
PA0MX PA0MX PA0MX DE G6XX G6XX G6XX	0MX 0MX 0MX NG 6XX 6XX 6XX
I1MT I1MT I1MT DE G6XX G6XX G6XX	1MT 1MT 1MT IG 6XX 6XX 6XX
VA9BL VA9BL VA9BL DE F8AÉ F8AÉ F8AÉ	9BL 9BL 9BL CF 8AÉ 8AÉ 8AÉ

SWITCHING.

JACKS AND SWITCHES—HOW TO USE THEM.

The object of this article is to show the advantages of using proper jacks, switches, and connectors, and how they may be included in a few typical circuits.

By W. JAMES.

1.—THE AERIAL CIRCUIT.

THE most elementary "switching" device consists of terminals which may be joined with a link of wire or metal as required. Take the case of the aerial and earth which end at terminals. When the receiver is not in use the aerial and earth are connected together by a wire for safety. This connection is removed when one wishes to use the receiver, and the terminals of the receiver are joined up to the aerial and earth. For example, the aerial may be connected to the receiver with a wire, and the same with the earth (Fig. 1A). This involves two separate operations, first the connection for the aerial and then the earth. When the receiver is no longer required the connecting wires are removed and a wire is joined between the aerial and earth. The time taken for establishing the connections could be reduced by connecting a plug to the aerial and a socket to the earth with a socket and a plug in place of the aerial and earth terminals as in Fig. 1B. Then when the receiver is not in use the earth plug may be pushed in the aerial socket, and when the receiver is to be used the plug and socket may be fitted to the corresponding socket and plug in the receiver. Besides saving time, the operation of connecting and disconnecting is simplified and there is no possibility of error, *i.e.*, connecting the aerial with the earth terminal. There is no loss in electrical efficiency as the result of using the easier method.

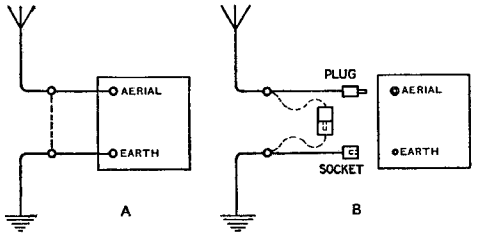


Fig. 1.

2.—BATTERY CIRCUITS.

As another illustration of the use of plugs and sockets consider the filament heating circuit of the receiver. The accumulator is usually connected to the filament terminals in the receiver by two wires. This, of course, is generally quite satisfactory, but a beginner may connect his wires the wrong way round. He may take the wires off the terminals on the receiver first, allow them to fall, make contact and short circuit the battery. It is better to provide a socket and a plug on the receiver and others on the battery and to make the connections between battery and receiver through wires having a plug and socket on each end as in Fig. 2.

The socket and plug may be secured in a piece of insulating material as in Fig. 2C. Alternatively, the insulating material may have screwed in it two plugs of different

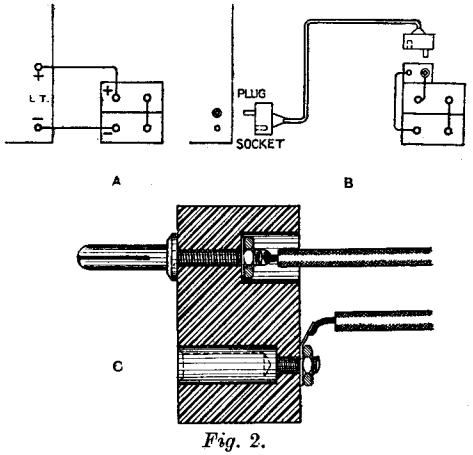


Fig. 2.

diameters which fit sockets of corresponding size on the battery and the receiver.

The advantage lies in the simplicity of the method and the fact that connecting and disconnecting is a foolproof job. Many manufacturers supply sockets and plugs of this sort as part of the receiver.

The connection with the high tension battery may be made in the same way, but using plugs and sockets which have elements with a larger space between them.

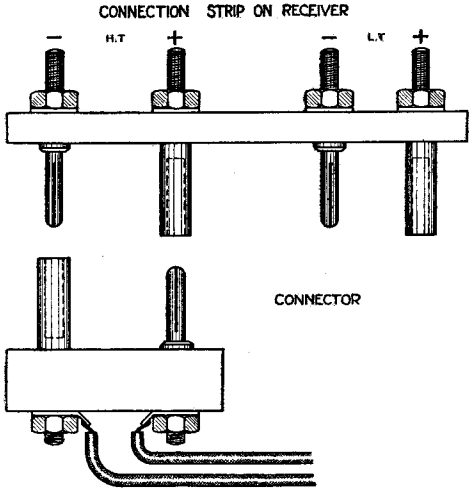


Fig. 3.

In this way it becomes impossible to connect the accumulator to the high-tension terminals and *vice versa*. Connectors of this sort are easily made. Valve sockets and pins may be appropriately mounted (Fig. 3), and are quite satisfactory.

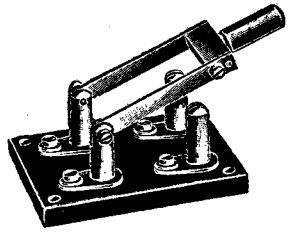


Fig. 4. *A two-pole single-way switch.*

Instead of employing connectors it is a simple matter to join up a switch. Referring to Fig. 2A, what we wish to do is to connect a switch with which the battery may be connected or disconnected from the filament heating circuit. When a switch is not used, connections are made between the battery and the terminals in the receiver by connecting wires as shown. Instead of wires,

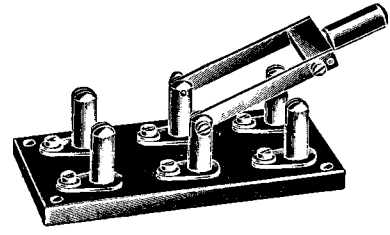


Fig. 5*A*. *A two-pole two-position switch.*

we could place the terminals close together and use copper links. If the links are held together by a piece of insulating material (Fig. 4), and the handle is pressed down the links make connection with the contacts. This sort of switch is called a double-pole single-way switch, because it controls two circuits with one operation and has only one "on" position.

By fitting another pair of contacts so that the switch may be put in one of two positions, *i.e.*, to the left or to the right, Figs. 5A and B, we have a double-pole two-

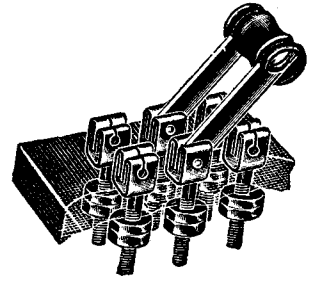


Fig. 5*B*. *Another two-pole two-position switch.*

position switch. This sort of switch may be used for many purposes in a wireless receiver. It is usually shown connected in the many circuit diagrams given in the *Questions and Answers* section of this journal. A double-pole two-position switch may be connected to the aerial circuit in place of the sockets and plugs, Fig. 1. Thus, referring to Fig. 6, when the switch arms are "up," the aerial is connected through to the aerial terminal

of the receiver and the same with the earth. When the switch arm is "down," the instrument is disconnected and the aerial and earth connected together through the bottom contacts.

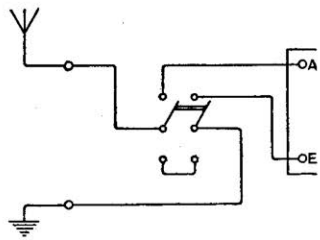
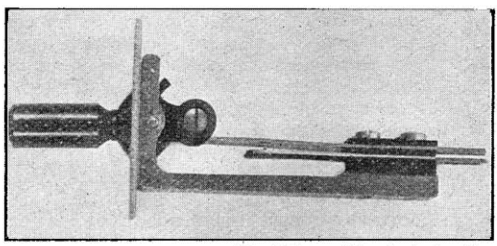


Fig. 6.

3.—SERIES-PARALLEL AERIAL SWITCHING.

It is very convenient to be able to join the aerial tuning condenser in series or parallel with the aerial tuning inductance.



The Ericsson Manufacturing Co.

A Dewar switch which is electrically similar to the switch of Fig. 4.

A very simple way is to connect the condenser and coil to terminals as in Fig. 7A. The earth is connected to the E terminal, and the aerial may be joined to either A_1 or A_2. If the aerial is joined to terminal A_2, the condenser and coil are in series. By connecting the aerial with terminal A_1 and joining a wire between A_2 and E, the condenser and coil are placed in parallel.

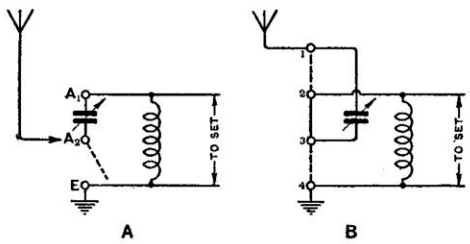


Fig. 7.

Alternatively, four terminals may be used as in Fig. 7B. The aerial and earth are connected to terminals 1 and 4 respectively. To join the condenser in series with the coil, a wire is connected between terminals 2 and 3. The condenser and coil are placed in parallel by joining terminals 1 2 and 3 4 as shown dotted in the figure.

Now instead of changing the wires between the terminals, with the possibility of error and the inconvenience every time we wish to try the tuning condenser in the alternative position, it is much easier to use a switch. The connections are then

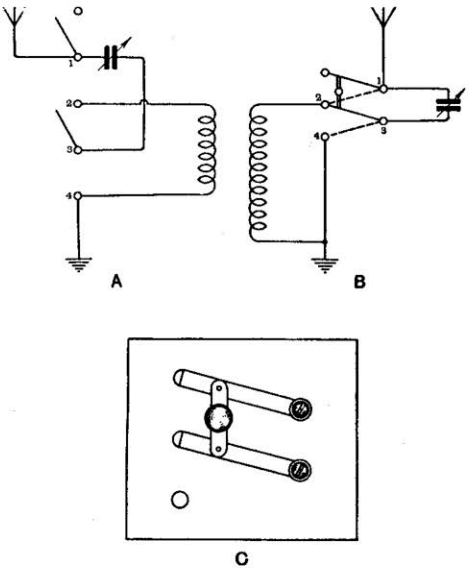


Fig. 8.

made once only and the circuit changed by moving the switch. The terminals of Fig. 7B may be redrawn as in Fig. 8A. If a copper link is provided on terminals 1 and 3, it will be seen that with both links up, terminal 1 is connected to the spare, terminal 3 to 2, and the condenser and coil are in series. By turning both links down, terminals 1 and 2 are joined, and so are terminals 3 and 4, and the condenser and coil are joined in parallel. The terminals may be rearranged as in Fig. 8B, and the two copper links secured together at one end by a piece of insulating material fitted with a knob. Now we have a two-way switch of the type shown in Fig. 8C. With the switch up, the coil and condenser are in series, with it down, they are in parallel.

Another sort of switch, which, however, is identical in principle with that first described, consists of a disc of insulating material carrying two short metal segments (Fig. 9). Spring contacts 1, 2, 3 and 4, are arranged to bear on the edge of the disc. The springs are numbered to correspond with the terminals of Fig. 8A and the metal

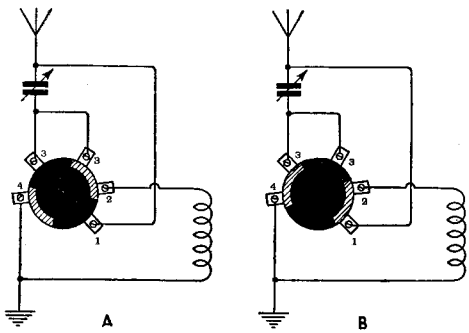


Fig. 9.

segments of Fig. 9 correspond with the metal links of Fig. 8A. When the movable disc of Fig. 9 is turned to make contact as in Fig. 9A, the condenser and coil are in series. because springs 2 and 3 are joined together by the metal segment. When the disc is turned to the position of Fig. 9B, the segments connect springs 1 2 and 3 4, placing the coil and condenser in parallel.

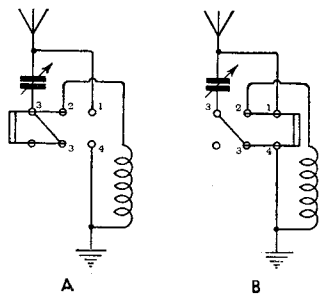


Fig. 10.

A two-pole two-position switch, like that of Fig. 5, may be used for switching the coil and condenser in series or parallel. The connections are given in Fig. 10. With the switch arms to the left, Fig. 10A, the coil and condenser are in series; when the switch is thrown over as in Fig. 10B, they are in parallel. The similarity between the switch contacts and switch arms, and the terminals and links of Fig. 8A should be noted.

(*To be continued.*)

Correspondence.

Homodyne.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—With reference to Mr. Colebrook's very interesting article on the "Homodyne" in your issue of February 20th.

Mr. Colebrook might be interested to hear of a paper* by Dr. E. V. Appleton, published a year or two ago. This paper treats the phenomenon of "locking" both from a mathematical and experimental point of view, and the following points which it established may be of general interest in this connection.

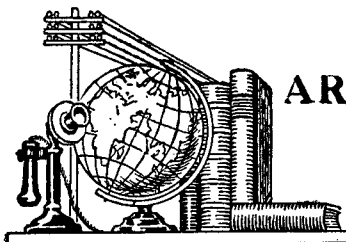
1. Local oscillations lock to the frequency of the incoming signals over an appreciable range. The width of this range is directly proportional to the ratio of incoming to local oscillation strengths.
2. The amplification noticed by Mr. Colebrook is only obtained near the centre of this range; the edges actually giving a sharp minimum of strength. This is due to a phase change between the incoming and local oscillations.
3. The best strength for the local oscillations is that which would normally give optimum heterodyne signals.

Since the publication of this paper, Dr. Appleton and others have used this system for receiving telephony and found it of great value, but since the only essential difference between this and ordinary regenerative reception is a rather tighter reaction coupling, many listeners must have unconsciously passed into this region while endeavouring to obtain maximum reaction.

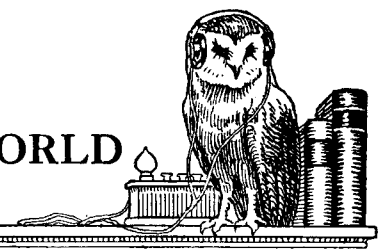
There is one point, however, in Mr. Colebrook's paper, which I feel inclined to question. He gives us to understand that, in receiving signals on a heterodyne wavemeter (and, incidentally, on the "Homodyne" system) ordinary rectification does not take place, but that the beat note is heard "on account of the fact that the value of the continuous anode current of the valve varies with the amplitude of oscillations in the attached wavemeter circuit." Surely this is ordinary rectification, for if the valve were not rectifying, the symmetrical oscillations impressed on the grid would produce symmetrical changes in the anode current and the value of the continuous anode current would not vary.

Cambridge. F.G.G.D.

*"Automatic Synchronisation of Triode Oscillators, by Dr. E. V. Appleton, M.A. Proceedings of Cambridge Philosophical Society for Easter, 1922.



AROUND THE WIRELESS WORLD



Official sanction has been given for a Belfast broadcasting station. The power of the station will be one and a half kilowatts, and transmissions will take place on 435 metres. The call sign will be **2 BE.**

* * * *

The Pope is now able to listen-in, a wireless receiver presented by a British firm having been installed at the Vatican.

* * * *

Low power wireless telephony sets are being employed by the Swiss Alpine Club to assist rescue work in the mountains.

* * * *

The B.B.C. announces that the Plymouth relay station will be opened on March 28th.

* * * *

Broadcasting in Czecho-Slovakia.

The Kbel Aerodrome, near Prague, is provisionally broadcasting every evening from 6.15 to 8.15 p.m. G.M.T., on 1,150 metres, according to information kindly supplied by a correspondent. The power employed is one kilowatt.

In the meantime a Westinghouse broadcasting station is being built at Strassnice, near Prague, to operate on a power of two kilowatts. It will probably be completed in five or six months.

Australian Broadcasting Stations.

Six broadcasting stations had been licensed in Australia up to December 31st, 1923. Of these, four are operated by Messrs. Farmer & Co., of Sydney and Melbourne, the other licensees being Messrs. Millswood Auto and Radio, Ltd., of Adelaide, and Messrs. Broadcasters (Sydney), Limited. The wavelengths used extend from 350 to 1,720 metres.

Transatlantic Amateur Working.

The list of British amateur stations who have worked with America up to the present is as follows:—**2 FU, 2 OD, 2 NM, 2 SH, 2 SZ, 2 WJ, 2 KF, 2 KW, 5 BV, 5 LF, 5 KO, 5 NN,** and **6 RY.**

New Radio Society.

A wireless club has been formed under the title of "The Orpington and District Radio Society." It is hoped that all in the Orpington and Crays district who are interested in wireless, and who may be desirous of joining the Society, will communicate with the Hon. Sec. (*pro. tem.*), Mr. S. C. Bushell, Fashion House, High Street, Orpington.

A Message from the Arctic.

The following interesting message was received by B.B.C. engineers just before switching off at 3.30 a.m., after the American transmission on March 9th:—**2 BD 2 BD** DE **WNP WNP** TKS OM TKS OM AR SK.

This message of thanks, addressed to the Aberdeen broadcasting station, emanated from the *Bowdoin*, the ship of the MacMillan Exploration Party now icebound off the north coast of Greenland.

South London Group of Affiliated Societies.

At the meeting of the South London Group of Affiliated Radio Societies on March 11th, at the Central Hall, Peckham, Messrs. Geo. Sutton (Wireless and Experimental Association), Mr. Hampshire (Sydenham and Forest Hill Society), and Mr. Carpenter (Lewisham and Catford Society), were elected to represent the Group on the new General Committee of the R.S.G.B., with Mr. A. W. Knight, of the Wireless and Experimental Association, as a reserve in case of need, to avoid the necessity for any by-election.

The General Committee hopes to stir some of the "dry bones" and drive off the sleepiness which is now affecting many societies.

An Esperanto Association for Radio Amateurs.

Readers may be interested to learn that an organisation called "Internacia Radio Asocio" has recently been formed with the object of facilitating relations between radio users, amateur and professional, in all parts of the world, by means of Esperanto.

The President of the new Association is Dr. Pierre Corret, the well-known French amateur, and the Honorary Secretary is Mr. H. A. Epton.

We understand that membership is not confined to Esperantists, but to all who are in favour of the adoption of Esperanto as the international radio language. Full particulars may be obtained from the Hon. Secretary, at 17, Chatsworth Road, Clapton Park, London, E.5.

A Holland-America Success.

Mr. H. J. Jesse, of Leiden, Holland, reports that on February 24th, from 6 to 6.30 a.m. (G.M.T.), he got into touch with the station of Mr. J. Lee, Jacksonville, Florida (**4 XE** ?). He has now worked with 18 American and two Canadian amateurs.

2 NM.

It is regretted that in two recent references in this journal to **2 NM,** the transmitting station of Mr. Gerald Marcuse, of Caterham, the call sign has erroneously been given as **2 MN.**

America Heard on 4-Foot Aerial.

We have received a report from Mr. R. E. Williams of Holyhead, who, it will be remembered, was the first British amateur to report the reception of U.S. broadcasting from **WJZ** in this country, relative to the use of diminutive aerials for such long distance reception. Employing as aerial only 4 ft. of bell wire running vertically from the aerial terminal of his receiving set he has picked up short wave communications between American **1XAM** and Dutch **PCII**, as well as broadcasting from **KDKA** and **WGY**. Both the last stations have been heard on a loud speaker—and complete programmes listened to in this way—in spite of the reduced size of aerial employed. Mr. Williams' receiving set included one H.F. valve, a detector, and two L.F. valves. An Igranic No. 25 coil was used to tune the circuit of the above aerial, with a No. 35 coil for reaction for the reception of **WGY**.

Short Wave Transmissions from FL.

We understand that a special series of test transmissions (C.W.) is being sent out from the Eiffel Tower **(FL)** on Mondays, Wednesdays and Fridays, between 9 and 9.35 p.m., on a wavelength of 115 metres.

2 LO's New Site.

Rumour has it that the suggested new site of the London Broadcasting Station will be at Selfridges, London, W., on the roof of which the masts are shortly to be erected. It is also considered probable that the power of **2 LO** will be increased to 12 kilowatts.

A Transatlantic Broadcasting Novelty.

In the early morning of March 8th, when the broadcast proceedings of the Annual Dinner of the Massachusetts Institute of Technology were received at the Hale Station of the Metropolitan-Vickers Electrical Co., Ltd., a special marconigram of greeting was despatched from the latter station and read before the assembled guests in New York before the conclusion of the dinner.

Reception in Belfast.

Mr. Ashton Cooper **(5 TR)**, of Ilford, wishes it to be known that although his signals have been heard by Mr. Neill, of Belfast, he was by no means the first amateur transmitter to establish communication with Mr. Neill, as was suggested in our last issue.

"CQ Europe."

Information has been received by Mr. F. Walker that **U 1 AJA** will be sending "CQ Europe" from now onwards on 145 metres on any night after 11 p.m. (G.M.T.). **1 AJA** is the station of Mr. G. J. Etter, 66, Adams Street, Dorchester, Mass., U.S.A., and reports of reception would be welcomed.

New York Adopts Educational Broadcasting.

The New York Board of Education, acting in co-operation with the Radio Corporation of America, has initiated a permanent scheme of educational broadcasting. Special programmes for schools are now broadcast on school-days by **WJZ** from 2 to 2.30 p.m., and it is understood that they will later take the form of recitations, music lessons, glee club and school orchestra concerts, spelling bees and other items to be supplied by pupils themselves.

Amplifiers for Short Wave Reception.

The Radio Society of Great Britain held an informal meeting at the Institution of Electrical Engineers on Wednesday, March 12th, when the chair was occupied by Dr. W. H. Eccles, F.R.S.

In opening a discussion on Short Wave Amplification, Mr. Frank Phillips, A.M.I.E.E., said that high frequency amplification on short waves could be classified under the two main headings of Straight Circuits and Special Circuits of the Superheterodyne type. Devoting his talk to circuits of the former type he pointed out that it was often assumed that on short wavelengths it was impossible to get high frequency amplification, but in his experience and by using two suitably arranged high frequency valves, a detector and two note magnifiers, he was able to get full loudspeaker strength from **KDKA**.

Amplification on this wavelength, however, was not so great as that obtainable with a similar circuit on longer wavelengths. He described certain modifications he had introduced for rendering the circuit stable, and in doing so made special reference to the unsatisfactory method of stabilising by the use of a potentiometer to control the potential of the grids of the high frequency valves. It will be appreciated that if a more or less positive bias is applied, that distortion is bound to result as a result of grid current rectification. He was very much against this method by which stability was obtained at the expense of efficiency.

The arrangement he used consisted of a non-inductive resistance of a value of about 3,000 or 4,000 ohms introduced in series with the tuned anode circuit, and he pointed out that it was essential that this resistance should be as non-inductive as possible, so as not to upset the constants of the circuit. The resistance he used consisted of a short tube of brass on which was wound a single layer coil of resistance wire. It might be thought that such a winding would be inductive, but Mr. Phillips explained that the inductance of this winding was very much reduced as a result of the high distributed capacity. He said that it was possible to so proportion the number of turns and the thickness of the wire and its insulation, to result in a resistance being introduced into the circuit on a 100 metre wave adjustment, so that the wavelength of the circuit was not altered by more than half or one per cent. He recommended a loose coupled receiving circuit, aerial coil consisting of three or four turns on a $2\frac{3}{4}$ in. former with a series condenser of maximum value 0·0001 mfds.; secondary inductance of ten turns with a tuning condenser having a value up to 0·0005 mfds., and two straightforward tuned anode circuits rendered stable by the introduction of the 4,000 ohm resistance. Stability is so satisfactory with this method that the grids can be made fully negative without the set oscillating, whilst reaction control was found to be very delicate.

Mr. Phillips uses D.E.3, D.E.5, A.R.06, D.F.Ora or V.24 valves.

The discussion that followed was of considerable interest, and Mr. Phillips dealt with the questions as they were put.

Dr. Eccles having vacated the chair earlier in the evening, Mr. J. H. Reeves expressed the indebtedness of those present to Mr. Phillips for his admirable treatment of an interesting subject.

The Radio Society of Great Britain

A Short Talk by Mr. J. F. Stanley, broadcast from the London Station on Thursday, March 13th.

As Honorary Secretary of the General Committee of Affiliated Societies I welcome this opportunity of addressing a few remarks to the members of the Radio Societies throughout the country, and more especially to the Secretaries of those Societies.

The Wireless Amateurs' Parliament is at last an established fact. Some of those who are listening at this moment were present at the Annual Conference of Affiliated Societies held at the Institution of Electrical Engineers last Saturday week, but for the information of the thousands of amateurs who were not present, a few words on the results of the Conference may be of interest. To put the matter into a nutshell, the various Societies throughout the Country are now organised in such a way that all matters concerning the interests and the welfare of those Societies can be discussed by a General Committee consisting of representatives drawn from all parts of the country. In the past there has been no such opportunity for discussion except at the Annual Conference, held in London in January, and many Societies have felt that such a Conference, though of great value, was very inadequate for the purpose of really bringing the Affiliated Societies into close touch with one another and with the parent body. Owing to this lack of co-operation between the Radio Society of Great Britain and the Affiliated Societies, misunderstandings and dissatisfaction were bound to arise, and in order to remedy this there were two courses open to affiliated societies. Firstly they could renounce their affiliation to the parent body, and resolve to have nothing more whatever to do with it, and, secondly, they could agitate for a better scheme of affiliation, which would ensure that everybody had an opportunity of becoming active citizens in the wireless amateur community, with adequate representation in a truly representative Amateur Parliament. A few Societies, I regret to say, adopted the first course, but now that the Parliament, which in future will be known as the General Committee of the Affiliated Societies, is in existence it is to be hoped that it will receive the wholehearted support of every Radio Society in the Kingdom, whether they are affiliated at the present time or not. The constitution of this Committee has been dealt with in the press and on the broadcast fairly fully already; it only remains to be said that when a list is published, as it will be shortly, showing the Societies who have already elected their representatives, I hope that all Societies who consider that they have been overlooked will immediately get into touch with their neighbouring Societies and decide whether they are strong enough to form themselves in a group, thus having the right to nominate a representative to the General Committee. Such a group should, as a general rule, consist of not less than six individual Societies, but in special cases this number can be reduced. It is hoped to be able to convene the first meeting of the General Committee in the near future, and therefore please get on with the job of electing your man if you have not already done so, and send his name and address to the Honorary Secretary of the General Committee of the Radio Society of Great Britain, 53, Victoria Street, London, S.W.1, with as little delay as possible.

As regards the Conference on Saturday week I think I am not far from the truth when I say that all the important resolutions put to the meeting were carried unanimously, and this harmonious state of affairs gives the General Committee an excellent start.

Besides being the House of Commons, as distinct from the House of Lords, represented by the Council of the Radio Society of Great Britain; if I may be permitted to use such an analogy, I think this General Committee should be a clearing house for ideas put forward by individual Societies, for we want to get to know each other better. So please, Secretaries, do not hesitate to get into touch with your representative—as I have already said a full list of the Committee will be published as soon as possible—or if you cannot conveniently do that, write to the Hon. Secretary at the address I have already mentioned, that is, 53, Victoria Street, London, S.W.1. It will save the Central Office a lot of correspondence, however, if you will communicate your suggestions through your local representative as far as possible.

As regards the work immediately in front of the General Committee I have said nothing, for the simple reason that were I to start to do so the five minutes allotted to me would be over before I had properly started. Now that the Committee is in being, however, I think you can rely on the members thereof doing their utmost to make it an active concern, and all Societies will be kept informed of the progress of its work, as well as of the work of the Council in so far as it concerns the Affiliated Societies, by means of a monthly letter or otherwise.

Transmitting and Relay Section.

An informal meeting of the Transmitting and Relay Section will be held at 6.30 p.m. at the Institution of Electrical Engineers on Friday, March 28th, when Mr. F. L. Hogg will open a discussion on "High Tension Supply for Valve Transmitters."

A New French Radio Book.

"La Télégraphie sans Fil," by M. Julien Verdier,* is designed to interest radio amateurs and the general public. A vast amount of information concerning recent radio developments, not only in France, but throughout the world, is packed into its 412 pages, which also contain many interesting illustrations. Applications of wireless telegraphy and telephony to railways, aircraft, meteorology, military and naval operations are among the subjects treated, and a useful section is included dealing with the technical aspect of transmission and reception.

* "La Télégraphie sans Fil: Ses applications en temps de paix et pendant la guerre." By Julien Verdier. (Paris: Gauthier-Villars et Cie, 55, Quai des Grands-Augustins. Price 35 fr.)

Questions & Answers
Solutions of Readers' Difficulties

1. *All questions are answered through the post. A selection of those of general interest is published.*
2. *Not more than four questions may be sent in at any one time.*
3. *Every question should be accompanied by a postal order for* **1/-**, *or* **3/6** *for four questions, and by a coupon taken from the current issue.*
4. *A free coupon appears in the first issue of each month and if this is sent in together with coupons from the three previous issues, the reader is entitled to have one question answered free of charge.*

"*E.R.B.*" (*Sidcup*) **asks for a diagram of a four-valve receiver (2-v-1), with a switch to cut out one stage of H.F. amplification.**

The circuit is shown in Fig. 1. The reaction coil may be coupled either with the A.T.I. or second tuned anode circuit, the two reaction coil holders being connected in parallel. A reaction reversing switch is provided to change the connections of the reaction coil when the first valve is switched in or out of circuit. Separate H.T. tappings are provided for each valve, and the grid potential of the H.F. valves is controlled by means of a potentiometer.

"*A.H.P.*" (*London, S.W.*1) **is troubled with crackling noises in his loud speaker, and asks how to trace and eliminate these disturbances.**

In order to decide whether the noises are due to faults in the instrument or to outside disturbances, the aerial and earth wires should be disconnected from the receiver. If the noises cease, they may be due to atmospherics, or to faulty insulation in the aerial and earth system. The earth wire should be insulated between the point where it leaves the instrument and the point of entering into the earth. A bare wire making intermittent contact at several points with, say, a damp wall, will often cause crackling noises. If noises are caused by the instrument itself, the H.T. battery may be run down, or there may be faulty insulation in the loud speaker windings. Also test the grid leak. Noises due to atmospherics and electric machinery reach a maximum when the receiver is adjusted to its most sensitive condition with all tuned circuits in resonance. It is difficult and often impossible to eliminate noises from these causes.

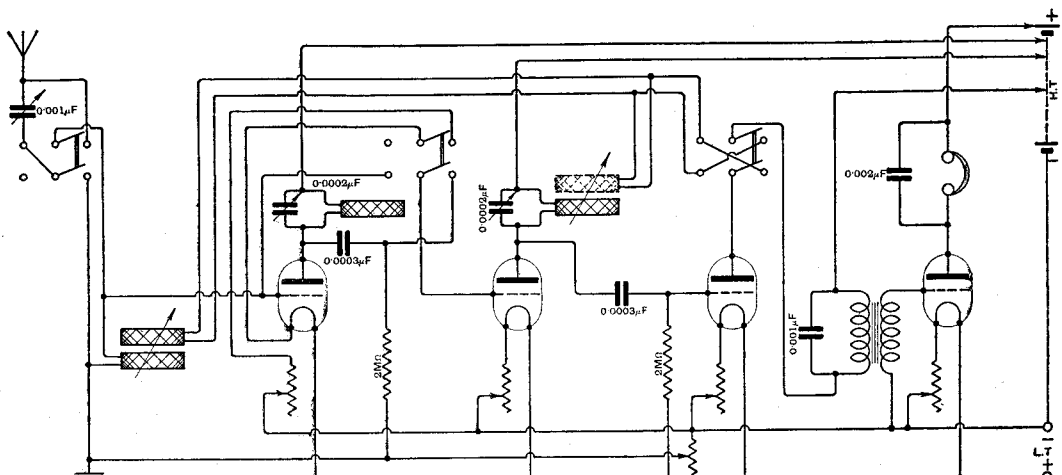


Fig. 1. "*E.R.B.*" (*Sidcup*). *A receiver with* 2 *H.F., valve detector, and* 1 *L.F.*

"A.L." (*Twickenham*) asks for a diagram of a three-valve receiver, with jacks joined in the L.F. circuit.

The diagram is given in Fig. 2. The aerial circuit is tuned with a 0·001 variable condenser, which may be switched in series or parallel with the lower plug-in coil. The secondary circuit consists of the centre plug-in coil and the 0·0005 variable condenser. It may be helpful to connect a two-plate condenser across this circuit for fine tuning. The first valve operates as a high frequency amplifier, with a tuned anode circuit which consists of the upper coil in the three-coil holder and the 0·0002 variable condenser. The three coils are coupled, therefore reaction effects may be obtained by varying the coupling between the anode coil and the remaining coils. The second valve is the detector, and has in its grid circuit a 0·00025 fixed condenser and a 2 megohm grid leak. The grid leak is joined between the grid and the positive terminal of the filament heating battery. It may be found that a higher leak resistance will give better results when weak signals are being received; however, if the leak has a too high resistance, a clicking noise or a squeal may be generated. A jack is connected in the anode circuit of the detector valve, so that when the plug attached to the telephones is pushed into this jack, the telephones are connected in circuit in place of the primary winding of the intervalve transformer. When the plug is out, the transformer is connected through to the third valve, which operates as a note magnifier. The filament circuit of the note magnifier is closed through the upper two contacts of the jack when the plug is inserted, and the telephone circuit is completed through the lower spring and the frame. The filament resistance is joined in the negative lead from the filament heating battery, because in this way the grid may be given a small negative bias with respect to the negative end of the filament. For broadcast reception, the aerial coil may be a No. 35 or a No. 75 when the condenser is in parallel or in series respectively. The closed circuit coil may be a No. 50 and the anode coil a No. 75.

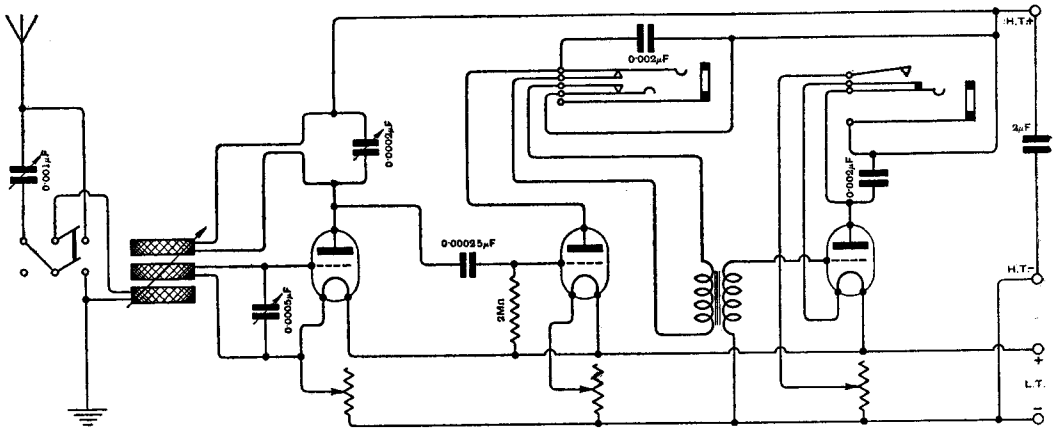


Fig. 2. "A.L." (Twickenham). A receiver with 1 H.F., tuned anode, detector, and note magnifier with jacks.

"L.B." (*Manchester*) wishes to wire a receiver consisting of a detector and a note magnifier, with variometer tuning and reaction.

The diagram is given in Fig. 3. The aerial circuit is tuned by means of one of the variometers and a fixed condenser of 0·0002 mfds. capacity is connected in series with the aerial circuit for the purpose of improving the selectivity. The variometer in the anode circuit of the detector valve will produce reaction effects as the result of capacity coupling between the plate and grid circuits.

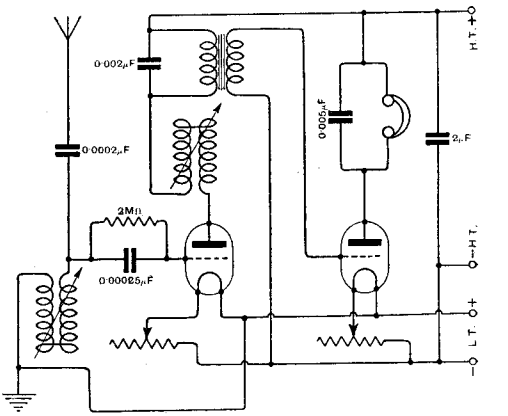


Fig. 3. "L.B." (Manchester). A receiver with detector and note magnifier. Reaction effects are obtained by the variometer joined in the detector anode circuit.

This variometer should have many more turns than the variometer connected in the aerial circuit or alternatively, when both variometers have the same dimensions, the anode variometer may be shunted with a fixed condenser of 0·0002 mfds. The note magnifier is connected in the usual way.

Calls Heard.

Contributors to this section are requested to limit the number of calls sent in to those heard within the previous three weeks, these being of greater interest and value to transmitters than earlier records. The repetition of the same call sign in consecutive lists is not recommended. Contributors will also assist by kindly arranging their reports in alphabetical order.

Mablethorpe, Lincs (February 11th).
American calls: **1 ALJ, 1 AOL, 1 APY, 2 CEI, 2 OMF, 5 AIR, 8 COI, 9 ZL.** (A. Simons.)

Nr. Manchester.
2 AO, 2 AP, 2 DF, 2 DX, 2 FZ, 2 GW, 2 IJ, 2 KF, 2 KW, 2 LZ, 2 PC, 2 PP, 2 QJ, 2 TP, 2 UF, 2 UM 2 UR 2 WF, 2 WK, 2 XQ, 2 ZU, 5 AW, 5 AY, 5 BA, 5 BV, 5 CK, 5 CR, 5 FD, 5 HI, 5 IK, 5 KO, 5 OL, 5 OW, 5 PU, 6 HG, 6 HS, 6 HZ, 6 IK, 6 PK, 6 XY, 8 BF, 8 BM, 8 CF, 8 CJ, 8 DA, 8 HZ, 8 LB, 8 LY, 8 RJ, 0 DV, 0 KX, 0 PB, 0 XP, 1 AJA, 1 AUR, 1 IF(?), 1JW. (3 valves.)
(T. R. Johnson.)

Birmingham (heard on Sunday, February 10th).
2 AFS, 2 AIT, 2 DU, 2 HO, 2 KO, 2 LX, 2 NP, 2 NV, 2 YC, 2 YV, 2 YX, 2 ZD, 5 CI, 5 FH, 5 FI, 5 HN, 5 KD, 5 MB, 5 TV, 5 XL, 5 YS, 5 YW, 6 HU, 6 NQ, 6 RH, 6 UC, 6 UR. (1—v—0).
(A. C. Edwards.)

Floreffe, Belgium (heard between January 20th and 30th).
1 MT (Venice), **2 FN, 2 KR, 2 KW, 2 NR, 2 YQ, 2 ZT, 5 DU, 5 MO, 5 QV, 5 RZ, 5 SI, 5 US, 5 YI, 6 NF, 6 QD, 7 ZM, 8 AE 2, 8 AQ, 8 AU, 8 BA, 8 BI, 8 BN, 8 BP, 8 BV, 8 CF, 8 CH, 8 CN, 8 CS, 8 CT, 8 CZ, 8 DP, 8 DU, 8 DY, 8 EB, 8 ED, 8 EI, 8 EM, 8 OS, 0 AA** (Luxembourg), **0 FL, 0 KX, 0 PB, 0 SA.** (0—v—0 and 0—v—2.)
(Brn. Albert de Dorlodot.)

Gloucester.
2 AC, 2 AR, 2 AS, 2 CV, 2 CW, 2 DN, 2 DU, 2 FH, 2 FL, 2 FU, 2 GG, 2 HQ, 2 KF, 2 KO, 2 KP, 2 KT, 2 LG, 2 MT, 2 MB, 2 MN, 2 MP, 2 MZ, 2 OM, 2 OP, 2 OK, 2 QR, 2 RH, 2 RS, 2 SH, 2 VP, 2 WO, 2 WU, 2 XC, 2 YS, 2 YX, 5 BK, 5 NB, 5 WO, 5 KO, 5 KY, 6 CQ, 6 MZ, 6 NY, 6 QP, 6 IV, 6 UG, 8 AB, 8 AU, 1 MT, 0 MM(?).
(A. R. E. Jennings, 6 HH).

London, S.W.11.
2 FQ, 2 KF, 2 OM, 2 PX, 2 PU, 2 QQ, 2 WJ, 2 XL, 2 XR, 2 XB, 2 XI, 2 YH, 2 XZ, 2 SK, 2 SZ, 2 TP, 2 KT, 2 KZ, 2 TQ, 2 ET 2 OW, 2 TI, 2 FJ, 2 SX, 2 VS, 2 AQ, 2 JU, 2 ZE, 2 QS, 2 YQ, 2 NM, 2 BZ, 2 SF, 2 MF, 2 CO, 5 CP, 5 DT, 5 FR, 5 HY, 5 EV, 5 IM, 5 IO, 5 JS, 5 LP, 5 OP, 5 OX, 5 PU, 5 SU, 5 UD, 5 UL, 5 VR, 5 VD, 5 XC, 5 OB, 5 DB, 5 PD, 5 JW, 5 KS, 5 CB, 5 BV, 5 AC, 5 CZ, 5 HI, 5 WN, 5 UO, 5 QV, 5 HL, 6 IM, 6 MZ, 6 RM, 6 MH, 6 NS, 6 RY, 6 JX, 6 NF, 6 EA, 6 AH, 6 QB. French: **8 AE, 8 CG, 8 AG, 8 DU, 8 BL, 8 AQ, 8 CH, 8 AU, 8 EB, 8 BM, 8 AB, 8 CZ, 8 LY, 8 ARA, 8 CS, 8 BF, 8 AP.** Dutch: **0 MX, 0 YS.** Danish: **7 ZM.**
(0—v—0.) (C. W. Picken.)

Cambridge.
British: **2 AC, 2 AH, 2 AJ, 2 AO, 2 AR, 2 AU, 2 BV, 2 BX, 2 BZ, BXH, 2 CC, 2 CF. 2 CH, 2 CO, 2 CP, 2 CW, 2 CX, 2 DF, 2 DM, 2 DR, 2 DS, 2 DU, 2 DX, 2 FK, 2 FL, 2 FN, 2 FQ, 2 FU, 2 GG, 2 GM, 2 GO, 2 GV, 2 HF, 2 IJ, 2 IN, 2 JF, 2 JO, 2 JP, 2 JV, 2 JX, 2 KF, 2 KL, 2 KQ, 2 KT, 2 KV, 2 KW, 2 KX, 2 KZ, 2 LM. 2 LU, 2 LV, 2 LW, 2 LX, 2 LZ, 2 MB, 2 MF, 2 MG, 2 MI, 2 MN, 2 NA, 2 NH, 2 NM, 2 NO, 2 NP, 2 OD, 2 OF, 2 OG, 2 OJ, 2 OM, 2 ON, 2 OZ, 2 PCG, 2 PF, 2 PG, 2 PP, 2 PX, 2 PY, 2 PZ, 2 QA, 2 QG, 2 QN, 2 QQ, 2 RB, 2 RS, 2 SF, 2 SH, 2 SL, 2 SM, 2 SQ, 2 SZ, 2 TB, 2 TF, 2 TG, 2 TM, 2 TO, 2 TR, 2 TU, 2 TV, 2 TW, 2 TY, 2 UG, 2 UV, 2 UW, 2 UY, 2 VF, 2 VJ, 2 VM, 2 VN, 2 VO, 2 VQ, 2 VS, 2 VW, 2 WD, 2 WJ, 2 WK, 2 WM, 2 WY, 2 XB, 2 XC, 2 XG, 2 XH, 2 YK, 2 YQ, 2 ZC, 2 ZD, 2 ZG, 2 ZK, 2 ZT, 2 ZU, 5 AP, 5 AS, 5 AT, 5 BA, 5 BG, 5 BP, 5 BT, 5 BV, 5 CB, 5 CD, 5 CP, 5 CS, 5 CV, 5 CX, 5 DB, 5 DK, 5 DN, 5 DO, 5 DT, 5 DY, 5 FD, 5 FS, 5 FT, 5 FV, 5 GF, 5 GL, 5 GS, 5 GX, 5 HI, 5 HW, 5 HY, 5 ID, 5 IO, 5 JP, 5 JX, 5 KO, 5 KW, 5 LN, 5 LP, 5 LT, 5 MA, 5 MJ, 5 MO, 5 NN, 5 OM, 5 OP, 5 OT, 5 OZ, 5 PS, 5 PU, 5 PV, 5 PZ, 5 QM, 5 QV, 5 RI, 5 RZ, 5 SI, 5 SU, 5 SZ, 5 TG, 5 US, 5 VD, 5VR, 5 WS, 5 WR, 5 WW, 5 XC, 5 XD, 5 XR, 5 XY, 5 YI, 5 YR, 5 ZU, 5 ZW, 6 AB, 6 AL, 5 BF, 5 BT, 6 DW, 6 EA, 6 GO, 6 GY, 6 HA, 6 IM, 6 JQ, 6 LS, 6 NI, 6 OY, 6 RY, 6 SO, 6 TM, 6 UD, 6 VP, 6 XG, 6 XX, 6 ZK, 2 T 4, 2 NAB, 9 AN.** Dutch: **0 AA, 0 AB, 0 AC, 0 AG, 0 AR, 0 BP, 0 BQ, 0 DV, 0 FN, 0 KX, 0 MA, 0 MR, 0 MX, M 3, 0 NP, 0 NY, 0 PZ, P 2, PA 9, PCH, PCTT, PR, 0 RM, 0 SA, 0 VP, 0 WQ, 0 WS, 0 XM, 0 XO, 0 XP, 0 XQ, 0 XW, 0 ZN, 0 ZZ.** Danish: **7 EC, 7 MW, 7 ZM.** Italian: **1 MT, 1 JW.** French: **8 AA, 8 AB, 8 AE, 8 AEI, 8 AE 2, 8 AG, 8 ARA, 8 AS, 8 AU, 8 AW, 8 AZ, 8 BA, 8 BF, 8 BL, 8 BM, 8 BN, 8 BP, 8 BW, 8 BY, 8 CC, 8 CD, 8 CF, 8 CG, 8 CH, 8 CJ, 8 CM, 8 CS, 8 CT, 8 CY, 8 CZ, 8 DA, 8 DD, 8 DK, 8 DP, 8 DU, 8 DX, 8 DY, 8 EB, 8 EI, 8 SL, 8 KD, 8 LS, 8 LY, 8 NX, 8 OH, 8 RG, 8 SSU, 8 TU 8 UF, 8 WV, 8 ZA, 8 ZP, 9 AIM.** American: **1 AGK, 1 AGM, 1 AJX, 1 AL, 1 ALD, 1 ALL, 1 ASU, 1 AT, 1 AW, 1 AYI, 1 BCF, 1 BD, 1 BDI, 1 BEP, 1 BOQ, 1 BV, 1 BVL 1 BX, 1 CK, 1 CMP, 1 CPN, 1 FA, 1 FD, 1 FS, 1 GO, 1 GS, 1 GV, 1 KX, 1 ML, 1 MV, 1 MWE, 1 RR, 1 VV, 1 YB, 2 AEZ, 2 ANA, 2 AWF, 2 BD, 2 BH, 2 BL, 2 BM, 2 BQD, 2 BY, 2 CE, 2 CC, 2 CLA, 2 CQI, 2 CSR, 2 CXL, 2 DX, 2 GK, 2 GQZ, 2 IC, 2 JIL, 2 PA, 2 PC, 2 PV, 2 TAP, 2 TS, 2 ZXM, 4 FT, 5 DF, 8 ACY, 8 APT, 8 BDA, 8 BF, 8 BTI, 8 CGM, 8 CJ, 8 COI, 8 CPX, 8 CTP, 8 DCC, 8 DDA, 8 DKJ, 8 GX, 8 PL, 8 PU, 8 PV, 8 QAO, 8 YT, 8 ZZ, 9 AOU, 9 AYO, 9 EQ, 9 UM**
(Single valve.) (F. G. Turner.)

Nr. Manchester.
2 FZ, 2 PP, 2 QY, 2 RM, 2 RP, 2 TR, 2 UF, 2 VF, 2 WH, 2 WK, 2 XW, 2 ZK, 2 ZU, 5 AJ, 5 CR, 5 CY, 5 DC, 5 IK, 5 KC, 5 LC, 5 LS, 5 NX, 5 OW, 5 VK, 6 AJ, 6 DX, 6 HS, 6 IC, 6 JQ, 6 KH, 6 KK, 6 LC, 6 LD, 6 NI, 6 TI, 6 TR, 6 VF, 6WC, 6 ZY.
(0—v—1.) (W. Clough.)

Shipley, Yorks.
2 CW, 2 IL, 2 IN, 2 JP, 2 MG, 2 NK, 2 NM, 2 NX, 2 OD 2 TF... 2 TB 2 ZU 5 BG 5 BY 5 BH 5 CX 5 DO 5 DN 5 IK 5 ID 5 JX, 5 KO 5 QA 5 US 5 EA 6 LD, 6 QW, 6 RY, 8 AF, 8 AK, 8 AQ, 8 AW, 8 BC, 8 BF, 8 BM, 8 BX, 8 CM, 8 CS, 8 CT, 8 CZ, 8 DK, 8 DP, 8 EA, 8 EM, 8 FF, 8 FI, 8 FN, 8 JL, 8 RJ, 8 RM, 0 BQ, 0 KX, 8 DP, 8 EA, 8 EM, 8 FF, 8 FI, 8 FN, 8 JL, 8 RJ, 8 RM, 0 BQ, 0 KX, 0 MR, 0 MX, 0 MY, 0 NY, 0 XO, 0 XP, 0 XW, 0 ZZ, PCII, 7 EC, 7 ZM. (1—v—0) or (1—v—1.) (S. R. Wright, 2 DB.)

Caterham Valley, Surrey.
2 AQ, 2 BZ, 2 JU, 2 KF, 2 LN, 2 LZ, 2 NM, 2 PX, 2 XR, 2 XZ, 2 ZO, 2 ZT, 5 AC, 5 BV, 5 DT, 5 MA, 5 MY, 5 OX, 5 OY, 5 WF, 5 WN, 5 XN, 6 IJ, 6 PR, 6 PS (1—v—1.) (J. W. Davies, 6 NH.)

Halifax.
2 AW, 2 CW, 2 DF, 2 DR, 2 DX, 2 FL, 2 FQ, 2 FU, 2 JF, 2 KF, 2 KW, 2 LZ, 2 NK, 2 NM, 2 NO, 2 OD, 2 OG, 2 OM, 2 ON, 2 PC, 2 PP, 2 SH, 2 SZ, 2 TA, 2 TB, 2 TC, 2 UF, 2 VT, 2 WK, 2 ZU, 5 AT, 5 AJ, 5 BG, 5 BT, 5 BV, 5 CU, 5 CX, 5 CY, 5 DN, 5 FL 5 HI, 5 ID 5 IK. 5 JX 5 KO 5 LF 5 ND 5 NG. 5 OW 5 PR 5 QM. 5 ST, 5 SZ, 5 SU, 6 XX, 6 XY, 6 ZY, 8 AQ, 8 ARA, 8 AS, 8 AW, 8 BA, 8 BF 8 BM 8 BP 8 BV 8 CF 8 DA. 8 DY 8 EB 8 OH. 8 LY 8 ZZ, 0 BA, 0 CS, 0 FL, 0 FN, 0 KX, 0 NY, 0 PB, 0 YS, 3 OX, 37 X, PCII, PCTT, 7 EC, 7 ZM, 1 BWJ, 1 XW (1 valve.)
(John W. Jagger.)

London, N.W.8.
2 AH, 2 AU, 2 CB, 2 CW, 2 DF, 2 DY, 2 FG, 2 FK, 2 FN, 2 GO, 2 GY, 2 HF, 2 HZ, 2 JF, 2 JU, 2 LT, 2 LZ, 2 OG. 2 PX, 2 PY, 2 QT, 2 SH, 2 SK, 2 TP, 2 VH, 2 VQ, 2 VR, 2 WK, 2 XD, 2 XP, 2 YK, 2 YQ, 2 ZK, 2 ZT, 2 ZU, 5 AS, 5 BB, 5 CF, 5 CS, 5 FL 5 GA, 5 GF, 5 GQ, 5 GX, 5 HI, 5 HN 5 IC, 5 ID, 5 KO, 5 LN, 5 LZ, 5 MJ, 5 MO, 5 OC, 5 PZ, 5 QB, 5 QV, 5 RQ, 5 RZ, 5 SI 5 SR, 5 UO, 5 VX, 5 WR, 5 YM, 5 YX, 5 ZJ, 6 AH, 6 DJ, 6 DW, 6 GT, 6 IV, 6 JT, 6 JX, 6 KI, 6 NF, 6 QB, 6 QF, 6 QV, 6 RS, 6 TS, 6 VP, 6 VS, 6 XG, 2 AAH, 2 ABZ, 2 AGT, 2 AIB, 8 AE, 8 AEI, 8 AG, 8 AQ, 8 AU, 8 AZ, 8 BL, 8 BP, 8 BV, 8 CC, 8 CF, 8 CG, 8 CH, 8 CJ, 8 CS, 8 CT, 8 CY, 8 CZ, 8 DA, 8 DK, 8 DO, 8 DU, 8 DX, 8 DY, 8 EB, 8 EI, 8 EM, 8 EN, 8 EW, 8 FF, 8 JL, 8 MH, 8 OH, 8 PX, 8 SSU, 8 WD, 8 ZA, 0 AA, 0 DV, 0 FL, 0 FN, 0 KX, 0 MR, 0 NY, 0 PB, 0 PZ, 0 XO, 0 YS, 0 ZN, 0 ZZ, 8 EC, 1 MT, 1 JW, XY (1 valve.)
(M. Samuel.)

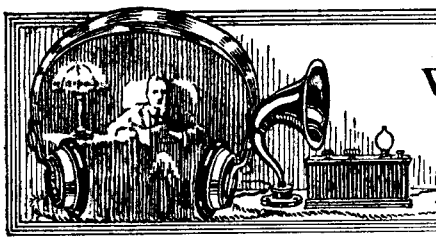
Norwich.
2 FX, 2 KF, 5 BV, 5 KO, 5 MO, 6 XX, 8 BF, 8 BP, 8 CT, 8 CZ, 8 DA, 8 DY, 8 EM, 8 ÉM, 0 AA (J. B. Hampson.)

Brussels.
2 AO, 2 AP, 2 AW, 2 CW, 2 DA, 2 DF, 2 DJ, 2 DX, 2 FN, 2 FU, 2 GG, 2 HF, 2 JF, 2 JO, 2 JZ, 2 KF, 2 KP, 2 KW, 2 KX, 2 LM, 2 NA, 2 ND, 2 NM, 2 OD, 2 OG, 2 OM, 2 ON, 2 PC, 2 SH, 2 TA, 2 TB, 2 VN, 2 VQ, 2 VS, 2 WA, 2 WJ, 2 WO, 2 WP, 2 XU, 2 XY, 2 YK, 2 YQ, 2 ZG, 2 ZS, 2 ZT, 5 AA, 5 AW, 5 BA, 5 BT, 5 BV, 5 DN, 5 GX, 5 IC, 5 JS, 5 KO, 5 MO, 5 NN, 5 OL, 5 PU, 5 QV, 5 SI, 5 SZ, 5 YI, 6 AA, 6 CN, 6 OK, 6 RY, 6 XH, 6 XX, 6 XY, 7 EC, 7 MX, 7 QF, 8 AA, 8 AB, 8 AD, 8 AE, 8 AG, 8 AQ, 8 AS, 8 AZ, 8 BC, 8 BE, 8 BF, 8 BH, 8 BL, 8 BM, 8 BN, 8 BP, 8 BV, 8 BW, 8 CC, 8 CF, 8 CJ, 8 CS, 8 CT, 8 CZ, 8 DA, 8 DO, 8 DU, 8 DX, 8 DY, 8 ÉA, 8 ÉB, 8 EI, 8 ÉK, 8 ÉM, 8 EN, 8 ER, 8 FF, 8 IC, 8 MH, 8 ML, 8 MM, 8 MX, 8 NA, 8 OH, 8 ON, 8 RCD, 8 SSU, 8 TT, 8 XX, 8 XY, 0 AA, 0 BQ, 0 CN, 0 FN, 0 KNN, 0 KX, 0 MX, 0 MY, 0 MZ, 0 NS, 0 NY, 0 PB, 0 PD, 0 PZ, 0 RZ, 0 SA, 0 ST, 0 YS, 1 JW, 1 MT, GG, MX, XY American: **1 MA, 1 CMP, 1 BQ, 1 BDI, 1 ALJ, 1 XAR, 9 CKW, 1 AXM, 1 XAM, 8 CGU, 1 BOQ, 3 MB. 9 AOU, 3 BWT, 3BW, 9 BL, 1 XWJ.**
(R. Deloor.)

London, S.W.5.
2 AC, 2 AH, 2 AO, 2 BZ, 2 CC, 2 CW, 2 DF, 2 DR, 2 DY, 2 FJ, 2 FQ, 2 FU, 2 GO, 2 IB, 2 JU, 2 KF, 2 KG, 2 KT 2 KV, 2 KW 2 LD, 2 LU, 2 MO, 2 MS, 2 NM, 2 OD, 2 OM, 2 PC, 2 PV, 2 PX, 2 PY, 2 QS, 2 RX, 2 SH, 2 SX, 2 SZ, 2 TA, 2 TP, 2 VQ, 2 VR, 2 VS, 2 VU, 2 WA, 2 WJ, 2 WK, 2 XZ, 2 YQ, 2 ZT, 5 AT, 5 BA, 5 BT, 5 BV, 5 CB, 5 CX, 5 DU, 5 FL, 5 FS, 5 GF, 5 GX, 5 HA, 5 HW, 5 HY, 5 IC, 5 IH, 5 IO, 5 KO, 5 LF, 5 LS, 5 MA, 5 NN, 5 OB, 5 OL, 5 OX, 5 PD, 5 QV, 5 RZ, 5 SI, 5 SL, 5 SU, 5 SZ, 5 TG, 5 UL, 5 US, 5 VP, 5 VR, 5 WM, 5 XW, 6 AH, 6 EA, 6 IM, 6 JX, 6 KI, 6 KO, 6 MA, 6 NF, 6 PS, 6 QB, 6 QZ, 6 RY, 6 TM, 6 VP, 6 VR, 6 WM, 6 XX, 6 XY, 6 ZA, 6 ZY, XY, 0 AA, 0 AE, 0 DV, 0 KW, 0 MX, 0 NY, 0 PB, 0 PZ, 0 SA, 0 XF, 1 MT, 1 JW, 2 AQN, 4 LA, 4 ZZ, 7 EC, 7 ZM, 8 AA, 8 AE 1, 8 AE, 8 AG, 8 AQ, 8 AU, 8 BF, 8 BL, 8 BN, 8 BP, 8 CC. 8 CF, 8 CG, 8 CJ, 8 CT, 8 CU, 8 CZ, 8 DA, 8 DP, 8 DU, 8 DX, 8 DY, 8 ÉB, 8 EI, 8 ÉM, 8 FF, 8 MH, 8 OH, 8 SSU. (0—v—1 and 1—v—0.) (C. H. Savage.)

Dovercourt, Essex.
American Calls: **1 AR, 1 ARY, 1 AUT, 1 BDI, 1 BQ, 1 BVB,* 1 CAB, 1 CMP, 1 RR, 1 VV, 1 YB, 2 AFP, 2 BG, 2 BY, 2 BYA, 2 CXD, 2 RK,† 3 AJD. 3 TJ, 4 EB, 4 FG, 4 F 6, 4 HN, 8 AAM, 8 CUV, 8 GS, 8 GZ, 8 HN, 8 NB, 8 OS, 8 XAN, 8 XE, 9 AIM, 9 AN, 9 BP, 9 BWK, 9 CTB, 9 MC, 9 VM, 9 ZT.** (0—v—1.)
(F. R. W. Strafford.)

* R 5—6 (1 valve). † R 8.



WITH THE SOCIETIES

The Southampton and District Radio Society.*

On Thursday evening, February 28th, the Society commenced a specially-arranged experimental wireless course, the first subject being aerial tuning. The different methods of tuning were demonstrated on the Society's new experimental apparatus.

Hon. Sec., P. Sawyer, 55, Waterloo Road, Southampton.

Battersea and District Radio Society.*

An interesting lecture was given by Dr. B. Hodgson on February 28th, on "High Power Silica Valves." by kind permission of the Mullard Radio Valve Co., Ltd.

The subject was dealt with in an informative manner, inasmuch as the various parts of the valve were demonstrated singly in addition to the assembled unit. The lecturer explained very carefully the advantage Silica has over the glass envelope of ordinary receiving valves.

Battersea and district readers wishing to benefit by these lectures will do well to communicate with the Hon. Sec., T. M. Norris, 39, Warriner Gardens, Battersea, S.W.11.

The Leicestershire Radio and Scientific Society.*

An interesting evening was spent on March 3rd, when a general discussion of radio difficulties took place. Much varied information was forthcoming on several subjects, from tramway interference to the direct reception of **KDKA**, and many members gave their experiences.

Any communications regarding the Society should be addressed to the Hon. Sec., Jos. W. Pallett, 111, Ruby Street, Leicester.

Sheffield and District Wireless Society.*

Mr. R. Pritchett, B.Sc., of Nottingham, lectured upon the subject of "Super Regeneration" on February 29th.

Mr. Pritchett gave a most interesting exposition of the theory of the Armstrong and Flewelling Circuits, and also some practical details of the latter circuit, with which he had been experimenting for many months. The extreme sensitiveness of the circuit was shown by the fact that he had been able, with a 12 in. frame aerial stitched in the back of his coat, to obtain the majority of the broadcasting stations, and even to demonstrate the directive properties of the frame.

Hon. Sec., R. Jakeman, "Woodville," Hope, Sheffield.

The Lewisham and Catford Radio Society.*

At a well-attended meeting on March 6th, at which many ladies were present, Mr. P. R. Coursey, B.Sc., lectured on "Modern Developments in the Manufacture and Use of Condensers for Radio."

This meeting was thrown open to the public free, in the hope of further fostering local enthusiasm and educating the public in the use of their apparatus in a way that does not jeopardise the enjoyment of others.

The lecturer showed on the lantern screen many early forms of glass and air dielectric condensers, and then stated that, taken on the whole, mica was the best dielectric and air was better than glass.

The methods of manufacture of small fixed condensers were then followed up to their final tests, and it was stated that even the very smallest condensers have to show an insulation resistance of at least 300 megohms.

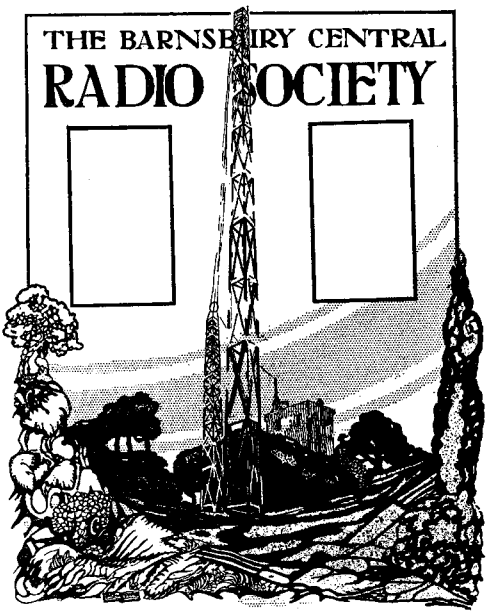
The making of variable air-dielectric condensers was also followed, and likewise the grid leak and anode resistances, the latter being of the same style as leaks but built bigger to pass more current without overheating. Standard condensers were shown, one which, with 12 switches, enabled over 1,200 different capacities to be obtained.

Many slides of large transmitting condensers were then shown, and it was stated that these worked continuously at 45,000 volts on a C.W. station, and dealt with 50 amps of high frequency current and then showed an efficiency of 99·99 per cent.

Large condensers for power line protection were discussed, and these, it was stated, had to stand up to a potential of 90,000 volts at 50 cycles, day and night, for years, in all sorts of weather.

One slide was shown of the result of a direct atmospheric discharge on to a sub-station which was unprotected for such a violent surge. The result had been devastating, and every part had been burnt out. These condensers were always tested at the voltage of 270,000 volts!

The Secretary, Mr. Tynan, would be pleased to hear from any prospective member, writing to 62, Ringstead Road, S.E.6.



A reproduction of a poster designed by Master Arthur Propper (aged 13), a scholar at the Barnsbury Central School, to announce forthcoming meetings of the wireless society, an active organisation affiliated with the Schools' Radio Society.

The Leeds Radio Society.*

At a recent meeting, Mr. W. J. Caulder lectured upon "The Application of Electricity to Medical and Surgical Work." X-ray work was particularly examined, and also the effects of electricity on the nervous system. A well-sustained discussion followed.

At an instructional meeting recently held, Mr. W. G. Marshall lectured on "Resonance" (Part II). The elements of capacity and the important effects of the inclusion of condensers in A.C. circuits of both high and low frequency were closely considered.

Mr. E. V. Elwes recently delivered an excellent paper upon "Electron Emission." The history of the subject was briefly examined, Mr. Elwes paying special attention to thermionic emission systems. The cases of high temperature heavy current, dull emitting and fine filament valves were analysed in turn and the photo-electric effects of electron emission were treated.

At a further instructional meeting, Mr. G. F. Brett gave a useful paper entitled "Detection and Correction of Faults in Receiving Circuits."

On February 22nd, Mr. C. W. Osborn lectured on "Workshop Practice." An extensive display of small tools suitable for instrument making was on view.

On February 29th, at the U.M. Church Schools, Mr. E. M. Washington delivered a valuable paper entitled "Ether Waves,

Their Properties and Detection." The lecturer paid particular attention to the electron theory, and by means of apparatus successfully demonstrated examples of electronic disposition and emanation. Wave motions in ether were also demonstrated by means of very simple apparatus. The band of ether waves from X-rays to radio waves was examined closely, the detecting devices that were used for different wavelengths being explained.

At the instructional meeting held on March 7th, Mr. D. E. Pettigrew lectured upon "The Possibilities of Crystal Reception in Leeds." The theoretical side of the matter was discussed in detail, and the lecturer put forward much information that should benefit the beginner. The lecturer said that it was quite possible to receive **2 ZY** and **5 NO** any time in Leeds on a crystal detector without valve apparatus.

Hon. Sec., D. E. Pettigrew, 37, Mexborough Avenue, Leeds.

B.T.H. Radio Society.

The Society met on Wednesday, February 13th. The first half-hour was devoted to Morse practice, after which Mr. P. T. Harris gave a most helpful lecture entitled "Amplification."

Mr. Harris dealt particularly with low frequency amplification, and pointed out, very clearly, the causes of distortion of amplified speech and music, and showed how this difficulty may be overcome.

The lecturer brought with him radio apparatus with which he illustrated the various points in his lecture, in particular the effect of introducing grid bias batteries.

Hon. Sec., F. J. Bradley, Recreation Club, British Thomson-Houston Co., Ltd., Rugby.

The Wembley Wireless Society.*

Before a large audience on Friday, February 15th, Mr. Percy W. Harris gave an instructive lecture and demonstration on "Modern Circuits." A single-valve straight circuit was first depicted and to this was added tuned anode, an L.F. transformer and crystal detector, a second transformer and valve, and then a complete dual amplification circuit filled in with the latest modifications. The failure of some dual amplification circuits was mentioned as being due in many cases to inefficient L.F. transformers and the incorrect disposition of parts. Wave traps and frame aerials also found a place in the lecture.

Mr. Harris ably answered the numerous questions addressed to him at the close of his remarks.

Hon. Sec., W. R. Mickelwright, A.M.I.E.E., 10, Westbury Avenue, Wembley, Middlesex.

Streatham Radio Society.*

The Second Annual Dinner of the Society was held on February 14th at the Telegraph Hotel, Brixton Hill, when about 50 members and friends sat down to an excellent repast. The Chairman, Mr. H. Bevan Swift, presided. During the evening the transmission from **2 LO** was enjoyed from two loud speakers kindly lent for the occasion by the Telephone Manufacturing Company, and operated by Mr. W. Lance. Following the dinner the usual toasts were given and responded to. This was followed by an impromptu concert in which many members took part.

The Society is steadily increasing its numbers, and is proud of th fact that many of its members hold transmitting licences. The Society not only attends to the technical welfare of its members, but makes attempts to see that the social side is not overlooked.

Hon. Sec., S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

Clapham Wireless Society.*

A meeting of this newly-formed Society was held at the Headquarters, "The Sun," Old Town, Clapham, S.W., on Wednesday, February 27th.

The Chairman, Mr. Brierley, read an instructive paper on the subject of "Aerials," which gave ample scope for questions and discussion.

It was proposed by Mr. Cooke, Senr., seconded by Mr. Hall, and carried by the meeting that the annual subscription be 5s. It was also agreed to institute an entrance fee of 2s. 6d.

Prospective members are warmly welcomed, and enquiries should be addressed to the Hon. Sec., M. F. Cooke, 13, Fitzwilliam Road, Clapham, S.W.4

Croydon Wireless and Physical Society.

On Monday evening, February 25th, at the Croydon Camera Club Room, East Croydon, a lecture was given on "Crystals" by Capt. A. Hinderlich, M.A. The lecturer, after briefly reviewing the method of growth of minerals, dealt with each of the wireless crystals in turn. He laid special emphasis upon the relative stability of each, estimating their purity (ease of finding good spots), requisite contact pressure (ability to withstand mechanical shock), and hardness (resistance to mechanical wear). Large specimens of some twelve distinct varieties were exhibited to the meeting. Finally the lecturer offered to crack Brazil nuts with a detector mounted on a mallet, but the demonstration could not take place owing to there being no nuts available. An animated discussion then took place, numerous questions being dealt with by the lecturer and the members.

Hon. Sec., H. T. P. Gee, 51 and 52, Chancery Lane, London, W.C.2.

Honor Oak Park Radio Society.

On February 22nd, the Society held a very successful exhibition of members' home-made apparatus. A competition had been arranged, the judges being Mr. Hampshire, of Forest Hill, and Mr. Stokes, of Balham. The prize for valve sets went to Mr. F. Gandon for a three-valve receiver (H.F., detector and L.F.), with jacks to cut out valves as required. The prize for crystal sets was awarded to Mr. King for a very neat little untuned set.

Hon. Sec., J. McVey, 10, Hengrave Road, S.E.23.

Hans Renold Ltd. Social Union (Radio Section).

Mr. H. W. Taylor, of the British Electrical Instruments, Ltd., gave a most instructive lecture on Tuesday, February 19th, dealing with Aerials and Variometers. After the lecture a demonstration was given with a five-valve set and loud speaker, with excellent results.

Gen. Sec., A. Passmore, Burnage Works, Didsbury, Manchester.

Bromley Radio and Experimental Society.

On February 13th, a party of members was taken over the studio of **2 LO** and the transmitting station at Marconi House, where a most interesting hour and a half was spent.

On February 18th, the Society held an interesting meeting when Mr. E. Cuddon lectured on Heterodynes, their action and application. His lecture was ably demonstrated by the large amount of apparatus which he kindly brought.

The Secretary will be pleased to hear from prospective members.

Hon. Sec., L. R. Stephens, 73, Masons Hill, Bromley, Kent.

FORTHCOMING EVENTS.

WEDNESDAY, MARCH 19th.

Edinburgh and District Radio Society. At 8 p.m. At 117, George Street. Lecture: "Elementary Principles." By Mr. R. Ogilvie Crombie.

Golders Green Radio Society. At 8.30 p.m. At the Club House, Willifield Way, N.W.11. Lecture: "Note Magnification." By Mr. C. W. Ives.

Clapham Park Wireless and Scientific Society. Lecture by Dr. B. Hodgson, of the Mullard Radio Valve Company.

North Middlesex Wireless Club. At the Shaftesbury Hall, Bowes Park. Annual Genera Meeting.

THURSDAY, MARCH 20th.

Sale and District Radio Society. At 37, School Road. Lecture by Mr. Dan Godfrey, Junr.

Radio Association of South Norwood and District. Lecture: "The Construction of a One-Valve Set." By Mr. Jeffree (**5 FR**).

Blackpool and Fylde Wireless Society. Gramophone Demonstration: "Marconi Official Records." By Mr. C. S. Doeg.

Ilford and District Radio Society. Lecture: "Selectivity." By Mr. A. E. Gregory.

FRIDAY, MARCH 21st.

Sheffield and District Wireless Society. At 7.30 p.m. At the Department of Applied Science, St. George's Square. Lecture: "Loud Speakers" (illustrated by experiments). By Mr. W. E. Burnand, M.I.E.E.

Leeds Radio Society. At 7.30 p.m. At the Woodhouse Lane U.M.C. Schools. Lecture: "Aerial and Earth Systems and Equipment." By Mr. D. E. Pettigrew (Hon. Sec.).

MONDAY, MARCH 24th.

Ipswich and District Radio Society. At 55, Fonnereau Road. Open night.

Dulwich and District Wireless and Experimental Association. Special Experimental Exhibition.

Sale and District Radio Society. At 37, School Road. Open discussion.

Hornsey and District Wireless Society. At Queen's Hotel, Broadway, Crouch End, N.8. Lecture: "Electric Accumulators." By Mr. F. J. Holmes, M.I.E.E. (of the Hart Accumulator Co., Ltd.).

TUESDAY, MARCH 25th.

West London Wireless and Experimental Association. At 7.45 p.m. At Acton and Chiswick Polytechnic, Bath Road. Lecture: "Some Important Points in Radio Design." By Mr. O. S. Puckle.

WEDNESDAY, MARCH 26th.

Radio Society of Great Britain. At 6 p.m. (Tea, 5.30). At the Institution of Electrical Engineers. Lecture: "The Possibility of Electrical Television, both with and without wires." By Mr. A. A. Campbell Swinton, F.R.S.

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 241. (No. 26. Vol. XIII.) MARCH 26th, 1924. WEEKLY

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ASSISTANT EDITOR:
F. H. HAYNES.

QUESTIONS AND ANSWERS DEPARTMENT:
Under the Supervision of W. JAMES.

CONTENTS

THE EDITOR will be glad to consider articles and illustrations dealing with subjects within the scope of the Journal. Illustrations should preferably be confined to photographs and rough drawings. The greatest care will be taken to return all illustrations and manuscripts not required for publication if these are accompanied by stamps to pay return postage. All manuscripts and illustrations are sent at the Author's risk and the Editor cannot accept responsibility for their safe custody or return. Contributions should be addressed to the Editor, "The Wireless World and Radio Review," 12 and 13, Henrietta Street, Strand, London, W.C.2.

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THE VISIT OF Mr. HIRAM P. MAXIM.

ON Monday, March 17th, an informal dinner was given by the Council of the Radio Society of Great Britain to entertain Mr. Hiram Percy Maxim, President of the American Radio Relay League. It has already been explained in a previous editorial that Mr. Maxim's mission to Europe has, as its object, the promotion of an international amateur organisation for the purpose of conducting and controlling international amateur transmissions.

Mr. Maxim had just returned from Paris where a Conference took place at which representatives of amateurs of almost all of the European countries were present. At that Conference the formation of an organisation under the name of the International Amateur Radio Union was approved, and Mr. Maxim was elected to act as President, whilst Dr. Pierre Corret of Paris, who is so well known to all amateurs, accepted the position of Secretary.

The Easter holidays of 1925 is chosen as the date for a Conference to be held, probably in Paris, when the object will be to establish a permanent organisation and to adopt proposals to be discussed prior to that date by the various countries concerned.

Mr. Maxim has explained that although American amateurs have taken the first step in proposing such an organisation, they do not wish to interfere with its formation, and would prefer that the organisation should be worked out in Europe when the American amateurs would be glad to fall in with any scheme adopted.

On the occasion of the Dinner in London, Mr. Maxim gave a most interesting account of amateur activities in America, and in particular, he emphasised the importance of the amateur in the United States. As an example of the status of that body in the States he cited an instance of how, when the broadcasting organisation required to be revised, representatives of all interested parties were called upon to send delegates to a Conference. The order in which these delegates were called upon to state their views were, first the Government Services and next the representative of the organised amateurs.

Mr. Maxim showed that this is the spirit in which the Government Departments regard the amateur. No irksome restrictions of any kind are placed on the experimenting amateurs of the United States, but rather every facility is given them to further their interests and the development of their experimental work. No fees of any kind are exacted for experimental licences, and the only stipulation is that the amateur shall conduct his work in a " gentlemanly manner," with due regard to other users of the ether. This state of affairs stands out in striking contrast to the position in this country, where it certainly cannot be said that the amateur enjoys any large degree of freedom and where, in addition, he is required to pay fees which appear to be in direct proportion to the importance of his contributions to wireless development and research.

A reference was made by one speaker to the heavy fees demanded by the authorities from those amateurs who wished to take part in Transatlantic transmissions on short wavelengths. Mr. Maxim pointed out that nothing of this kind would ever happen in the United States. There are, in addition, no restrictions in the United States as to the nature of communications and as a consequence, messages of greeting can pass by relay from one amateur station to another, right across the Continent of America, and even beyond its borders with complete freedom from any interference through violation of Government monopoly in the transmission of communications.

Government Departments of this country, and particularly the Post Office, have established a reputation for inertia, and since international amateur communications have only been achieved within recent months, one must not be premature in criticism of the authorities for not having already expressed their willingness to give additional facilities. No doubt they are giving consideration to the matter, and the views expressed by Mr. Maxim, when they reach their ears (as no doubt they will), should serve to assist them in what we believe to be their good intentions to offer much freer facilities for experimental work, and particularly international amateur communications, in the near future.

THE ELECTROSTATIC TRANSMITTER.

By E. K. SANDEMAN, B.Sc.

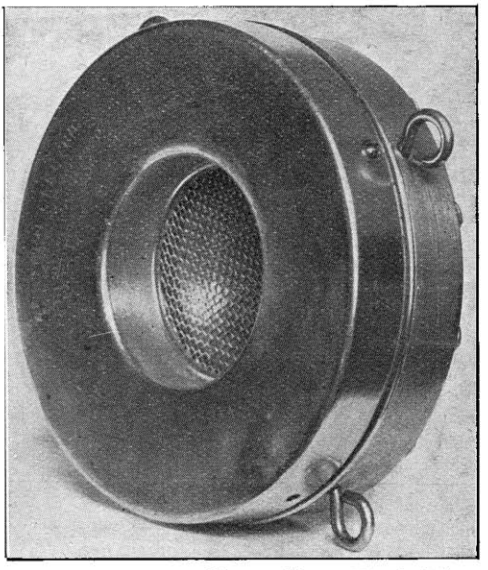
IF we consider the progress of a spoken word or a musical note from the time it is produced in a broadcasting studio to the time it is *re*produced at the ear of the listener, we see that there must be a large number of phases of existence through which any integral part of the word or note may be said to pass. For instance, it exists firstly as a variation of pressure in the air of the studio and travels across the studio until it impinges on the diaphragm of the microphone, or whatever device is used to "pick up" the sound wave, generally spoken of as a transmitter.

Since in general the sound travels in all directions, it also strikes the walls, floor and ceiling of the studio, where it is reflected in greater or less degree, but we are only immediately concerned with the wave which reaches the diaphragm of the transmitter. This causes the diaphragm of the transmitter to oscillate, the aim of the designer being to make these oscillations of exactly the same form as the oscillations of sound pressure which are impressed on the diaphragm.

The sound thus exists firstly as a mechanical vibration in a musical instrument or in the larynx and resonating chambers of the throat and mouth of someone talking or singing, then as a sound wave in air, whence it is reconverted into a mechanical (forced) oscillation in the diaphragm of the transmitter. It is then converted into electrical oscillations by any one of a large number of methods, of which we will consider a few.

Probably the most well-known method is to make the diaphragm press lightly against a small capsule containing carbon granules in such a way that the granules are made to press against one another with pressures proportional to the pressure changes in the air. This causes the whole mass of granules to present a varying resistance to an electric current, the change in resistance of the carbon contracts being very approximately directly proportional to the change in air pressure applied to the diaphragm. Any non-linearity in the pressure-resistance law for carbon may be compensated for by a differential (push-pull) device similar to that employed in the Western Electric double button stretched diaphragm transmitter.

A second method which has been very successful, and one which is due to Captain Round and Prof. Sykes, is to construct a diaphragm made of a spiral of aluminium wire, the whole diaphragm being situated in a strong magnetic field in such a way that movement of the diaphragm along its axis



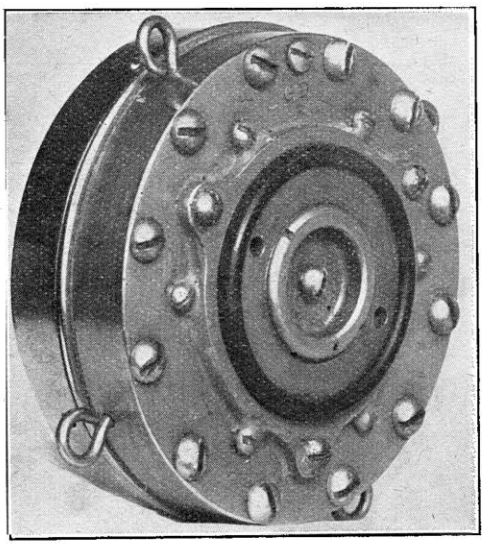
(Courtesy Western Electric Co.)

Front view of condenser transmitter.

generates an electro-magnetic force in the coil just as an electro-magnetic force is generated in the armature of a dynamo when rotated in a magnetic field. It is evident that if the magnetic field is substantially uniform over the travel of the diaphragm the e.m.f.'s induced will be directly proportional to the velocity of movement of the diaphragm. Further, if the diaphragm is supported in such a way that any restoring force acting on it is negligible, its amplitude of movement will be inversely proportional to frequency, causing a definite and known

distortion which may be easily corrected for by a filter circuit which ideally would consist of a single series condenser situated in a part of the circuit which was of zero impedance. This, of course, is impossible to realise in practice, but a practical approximation may be obtained by employing a condenser of such value that its impedance is always high compared to that of the circuit.

Another form of transmitter which it is understood has been used with great success is of the simple electro-magnetic type. The particular one in question, we understand, consisted of a certain make of loud speaker, which is constructed along the lines of an



(Courtesy Western Electric Co.

Back view of condenser transmitter.

ordinary telephone receiver, used in its inverse function, just like the earliest form of Bell telephone transmitter. In order to eliminate the resonant points in the diaphragm the case of the loud speaker was filled with oil, thus damping the diaphragm so heavily that the mechanical impedance due to damping was always (*i.e.*, at all frequencies) much greater than that due to the reactance of the mass of the diaphragm and its elasticity.

The electrostatic transmitter employs still another principle.

As constructed by the Western Electric Company it consists essentially of a condenser of about 500 micro-microfarads capacity formed between a solid back plate of steel and a steel or special alloy diaphragm about 2 mils thick. The distance between the

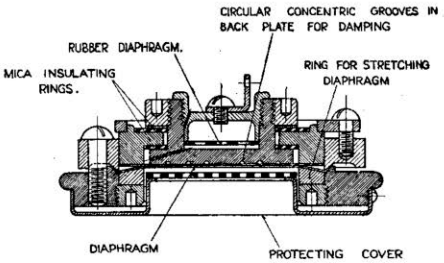


Fig. 1. Sectional view of the electrostatic transmitter.

diaphragm and the back plate is of the order of 1 mil.

In Fig. 1 is shown a section through the centre of this transmitter. It is, of course, impossible to draw the diaphragm and the space between it and the back plate correctly to scale, but a very accurate idea of the construction may be obtained from an examination of this sketch, which is practically self-explanatory.

In order to avoid the distortion which normally occurs in any instrument employing a diaphragm, the diaphragm of this electrostatic transmitter is stretched to raise its natural frequency as high as possible. This is further raised by a special method of air damping obtained by the provision of a number of concentric grooves in the back plate of the condenser, the actual natural frequency of the diaphragm in the assembled transmitter being of the order of 10,000 cycles per second.

The transmitter is connected in circuit as in Fig. 2, where it is shown connected to the input of its associated amplifier.

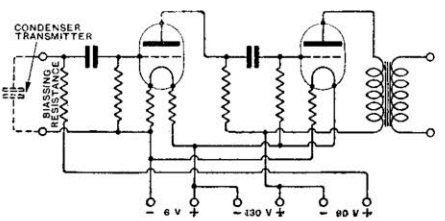


Fig. 2. Western Electric amplifier for use with condenser transmitter.

The principle of the condenser transmitter is extremely simple. Referring to Fig. 2, we see that the diaphragm of the condenser

transmitter is maintained at a potential of 220 volts above that of the back plate, being " polarised " by means of the left hand biassing resistance. The value of this resistance should be as high as possible for obvious reasons (*i.e.*, since it is a shunt across a high impedance circuit).

Sound waves striking the diaphragm cause it to pulsate, and so to vary the capacity formed between the back plate and the diaphragm.

We can thus regard the condenser transmitter as containing a definite quantity of electricity :

$Q = CV = 250 \times 10^{-12} \times 220$ coulombs, which is virtually constant, since any changes in capacity which occur are too rapid for current leaking through the biassing resistance to have any appreciable effect in equalising the voltage.

We have then at any instant the voltage across the condenser

$$v = \frac{Q_1}{c_1}$$

where c_1 is the capacity of the condenser $= C + \Delta c \sin \omega t$, where C is the mean value of the condenser and Δc the maximum variation for a given sustained tone of frequency $f = \frac{\omega}{2\pi}$

$$\therefore v = \frac{Q}{C + \Delta c \sin \omega t}$$

$$= \frac{Q}{C} - \frac{Q\Delta c}{C^2} \sin \omega t + \frac{Q\Delta c^2}{c^3} \sin^2 \omega t - \frac{Q\Delta c^3}{C^4} \sin^3 \omega t + \text{etc.}$$

Hence provided Δc is small compared to C, and actually it is probably less than 10^{-6} of C, the output of the condenser is directly proportional to Δc, the change in capacity of the condenser.

To show that Δc is small compared to C, let t be the separation of the plate and diaphragm, Δt the maximum movement of the diaphragm, and A the area of the plate. Then :

$$C = \frac{A}{4\pi t \times 9 \times 10^{11}}$$

$$\therefore dc = \frac{-A dt}{4\pi t^2 \times 9 \times 10^{11}}$$

$\therefore$ approximately

$$\Delta c = \frac{-A\Delta t}{4\pi t^2 \times 9.10^{11}}$$

$$\therefore \frac{\Delta c}{C} = \frac{\Delta t}{t}.$$

Now the maximum movement of the air particles at a distance of 5 ft. from the mouth is of the order 10^{-6} ins., and the impedance of a non-stretched diaphragm at frequencies away from resonance may be as much as 1,000* abohms per square centimetre, while that for air is only 40 abohms per square centimetre. From the relative sensitivities of an ordinary microphone and the stretched duralumin diaphragm above, we should expect that the stretching increases the impedance to movement of the diaphragm about 100 times (= the square root of the power output ratio) so that the impedance of the stretched diaphragm is at least 1,000 times that of the air to which it is coupled.

Thus there will be a transition loss of the order of 1,000 times pressure ratio, or rather greater since this diaphragm is stretched. Hence the amplitude of vibration of the diaphragm cannot be more than 10^{-9} ins.

The harmonics produced are therefore absolutely negligible, even taking the worst possible cases.

Next we are concerned with the response characteristic for the transmitter; the relative strength of reproduction of each individual frequency.

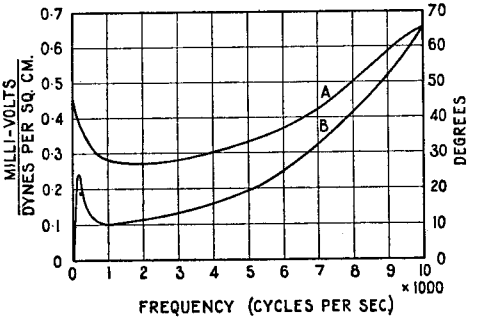


Fig. 3. Sensitivity-frequency characteristic of the electrostatic transmitter. A. Volts per unit of pressure ; B. phase lag of E.M.F. behind pressure.

*An abohm is a unit expressing the relation between the maximum excess pressure (due to sound), at a point, and the maximum velocity of movement of the air particles at that point. It thus has the dimensions of $\frac{MLT^{-2}}{LT^{-1}} = MT^{-1}$ and is most conveniently expressed as dyne seconds per centimetre.

A response characteristic may be plotted in a number of ways; in this case, since the condenser is connected directly to the grid of a valve, what we are immediately concerned with is voltage. The analogue of voltage in aerodynamics is pressure. Hence most reasonably we should calibrate this transmitter in dynes per square cm. R.M.S. excess pressure and in R.M.S. excess volts.

Such a calibration is shown in Figs. 3 and 3*a*. The abcissa represent frequency and the ordinates represent millivolts output against dynes per square centimetre pressure on the diaphragm as defined above. Fig. 3 shows the frequency range from 0–10,000 cycles for one instrument, and Fig. 3*a* to an enlarged scale, the calibration below 200 cycles, for another instrument. Fig. 3*a* is of special interest since it shows the original comparison between thermophone and piston phone measurements (see below).

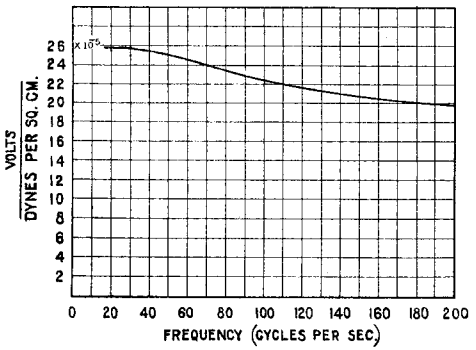


Fig. 3A. Efficiency of electrostatic transmitter.

(In Fig. 3 the phase lag due to the inertia of the diaphragm is also shown, but this is of comparatively small importance).

The curve is seen to be substantially flat over the speech frequency range. In looking at this curve two things must be brought to mind. Firstly the permissible distortion—experiment shows that any one frequency may be reproduced nearly three times as well as another before the distortion is definitely detectable by ear (and the worst ratio on this curve is 2·2 for the extreme frequency range). So that the distortion over the part of the audiospectrum represented (0—10,000 cycles per record) is negligible, and even if it were not negligible the distortion of all telephones and loud speakers has a curvature the inverse of this, so that the condenser transmitter tends to correct for their distortion; further, it is a simple matter to construct an amplifier whose distortion is the inverse of that in the condenser transmitter. This last is, however, a small point compared to the fact that the distortion is practically undetectable by ear.

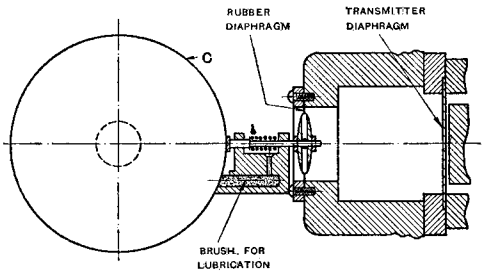


Fig. 4. Use of pistonphone for calibrating an electrostatic transmitter.

The method of obtaining this response frequency characteristic is very interesting, and is an illustration of the extreme pains sometimes necessary in fundamental physical research. The method consists essentially in applying a known variation of pressure to the diaphragm and measuring the electrical output from the transmitter. The known variation of pressure was applied in two fundamentally different ways, in order to obtain a check on the results, by means of a pistonphone and by means of a thermophone.*

The condenser transmitter was arranged so that the diaphragm formed part of one wall of a small enclosed space, as shown in Figs. 4 and 5. In the one case (Fig. 4) a small oscillating piston (the pistonphone) was arranged to form the opposing wall, so that the change of pressure on the diaphragm could be calculated from the movement of the piston and the change in volume of the enclosed space. By this means any frequency up to about 200 cycles per second could be applied to the diaphragm.

In the other case a thermophone was inserted in the enclosed space (Fig. 5) (now rather smaller), and the change of pressure calculated by the change of current entering the thermophone, the thermophone being

*E. C. Wente: "The Thermophone" *Physical Review*, 1922, Vol. 19; also E. C. Wente "The Sensitivity and Precision of the Electrostatic Transmitter for Measuring Sound Intensities," *ibid.* 1922, Vol. 19, p. 98.

supplied with alternating current from a valve oscillator. The thermophone is a device consisting of a thin filament of Woollaston wire (or sometimes gold or platinum foil), which, when an alternating current is passed through it, causes the air to expand or contract owing to the heating of the filament, forming sound waves of a

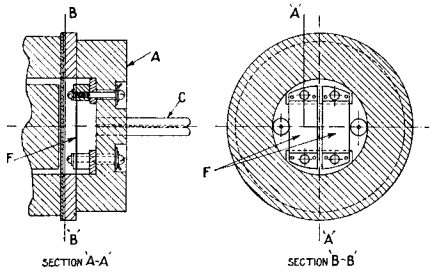


Fig. 5. Thermophone in place for calibrating an electrostatic transmitter.

similar form to the electric oscillations in the wire. For those who are interested in the mathematical aspect of the problem, the evolution of the formulæ relating the input electrical energy to the thermophone and the output sound energy is outlined in the *American Physical Review* referred to above.

Consistent results were obtained using both methods for frequencies up to 200 cycles per second, and above this the thermophone was employed to continue the calibration up to 10,000 cycles per second.

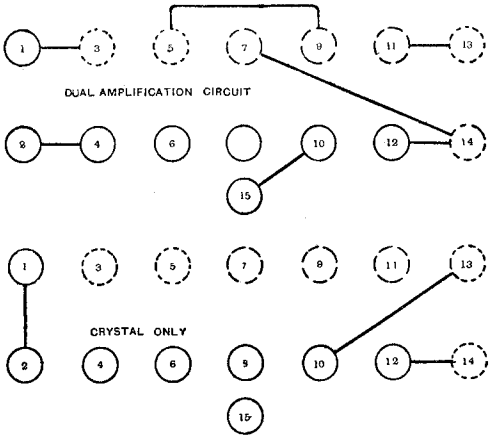
We have seen above that the condenser transmitter from theoretical considerations is practically a perfect instrument, since its asymmetric distortion is virtually non-existent and its response distortion is negligible over a range of frequencies covering the most rigid requirements for the reproduction of instrumental music or of speech.

The performance of this instrument in no way falls off from expectation, and it is doubtful if the most expert ear could detect any departure from naturalness when this transmitter is employed with a telephone receiver free from distortion, or whose distortion has been equalised by means of a suitable filter circuit.

Considered as an engineering achievement, the electrostatic transmitter is most noteworthy; it is often a simple matter to construct a piece of apparatus from theoretical considerations which will operate under laboratory conditions, but the development of a reliable instrument which will stand up to commercial conditions and which may be handled by comparatively unskilled operators is quite a different proposition.

There are a number of other ways in which a condenser may be adopted to serve the purposes of a telephone transmitter, but the above instance will serve as an indication of what has been actually realised in practice.

(In connection with Figures 1, 3, 3A, 4 and 5, acknowledgment is made to the *Physical Review*, and the Western Electric Co.)



MULTI-CIRCUIT EXPERIMENTAL VALVE PANEL.

An error unfortunately appeared in the diagram on page 736 showing the method of linking up the various sockets to produce the dual amplification and crystal circuits. The connections omitted are here shown in the upper figure between sockets 5 and 9, while in the lower figure a connection has been added between 12 and 14.

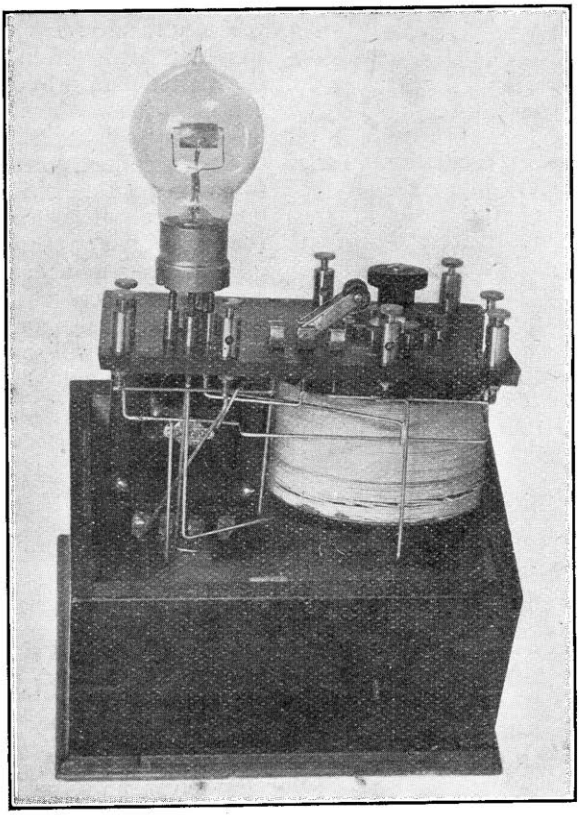
DESIGN OF A

CRYSTAL SET WITH NOTE MAGNIFIER

An easily constructed set designed to give good signal strength with a minimum consumption of filament current.

By S. J. HEX.

THOSE persons who live anything from 25 to 40 miles from the nearest broadcast station find that consistent reception on a crystal set alone is generally not all that can be desired in matter of strength, more especially if two or more pairs of telephones are brought into commission. To the man of limited means and who does not wish to experiment beyond getting good results, the following description of a crystal set with one note magnifier, will, perhaps, appeal.



Tuner with crystal detector and valve note magnifier. This illustration shows clearly the arrangement of the parts. The detector is behind the valve.

The general layout of the set herein described can be clearly seen in the photographs. The ebonite panel measures $6\frac{3}{4}$ ins. by $4\frac{1}{2}$ ins. by $\frac{1}{4}$ in. thick and is first of all rubbed down with fine emery paper and turpentine. In rubbing, the movements of the emery should be circular and not too hard. When all the glossy surface is removed from both sides a clean cloth should be rubbed hard over the panel and the result will be a good dull black finish.

The marking out for the holes should now be done carefully, making sure that all are in alignment for the various terminals. For the correct marking out of the rotary switch, a compass should be taken and a circle described to suit the switch arm radius. Sixteen holes should be marked off round the circle with a pair of dividers, or if these are not in the tool chest (as indeed they should be, for instrument making) a ruler with 1/32 in. scale must be resorted to. When about to drill the holes it is advisable to punch each position with a light centre punch, otherwise the drill is apt to turn just off the spot and the result is a hole 1/32 in. or so out.

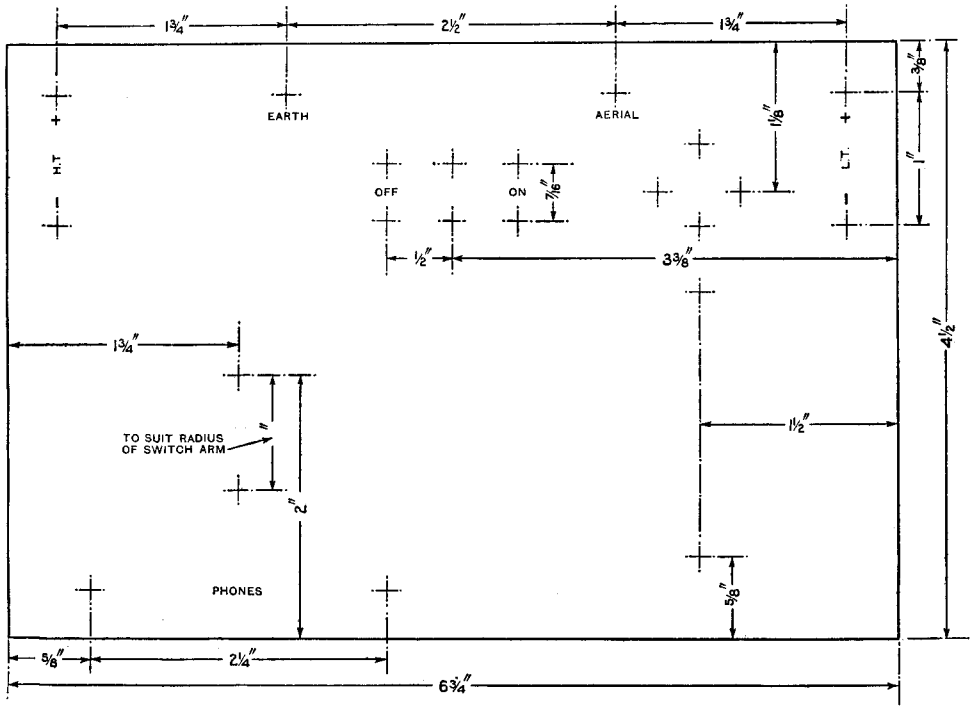
The crystal detector is now attached to the panel, using the base on which it was mounted when bought as a drilling template. The holes for the screws that hold the transformer can next be drilled, countersinking being effected on the top of the panel. Likewise the small " on and off " switch and the valve sockets.

To make a neat job of the set, the panel can be sent away to be engraved for a very small sum. For this purpose it is necessary

to remove all components and carefully mark on the panel in pencil the characters to be engraved, stating the size (one-tenth in. was used in this case.) Whilst the panel is away the aerial coil can be wound and the tappings taken off.

The writer used a 3½ in. diameter ebonite tube (postal tube would do quite well impregnated with wax) and wound on No. 24 D.C.C. taking tappings off at turns 30, 34, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52—sixteen in all. As each tap is file or a piece of coarse emery cloth wound round a ruler or file and rub the studs with a perfectly horizontal motion. When all the studs are even in height the arm will move over them without that "click" which denotes poor workmanship on any set.

The coil can be mounted now by screwing to the underside of the panel using the angle pieces previously mentioned, and the tappings soldered to the studs—No. 30 to first stud, No. 34 to second stud, and so on. The



Drilling diagram of the panel.

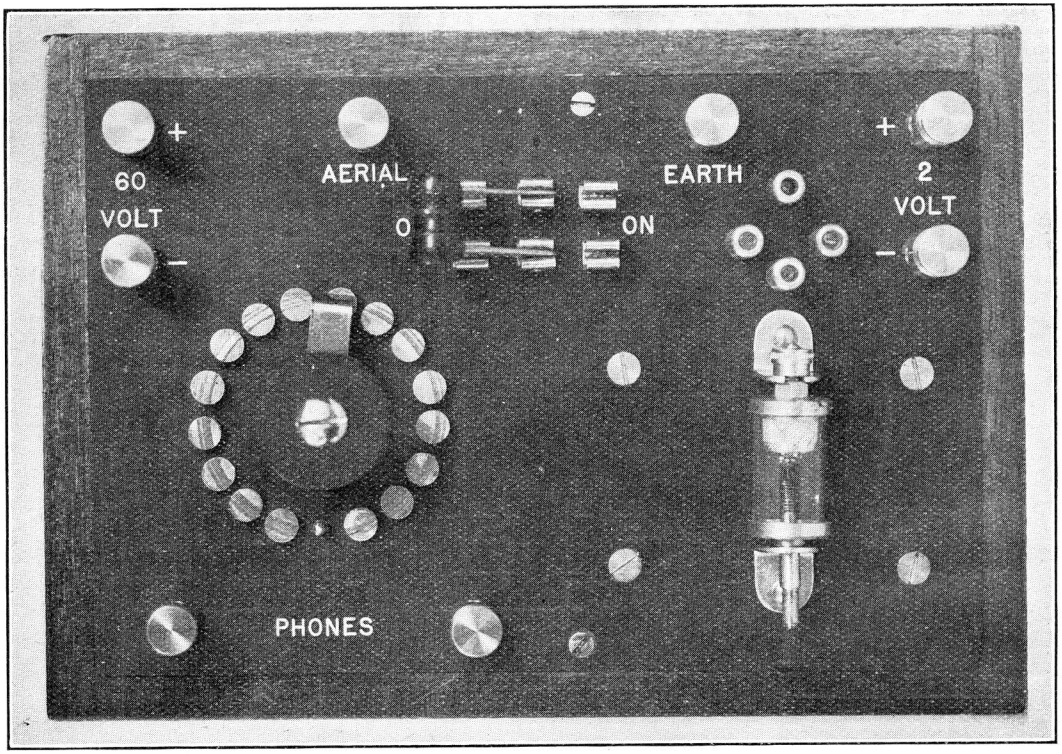
taken off it is passed through a small hole drilled in the tube to the centre, where a length of say 2 ins. can be twisted and cleaned ready to be soldered to the studs.

Two lugs or small angle pieces are fitted to the base of the tube by 5B.A. screws and nuts. These are to secure the tube to the underside of the panel.

When the panel is back from the engravers, first of all mount the 16 studs and switch arm, and see that the arm moves smoothly over the studs. If not, then take a fine transformer, which should be the best the pocket will allow, can now be screwed on, using countersunk screws and nuts.

The wiring can be carried out with No. 16, making a neat job, and the diagram is given for reference. The double-pole switch breaks the H.T. and L.T. circuits.

The high tension battery may be about 60 volts, according to the type of valve to be used. The writer incorporated a "D.E.R." dull emitter valve, necessitating a 2-volt accumulator and 36/60 H.T.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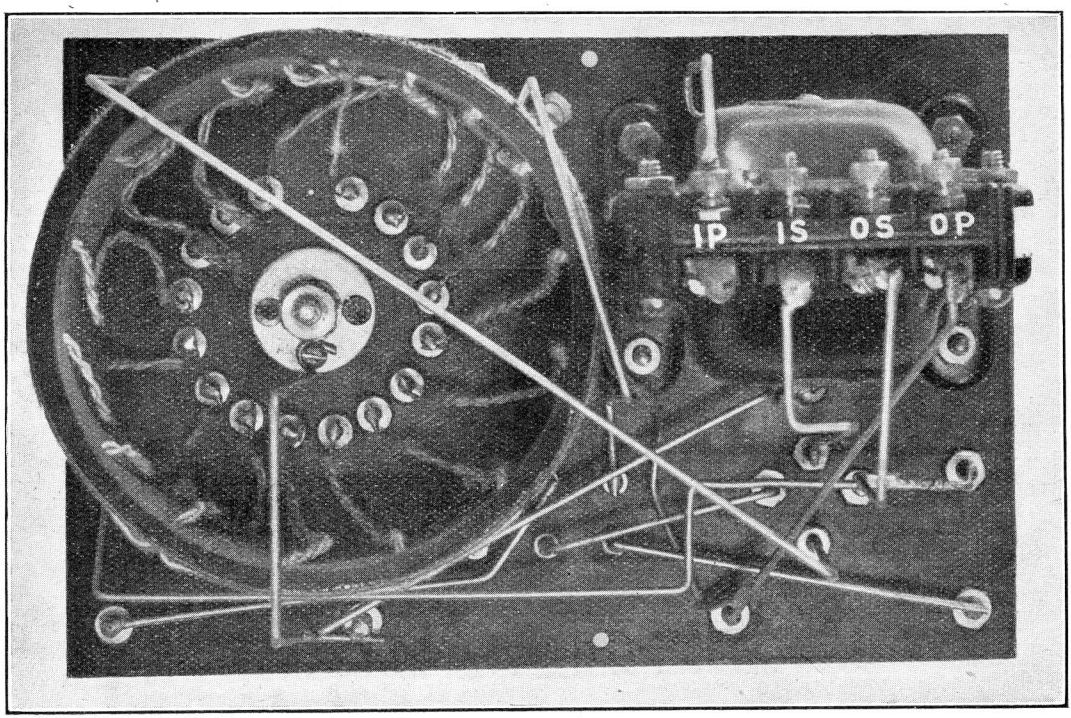
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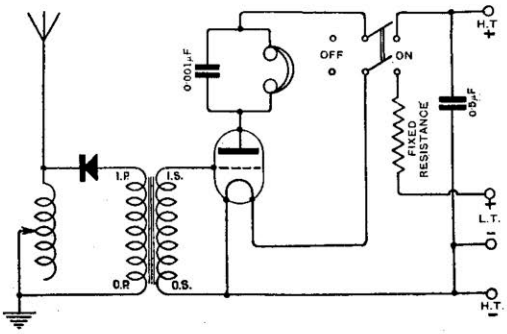
When using a valve of this type, 1·8 to 2 volts is quite sufficient for its operation, and it is indeed harmful to put a fully-charged cell which should register 2·5 to 2·6 volts, across the filament without some sort of resistance. Therefore a short piece of resistance wire (1¼ ins. of No. 38 for example) must be placed in series with the battery and valve. This will ensure that no more than 2 volts pressure is maintained across the filament at any time, of course provided that no more than one cell is used.

With a suitable type of accumulator, long intervals can elapse between charges of the cell, provided that it is not completely exhausted by almost continuous running. A 40 amp. actual capacity 2 volt cell should last approximately 100 hours on one charge. This is distinctly useful for those who live in rural districts where difficulty and inconvenience are caused in taking large cells to the nearest station at very short intervals.

In conclusion, the writer would say that at a distance of 25 miles with a 50 ft. aerial 15 ft. average height and badly screened



Circuit of detector and note magnifier set.

by trees, **2 LO** comes through at a comfortable strength on four pairs of telephone receivers.

ITALIAN TRANSMITTER ACD.

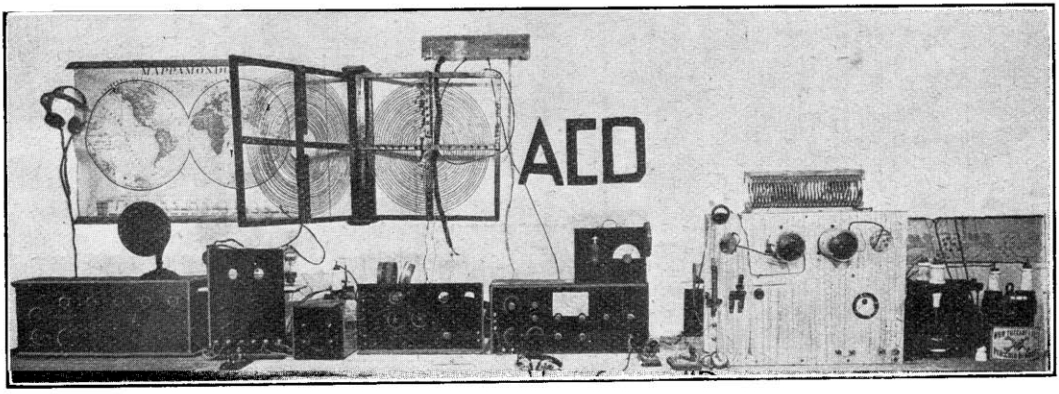
Situated at Bologna and operated by Mr. Adriano Ducati, this station is well known to those experimenters who interest themselves in international wireless work.

The receiving equipment is shown on the left in the illustration, and includes a full range tuner for use on wavelengths from 100 to 20,000 metres. The London Broadcasting Station is heard at a good strength on this set.

The transmitting apparatus is on the right, and operates on wavelengths from 160 to 250 metres. The transmitting valves are of French manufacture, handling 50 watts at 2,000 volts. These are fed from an alternating current input passing about 350 watts. The "reversed feed back" circuit is adopted, and an aerial current of 3 to 4 amperes is obtained on a wavelength of 180 metres.

The aerial is a wire cage 5 ft. in diameter of six wires, and 60 ft. long. A counterpoise is used beneath the aerial. This aerial system is claimed to have a very low resistance.

The station is heard when using only one transmitting valve, all over Europe, and is the first and only Italian station to work with the United States.



Receiving and transmitting equipment at the Bologna station **ACD.**

TELEVISION

AN ACCOUNT OF THE WORK OF D. MIHALY.

By NICHOLAS LANGER.

(Concluded from page 764 of previous issue.)

The receiver (Fig. 7 and photograph Fig. 8) in its chief features is similar to the transmitting arrangement. There is the tuning-fork interrupter I and the phonic drum G. The oscillograph C corresponds to the decomposing oscillograph C of the transmitter.

The most important part of the receiver is the so-called "light relay," that is the device for converting the current-fluctuations received into fluctuations of illumination. The light relay consists of a highly sensitive bifilar oscillograph of special design, which can record oscillations up to 20-30,000 a second. The arc-lamp A casts a narrow but very intensive beam of light upon the extremely small mirror P of the oscillograph, and the "picture currents" led into the loop cause deflections of the mirror P fixed on it according to the variations of the current coming from the transmitter (see also Fig. 1). When there is no current in the loop of the oscillograph Q, that is, in the ordinary position of the mirror P, a narrow beam of light reflected on the mirror is projected close to the specially-shaped diaphragm, so that no light can pass through it. When the mirror P is deflected, however, by fluctuating currents arrived from the transmitter, a greater or smaller part of the light beam passes through the diaphragm

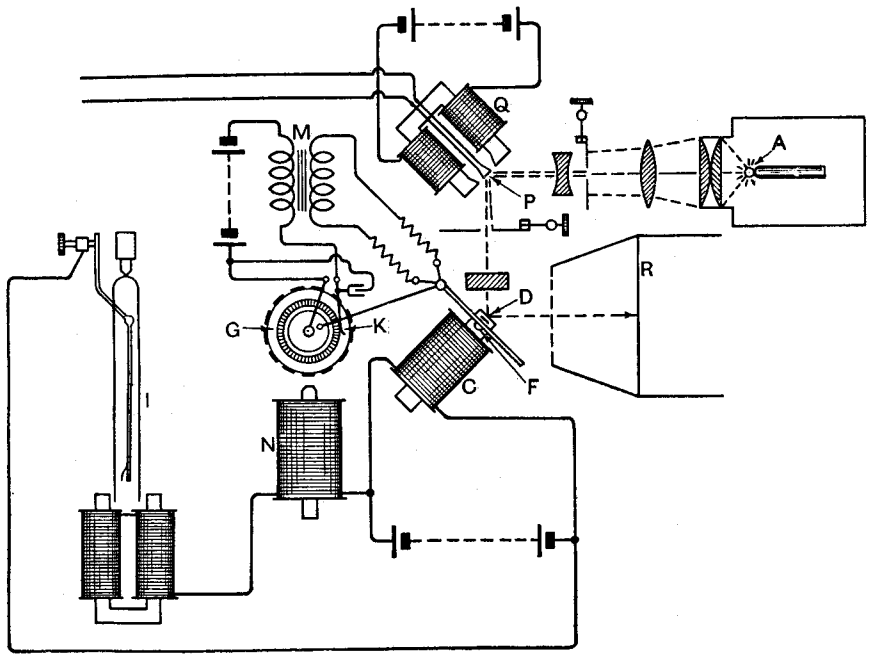


Fig. 7. The Receiver.

and falls upon the small mirror D of an oscillograph corresponding to that of the transmitter, which oscillates synchronously with the former. By means of this synchronously oscillating mirror D the picture elements produced by the light relay are distributed on the screen R in the same order as they were in the original picture.

The whole process of transmitting a picture takes place in about one-tenth of a second. Ten pictures a second may be transmitted, which suffices to transmit even pictures of objects moving at a moderate speed.

The perfect synchronisation of the decomposing mirror D (Fig. 4) with the corresponding mirror D (Fig. 7) of the receiver is of extreme importance. The very smallest deviation from synchronism causes the appearance of bright and black spots instead of the picture transmitted. Although when the tuning-fork interrupters of the transmitter and of the receiver are started simultaneously, synchronism is secured for a considerable time, it often happens that through differences in temperature the tuning forks alter their pitch. An ingenious automatic arrangement for the correction of such changes is provided at the transmitter.

In front of the lens B (Fig. 4) is a glass plate A (Fig. 9) which has at its edge three black dots, x, y, x. Because these three small dots are in the way of the light rays they prevent the transmission of three corresponding picture elements, and cause three black spots to appear on the same part of the picture transmitted on the screen at the receiving end, $x_1 y_1 x_1$. These black spots must, in case of synchronism always appear in the same place. If we place three small selenium cells on the edge of the receiving screen behind the three black dots they have a very great ohmic resistance because they are not illuminated. When the synchronism is disturbed the three black spots will not fall where the selenium cells are placed, but somewhere else. The selenium

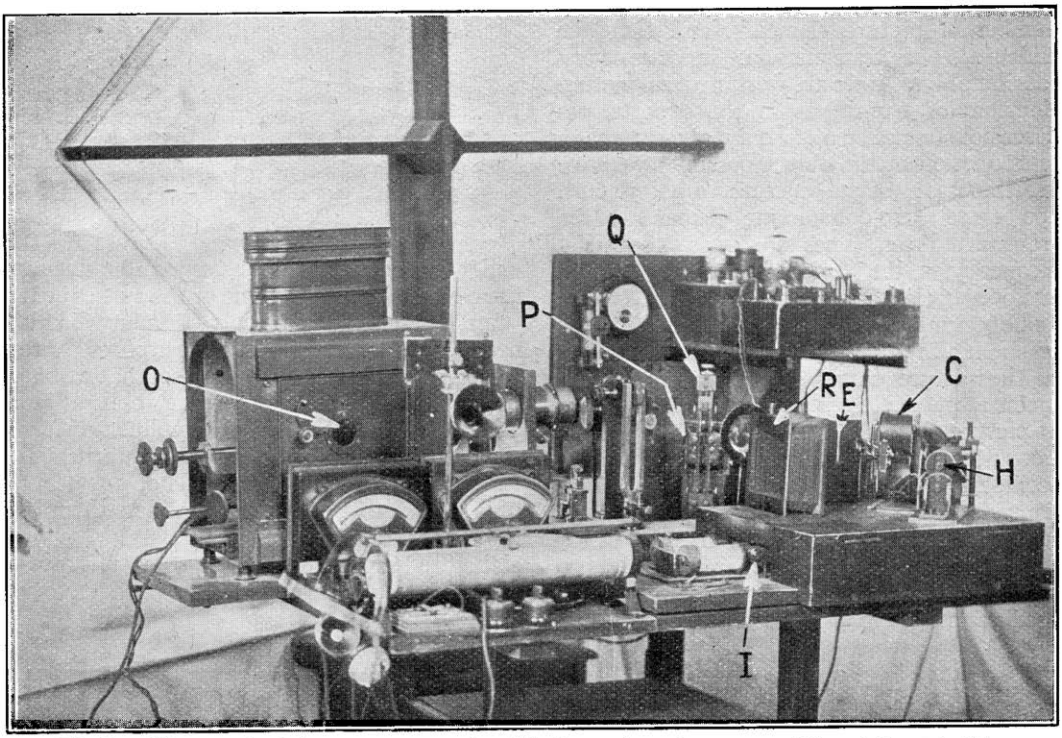


Fig. 8. Photograph of the apparatus employed in the receiver when arranged for wireless television. O = arc lamp ; Q = light relay oscillograph ; P = mirror of light relay ; R = screen ; E = diaphragm ; C = oscillograph ; H = electro-magnet of the phonic drum.

cells are thus illuminated, their resistance decreases, and by means of sensitive relays, magnetic couplings, brakes, etc., are caused to work until synchronism is again obtained, that is, until the picture of the three black dots transmitted falls correctly upon the three small selenium cells.

III.—CONCLUSION.

Mr. Mihaly began his experiments in 1916 and succeeded in 1919 in transmitting simple pictures of 10 × 10 cms. A simple calculation shows, however, that by increasing the size of the picture to be transmitted the number of picture elements, and thus the difficulties of transmission, increase very considerably. If we are working with picture elements of 1 m/m² as in the experiments described (which makes only a very rough reproduction of the object possible), we have in the case of a picture 10 × 10 cms. 100 × 100 = 10,000 picture elements to be transmitted ten times a second, that is a frequency of the "picture currents" up to 100,000 cycles a second. Fortunately the neighbouring picture elements are generally of similar brightness, so that the frequency of the picture currents increases only at a much more moderate rate than the number of picture elements. The number of oscillations the decomposing mirror D of the oscillograph C (Fig. 4) has to perform depends similarly on the size of the picture to be transmitted. As stated already, in the experiments described there were 500 oscillations a second, but it can easily perform oscillations up to 5-10,000 a second.

Experiments were also carried out on wireless television with about the same success as by wire. It is thought that in the case of greater distances, transmissions by wireless will prove easier than by wire, because of the great difficulties of leading the extremely weak picture currents of very high frequency along a lengthy land line. In consequence of the high frequency of the picture currents themselves the use of very short waves for wireless transmission is to be preferred.

The experiments were partly conducted

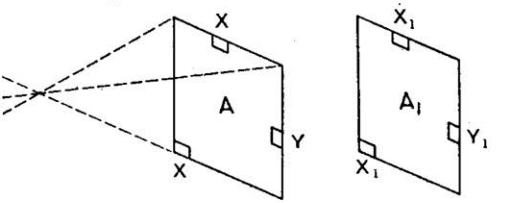


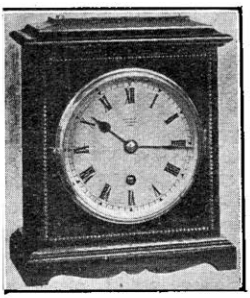
Fig. 9

under difficult conditions, especially during the Great War and in some of the subsequent years, when the materials of many kinds necessary for experimental purposes were scarcely obtainable, so much so that at one time the experimenters were obliged to undertake the making of amplifier valves themselves. Material difficulties interrupted the experiments in the middle of 1923, but it is hoped to be able to continue them in the near future, and by using more elaborate arrangements and some improvements, to obtain perfectly satisfactory results.

The Sporting Instinct in Wireless.

In 1921 a unique series of bets on the success of the Anglo-American amateur transmission was begun between Mr. W. W. Burnham, on this side of the water, and Mr. Kenneth B. Warner, Secretary of the A.R.R.L.

In that year, Mr. Burnham bet Mr. Warner a top hat that American transmissions would not be heard in this country. It is common knowledge that the bet was lost and that a suitably emblazoned top hat was sent over to America. In 1922 the bet was that the Americans would fail to get ten of their stations heard in Great Britain. Mr. Burnham lost again, and a walking stick was duly dispatched across the Atlantic. In 1923 Mr. Burnham challenged the Americans to receive twelve English or European amateur transmitters, the bet with Mr. Warner being a clock. The bet was again lost, and, as a matter of fact, Mr. Burnham's station (2 FQ) was among those received! The accompanying photographs show the clock and the



suitably engraved plate mounted on the top. Mr. Burnham informs us that his 1924 bet with Mr. Warner is on the subject of television, and is of such a nature that it is doubtful whether it will be taken on.

THE THREE-ELECTRODE VALVE.

THE VALVE AS AN AMPLIFIER.

By W. SYDNEY BARRELL.

LOW FREQUENCY AMPLIFICATION.

IN a previous article in this series it has been explained how the use of radio or high frequency amplification can materially increase the receiving range of a station by enabling the detector to operate efficiently. On the other hand audio or low frequency amplification, which it is now our purpose to discuss, while not assisting in bringing in distant stations, serves a very useful purpose in increasing the volume or intensity of a signal which has been rectified and is already audible. It can therefore be used to render signals sufficiently loud to operate a loud speaker.

High frequency amplification followed by a detector will give signals of telephone strength from distant stations, whereas a simple detector followed by low frequency amplification will give signals from short distance stations of sufficient strength to operate a loud speaker. It is thus seen that the two methods of amplification are not interchangeable, but each has a definite purpose to fulfil.

Both low and high frequency amplification depends upon the inherent magnifying properties of the three-electrode valve, that is to say a small variation in the voltage applied to the grid produces comparatively large variations in the anode current. Furthermore, if the circuit is correctly arranged and adjusted, the current changes will be exactly proportional to the grid-voltage changes and the valve thus operates as a perfect relay.

For some reason or other the low frequency amplifier unit receives but scanty attention at the hands of most beginners. This is much to be deplored because speech and music can be, and is, badly distorted by mal-adjustment of this part of a receiving set. It may be that L.F. amplifiers are looked upon as fool-proof pieces of apparatus, which unfortunately is far from correct. Indeed it is safe to say that 99 per cent. of bad quality reception is due to this unit. Distortion is the curse of L.F. amplification, and while much of it may be due to unsuitable or badly designed transformers and apparatus generally, a large percentage may easily be due to the valve.

Distortionless amplification means that the output from the amplifier is a faithful magnified reproduction of the input, and our purpose is to see, at any rate as far as the valve is concerned, how this may be attained.

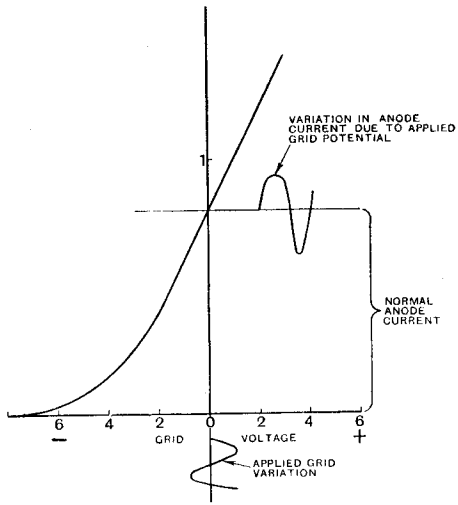


Fig. 1. Characteristic curve of an "R" type valve with an anode voltage of 50.

Three main types of L.F. amplifiers are in general use, these being (1) Transformer coupled, (2) Resistance coupled, (3) Inductance (choke) coupled, their respective merits being discussed in a recent number of this journal. Whichever type is used, however, is immaterial for our present purpose, for, as has already been noted, the action of the valve itself remains unchanged.

In order that the variations in anode current shall be proportional to the changes in grid voltage it is necessary that the

valve be worked on the straight part of its characteristic. This is fundamental, and may be looked upon as essential number 1. Unless a fairly high anode potential is used, this straight portion of the characteristic will occur either around zero grid volts or else for positive values of grid potential. This is shown by the lower curve in Fig. 1, which gives the characteristic for an "R" valve working at normal filament potential and with an anode potential of 50. Now suppose this valve to be operated under these conditions and so adjusted that the normal grid voltage is zero. Although variations in voltages of say 1 volt + and — would maintain the point of operation on the straight part of the characteristic yet the output current would give a lopsided curve as shown to the right of Fig. 1. The reason is that each time the grid is made positive, current flows to it, and thus the *effective* grid voltage is lowered. We therefore conclude that the circuit must be so arranged

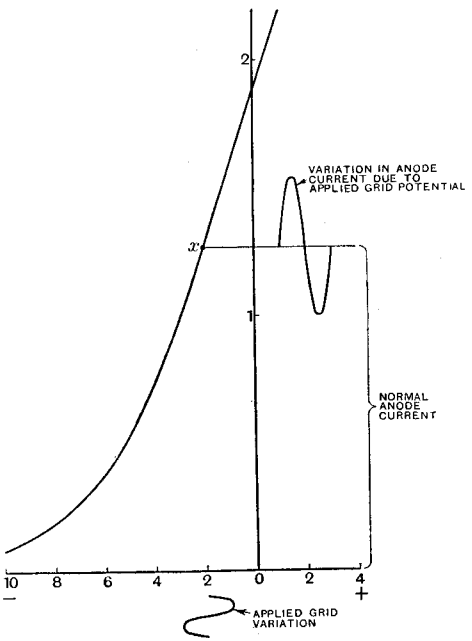


Fig. 2. Characteristic curve of an "R" type valve with 100 volts on the anode.

that the grid never becomes positive with respect to the filament. This we may call essential number 2.

In order then that these two essentials may be fulfilled, we must firstly increase our anode voltage and secondly provide for a steady negative potential to be applied to the grid. This will have the combined effect of shifting the characteristic bodily

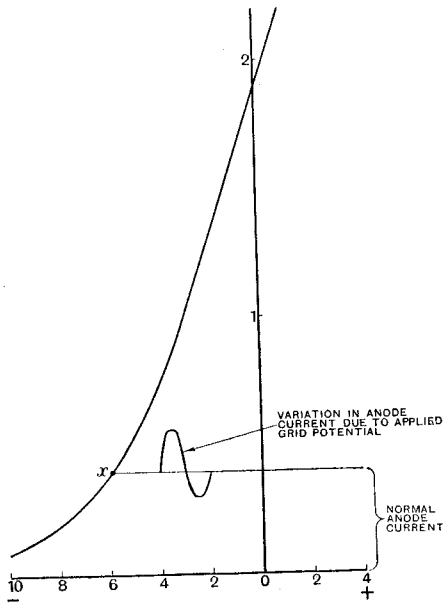


Fig. 3.

to the left and arranging the point of operation to its straight portion. This we show in Fig. 2, which is the characteristic for the same valve as in Fig. 1, but with the anode volts increased to 100. By suitable means, as for example, by inserting a small battery in the grid lead, we can adjust the operating point to *x* on the curve, and if we now apply the same grid variations as in Fig. 1 we get the undistorted curve of anode current shown to the right of Fig. 2.

If too great a negative potential is used partial rectification will be caused which will again produce a lopsided curve, see Fig. 3.

The actual value of negative grid volts or grid bias as it is sometimes called, will, of course, depend upon the type of valve used and the anode voltage which is applied to it. In practice, therefore, apply a moderately high anode voltage and then adjust the negative grid bias until the purest and clearest speech is obtained.

There is one further condition to be noted, although this will only arise in the case of multi-stage amplifiers, and that is the peak value of the input voltage applied to the grid must be kept within certain limits which are set by the upper and lower bends of the characteristic, for it will be obvious that if the impressed volts are such as to swing over the whole curve and on to the flat portions the anode current curve will be flat topped.

CHARACTERISTIC OF VALVE AND EXTERNAL CIRCUIT.

All the characteristics which we have shown in these notes have been for the valve itself, that is to say, the resistance of the circuit is negligible compared to the anode resistance of the valve. In practical work, however, these conditions do not hold, for the valve in say a L.F. resistance coupled amplifier has a large resistance in series with the anode.

We must then distinguish between the characteristic of the valve itself and that of the valve and external circuit combined, and we will consider the simple case in which the output circuit is non-reactive and has a resistance R, Fig. 4.

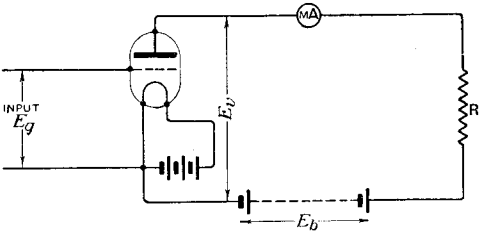


Fig. 4.

Now when the negative voltage applied to the grid is so great that the anode current is zero, then and only then will the voltage across the valve E_v be equal to the battery voltage E_b (Fig. 4). When a current flows in the anode circuit there will be a voltage drop across the resistance R equal to R times the amperes flowing, and consequently the voltage E_v across the valve will no longer be equal to the battery voltage E_b, but will be given by $E_v = E_b - RI_p$ where I_p is the current flowing in the anode circuit. This means that as we increase our grid volts and therefore the anode current, the anode voltage steadily decreases instead of remaining constant as was the case when the circuit was free from resistance. The obvious result will be that the characteristic will be flattened out and the greater the resistance the less steep will the curve be. This is shown graphically

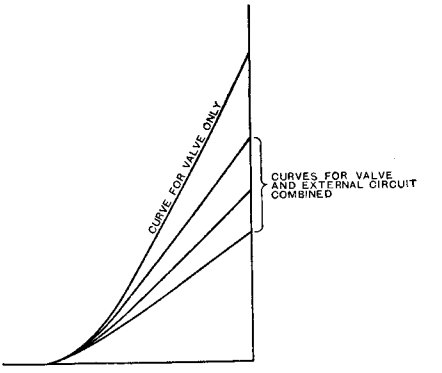


Fig. 5.

in Fig. 5, where the top curve shows the characteristic for the valve itself and each of the lower curves represents the case for increasing resistance.

THE VALVES TO USE FOR L.F.

For successful L.F. work the valve used must be hard, and if only one stage of L.F. is being used, or for the first stage of a multi-stage amplifier, a good "R" valve with 100 volts on the plate is very satisfactory. Special loud speaker valves are now on the market. These have low internal impedance, thus providing large power amplification and give a straight line characteristic over a very extended range.

SCHOLARSHIPS IN ELECTRICAL ENGINEERING.

The British Electrical and Allied Manufacturers' Association direct attention to the fact that, in furtherance of technical education, they grant annually, to properly qualified candidates of British birth engaged in engineering works, ten scholarships, each of the value of £100, in addition to the payment of college fees. The last date for receipt of applications is June 1st. Forms of application and full particulars may be obtained by writing to the Secretary, The B.E.A.M.A., 36, Kingsway, London, W.C.2.

SWITCHING.

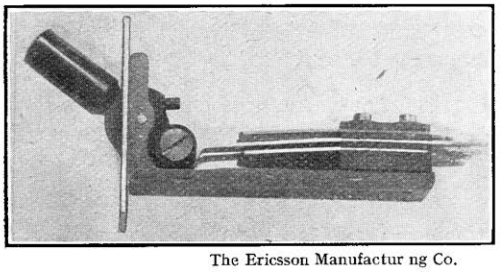
The object of these notes is to show that various types of jacks and switches are electrically similar, and how they may be joined in a few typical circuits.

By W. JAMES.

(*Continued from page 774 of previous issue.*)

3.—SERIES PARALLEL AERIAL SWITCHING.

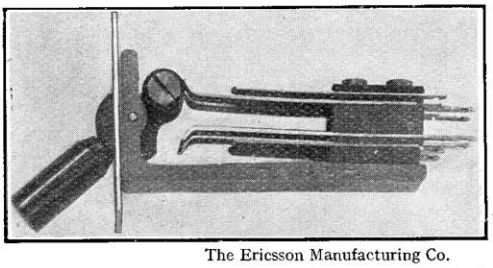
Many experimenters prefer to employ a switch of the Dewar type which has the elements arranged so that there is a minimum of capacity between them and in which the insulating material is chosen with a view to introducing the smallest possible high-frequency losses. There are many patterns,



The Ericsson Manufactur ng Co.

Fig. 11*A*. *A two-pole two-position Dewar switch.*

but ordinarily one of the two *types* illustrated in Fig. 11A and B will be used for switching the condenser in series or parallel with the tuning inductance. It must be understood that the switches (or keys) illustrated are ordinary Dewar switches intended for connecting in circuits carrying telephone frequency currents only. The special anti-capacity switches which should be used



The Ericsson Manufacturing Co.

Fig. 11*B*. *A two-pole three-position Dewar switch.*

are identical except that more care is taken in the choice of the insulating material and in the dimensions of the blades. It will be observed that the switch of Fig. 11A has six blades, which are arranged in two sets of three. The top pair and the bottom pair are fairly stiff and springy, and shorter than the two blades in the middle. The middle blades have one end bent over so that the rollers attached to the control lever bear firmly when the switch is operated. The control lever may be set in two positions only, one neutral and the other "up" as illustrated in the figure. The switch of Fig. 11B has eight springs, and the control lever may be placed in three positions, up, neutral or down. The method of representing these switches in diagrams is shown in Fig. 12A and B. The springs

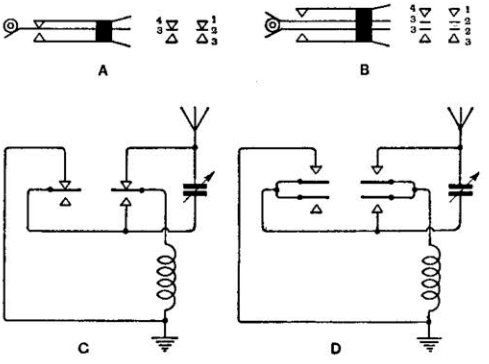


Fig. 12. *Series-parallel switching, using anti-capacity switches.*

are numbered to correspond with the terminals and contacts in the previous figures. The method of connecting the switch of Fig. 11A with the aerial condenser and coil is given in Fig. 12C. With the knob in the neutral position, the central springs make contact with the upper springs and the coil and condenser are in parallel. When the switch is operated, the central springs leave the top springs and make contact with the lower ones, connecting the coil and condenser in series.

This sort of switch is electrically similar to the two-pole throw-over switch, the middle blades corresponding with the switch arms. The switch of Figs. 11B and 12B becomes

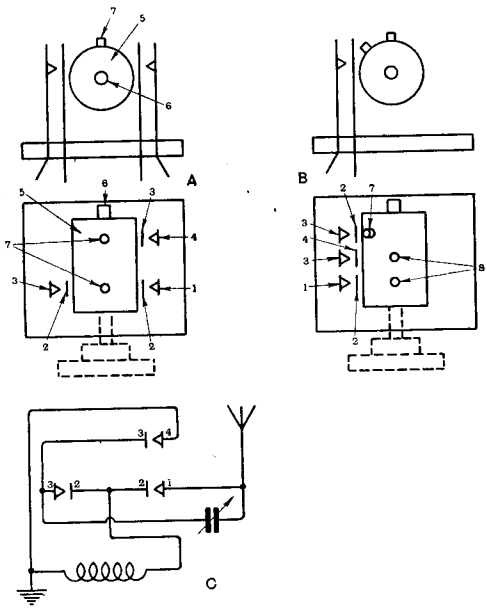


Fig. 13: *Barrel switches connected for series-parallel switching.*

electrically the same as that of Figs 11A and 12A if each middle pair is connected with a wire. The connections are given in Fig. 12B. With the knob in the neutral position, the condenser is disconnected from the coil; with it "up" they are in series; with it "down," in parallel.

There are many other switching devices which can be used. In one arrangement sketched in Fig. 13A, an ebonite barrel 5 has two round-headed screws, 7, suitably positioned. Three pairs of springs numbered 1 to 4 to correspond with the numbers on the previous switches are arranged at the sides. When the knob is turned to the left, the spring 2 is pressed into contact with 3 by the screw head 7, connecting the coil and condenser, Fig. 13C, in series. By turning the knob to the right, the screw heads 7 press spring 3 against 4 and 2 against 1, connecting the coil and condenser in parallel. An alternative arrangement of the springs and screws is indicated in Fig. 13B. The springs are numbered, corresponding with those of other figures. Either of these switches could be easily constructed by anyone who wished to use them.

One does not often find that jacks are employed for switching the aerial circuit. Anyone having jacks on hand could easily arrange them as in Figs. 14 and 15. In the jack sketched in Fig. 14 a cam is fitted so that by turning the knob the long spring is raised, or allowed to return to normal. The jack is shown in more detail in Fig. 15A, and the photograph of Fig. 16. Instead of the cam and knob a dummy plug, made like the proper plug but of fibre or ebonite, could be used. The connections are given in Figs. 15B and C. When the plug is out, or the cam normal, the coil and condenser are in parallel as shown in Fig. 15B. By

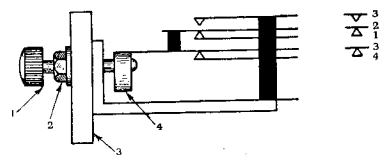


Fig. 14. *A jack of the same type as that of Figs.* 15 *and* 16, *but fitted with a knob and cam.*

inserting the plug, or turning the cam, spring 3 is moved away from spring 4, and 2 away from 1; but spring 2 makes contact

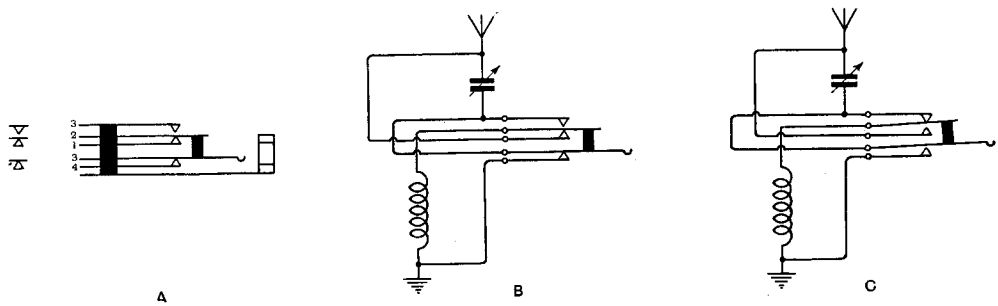
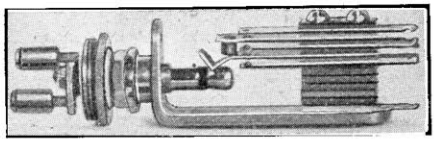


Fig. 15. *A jack connected as a series-parallel switch.*

with the upper spring 3, connecting the coil and condenser in series, Fig. 15C.

4.—TUNE STAND-BY SWITCHING.

It is often desirable to employ a switch for the purpose of connecting the aerial circuit directly to the amplifier and then, when the wanted signal is heard (perhaps



C. F. Elwell, Ltd.

Fig. 16. *A jack with the plug inserted.*

with interference) to connect the closed circuit to the amplifier. The switch should therefore have two positions; in one position connecting the aerial circuit to the amplifier and disconnecting the closed circuit, and in the second position connecting the closed circuit to the amplifier in place of the aerial circuit. It is necessary to provide for breaking the closed circuit because if this circuit remains coupled with

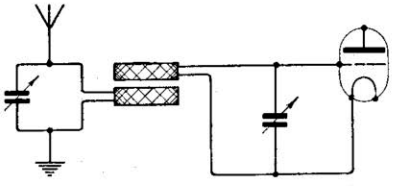


Fig. 17. *A two-circuit tuner connected to the grid and filament of a valve.*

the aerial when the switch is in the stand-by position (aerial to amplifier) the signal strength may be appreciably reduced by the induced currents. Perhaps the simplest arrangement consists of a three-pole double-throw switch connected as in Fig. 18A. With the switch to the left the aerial circuit is connected through contacts 1, 2 and 4, 5 and the closed circuit is broken at contacts 7, 8. By moving the switch arm over to the right the closed circuit is completed through contacts 7, 8 and connected to the valve by contacts 5, 6 and 2, 3. The switch may be arranged as in Fig. 18B, when the switch arm need only carry two blades. It will be clear that Dewar and barrel switches may be arranged to switch the circuits in the same way.

Very often it is an advantage to connect the earth with the filament heating battery. When this is done an ordinary two-pole two-position switch may be used as indicated in Fig. 19. The connections are drawn in full in Fig. 19A, and the switch represented is a double-pole throw-over knife switch. The contacts are numbered. Figure 19B refers to the type of switch used in Fig. 9; Fig. 19C to the Dewar (anti-capacity) switch of the type illustrated in Fig. 11A and Fig. 19D to Fig. 11B. The contacts are numbered to

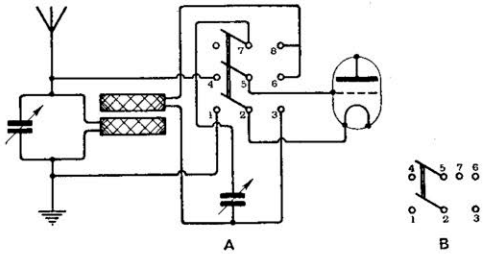


Fig. 18. *Use of throw-over switches for joining an aerial or closed circuit to a valve.*

correspond with the switch of Fig. 19A. The reader should pause and consider the various switches, noting their similarity. It is the writer's experience that a number of readers find themselves unable to make the correct connections when their switches

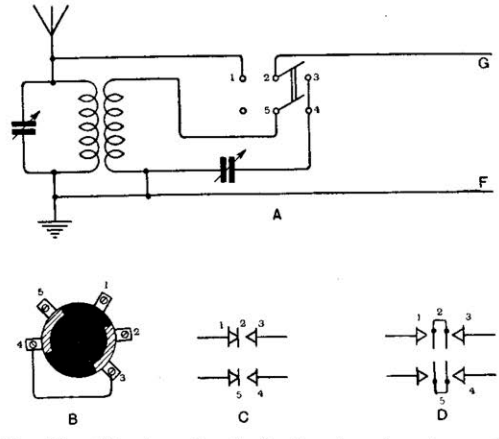
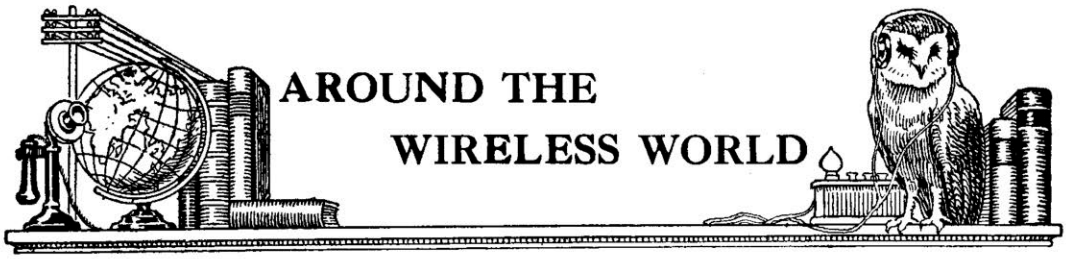


Fig. 19. *Showing the similarity of various types of switches.*

are of a different type to that shown in the working drawing, and it is the main object of these notes to show that many of the different types of switches ordinarily used are similar.



The first wireless telephone message from the Ross Dependency, 1,400 miles distant, has been received at the Awarua station, New Zealand.

* * * *

An International Wireless and Cinematograph Exhibition is to be held at the Palais d'Egmont, Brussels, from May 10th to 18th.

* * * *

Omnibuses running between Newport (Mon.) and Crumlin have been fitted with wireless, and passengers while away the journey listening-in.

* * * *

Transatlantic Working with Hand Generator.

"Done the trick at last. Borrowed an Evershed and Vignoles hand generator, with following result:—Reported by **U3DS**, Philadelphia, Radiation 0.5, pure C.W. Received on March 3rd."

This laconic message has reached us from Mr. W. E. F. Corsham (**2 UV**), to whom we offer our congratulations on what is undoubtedly a record in Transatlantic working. Mr. Corsham has hitherto been handicapped in his Transatlantic attempts by having no electrical mains for power supply, and being compelled to rely on dry batteries. To bridge the Atlantic with a hand generator is particularly noteworthy.

A German Wireless Exhibition.

The first wireless exhibition in Germany is to be held at Hamburg from May 29th to June 2nd, under the direction of the Hamburg Radio Club. A large area is placed at the disposal of German and Austrian exhibitors, and apparatus for home and export purposes will be on view.

French 8 AP.

Reports of the reception of his signals are welcomed by a French transmitter, Mr. J. J. Peugeot, **8 AP**, of Sous Roches, Audincourt, Doubs. **8 AP** transmits almost every evening at 9 p.m. (G.M.T.), on 100 metres, with a power of 100 watts (C.W. and telephony). He has already been heard at Bedford when sending on 65 metres.

Crest for the R.S.G.B.

In the course of his broadcast talk on Thursday, March 20th, Earl Russell referred to the suggestion that the Radio Society of Great Britain should adopt a crest or motto symbolical of the activities of the Society and such as would be recognised all over the world as the badge of the Radio Society of Great Britain.

With the object of securing a suitable emblem, the Council of the Society has decided to offer a prize of £5 for the best suggestion for the most appropriate badge or motto for the purpose. The competition is open to anyone interested, and is not confined to members. Sketches or verbal descriptions should be simple and brief, and should reach the Secretary, 53, Victoria Street, S W.1, before the end of April.

The New Wireless M.P.

Mr. Otho W. Nicholson, the recently elected M.P. for the Abbey division of Westminster, is well-known in amateur wireless circles. He gained experience as an amateur prior to 1914 and during the war acted as wireless officer in an important capacity. Since the war he has continued his interest in the subject. He is a keen transmitter and a member of the Transmitter and Relay Section of the Radio Society of Great Britain. He is probably the only British amateur who has a super heterodyne which is an exact replica of the set used by Paul Godley when he came over from America to show British amateurs how to receive American stations.

[*Photopress.*

Wireless amateurs will wish Mr. Nicholson every success in his career.

Lightship Radio.

The Hasborough Lightship, off the Norfolk coast, has been installed with wireless apparatus for the purpose of regulating shipping traffic in the Great Yarmouth Roads.

Wanted : A Little Patience.

There is a note of pathos in the report that the Houghton-le-Spring (Durham) Guardians have decided to abandon the wireless set at the workhouse because "it is like the howling of dogs and exasperates the inmates."

The trouble may be due to local oscillation, but if, as seems likely, it is attributable to inefficient handling, the Guardians would be well advised to obtain expert assistance before discarding the instrument. A little patience would probably solve the difficulty and provide the "exasperated" inmates with an antidote for ruffled feelings and an unfailing source of entertainment.

Southend-on-Sea Wireless Exhibition.

A wireless exhibition under the auspices of the Southend-on-Sea Radio Society is to be held on April 12th, at 2 p.m., at the Boys' High School Southend. Features of the exhibition, besides demonstrations in reception, will be sections devoted to apparatus constructed by novices and experts, and to trade displays. Entries are invited and. application forms may be obtained from the Hon. Secretary, E. Haws, 101, Southchurch Avenue, Southend-on-Sea. A number of suitable prizes will be given. There will be no charge for admission.

A Prosperous Society.

Owing to the increase in membership and consequent crowding at meetings, the St. Pancras Radio Society has changed its headquarters to more commodious premises at 71, Park Street, Camden Town, N.W., where all future meetings will be held.

Broadcasting and the League of Nations.

It is the intention of the League of Nations, we understand, to invite business firms, including the B.B.C., to participate in an International Wireless Conference to draw up rules for broadcasting.

New York's Endeavour to Reduce Interference.

An effort to eliminate radio interference with broadcasting was decided on at a recent meeting of radio manufacturers and publishers in New York. Their plan is twofold. It is proposed, firstly, to urge manufacturers to put out only non-radiating sets, and secondly, to provide advice to listeners-in as to the methods of remodelling existing sets with a view to avoiding interference to their neighbours.

Major Armstrong, inventor of the regenerative circuit, who was present at the discussion, offered many suggestions, including his plan to add a stage of radio frequency as a "muffler."

Empire Press Union on Utility of Wireless.

Apropos of the Imperial Wireless Committee's Report, a resolution has been passed by the Empire Press Union, under the chairmanship of Viscount Burnham, re-affirming the views of the Committee and emphasising that the paramount necessity is immediate action to secure for the British Empire full use of wireless telegraphy as an additional and cheaper means of world communication, especially for the dissemination of news.

Radio in New Zealand.

Broadcasting is on a permanent footing throughout New Zealand, and regular services are in operation for the dissemination of music, weather reports and market news.

Some interesting details concerning broadcasting and amateur work in New Zealand has been forwarded to us by a reader at Dunedin. As long ago as 1920 musical items and lectures were broadcast from Otogo University. A power of 40 watts was employed and reception was recorded 1,300 miles away.

One of the most active amateur transmitters is **4 AA** (F. D. Bell), who also has several Australia-New Zealand reception records to his credit.

The chief hobby of the keener amateurs is "bagging Yanks," and over 100 American transmitters, including some in the First District 9,000 miles away, have been logged by **4 AG** (Mr. Ralph Slade). Recently a Los Angeles concert was picked up by a Brisbane amateur and re-transmitted over New Zealand. The two enemies to successful reception in the country are atmospherics and fading, both being very prevalent.

New York Municipal Wireless Station.

It was announced on March 15th that New York City had arranged to install a 1,000-watt wireless broadcasting station on top of the Municipal Building, says *The Times*. The plant will be owned and operated by the municipality and be used to broadcast events in which the city is concerned. The wireless set is that which the Westinghouse Electric Manufacturing Company built and used for demonstration purposes at the Rio de Janeiro Exhibition in 1922. While in use there, its messages were heard at Honolulu, 7,000 miles distant.

A New Society.

"The Yeovil and District Radio Society" is the name of a new Dorsetshire wireless club. Several meetings have already been held and membership is rapidly increasing. Particulars will be gladly supplied by the Joint Hon. Secretaries, Mr. R. J. W. Marr, "Kismet," Sherborne Road, Yeovil, and Mr. W. G. Hall, B.Sc.Tech., Greenhill, Sherborne.

Correspondence.

Amateurs in Oxford.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—Having read with great interest "Wiped Out's" letter in a recent issue regarding harmonics from Leafield and the existence of an Oxford Radio Society, I should like to take the opportunity of saying that there is an *Affiliated Society*, and I shall be pleased to supply particulars to "Wiped Out" or to anybody else interested.

V. TURNER,
Hon. Sec.

193, Iffley Road,
Oxford.

A PRACTICAL DEMONSTRATION OF SOME APPLICATIONS OF THE CATHODE RAY OSCILLOGRAPH.

By N. V. KIPPING.

(*Concluded from page* 709, *March 5th issue.*)

DISCUSSION.

The Chairman (Dr. W. H. Eccles).

It is now my duty to call upon anybody who would like to discuss this paper. The author has crowded a great deal into an hour and a quarter. He has endeavoured, I think, to cover every application of this wonderful new tool that has occurred to him. Of course I can imagine that many of you must have thought, during the progress of these experiments, of a thousand other applications. Like every other new tool, it will be used enormously in the next few years. It reminds one of the time of the introduction of the Blondel and Duddell oscillographs. Those of us who are old enough to remember when they arrived will recall with what avidity all sorts of people who had not been able to get anything they wanted in the way of knowledge of alternating current and alternating current machinery seized on these two instruments and applied them in every direction. The same thing will happen with this new oscillograph tube that the Western Electric Company have developed and introduced to us.

(The Chairman here vacated the chair to Dr. Barlow, Chairman of the Students' Section, as he had to attend another appointment.)

Mr. Reyner (Secretary of the Students' Section of the Institution of Electrical Engineers).

The first thing I should like to do is to congratulate the author very heartily on the information he has brought before our notice this evening. Some time ago I saw a paper on the Braun tube—about two years ago, I think—and I was very pleasantly surprised to-night to notice the great improvements that have been made in the cathode ray oscillograph in the last two years. I must confess that on the previous occasion I was distinctly puzzled by the Lissajou figures that were shown, and the practical applications of the Braun tube employed on that occasion seemed to be rather remote. But to-night the author has shown us all the old friends—hysteresis curves and valve characteristics—in the form in which we are used to recognising them, and it seems to me that an enormous amount of development must take place in this direction. Dr. Eccles has mentioned the possible applications that must suggest themselves to everybody, but there is one I should like to mention. I should like to suggest to Mr. Kipping that a possible line for research is the building up of the grid condenser in the method of cumulative grid rectification. It seems to me that the time taken for the condenser to build up, and the exact effect of the leak, is a matter which can be investigated with advantage. There were one or two remarks made about the rotator circuit upon which should like a little more information. First all, I think the author made a statement which is rather apt to be confusing. He said that he had obtained two voltages, 90 degrees out of phase, by tapping across the resistance and a condenser in series, and then he said he had proceeded to put them a further 90 degrees out of phase, making 180 degrees in all, and so obtained a circle. It seems to me that he is there confusing the time and the space displacement. The 90 degrees out of phase in the first case is the time displacement, and the other displacement is obtained by the fact that the two plates in the oscillograph are displaced in space 90 degrees. It seems to me that you do not get 180 degrees in all. There is also another point. The author mentioned the question of Lissajou's figures and the obtaining of an exact circle when the two frequencies obtained were exactly in phase. That statement seems to me to be contradicted by the previous one, and I should imagine that the two frequencies should be 90 degrees out of phase to obtain an exact circle. These are only minor points which occur to me, and I may quite possibly be wrong, in the second one, at any rate. I do not think there are any other points, but I should like to congratulate the author very much on his demonstration. I know these demonstrations; I have had some. You spend a couple of days preparing everything, and on the night the whole apparatus has a tendency to slack, and I think the fact that the demonstration has come through with flying colours reflects very great credit on Mr. Kipping's organisation and preparation.

Mr. P. R. Coursey.

I should like to add my remarks to those of the last speaker in congratulating the author on the excellence of his demonstration. The facility with which the various phenomena are found to be produced with these cathode ray tubes is all the more striking after having used the Braun oscillograph some years ago. The trouble one had then to get satisfactory results is only emphasised by the facility with which the author's tubes show up the various phenomena that one is looking for and facilitate the investigation of new effects.

Mr. L. F. Fogarty.

I should like to ask the author if he has had any experience of an oscillograph which I understand operates on a similar principle and was demonstrated at the recent Physical Exhibition in Paris. In that particular instrument, I believe, provision is made for inserting a photographic plate into the actual oscillograph itself. To be able to take actual photographs seems to be a great advantage, more particularly in dealing with transient phenomena,

i.e., things like atmospherics which are not likely to repeat themselves at any given moment. If that could be done, I think the use of the apparatus would be more extensive, and I should be pleased to hear if some such instrument has been made.

A Speaker.

May I ask the author if any experimental work has been done in the way of finding out the effect upon the efficiency of varying the capacities or resistances in a feed back circuit.

Mr. Barraclough.

I should like to ask the author if any work has been done with this oscillograph upon commercial machinery, rotary converters, etc., in the determination of wave forms on open circuit, for instance.

Mr. Fuchs.

The point that seems to me weak in the demonstration is the method of obtaining the time basis upon which the curves are plotted. Perhaps the author could give us a few details of the accuracy of the method he uses and any other useful methods which could be employed.

A Speaker.

I think I can suggest a more accurate method of taking the time scale than that used by the author. Instead of using a neon lamp, charge up the condenser through a valve. That means that the condenser has a constant current flowing into it during the time of charge, or else it can be arranged to discharge at a constant current. Owing to the relationship of voltage and charge in the condenser, the rate of fall or rate of rise, as the case may be, of the voltage across the condenser terminals, is constant because the rate of change of charge is constant. In other words, the current is constant. We shall then get a high degree of accuracy in the constancy of the voltage and that will apply to the oscillograph in a similar manner. I think the previous speaker was referring to the Dufour oscillograph shown at the French Physical Society's exhibition in Paris. That is an interesting piece of apparatus, and the advantage of it is that the photographic plate is inside the tube, enabling one to photograph transient phenomena, and also to get actual wave forms of phenomena having frequencies as high as 250 million per second. I think that is the highest figure that has been used. Wave forms of oscillations at that frequency have actually been obtained. The Western Electric Company's instrument shown us to-night can take photographs by photographing the screen with a camera in the ordinary way, but the time required according to the nature of the figure may be anything from five minutes to half an hour. At any rate, only the continuous phenomena can be recorded in that way. One thing about this apparatus is that when the photographic plate inside the tube has been exposed it has to be removed, and that necessitates the exhausting of the tube each time the plate is changed. This, of course, is a limitation on the use of the apparatus. A tube like the one we have seen to-night can be taken where it is wanted to be used and there is no necessity to carry a pumping plant with it. Another point of difference is that this French apparatus obtains its sensitivity by using a potential of the order of 30,000 volts, and that is higher than has been used even in the original Braun tube.

Dr. Barlow (Chairman).

Before calling on the author to reply to the various questions that have been put to him, there is one point which has occurred to me in connection with the repulsion between the electrons projected from the cathode. It struck me that perhaps the electromagnetic striction effect, *i.e.*, the pinch effect, which occurs in an ordinary mobile conductor carrying a current, may also have some influence on the mutual action between these electrons. With the repulsion effect, the charges naturally tend to separate, but on the other hand the electromagnetic striction tends to contract the section of the conducting vein. Therefore, I should like to ask the author whether this latter effect has any appreciable influence on the motion of the electrons. I should also like to thank the author very much for his exceedingly interesting lecture. It is seldom that a lecture of this kind, with demonstrations, is carried out so successfully. The author has obviously taken a great deal of trouble to get the apparatus to work as he has done.

Mr. N. V. Kipping, replying to the discussion, said :—

I must first of all thank you for your very kind remarks with regard to the demonstration, but I must disclaim any credit for having put in a lot of time in connection with it. It has not taken very long.

I must stand corrected by Mr. Reyner regarding the phase question. Of course the circle is produced with the two deflections 90 degrees out of phase. Were they 180 degrees out of phase we should get back to the straight line condition again. Consequently in the case of the rotator circuit we have a deflection 90 degrees out of phase through having a resistance and condenser in series.

The 90 degrees displacement of the oscillograph plates themselves in space serves only to enable any figure produced by electric fields across the plates, to be plotted in rectangular co-ordinates.

With regard to the Dufour oscillograph, that was not mentioned by me because it was my intention to avoid bringing in a discussion of other more complicated types of oscillograph, except where it was necessary for a proper consideration of the subject, such as was necessary with the Braun tube. I intended as much as anything to emphasise how easy it is to work with this oscillograph. It would be impossible to go into details of other types with the demonstration facilities I have here to-night.

For its own very specialised branch of work, the Dufour oscillograph has done some very interesting work, and is a clever device, but the necessity for exhausting the tube between each two exposures is apt to become very wearisome. The high voltages necessary for working the Dufour oscillograph all add to the cost and difficulties of operation. Such elaborations, although necessary for the highly specialised work for which they were developed, are totally unnecessary for general applications. One might as well use a ten-valve set for getting London at half-a-mile distant

With regard to the effects of varying the capacities and resistances in a feed-back circuit, I believe

Dr. Appleton of Cambridge has been doing a great deal of work in this connection, and I think will be publishing something before long. At any rate, I have not gone into the question at all.

There was an enquiry regarding the examination of wave forms of commercial machines. The best method of doing this, leaving out the question of whether we have a decent tune base or not, is to forget one of the pairs of plates inside the tube, and use instead two external plates placed a suitable distance apart, so that the high voltage across the distant plates will produce the same deflection as a smaller voltage across the ordinary oscillograph plates. For examining the wave form of a 50 cycle supply of 6,000 volts, the plates could be tapped across the busbars, and placed, perhaps, 2 ft. 6 ins. apart either side of the oscillograph, in the right plane. You cannot, I understand, put anything on a busbar without a thousand pound switch, or something of that sort. I do not know whether that would apply to a connection to the busbar of a lead which goes nowhere else than to a highly insulated metallic plate, as in this case. I do not know whether the arranging of such a system would be a matter of much difficulty, but believe several power men have been or are now using these tubes for the purpose.

I was aware of the method for using a two-electrode valve in place of the resistance in the neon lamp circuit, but I have not tried it. We have to consider many things in considering this time basis question. We are not, for our problem, out for supreme accuracy of the time base, because the oscillograph is not an oscilloscope, and that should be remembered. The amount of inaccuracy introduced by the slight deviation from the straight line time base is probably no greater than the inaccuracy resulting from the thickness of the oscillograph spot.

In the case of the Radio Research Board's work on atmospherics, they were out for great accuracy in the time base because, for lack of an alternative, they had to make the best of using the cathode ray oscillograph for highly accurate measurements, a thing for which it is not intended. Consequently every additional increase in accuracy was of importance in making the best of a bad job.

I have not been suggesting this evening that the oscillograph was a highly accurate instrument. It is suitable for *indicating* the conditions inside a circuit, or elsewhere, rather than precisely measuring those conditions.

Besides this question of the necessary degree of accuracy for the time base, we have to look at it from a commercial standpoint, not only from a laboratory standpoint. We did not think it worth while from the commercial point of view, going on with the slightly more accurate time base which nevertheless involved the use of vacuum tubes, with their corresponding battery troubles and so on. For the purpose of Dr. Appleton and the Radio Research Board, it would be worth while. From our own, it was more necessary to find something very cheap and very simple, while sufficiently accurate.

As a matter of fact, I know of two time bases which are almost precisely straight, but I am not at liberty to describe them. Perhaps I shall be able to a little later, if anybody still has an interest in the matter.

I am afraid that one speaker has rather doubted my veracity when I made the statement regarding the exposures necessary for photographing results. Of the photographs I have shown to-night one was taken in four minutes—that was the hysteresis curve—and the others had only one or two minutes exposure each.

In the first tubes which were made, the coating on the screens was composed very largely of calcium tungstate, which gave a bright green-coloured fluorescence. This was all right for visual work, but very poor photographically. You will have noticed, however, that the tubes which I have been using have a bluish glow. In these, the screens are composed of a mixture in about equal parts of calcium tungstate and zinc silicate, a mixture which has now been standardised by the makers of the tube after research, as it is sufficiently bright for visual work, and at the same time a very great deal more active photographically. With this newer type of screen, an exposure of about two minutes is ample.

It is true, as has been remarked, that only cyclic and synchronous phenomena can by recorded photographically with these tubes, but the main use of the tubes is for such work, the transient business being a case of making the best of a bad job.

With regard to the remarks on making use of striction coils, we have used these, and they do the job perfectly well, although their use is a nuisance with the extra batteries and trouble necessary. The normal method of procuring a good spot is satisfactory until the emission falls off at the end of the tube's life, and then the use of striction coils to bring the ray to a focus may prolong the life of the tube by a few hours. It is scarcely worth arranging the striction coils for such a small improvement in life.

FORTHCOMING EVENTS.

WEDNESDAY, MARCH 26th.

Radio Society of Great Britain. At 6 p.m. (Tea at 5.30). At the Institution of Electrical Engineers. Lecture: "The Possibilities of Electrical Television both with and without Wires." By Mr. A. A. Campbell Swinton, F.R.S., M.Inst.C.E., M.I.E.E.

Edinburgh and District Radio Society. At 8 p.m. At 117, George Street. Lecture: "Elementary Principles" (continued). By Mr. A. Ogilvie Crombie.

Clapham Park Wireless and Scientific Society. Testing Night.

St. Pancras Radio Society. At 8 p.m. At 71, Park Street, Camden Town, N.W. Lecture and Demonstration: "Dual Amplification." By Mr. P. W. Harris.

THURSDAY, MARCH 27th.

Hendon Radio Society. At 8 p.m. At the Society Hut, Brent Works. Practical Evening. "L.F. Amplification."

Sale and District Radio Society. At 37, School Road. Exhibition.

Blackpool and Fylde Wireless Society. Lecture by Mr. L. R. Blackburn.

FRIDAY, MARCH 28th.

Radio Society of Great Britian (Transmitter and Relay Section). At 6.30 p.m. At the Institution of Electrical Engineers. Discussion on "High Tension Supply for Valve Transmitters." To be opened by Mr. F. L. Hogg.

Radio Society of Highgate. At 8 p.m. At Edco Hall, Archway Road. Popular Talk by Prof. A. M. Low.

Sheffield and District Wireless Society. At 7.30 p.m. At the Department of Applied Science, St. George's Square. "Elementary Class."

Prestwich and District Radio Society. At 7.30 p.m. At Station 2 HD. Annual General Meeting.

Leeds Radio Society. Lecture, "The Poulsen Arc and Its Application to Radiotelephony." By Mr. F. Bowman.

MONDAY, MARCH 31st.

Ipswich and District Radio Society. At 55, Fonnereau Road. Lecture by Mr. E. Akester.

Sale and District Radio Society. At 37, School Road. Open Discussion and Experimental Work.

Hornsey and District Wireless Society. At the Queen's Hotel, Broadway, Crouch End, N.8. General Discussion and Questions.

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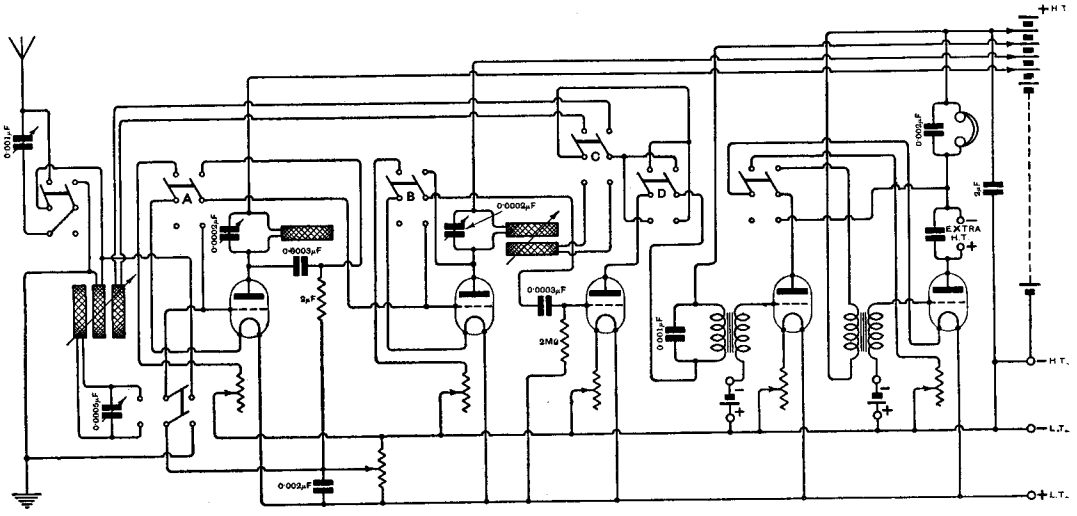

Fig. 1. "*P.B.S.*" (*Newcastle*). *A receiver suitable for all wavelengths, with detector and optional one or two stages of H.F. and L.F. amplification.*

"*P.B.S.*" (*Newcastle*) **asks for a diagram of a receiver with two stages of high frequency amplification, detector, and two note magnifiers, with switches.**

A diagram is given in Fig. 1. The aerial coil is tuned with the 0·001 condenser, which may be connected in series or in parallel, and is the centre coil in the three-coil holder. The outer coils are for reaction and the closed circuit. It is necessary to mount the coils in this way so that reaction effects may be obtained when the closed circuit is disconnected, and the aerial circuit connected with the grid and filament of the valves, as the result of placing the stand-by tune switch in the "tune" position. The first two valves have tuned anode circuits, consisting of plug-in coils tuned with 0·0002 variable condensers. A single condenser provided with a double set of plates could be used for tuning. A small variable condenser should then be connected across one of the coils for fine tuning. Switch A controls the first valve and switch B the second. Switch C connects the reaction coil with either the three-coil holder or the two-coil holder, and switch D is for reversing the reaction coil connections. The third valve operates as a detector, and the last two as note magnifiers. The correct values of the grid bias batteries should be determined by experiment. If an anode voltage of 120 volts is used with ordinary "R" type valves, a bias of three dry

cells is satisfactory. Suitable values for the coils for broadcast transmissions are as follows: Aerial circuit, No. 35 or No. 75, with the condenser in parallel and series respectively. Secondary circuit No. 50; reaction coil, No. 75 or No. 100; both anode coils, No. 75.

"*L.C.*" (*Durham*) **wishes to try a receiver consisting of a detector valve and a choke-coupled note magnifier.**

The diagram is given in Fig. 2. The aerial coil may be a plug-in coil tuned with a 0·0005 variable condenser. The reaction coil which is coupled with it may be a No. 75 or 100. The low frequency choke coil is connected in the anode circuit of the detector in series with the reaction coil. For this choke the secondary winding of an ordinary intervalve transformer, or better still, the primary and secondary windings connected in series, may be used. Alternatively, any form of choke coil which has a large number of turns—say 15,000 or more—may be tried. A suitable coupling condenser has a capacity of 0·005 to 0·01 mfd. The grid leak is in general not critical, and 2 megohms is an average value.

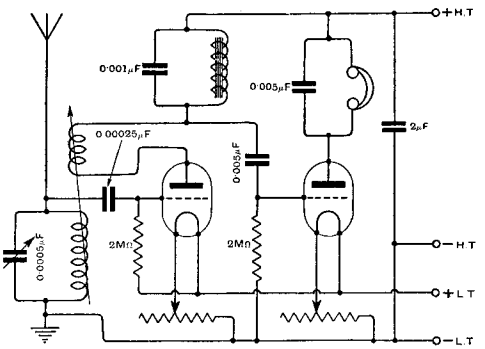

Fig. 2. "L.C." (Durham). A receiver consisting of a valve detector with a choke coupled note magnifier.

"*F.H.*" (*Chelsea*) **asks whether he should expect to obtain an increase in signal strength by converting his receiver, which has one stage of high frequency amplification followed by a valve detector, into a two-valve high frequency amplifier and a crystal detector.**

The two-valve high frequency amplifier will probably be very difficult to operate, and the signal strength no better than with the present arrangement, which uses the valve as a detector. A valve detector not only rectifies but amplifies, and in addition a reaction coil may be connected in its anode circuit so that the signal strength may be brought up and the selectivity increased by coupling the reaction coil with the aerial circuit. It has been stated by competent observers that a properly designed receiver with a regenerative detector valve and note magnifier is equivalent to a receiver with two stages of high frequency amplification followed by a valve detector but without reaction, and it is the experience of many experimenters that this is the case. The proper design of the elements of the regenerative detector valve calls for a certain amount of skill, and careful arrangement of the parts.

"*R.O.E.*" (*S.E.23*) **asks whether he will be able to so adjust the values of his coils that tuning condensers will be unnecessary.**

If you wish to tune in the signals of the London station only, the aerial circuit need not contain a variable condenser. The correct number of turns in the coil should be found by experiment, because the correct inductance of this coil is decided by the constants of the aerial circuit. You might use a fixed condenser of 0·0002 mfds. in series with the aerial circuit. This will enable you to wind more turns in the aerial inductance, which may increase the signal strength. The anode inductance may also be determined by experiment, and there is no need to tune it with a fairly large variable condenser provided the receiver is not altered in any way, and no reaction coil is coupled with it. It is an advantage, however, to connect a three plate variable condenser across the coil, or alternatively to arrange a metal plate which may be moved nearer or away from the anode coil, for the purpose of producing a small change in the inductance. A slight change in the anode voltage, or of the filament heating current will probably make it necessary to readjust the anode circuit, either by changing the position of the damping plate or varying the capacity of the small condenser. You might find it an advantage to use a fixed reaction coil, the number of turns and the position of this coil relative to the aerial coil being determined by experiment.

"*G.W.*" (*Dublin*) **refers to the H.F. transformers in the Neutrodyne receiver recently described in this Journal.**

It is not essential that the primary winding shall be wound on a separate tube and placed inside the secondary winding. The primary winding may be wound on a tube, covered with a layer of paper or empire cloth, and then the secondary winding wound over it. It has been found by experiment that it is much easier to adjust the circuits so that the capacity is neutralised when the neutralising condenser is connected between a tapping on the secondary winding and the grid. If you wish to experiment, you can make a number of tappings and try the effect of connecting one side of the neutralising condenser to the tappings in turn. It may be found that the signal strength is greatest when the receiver is not exactly neutralised, but there is a little capacity coupling which will have the effect of increasing the signal strength, although not sufficient to make the receiver unstable.

"*F.R.*" (*Northumberland*) **asks for the dimensions of a choke suitable for connecting in a telephone filter circuit.**

A suitable choke may be constructed by winding 15,000 turns of No. 42 S.S.C wire on a former 3″ long. The core may consist of a bundle of soft iron wires, built up to a diameter of half an inch. If the inductance of this coil is too small, there will be a loss of signal strength.

Calls Heard.

Contributors to this section are requested to limit the number of calls sent in to those heard in the previous three weeks, these being of greater interest and value to transmitters than earlier records. The repetition of the same call sign in consecutive lists is not recommended. Contributors will also assist by kindly arranging reports in alphabetical order.

Edinburgh.
2 DX, 2 KW, 2 KX, 2 PC, 2 VQ, 2 XY, 2 ZS, 2 ZT, 2 ZU, 5 LT, 5 NW, 5 OL, 5 OT, 5 OX, 5 RQ, 5 TG, 5 WM, 6 JX, 6 YA, 7 EC, 8 AP, 8 AQ, 8 ARA, 8 AZ, 8 BP, 8 CH, 8 CS, 8 CZ, 8 EB, 8 EM, 8 EI, 8 JL, 8 LS, 8 LY, 8 OH, 0 AA, 0 BQ, 0 KX, 0 MR, 0 ZZ, PCII, PA 9, PAR 14, P 2, 1 JW, 4 ZZ. American: **1 CMP, 2 BQH, 2 BY, 2 CPD, 2 DEY, 9 MC.** (Single valve Armstrong Super, and 2 ft. frame.) (J. G. W. Thompson.)

Bridlington, Yorks.
2 AW, 2 CW, 2 JP, 2 KW, 2 QH, 2 VW, 2 WD, 2 ZU, 5 JE, 5 NN, 5 SI, 5 YI, 6 AH, 6 NF, 6 NS, 6 SO, 8 AE, 8 AE2, 8 AQ, 8 AU, 8 BP, 8 CZ, 8 LP, 8 OH, 8 SSU, 8 WW, 00 W, PCII, 1 RF, A 4 UR. (1—v—1.) (F. G. Hall.)

Baildon, Yorks.
2 DR, 2 XY, 2 VO, 2 YQ, 2 AW, 2 YF, 2 OG, 2 TB, 2 SZ, 2 AC, 2 VF, 2 NM, 2 ZK, 2 VS, 2 WO, 2 FI, 2 FQ, 2 TF, 2 MG, 2 OD, 2 LZ, 2 HF, 2 FN, 2 OK, 2 KT, 2 IN, 2 NK, 2 UF, 5 US, 5 SI, 5 BG, 5 CX, 5 KC, 5 MO, 5 KO, 5 WR, 5 DN, 5 Id, 5 BH, 5 IT, 5 JX, 5 RH, 8 AO, 8 AQ, 8 BF, 8 NN, 8 CK, 8 AW, 8 BP, 8 DP, 8 DW, 8 CZ, 8 EB, 8 AG, 8 ES, 8 CJ, 8 RJ, 8 DY, 8 AE, 8 BE, 8 BW, 8 BA, 8 BX, 8 AW, 8 CM, 0 US, 0 YF, 0 KX, 0 AB, 0 XP, 0 YN, 0 ZN, 0 GS, PCII, PCTT, 1 JW, 1 MT, 1 XAR, P 1. (1—v—o.) (J. W. Reddingh, **5 SZ.**)

Tralleborg, Sweden (January 26th).
2 OD, 2 OM, 5 BV, 5 DN, 8 BP, 8 CT, 0 KX, 7 EC, 7 ZM. (B. Agren.)

Edinburgh.
1 MT, 2 AO, 2 AP, 2 CW, 2 DT, 2 FN, 2 JW, 2 MG, 2 NM, 2 VQ, 2 WK, 2 XR, 2 YQ, 2 ZK, 2 ZT, 5 AN, 5 BV, 5 DN, 5 GX, 5 IC, 5 ID, 5 KO, 5 LF, 5 MO, 5 NW, 5 OC, 5 OL, 5 QV, 5 SI, 5 TR, 6 EA, 6 FM, 6 JX, 6 RY, 6 VP, 7 EC, 8 AQ, 8 BP, 8 CJ, 8 CT, 8 CZ, 8 DP, 8 DU, 8 DX, 8 DY, 8 EC, 8 EB, 8 EM, 8 FM, 8 MH, 8 OH, 8 SSU, 8 ZY, 0 BQ, 0 DK, 0 KB, 0 KX, 0 MR, 0 NY, 0 XO, 0 XQ. (1—v—1.) (J. Bruce Dewar.)

Mayfield, Sussex.
2 AF, 2 AN, 2 AO, 2 AQ, 2 AZ, 2 BZ, 2 DF, 2 FQ, 2 HT, 2 IF, 2 IO, 2 JX, 2 KF, 2 KT, 2 KV, 2 KZ, 2 LT, 2 LW, 2 LZ, 2 NM, 2 OD, 2 OM, 2 ON, 2 PQ, 2 RB, 2 SL, 2 SZ, 2 WD, 2 XR, 5 BT, 5 BV, 5 CC, 5 DE, 5 DT, 5 GJ, 5 HY, 5 IF, 5 LP, 5 MA, 5 MC, 5 OC, 5 PU, 5 QV, 5 SR, 5 VR, 6 FQ, 6 HD, 6 IM, 6 PS, 8 AU, 8 BP, 8 CZ, 8 DA, 8 DY, 0 MX, 0 AA. (D. B. Fry, **5 UY.**)

Ramsgate.
2 AC, 2 AN, 2 AO, 2 FQ, 2 FU, 2 GU, 2 HF, 2 IF, 2 KF, 2 LZ, 2 MC, 2 MK, 2 MO, 2 ON, 2 OM, 2 OZ, 2 QW, 2 SL, 2 YY, 5 GJ, 5 IC, 5 IY, 5 MD, 5 QV, 5 SI, 5 SR, 5 TG, 5 TR, 5 WI, 6 IM, 8 AA, 8 BF, 8 EN, 1 MT, 0 AA, 0 PB, 0 ZZ. (0—v—1.) (R. I. M. Miller.)

Manchester.
English: **2 AA, 2 AC, 2 AD, 2 AG, 2 AP, 2 CK, 2 CW, 2 DJ, 2 FN, 2 FQ, 2 GK, 2 GZ, 2 HF, 2 II, 2 KS, 2 LG, 2 MG, 2 NM, 2 OO, 2 SH, 2 SZ, 2 TA, 2 TF, 2 VS, 2 WJ, 2 YQ, 2 ZS, 2 ZT, 2 ZU, 5 AW, 5 BA, 5 BV, 5 CS, 5 CU, 5 DN, 5 FD, 5 KC, 5 LJ, 5 LG, 5 LY, 5 MO, 5 NN, 5 OK, 5 OT, 5 PR, 5 QA, 5 QV, 5 RZ, 5 SI, 5 SR, 5 SZ, 5 WM, 5 XQ, 6 AJ, 6 FC, 6 GX, 6 HG, 6 HS, 6 LF, 6 MU, 6 NH, 6 OM, 6 PL, 6 TF, 6 UC, 6 VF, 6 XG, 6 XY, 6 ZF.** French: **8 AE, 8 AE, 8 AG, 8 AZ, 8 BF, 8 BP, 8 CD, 8 CE, 8 CF, 8 CH, 8 CM, 8 CS, 8 CT, 8 CZ, 8 DA, 8 DO, 8 DU, 8 DY, 8 EB, 8 EI, 8 JL, 8 LY, 8 OH, 8 ZZ.** Dutch: **0 KV, 0 AA, 0 BA, 0 FN, 0 KX, 0 XP, 0 KW, 0 ZN.** American: **1 AJX, 1 AP, 1 FD, 1 XM, 3 ADB, 3 BGL, 3 BTL, 4 IO, 8 DHV.** Danish: **7 CZ, 7 EC.** Italian: **1 MT.** (o—v—1.) (J. Barnes.)

Tynemouth, Northumberland (during February).
0 AA, 0 AAL, 0 AG, 0 AS, 0 BA, 0 FL, 0 KX, 0 MR, 0 NC, 0 NK, 0 NY, 0 UI, 0 XO, 0 ZN, 0 ZZ, 1 AR, HB 1, 1 JW, 1 MT, 1 XAM, 1 XAR, 2 AC, 2 AO, 2 AP, 2 CCX, 2 CW, 2 FF, 2 FG, 2 FN, 2 FZ, 2 GR, 2 GS, 2 GY, HB 2, 2 HO, 2 JF, 2 KT, 2 KW, 2 MC, 2 NA, 2 NM, 2 OG, 2 OM, 2 OQ, P 2, 2 RU, 2 TA, 2 TR, 2 WJ, 2 WK, 2 YG, 2 ZT, 3 UA, 4 FT, 4 ZZ, 5 AW, 5 BA, 5 BS, 5 BT, 5 BV, 5 CX, 5 CY, 5 FA, 5 GX, 5 HG, 5 IK, 5 JJ, 5 KO, 5 LV, 5 MO, 5 OC, 5 OK, 5 OT, 5 PU, 5 QV, 5 RQ, 5 SI, 5 UP, 5 US, 5 XT, 6 AA, 6 AN, 6 FG, 6 HS, 6 HY, 6 IR, 6 MH, 6 NE, 6 NF, 6 XX, 7 EC, 8 AE 3, 8 AG, 8 AH, 8 AQ, 8 AS, 8 BA, 8 BF, 8 BP, 8 BZ, 8 CF, 8 CJ, 8 CK, 8 CN, 8 CT, 8 CZ, 8 DA, 8 DP, 8 DU, 8 DY, 8 EB, 8 EI, 8 EM, 8 KK, 8 LY, 8 NA, 8 OH, 8 SSU, 8 ZZ, PA 9. (1—v—o, o—v—o, or o—v—1.) (H. F. Baker.)

Sidcup.
2 AIP, 2 AH, 2 AP, 2 AQ, 2 AU, 2 AV, 2 CO, 2 CW, 2 DF, 2 DY 2 FD, 2 FN, 2 FQ, 2 GO, 2 ID, 2 JW, 2 KF, 2 KT, 2 LT, 2 LZ, 2 NC, 2 NM, 2 OM, 2 PX, 2 SC, 2 SK, 2 SX, 2 TV, 2 UI, 2 WY, 2 VY, 2 XR, 2 XZ, 2 ZT, 2 ZU, 5 AC, 5 BV, 5 BT, 5 CB, 5 CS, 5 DN, 5 DR, 5 DT, 5 FL, 5 GF, 5 GJ, 5 HI, 5 HN, 5 HW, 5 HY, 5 IM, 5 JZ, 5 LN, 5 LZ, 5 MJ, 5 PD, 5 PU, 5 PZ, 5 QV, 5 RF, 5 RW, 5 SO, 5 TR, 5 UL, 5 UR, 5 WN, 5 WR, 5 WS, 5 XN, 6 GD, 6 IM, 6 JX, 6 KI, 6 NH, 6 OT, 6 PS, 6 QM, 6 QV, 6 RJ, 6 VP, 0 AA, 0 BQ, 0 FL, 0 IA, 0 JZ, 0 KX, 0 NY, 0 XP, 0 ZX, 0 ZZ, 1 MT, 1 JW, 7 TM, 7 ZM, 8 AE, 8 AE 2, 8 AP, 8 AZ, 8 BP, 8 BV, 8 CF, 8 CJ, 8 CQ, 8 CS, 8 CT, 8 CY, 8 CZ, 8 DO, 8 DU, 8 DV, 8 DX, 8 DY, 8 EB, 8 FT, 8 JL, 8 LY. (o—v—o or o—v—1.) W. J. Clifford.)

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PARIS (Compagnie Francaise de Radiophone Emissions "Radiola"), SFR, 1,780 metres. Daily, 12.30 p.m., Cotton Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9 p.m., News; 9 p.m., Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

ECOLE SUPERIEURE des Postes et Telegraphes, 450 metres. 9 p.m. (Sunday, Wednesday, Thursday, Friday and Saturday), Talk on Literature, Dramatic and Musical Selections. 8.15 p.m. to 9.25 p.m. (Tuesday), Morse Practice, English Lesson, Lecture and Concert.

LYONS, YN, 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m., Gramophone Records. 450 metres. At 11 a.m., Concert and News. 3.45 p.m., Market Reports. 5 p.m. and 9 p.m., Concert and News.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. At 1 p.m. and 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

BRUSSELS ("Radio Electrique"), 410 metres. Daily, 5 to 6 p.m., 8.30 p.m. to 9.30 p.m., Concert.

HOLLAND.

THE HAGUE, PCGG, 1,070 metres. 3 to 5 p.m. (Sunday), 8.40 to 10.40 p.m. (Monday and Thursday), Concerts.

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 8.40 to 9.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

THE HAGUE (Velthuisen), PCKK, 1,050 metres, 8.40 to 9.40 p.m. (Friday), Concert.

HILVERSUM, 1,050 metres. 8.10 to 10.10 p.m. (Sunday), Concert and News.

IJMUIDEN (Middelraad), PCMM, 1,050 metres. Saturday 8.10 to 9.40 p.m., Concert.

AMSTERDAM, PA 5, 1,050 metres (Irregular). 7.40 to 9.10 p.m., Concert.

AMSTERDAM (Vas Diaz), PCFF, 2,200 metres. 8 a.m. and 4 p.m., Share Market Report, Exchange Rates and News.

DENMARK.

LYNGBY, OXE, 2,400 metres. 7.30 to 8.45 p.m., Concert (Sunday excepted).

GERMANY.

BERLIN (Koenigswusterhausen), LP, 2,800 metres (Sunday), 10.50 a.m. to 11.50 a.m., Orchestral Concert; 650 metres, 4.30 p.m. to 6 p.m. (Weekdays), 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 to 12.30 p.m., Music and Speech; 4.0 to 4.30 p.m., News; 650 metres, 8.30 to 9.30 p.m., Concert.

EBERSWALDE, 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 7 to 8 p.m., Concert.

BERLIN (Vox Haus), 400 metres. 8 to 9 p.m. Concert.

CZECHO-SLOVAKIA.

PRAGUE, PRG, 1,800 metres. 7 a.m., 1 a.m. and 3 p.m., Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m., and 9 p.m., Concert.

KBEL (near Prague), 1,000 metres. Daily, 6.20 p.m., Concert, Meteorological Report and News.

SWITZERLAND.

GENEVA, 1,100 metres (Weekdays). At 2.15 p.m. Concert or lecture.

LAUSANNE, HB 2, 1,100 metres (Monday and Wednesday), 4 p.m., Concert; 1,000 metres (Friday and Saturday), 7 p.m., Concert.

SPAIN.

MADRID, 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests.
MADRID, PTT, 400 to 700 metres. 4 to 5 p.m., Tests.

ITALY.

ROME, ICD, 3,200 metres. Weekdays, 11 a.m., Gramophone Records.

WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary. Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

The Radio Society of Highgate.*

An interesting lecture was given on Friday, March 7th, by Mr. A. N. Browning, on "The Possibilities of Television." No satisfactory scheme has yet been evolved, said the lecturer, but there have been several ingenious attempts to solve the problem, notably those of Jennings in America, and Korn in Berlin. The systems employed by these two scientists were explained by means of diagrams and it was seen that both methods depended upon the curious properties of selenium. Mr. Browning described the properties and the construction of a selenium cell, and said that owing to its numerous defects it was unlikely that this substance would be used when the problem of television is finally solved. At present, however, there is no substitute for it as a means of converting light impulses into electrical impulses, and until such a substitute is found there is little prospect of television becoming an accomplished fact. Selenium is very satisfactory, however, for use in the transmission of photographs, since for this purpose the inertia effect of selenium is of little importance. Mr. Browning concluded by describing some of the ways of reducing this inertia effect.

Hon. Sec., J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

Blackpool and Fylde Wireless Society.*

The Society has now commenced a new year with renewed activity. The Director of Education for Blackpool, Mr. A. E. Ikin, LL.D., B.Sc., has accepted the office of President for the year.

On February 7th, the members held a discussion on the problem of "Radiating Receivers," and many interesting points arose in this connection. Many excellent devices to minimise the bad effects produced were noted.

On February 26th, a lecture was given before the Fleetwood Wireless Society, under the auspices of the Fylde Radio Association, by Mr. B. D. Taylor, taking the subject, "An Amateur's Wavemeter."

On March 6th, Mr. L. R. Blackburn gave a very interesting talk on the effect of the "Heavyside Layer."

A Whist Drive and Dance was held at Feldman's Arcade Café on March 12th.

Hon. Sec., B. D. Taylor, 58, Regent Road, Blackpool.

Ilford and District Radio Society.

On March 6th, Mr. R. O'Grady read a paper on "Cabinet Making." The subject formed a pleasant change from the usual wireless lecture, and yet was of interest to all. Mr. O'Grady dealt with the whole business of making a box, from buying the timber to the final french polishing or varnishing. Much valuable information was gained during the discussion which followed.

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

Belvedere, Erith and District Radio and Scientific Society.*

On Friday, March 7th, the lecturer before the Society was Mr. Geo. Sutton, A.M.I.E.E.. After explaining the very early experiments of Hertz, the lecturer passed on to simple oscillatory circuits. The method of propagation of disturbances through the æther were explained in a very lucid manner, and old and modern methods used for detecting these disturbances were outlined.

Several practical circuits were given for transmitting continuous waves and telephony, preference being given to the "choke control" method. This particular arrangement was explained in detail, great stress being laid on the importance of choosing correct values for the iron-cored choke and the radio frequency choke.

The more difficult and important parts of this interesting subject were simplified by the apt use of simile and metaphor, and considerably helped by humorous illustrations.

Hon. Sec., S. G. Meadows, 110, Bexley Road, Erith, Kent.

Barnet and District Radio Society.*

At the last bi-monthly meeting of the Society, Mr. L. Wild, A.M.I.E.E., of Barnet, gave an instructive talk on "Audio Frequency Intervalve Transformers." Mr. Wild spoke of his own experiences in the building and use of transformers, with which, for many years, he has carried out experiments. He dealt with the question of distortion, and showed how to avoid a great deal of the distortion so prevalent in many valve sets, afterwards answering numerous questions put to him by the members.

Recently a party of members visited the Barnet telephone exchange, where they spent a thoroughly instructive afternoon.

Hon. Sec., J. Nokes, Sunnyside, Stapylton Road, Barnet.

Wimbledon Radio Society.*

An interesting lecture, entitled "Reflex Circuits," was delivered on Friday, March 7th, by Mr. W. E. Milton Ayres, A.M.I.E.E., Mem.A.I.E.E.

The lecturer differentiated between circuits employing (1) Crystal rectification, (2) Valve rectification, and many circuits employing either type were drawn on the blackboard. Of particular interest were circuits designed especially for the elimination of A.C. noises, this usually proving very troublesome in the Wimbledon area; and at the conclusion of the lecture a two-valve set employing such a circuit was demonstrated on the Society's aerial.

The Assistant Hon. Secretary, Mr. P. G. West, of 4, Ryfold Road, Wimbledon, S.W.19, will be pleased to furnish particulars of the Society's activities to intending members. He will also be pleased to arrange for members to assist or advise anyone contemplating the installation of a broadcast receiver, or who is experiencing difficulty in the operation of an existing receiver, if they will apply to him at the address given above. The Society have decided to arrange for this service in order to prevent, as far as possible, interference being caused by the "howling" of a receiver in inexperienced hands.

Hon. Sec. (*pro tem.*), C. G. Stokes, Red Cross Hall 59, Church Road, Wimbledon, S.W.19.

Ilford and District Radio Society.*

On Thursday, February 21st, Mr. J. N. Nickless, A.M.I.E.E., opened a discussion on "Super Short Wave Reception." He referred to the band of waves around 100 metres, and described the various experiments he had made in connection with the reception of the American broadcasting station of **KDKA**. Mr. Nickless favours the type of receiver making use of an aperiodic aerial system. Many interesting hints were exchanged during the discussion. Mr. J. F. Payne advocated the use of a single circuit tuner together with extreme simplicity of layout. Mr. A. E. Gregory drew attention to the fact that a popular mistake in designing a short wave receiver is the use of too large a reaction coil. It is to be hoped that as a result of the discussion more members will have the satisfaction of being able to listen to the **KDKA** programme.

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

Streatham Radio Society.*

The March meeting of the Society was held upon the 12th of the month, when an excellent lecture was delivered by Mr. H. S. Walker (**2 OM**). The lecturer gave some very interesting facts regarding short wave transmission, dealing with many practical points in aerial, earth and counterpoise design. He next took up the question of "fading," and gave a graphic outline of the effect of the Heaviside layer in the refraction of ether waves. A full discussion followed.

Ten new members were elected at the meeting and a number of letters to the Society from Streatham residents were read, dealing with local interference and jamming of broadcast reception. The Society is making every endeavour to trace the cause of these complaints and a special committee has been arranged for their investigation.

Hon. Sec., S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

The Hornsey and District Wireless Society.*

On Monday, March 10th, by the kind permission of Messrs. The Peto-Scott Company, Ltd., Mr. R. J. Willis gave a lecture and demonstration on the subject of "Assembling Valve Receivers on the

Unit System" Mr Willis produced quite a lavish display of apparatus manufactured by his Company, and wired up a four-valve receiver on the unit system. London was received with good strength and a remarkable absence of distortion on the loud speaker, and Newcastle was also received on the loud speaker without any interference from London. Mr. Willis dealt with a variety of other subjects, including faults in aerial construction, the characteristic curves of valves and the various methods of high frequency amplification.

Hon. Sec., H. Hyams, 188, Nelson Road, Hornsey, N.18.

Woolwich Radio Society.*

During the past month the Society has been very active. On January 30th the President (Capt. C. T. Hughes, R.E.), gave an interesting lecture and demonstration on "Dull Emitter Valves." There were two types of dull emitter valve, said the lecturer. The true dull emitter of the peanut type only glowed a dull red when working, but was too heavy in current consumption to be used with dry cells. The relatively bright emitter (of the D.E.3 and B.T.H.5 type) consumed only ·06 amperes. A demonstration of each kind was given on the Club set.

A lecture on "Loud Speakers" was given on February 6th by Mr. Ricketts, of Messrs. Radio Acoustics. The lecturer's remarks proved most interesting, and his demonstration with four different types of Amplion models was much appreciated. "The Manufacture of the Cossor Valve" formed the subject of a lantern lecture delivered on February 13th by a representative of the Cossor Valve Company. On February 20th an auction sale of surplus apparatus was held, and on March 5th an admirable talk was given by Mr. Bartle, a Vice-President, on his newly-constructed super-sonic receiver, which had successfully received **KDKA.**

The Society meets every Wednesday evening at 8 p.m. at the Y.M.C.A., Thomas Street, Woolwich. Visitors are welcomed.

Hon. Sec. H. J. Smith, 42, Greenvale Road, Eltham, S.E.

High Wycombe and District Radio Society.*

At the first annual meeting of the Society it was determined that vigorous efforts should be made to demonstrate the utility of the Society. To this end a club room has been acquired in Castle Street, adjoining Oakley Hall, where quite informal meetings will be held and practical constructive and experimental work will be carried out by the members. An electrical supply from the town mains will shortly be available, and it is hoped to open the premises each evening.

Mr. T. J. Northy has again been elected President of the Society, Mr. L. R. Howland, Hon. Treasurer, and Mr. A. C. Yates, Hon. Secretary, with Mr. C. T. Westlake as Chairman in lieu of Mr. Russell Jackson, retiring.

The Hon. Secretary reported a credit balance on the year's working of £6 13s. after the collection of only four unpaid subscriptions, out of a total membership of 70. This is a very satisfactory state of affairs considering that the annual subscritpion is only 5s.

Hon. Sec., A. C. Yates, 30, High Street, High Wycombe.

The Thornton Heath Radio Society.

On Monday, March 10th, the members had an unusual treat in a lecture by Mr. Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E., on "Condensers, their Construction and Use." A well delivered, interesting and instructive lecture, illustrated by numerous slides, was listened to with great interest by all the members, and hearty thanks are due to the lecturer for his courteous and lucid replies to questions. The lecture was illustrated by views of the Dubilier Co.'s works, where the care taken in all the stages of manufacture and the severe tests applied repeatedly in all the processes, explain the reason why these condensers have obtained such popularity. There are still vacancies for more members and the secretary will be pleased to forward particulars to enquirers.

Hon. Sec., A. H. Banwell, 150, Frant Road, Thornton Heath.

Taunton School Radio Society.

Two short lectures of instructional value were given before the members on March 5th.

Mr. Fleming lectured on "The addition of an L.F. Valve," dealing with the subject in all its aspects. Details were given of the construction of standard transformer and resistance capacity coupled amplifiers, the theory of each being explained. "Methods of Tuning" was the subject of the second lecture, given by Mr. W. O. Coate. The lecturer demonstrated the various types of aerial tuning, and explained semi-aperiodic and aperiodic anode tuning circuits.

Hon. Sec., J. K. Haynes, Taunton School, Taunton.

The Honor Oak Park Radio Society.

On February 29th, the Chairman, Mr. G. J. Price, gave an instructive lecture on "Cabinet Making and Wood Work for Wireless Sets." The lecturer, who has taken the woodwork course at the City and Guilds Technical College, explained the uses and care of all necessary tools, and illustrated his words by producing a very complete set. He gave advice on the choice of woods, and went fully into the subject of marking out designs, and making joints, also including a short talk on staining and french polishing.

Hon. Sec., Mr. J. McVey, 10, Hengrave Road, S.E.23.

The Dulwich and District Wireless and Experimental Association.

On Monday, January 21st, the President, Geo. Sutton, Esq., A.M.I.E.E., favoured the Association with a very able and lucid lecture on "The Sine Curve." The subject had been giving new members a certain amount of trouble, and Mr. Sutton's lecture cleared up several misapprehensions.

Mr. Skinner, on January 28th, gave a lecture of absorbing interest on "Choke Coils," dealing in particular with their application to receiving circuits.

On February 4th, members had the pleasure of listening to a very interesting lecture entitled "Amateur Transmission and Transmitting Circuits," by the Hon. Sec., Mr. Harrie King (**2 AIP**), who was ably assisted at the blackboard by Mr. J. Barrett.

The announcement that Mr. Harrie King had been appointed Assistant Secretary of the Radio Association was received by all members with great satisfaction, and a vote was passed wishing Mr. King every success in his new venture.

At the Headquarters of the above Association on Monday, February 11th, a very entertaining lecture on "The Design of Experimental Wireless Recievers" was given by Mr. H. J. Camplin. The striking and humorous way in which the lecturer emphasised his seven points, viz., efficiency, selectivity, long range, good volume, flexibility, economy and portability, was highly appreciated, and the evening was voted a great success.

A highly interesting lecture was delivered on Monday, February 18th, by Mr. R. J. Stanley, on "Various Methods of High Frequency Coupling." The subject was treated in a very lucid manner by the lecturer, who included some very interesting remarks on the Armstrong circuit.

The President of the Association, Mr. Geo. Sutton, A.M.I.E.E., gave an excellent lecture on "Telephony Transmission," covering the whole ground of telephony transmission from the earliest days of the spark gap to the latest practice in continuous wave.

New members are required, and enquirers are assured of a prompt reply. Letters to be addressed to the Hon. Sec., Harrie King, 2, Henslowe Road, East Dulwich, S.E.22.

St. Pancras Radio Society.

This Society had a very busy and interesting time during February. On the 7th of the month Mr. W. J. Jones, of the Cossor Valve Co., gave a most interesting lantern lecture on the development and manufacture of the Cossor Valve, and pointed out the reasons for the difference in the design of that valve as compared with others.

On February 14th, Mr. S. E. J. Hex exhibited several receiving sets of his own construction and design, of which special mention must be made of a three-valve resistance-coupled amplifier of very compact design and which on test gave unusually pure reception.

On February 21st, Mr. F. T. Nunn gave a demonstration of the methods of obtaining characteristic curves of valves.

The Society was honoured on February 28th with a visit from Mr. Oswald Carpenter (of the Marconi Co.), who lectured to the Society on "Some Interesting Valve Circuits," and explained the circuit arrangements of the Marconiphone V2a, Reinartz and Armstrong Super receivers and described the purpose of the unusual parts of those circuits.

The Society meets every Thursday evening at 1, Mornington Crescent, at 8 p.m., when visitors are always welcome.

All information regarding the Society will be willingly given by the Secretary, R. M. Atkins, 7, Eton Villas, N.W.3.

Radio Association of South Norwood.

A discussion on "Reaction and its Uses" was opened by Mr. Fenny on March 6th. Various methods of coupling were dealt with, viz., direct, tuned anode, transformer, capacity and low frequency.

Hon. Sec., C. H. P. Nutter, 243a, Selhurst Road, Norwood Junction S.E.25.

The South London League of Radio Societies.

At a meeting of delegates from societies forming this League, held on March 8th, the final details of the forthcoming Exhibition of Wireless Apparatus at the South London Art Gallery, on March 27th, 28th, 29th, were decided, and the sub-Committee's report adopted in full.

After discussion concerning the distribution of League lecturers, Mr. P. R. Coursey, B.Sc., A.M.I.E.E., gave an interesting talk on the Radio Society of Great Britain.

The speaker dealt briefly with its history, problems, constitution, relations with the P.M.G. and likely future developments.

On dissatisfaction concerning the supply of lecturers by the R.S.G.B. to its affiliated Societies being expressed, the speaker admitted that an interchange of lecturers could best be carried out by a League of Societies, such as the South London League of Radio Societies.

Hon. Sec., G. J. Price, 22, Honor Oak Park, Forest Hill, S.E.23.