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THE
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Practical Data for Building the Armstrong Super-Regenerative Circuit

By EDGAR H. FELIX, Associate I.R.E.

AS soon as Major Armstrong demonstrated his discovery of the super-regenerative circuit before the Institute of Radio Engineers, there was an immediate rush to build sets embodying the principles he had explained. "As soon as" is not exaggeration, for at the close of the meeting several enthusiastic engineers hailed taxicabs and hastened to their laboratories to try the new circuits.

Lacking detailed information as to constants of circuits, many of the most skilled engineers have had difficulty in getting satisfactory results.

Since the article describing the super-regenerative circuit appeared in *The Wireless World and Radio Review*, I have received letters from British amateurs requesting constants of the various instruments used in the circuits. Because of their desire for information, I here describe in detail the set built by Major Armstrong and used for demonstration at the Institute of Radio Engineers. Fig. 1 is a photograph of the equipment.

The set employs three valves and secures results approximating those obtainable with a super-heterodyne set employing ten valves. Of the super-regenerative circuits, it is the most easily operated because each function of the circuit—regeneration and amplification, variation of negative resistance and detection—is performed by a separate valve and a separate valve circuit, each adjusted independently of the others.

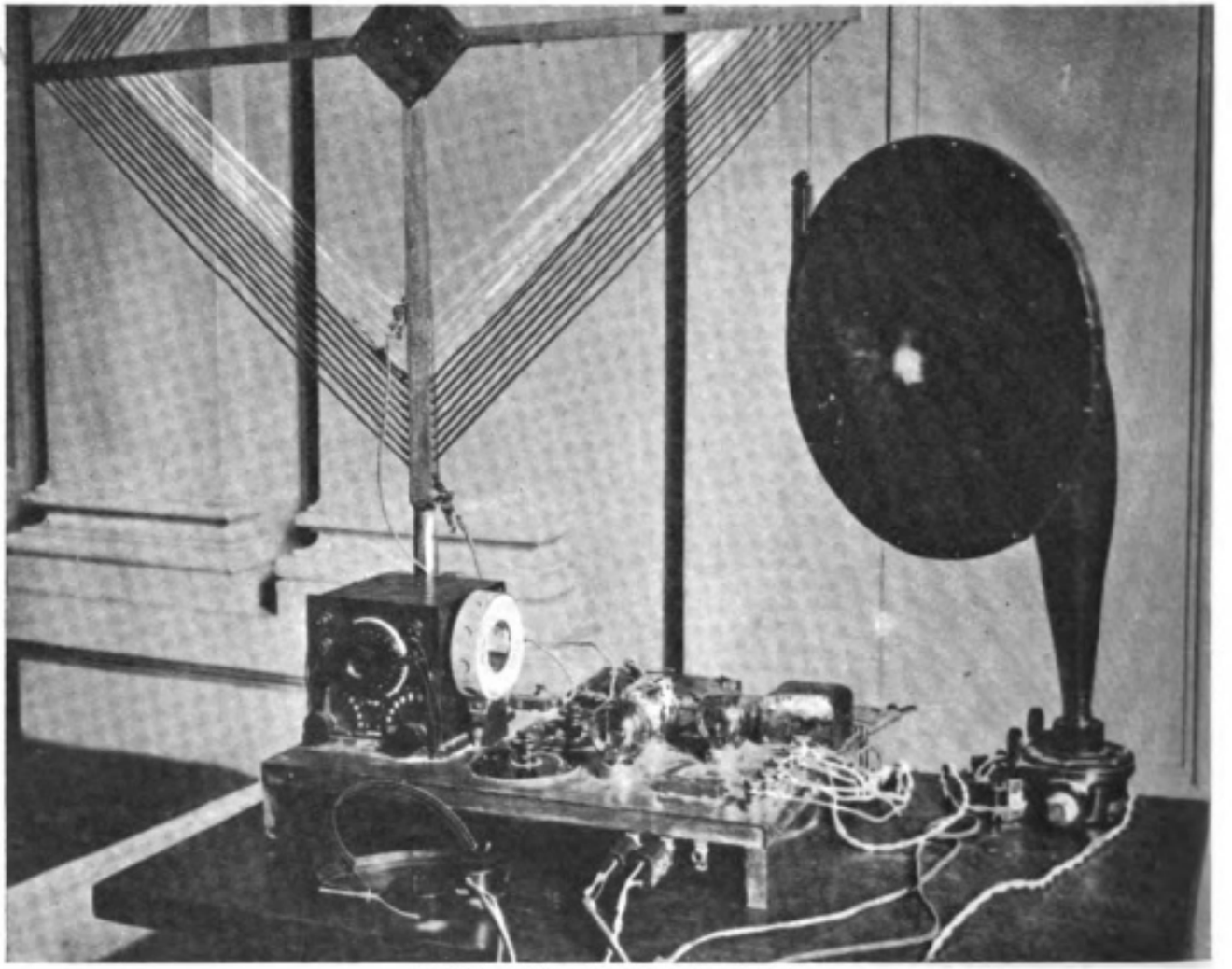
It is inadvisable for an amateur to attempt the operation of a super-regenerative set except he be thoroughly familiar with the operation of an ordinary regenerative circuit. Super-regeneration adds a new series of sounds. The amateur must learn to recognise these and become experienced in making the proper adjustment called for by each sound. With the three valve circuit it is less difficult to analyse the cause of these and make the proper adjustment to correct them than it is with sounds representing frequencies caused by the interaction of the various circuits combined in one or two valves.

Major Armstrong recommends that super-regeneration be attempted only with a loop antenna. In adjusting the circuit, numerous frequencies which interfere with reception by other stations are radiated from an antenna. Therefore, the suggestion that an antenna for receiving with the Armstrong super-regenerative circuit should not be used and that the loop should be employed.

Only "hard" valves should be used—that

is, valves without any appreciable gas content. Since the limit of amplification with this circuit is the maximum output of the valves themselves, five-watt power valves are recommended instead of receiving valves.

In my first article, explaining the principles of the circuit, I stated that the efficiency of the super-regenerative system increases inversely as the square of the wavelength. The upper limit of satisfactory working is 1,000 metres. Extraordinary efficiency is obtained on the 360 metre wave upon which



(*Photo by courtesy American Radio Journal.*)

Fig. 1. Receiving Set embodying the Super-Regenerative Circuit.

American broadcasting operates. At 50 metres efficiency is greatly augmented.

Fig. 2 is a diagram of Major Armstrong's receiving set. The loop in these tests consists of ten turns mounted on three foot square frame.

The tuning element consists of the stator of the conventional vario-coupler. The one shown in the photograph is a " Grebe " vario-coupler. A typical vario-coupler is 3½ inches in diameter with a winding of 100 turns tapped at each ten turns.

The amplifier or regenerative valve circuit includes the secondary vario-coupler, shunted by a variable capacity. The rotor of the vario-coupler is used as the reaction or feed back coil. The reaction coil should be double the usual inductance of a reaction coil. 125 turns of 26 wire is satisfactory for the purpose.

The variable capacity, C_1, for tuning, is of 0·001 mfd. capacity. Nevertheless, half that capacity is sufficient with most sets. A negative battery, B_1, is substituted for the usual grid condenser and grid leak. This battery should be variable from zero to five volts, in order that the value most effective for the particular valve used may be determined.

Because of the periodic action of the oscillator valve in preventing the generation of oscillations by the oscillator valve circuit

and the consequent prevention of valve paralysis, unusually high plate voltages are used. The limit of plate voltage useable is determined by the voltage capacity of the valve itself. For this reason, use a plate battery supplying from 80 to 100 volts.

The oscillator valve circuit is coupled to the amplifier valve circuit through the tap at the top of the vario-coupler. In most cases, the best results are obtained by tapping the very top turn of the vario-coupler. However, if the utmost is desired, test each turn from the top to the fifth turn from the top after the circuit is operating properly. In some cases better results are obtained slightly below the top of the coil. The coupling to the oscillator circuit is completed by the filament connection.

by the second valve is determined by the adjustment of L_3 and C_3. Once a proper value has been determined it does not require readjustment.

Major Armstrong uses a duolateral coil of 1,250 turns, shunted by a variable capacity of 0·0025 mfd.

The plate circuit of the oscillator valve is coupled to the grid circuit through C_2, a variable condenser of 0·001 mfd. capacity. A 5 millihenry air choke coil keeps out the audio-frequency oscillations. The adjustment of C_2 determines the amplitude of the oscillations generated.

The plate potential for the oscillator valve is supplied through the filter circuit from the generator valve.

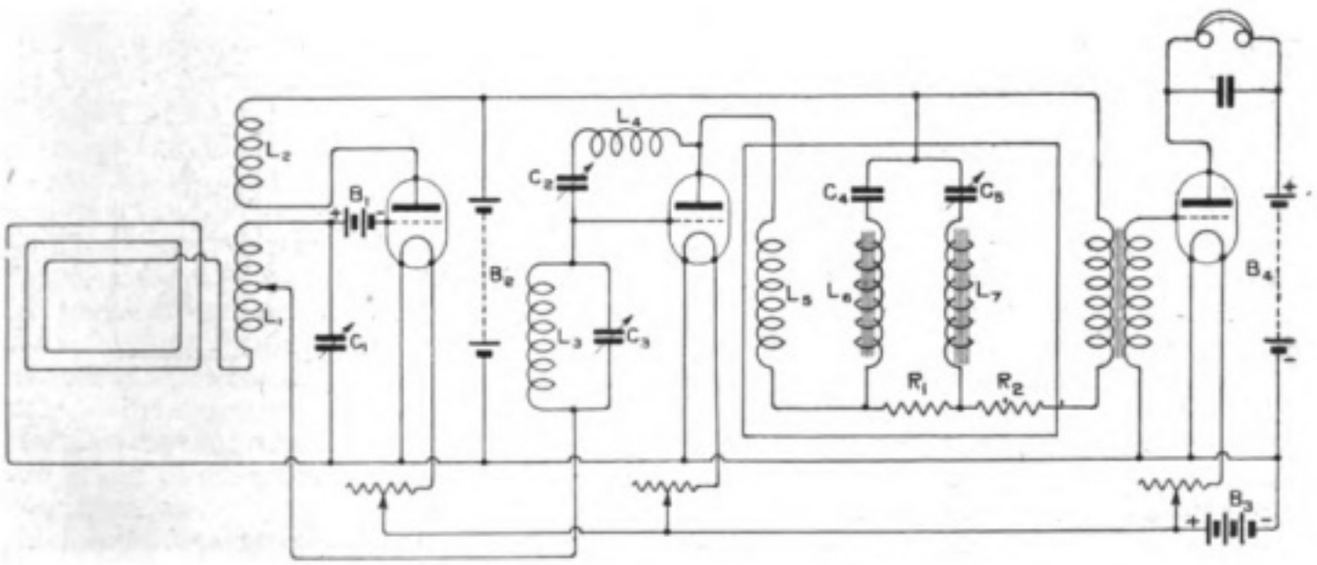


Fig. 2. Three-Valve Super-regenerative Circuit.
L_1 = *Tuning inductance.*
L_2 = *Reaction coil.*
C_1 = *Tuning condenser,* 0·001 *mfd.*
B_1 = *Grid battery,* 0-5 *volts.*
B_2 = *Plate potential battery,* 80-100 *volts.*
C_2 = *Oscillator tube circuit coupling capacity,* 0·001 *mfd.*
L_3 = *Oscillator inductance, DL.* 1,250.
C_3 = *Oscillator capacity,* 0·0025 *mfd.*
L_4 = *Choke coil,* 5 *milli-henries.*
L_5 = *Choke coil, DL.* 1,500.
L_6, L_7 = *Iron core choke coils,* 1 *henry.*
B_3 = *Filament lighting battery.*
B_4 = *Plate potential battery,* 200 *volts.*
R_1, R_2 = *Resistances,* 12,000 *ohms.*
C_4 = *Fixed condenser,* 0·005 *mfd.*
C_5 = *Variable condenser,* 0·005 *mfd.*

In this circuit the negative resistance of the regenerative circuit is varied by changes in the positive resistance of the circuit. When the oscillator valve is conductive, it practically short circuits the secondary inductance; when the oscillation reverses in the oscillator valve circuit, its resistance rises to a high value.

The frequency of the oscillations generated

The filter circuit consists of a 1,500 turn duolateral coil in series with two 12,000 ohm non-inductive resistances. Two iron core choke coils of one henry inductance, in series, respectively, with a 0·005 fixed capacity and a 0·005 variable capacity, complete the filter circuit. Satisfactory results may be obtained without choke coil L_6. Any suitable

filter circuit may be substituted for the one shown in Fig. 2. For this reason it is enclosed with lines.

The output of the generator and oscillator valve is supplied to the usual audio-frequency transformer, which, in turn, makes the audio-frequency currents available to the detector tube. The detector circuit is conventional, except that an unusually high plate potential is supplied by a 200-volt plate battery.

The first adjustment in operating this circuit is tuning to the incoming signal by means of C_1. The oscillator valve is then set into action by a correct adjustment of C_2. The reaction coupling is gradually increased as soon as the familiar click, indicating that oscillations are being generated by the oscillator valve is heard in the telephone receivers. A re-adjustment of C_1 is usually required to effect more exact tuning. Adjustments of C_3 and C_5 need be made only once; when the correct values are found no subsequent adjustment is necessary.

In some cases, a reversal of the filament lighting battery, B_3, improves the signal strength. If satisfactory results are not obtained at a time when the circuit is otherwise operating properly, try reversing the battery connections.

Fig. 3 shows a super-regenerative circuit in which all the functions are performed by a single valve. This circuit was set in operation in a steel frame building, 25 miles distant from the nearest broadcasting station transmitting at the time of the test. Employing a loop antenna, the signals received were so loud that they completely "paralysed" the head telephones. Using a loud speaker, music was easily heard in all parts of a large lecture hall.

This circuit requires the utmost delicacy of adjustment and it will satisfy the most insatiable appetite for feats of technique in adjustment. The same vario-coupler as previously described was used for L_1 and L_2; L_3 and L_4 are duo-lateral coils of 1,250 and 1,500 turns respectively, shunted by 0·0005 mfd. variable capacities. The plate potential is 80 volts. C_4 is fixed of 0·005 capacity; C_5 of 0·001 capacity; the resistances are 12,000 ohms; the iron core choke of one henry inductance.

No doubt within a few months hundreds of successful super-regenerative receivers will have been built by amateurs and descriptions of simpler circuits and more specific data will be available. Although considerable patience is required in learning to adjust the circuit, the almost incredible results obtainable make the effort well worth while.

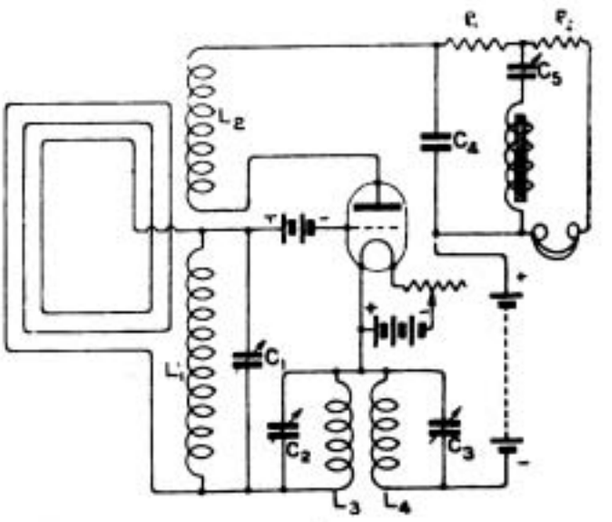


Fig. 3. One Valve Super-regenerative Circuit.
L_1 = *Tuning inductance.*
L_2 = *Reaction coil.*
C_1 = *Tuning capacity,* 0·001 *mfd.*
C_2 = *First oscillator circuit capacity,* 0·005 *mfd.*
L_3 = *First oscillator circuit inductance, DL.*1,250.
C_3 = *Second oscillator circuit capacity,* 0·005 *mfd.*
L_4 = *Second oscillator circuit capacity, DL.*1,500
C_4 = *By-pass capacity,* 0·005 *mfd.*
C_5 = *Filter circuit capacity,* 0·001 *mfd.*
R_1, R_2 = *Resistances,* 12,000 *ohms.*

Experimental Station Design

Continued from page 662, August 19th, 1922.

These articles, which appear in alternate issues, are intended not only to be a complete guide to those new to wireless, but to give explicit details on the construction of all the components of the Experimental Station. Actual designs are of necessity in some instances be somewhat crude, in order that they can be made up without elaborate workshop equipment. Practical working instructions are given where necessary for the help of those unacquainted with the more simple processes of instrument making. Of course, where good workshop facilities exist, the designs may be readily modified.

Economy is made an essential feature, bearing in mind always that where low-priced component parts can be obtained their use has been embodied in the designs. For those who do not desire to make their own apparatus, the descriptions will assist them in selecting the equipment for their stations.

The information contained in the first few articles under this heading is to help those new to wireless and whose first aim is to build a simple set capable of receiving broadcasted telephony, and consequently may cover ground already familiar to many readers. The succeeding instalments, however, advance by easy stages, and in the course of the series the construction of an elaborate station will be evolved.

XI.—HIGH FREQUENCY INTERVALVE TRANSFORMERS.

WHEN great receiving range is desired it is necessary to adopt amplification at radio frequency, that is, the amplitude of the oscillations is increased prior to rectification by the detector valve. High frequency amplification does not produce such an increase in signal strength for each high frequency valve circuit added as low frequency amplification. The former will bring in signals though perhaps weak, which any amount of low frequency amplification alone would not render audible, because a certain oscillation strength is required to operate a detector valve.

One of the simplest forms of H.F. transformer is shown in Fig. 1. This consists of two basket coils of the type described on page 328, June 10th, 1922, issue. The coils are held together by means of a small bolt passing through the centre which also serves as a support. Two coils, one for primary and one for secondary, will give a transformer suitable for use on wavelengths of about 220 metres, whilst two coils in series for the primary, and two for the secondary, is suitable for wavelengths of 300-450 metres. A piece of waxed paper should be placed between the coils and when four or more coils are used primary and secondary coils should be assembled alternately, taking care that the direction of winding is not reversed in consecutive primary or consecutive secondary coils. A good way of doing this, when assembling four coils, is to lay them out with their beginning ends all pointing in the same direction. Two coils are then lifted, one over the other, a hole being pierced in the top one for the purpose of passing through the inside end of the lower one. Another coil is then pierced with two holes, *turned over*, and placed on the other two coils passing the two inside wires through the holes. The lead which passes from the bottom coil is then connected to the inside lead of the

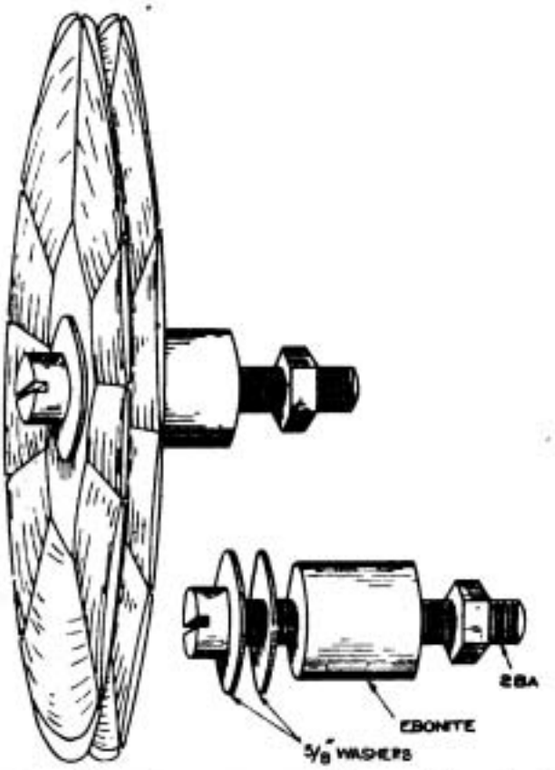


Fig. 1. Transformer consisting of two basket coils wound on card support and clamped together.

third coil and the joint wrapped with insulating material. The last coil, having one hole pierced in it, is then *turned over* and placed on the other three with the inside lead from the second coil passing through the hole. This lead is then connected to the inside lead

of the last coil and insulated. The insulating paper must, of course, be placed between the coils as they are assembled. A 2 B.A. brass bolt now passed through the centre, taking care to avoid the connecting wires, will clamp

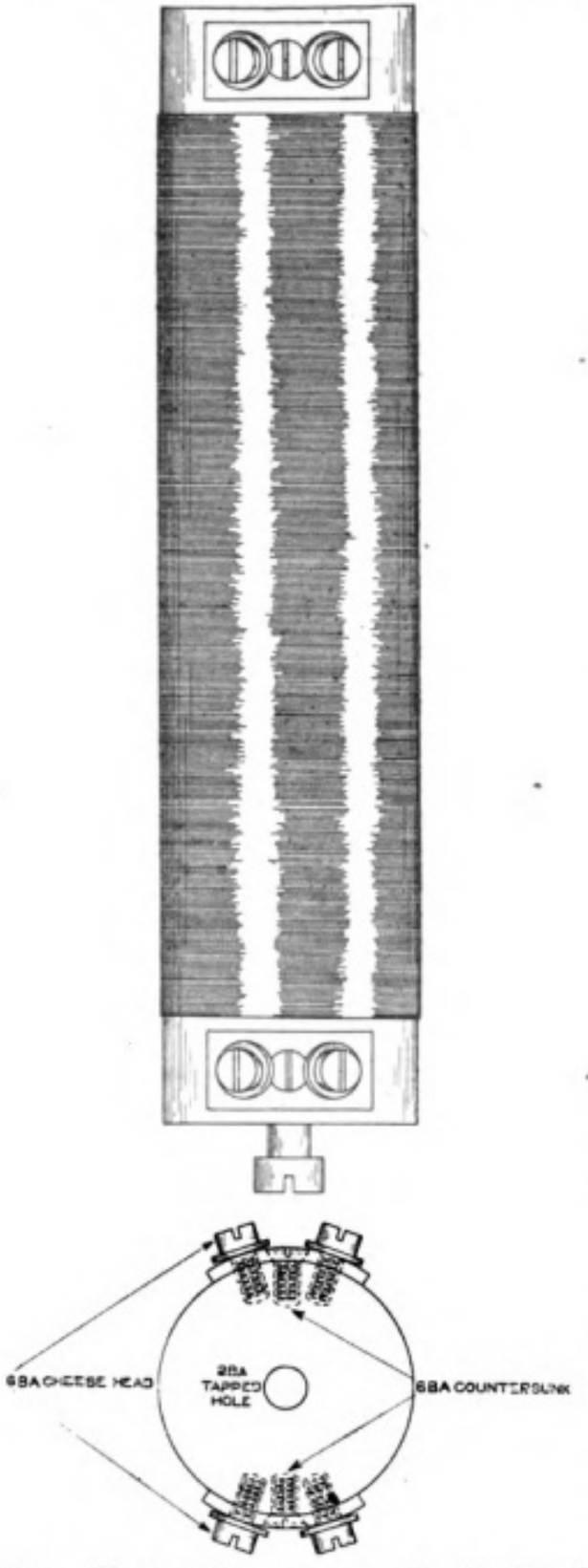


Fig. 2. The single layer type, wound on ebonite rod.

the coils closely together and provide tight coupling. It is desirable, in high frequency transformers, that they shall have reasonably

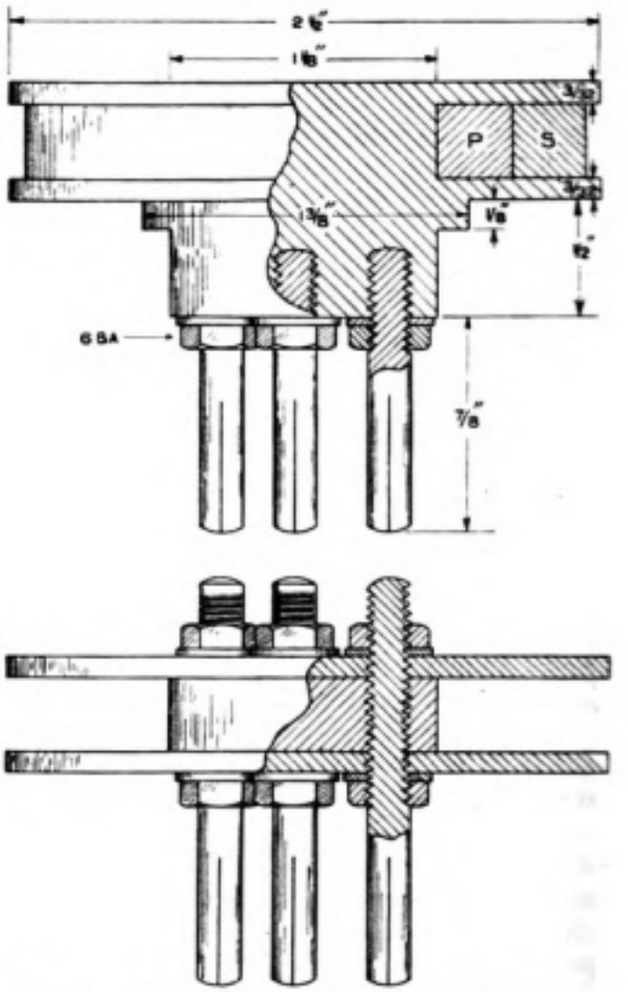


Fig. 3. Two types of interchangeable H.F. Transformers.

low self capacity in order that they may operate over as wide a band of wavelengths as possible. Basket coils are well known to possess very low self capacity whilst the method of assembling just described eliminates any appreciable increase in self capacity owing to the spacing between consecutive primary or secondary coils. On the other hand, the particular arrangement not only gives very tight coupling but gives maximum capacity between primary and secondary windings which is a very desirable property in H.F. transformers. Insulation between primary and secondary is very important as there is a difference of potential between them equal to that of the H.T. battery, and the particular design permits of good insulation being ensured.

The method of connecting high frequency transformers in circuit is shown in most of the very many circuits given in this journal,

but the direction in which the windings are connected up is important, in order to obtain maximum grid potential fluctuation and also to provide maximum capacity coupling between plates and grids of consecutive valves.

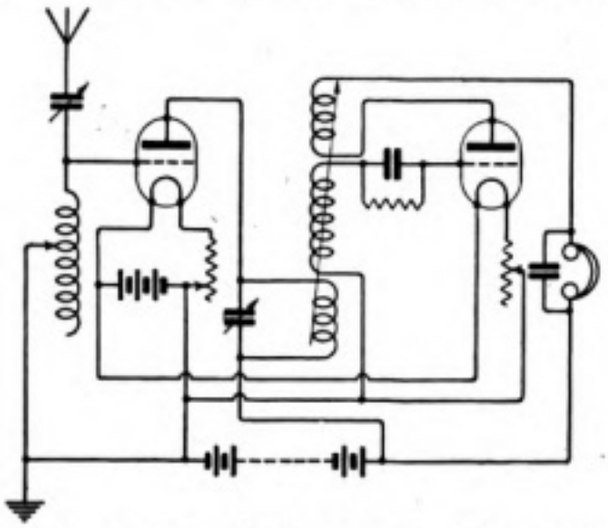


Fig. 4. A non-radiating circuit. The reaction coil is coupled to the H.F. Transformer windings.

In the case of the transformer just described, all leads will pass out from the outer edges of the coils. The lead from the first coil is taken to H.T. +, the lead from the next to L.T. — or potentiometer or in special circumstances to the L.T. +, the next to plate and the last to grid.

A high frequency amplifier making use of several high frequency valve circuits must have its transformers of such a design that they can be relied upon to all have identical inductive values or otherwise, one slightly different to the remainder, will filter out signals on which the others would give best amplification. H.F. transformers consisting of basket or single layer coils can be relied upon to be identical. In the case of windings that are run on into slots, the inductance will depend not only on the number of turns but very considerably upon the method and tightness of the windings, consequently it is only possible to give accurately, transformer windings for particular wavelengths when of the type described above or in the form of single layers.

Another type of transformer is shown in Fig. 2. The former on which the windings are arranged is a piece of 1⅛ ins. diameter polished ebonite rod. The windings terminate on screw tags and consist of single layers of fine single silk-covered copper wire, between 36 and 42 S.W.G. The wavelength range can be slightly broadened by winding with No. 44 S.W.G. or finer, S.S.C. resistance wire. Fine resistance wire is somewhat stronger than copper wire of a similar gauge and hence its use may be recommended as it is not so difficult to handle. A primary and secondary,

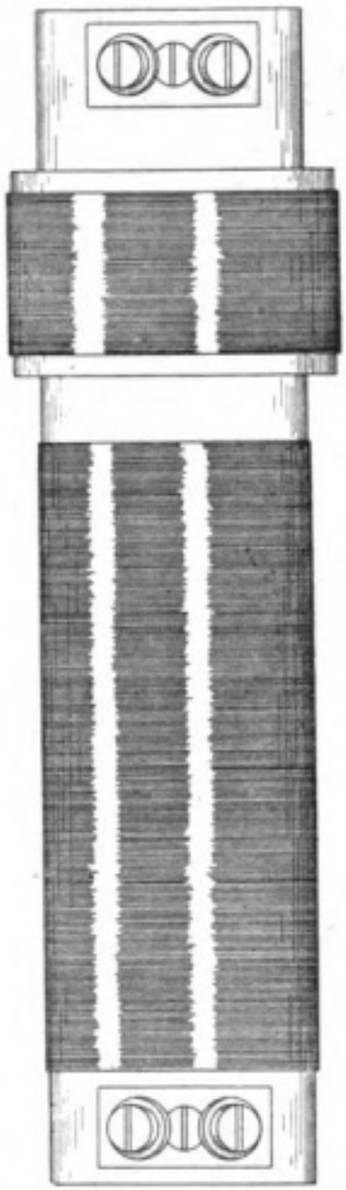


Fig. 5. Transformer with reaction coil

each of 280 turns, will give good amplification on wavelengths between 200 and 350 metres, whilst 450 turns is suitable for 300-500 metres, and 600 turns has an optimum wavelength of 600 metres. More than 600 turns in the form of a single layer will produce a transformer of excessive length and for greater wavelengths 2 ins. or 2½ ins. ebonite tube must be used. With this style of transformer the two windings should be insulated from one another with a single layer of empire cloth, and both wound

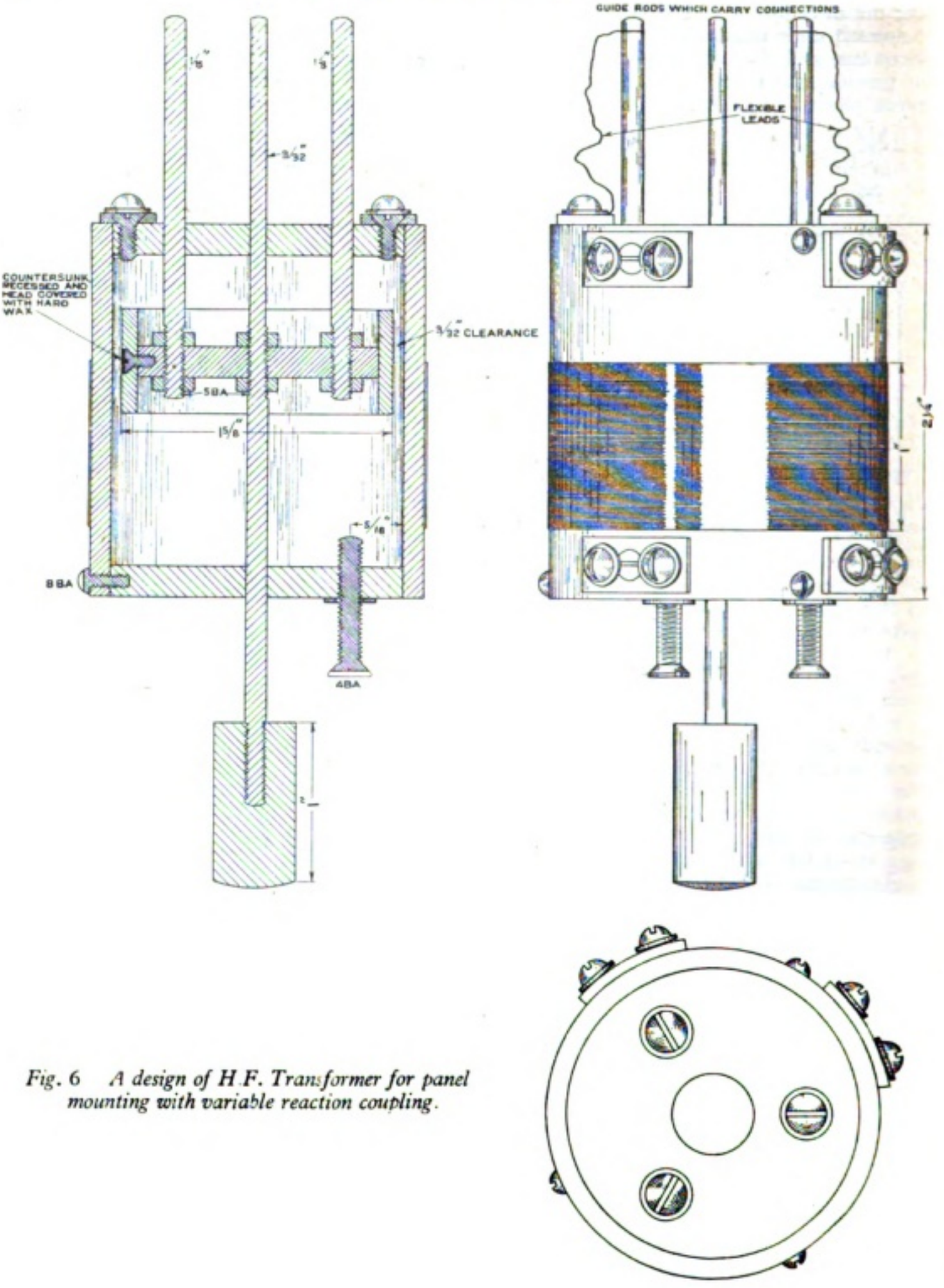


Fig. 6 A design of H.F. Transformer for panel mounting with variable reaction coupling.

in the same direction. The leads which terminate at one end are connected to grid and plate.

Mention might be made of the type of transformer which has now become very popular, having a slot to carry the windings and a four-pin base for the purpose of rendering it interchangeable with others (Fig. 3). With this type of transformer it is much better to wind the primary and secondary separately instead of running the two wires on together, in order to maintain good insulation between primary and secondary as mentioned above. The two windings should be in opposite directions, the two leads which pass out between the windings being taken to grid and plate.

A type of transformer giving very good results can be made with the use of a coil winding machine by running on two wires simultaneously. Care must be taken to avoid the wires crossing, and if primary and secondary wires are of different colours the winding can be easily watched. Thus wound each successive turn of the primary winding is spaced with a turn of the secondary and consequently the self capacity is kept as low as is possible, whilst the capacity between the two windings is a maximum. If the transformer is of a mean diameter of 1⅝ in. and has primary and secondary each of 120 turns of No. 28 D.S.C., it will be suitable for operation on wavelengths between 300 and 470 metres. The two leads passing from the outside of the transformer are for connection to grid and plate. This type of transformer can be conveniently mounted between ebonite discs as shown in the lower drawing in Fig. 3.

Apart from the advantages already mentioned, H.F. amplification permits of the provision of inductive reaction in a receiving set without causing radiation. This is effected by providing a H.F. transformer between the first and second valves, to the windings of which is coupled a coil connected in the plate circuit of the second valve, as shown in Fig. 4. By extending the length of the transformer shown in Fig. 2, in order to allow a space of one or two inches free of winding and slipping over the transformer, a closely fitting ebonite tube carrying a single layer winding (Fig. 5) reaction can be arranged on to the transformer windings as indicated in the circuit diagram. With such an arrangement the secondary should be the outer winding of the two windings on the rod. The leads to the connectors can be buried in grooves cut in the surface of the former and filled in with hard black insulating compound.

An alternative design is shown in Fig. 6, so arranged that the extent of reaction can be readily varied when the transformer is mounted in the panel of a receiver. It is not necessary to give constructional advice in the making of this instrument, as the drawing is sufficiently detailed and the methods of working ebonite and brass have been explained in previous articles under this heading. Attention might be drawn, however, to the great care necessary in drilling and tapping the thin walls of the ebonite tube. The grid circuit winding is beneath the primary, both windings being in the same direction. The grid and plate connections are taken from the front end of the transformer. For a wavelength range of 300-450 metres, 170 turns of No. 38 S.S.C. is suitable for primary and secondary windings. When it is intended to tune the primary with a low capacity condenser which, it might be mentioned, should be of the air dielectric type, with a capacity of not more than 0·0002 mfds., the secondary or grid circuit may consist of an additional 20 turns to the number on the primary. The reaction coil should be wound with 120 turns of No. 42 S.S.C. Modifications in the dimensions of the formers can be made to suit various wavelengths up to 2,000 metres, beyond which the resistance capacity method of intervalve coupling is usually adopted. F.H.H.

A Broadcasting Concert Platform.

Miss Olive Jenkins, the famous Cornish Soprano, broadcasting from Marconi House, accompanied by Signor Mancio de Veroli.

A Broadcast Receiver

Continued from p. 683 of issue of August 26th, 1922.

By A. J. BULL.

A glance at the photograph of the instrument, back view, Fig. 5, may assist to convey the idea of the spacing. Having wired the filament circuits, the intervalve transformer should be fixed in the position over the H.F. valve, as indicated in the double page diagram (pp. 680—681 of August 26th issue). A simple method of doing this with most transformers is to obtain a piece of brass, 4 ins. long × ⅞ in. wide × 1/16 in. thick. Measure off ¾ in. and make a right-angle bend. In the ¾ in. portion of the brass, drill two holes to take two 4 BA screws. With a 7/64-in. drill, bore two holes nearly through the ebonite panel in the position shown near the grid socket of the H.F. valve. As the reader views the panel in the double page diagram, this position will appear as about 3½ ins. immediately above the sketch of the Dewar switch.

As stated earlier in the article, by drilling with a 7/64-in. drill, the 4 BA screws may be made to cut their own thread in the ebonite, thus ensuring a tight fit. Having screwed the right-angled brass in position, it should stand out 3¼ ins. perpendicular to the panel. To this the transformer is secured by means of two 4 BA screws. Underneath this transformer on the opposite side a 0·001 mfd. fixed condenser is fastened to the angle brass by a single 1-in. 4 BA screw. This screw first passes through the insulation of the condenser as shown in the top right-hand corner of the double page diagram. The function of this condenser, which is connected across whichever transformer is switched in circuit, is to provide a path for H.F. currents, when the reaction coil is employed, which current would otherwise be stopped owing to the impedance of the transformer.

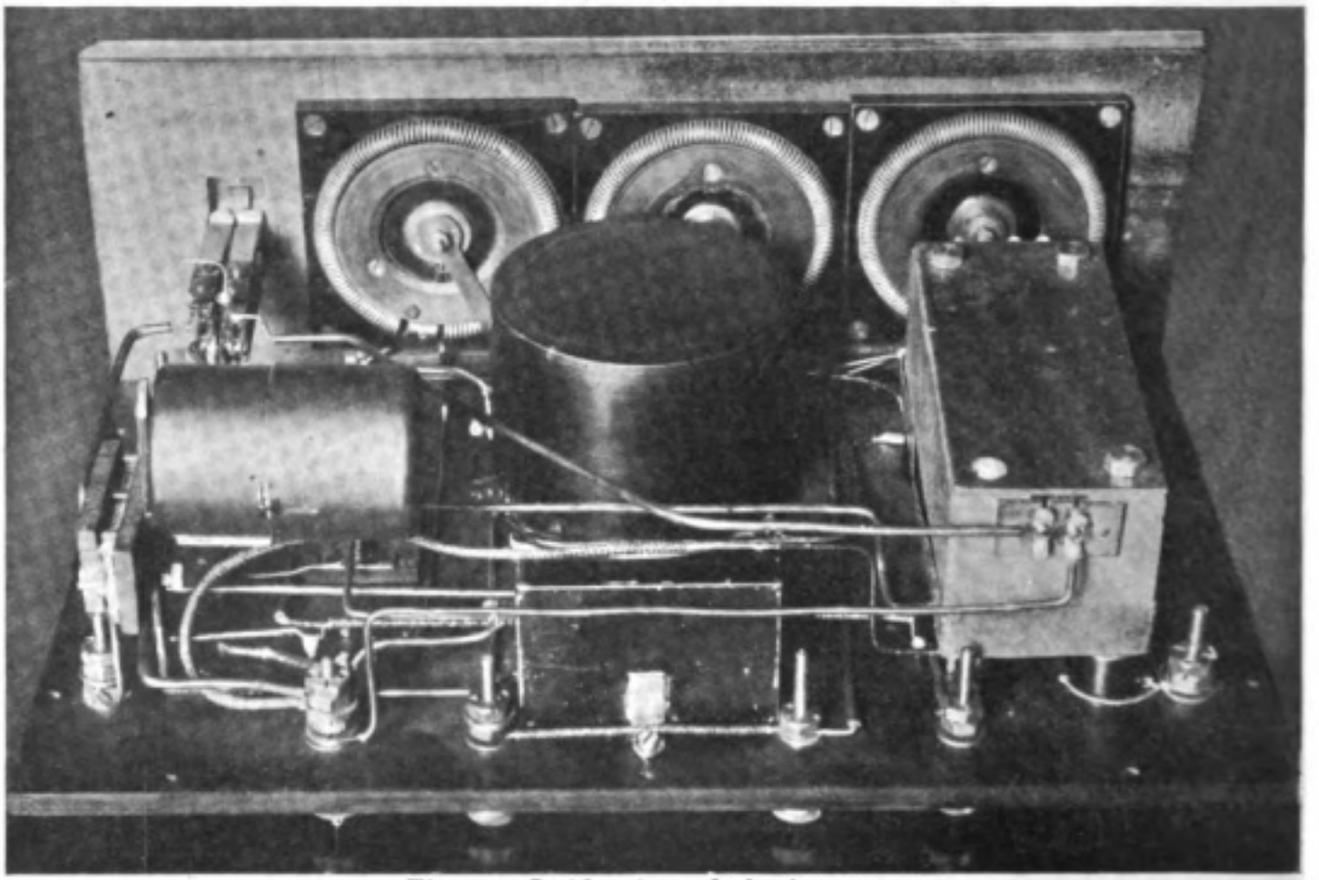


Fig. 5. Inside view of the instrument.

The telephone transformer now calls for consideration. This can be secured to the panel in a manner similar to that followed for the intervalve transformer, or by a method to be now described. The transformer depicted in the full-sized diagram near the telephone terminal is a captured German one, purchased from disposals, and is enclosed in

an iron case, which case provides a return path for the flux.

Four iron bolts, 2⅞ ins. long, threaded 4 BA for ¼ inch, pass through the case at the corners into the ebonite panel to a thread cut to receive them. Four spacing washers of ebonite ⅜ × ½ in. diameter, through which the bolts also pass, space the transformer ⅜ in. from the panel. In place of the telephone transformer, however, a pair of H.R. telephones could be inserted in the circuit. The disadvantage of doing so is that, if 60 or 80 volts plate potential are employed, an unfair strain is placed on the insulation of the telephone windings.

Although there are losses in all transformers due to magnetic leakage the author is of opinion that for experimental work with the thermionic valve, a pair of L.R. telephones, say 60 ohms each earpiece, of good make, employed in conjunction with a properly designed transformer, is efficient and most economical for the experimenter.

The statement of the dealer, therefore, that " any old transformer will do," should not be accepted.

A very good combination is a pair of Brown's 60 ohms telephones and a " valve to telephone transformer " from a service C. Mark III amplifier. The excellent results obtained with this combination is largely due, I believe, to the fact that the impedances of the two components are of a similar value.

An experiment was made somewhat hurriedly by the writer and two independent observers, to ascertain to what degree signals would be reduced in strength. An ordinary crystal set was employed in the test. The comparison was made between a transformer with L.R. telephones and three pairs of H.R. telephones, switched separately in circuit. Observations were made with very weak signals and all listening failed to detect any appreciable difference in signal strength.

To return to the instrument under construction. The variable condenser should now be fixed in position by means of suitable screws, and if a condenser from a Mark III receiver is employed it is advisable to slightly raise it off the panel, so as to permit of any wiring as shown in pp. 680-681 being passed between it and the panel. Four ebonite washers, approximately ⅜ in. diameter × ⅛ in., will serve this purpose. The twelve terminals, two-way switch, coil plug for H.F. circuit, 0·0002 mfd. grid condenser and leak, 0·03 mfd. condenser, and all wiring should now be added, the four wires, *A*, *B*, *C*, *D*, being left until last. The particular lugs of the switch to which these four wires, *A*, *B*, *C*, *D*, should be soldered, may not be clear at first sight to some, and therefore the following method of procedure may prove helpful.

First, check the position of the switch in the panel. The correct position is as indicated in the full-sized diagram, viz., the four screws in the switch being visible, as shown. Fig. 6 is an end view of the Dewar switch, and for clearness the lugs are shown as circles. The end of the actual switch should now be compared, side by side with Fig. 6, and a mental note made that *D* and *B* are two of the longest springs in the switch.

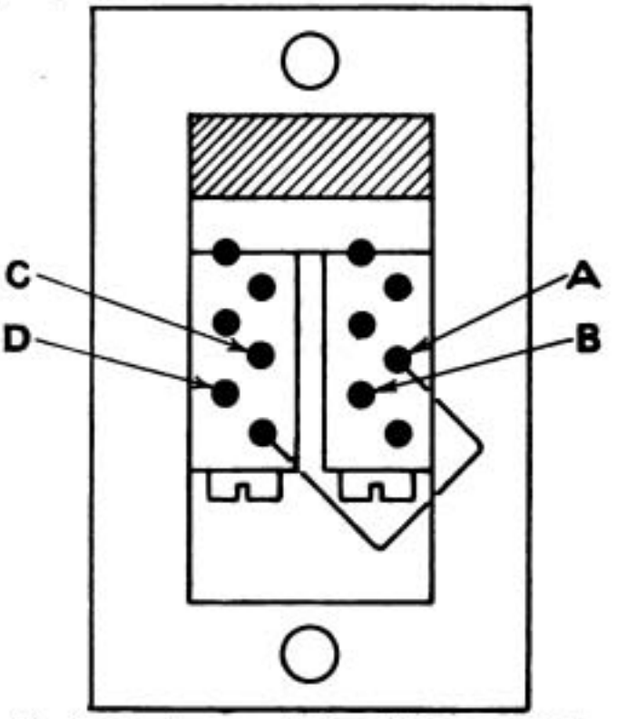


Fig. 6. Enlarged end view of Dewar switch showing connections.

The next step is, with the switch in the neutral position, to trace out on the instrument the path the wires *D*, *C*, are to follow.

The track is from H.T. + to primary of telephone transformer through the primary of the transformer to the lug *D* on the switch, thence through the tiny contact on *D* to lug *C*, and finally to the plate terminal of the third valve.

Follow the same method with wires *A*, *B*, and trace from H.T. + to primary inter-valve transformer, through the transformer to lug *B*, thence through the contact on *B* to lug *A*, thence to the reaction terminal thence through the strap bridging the two reaction terminals, and finally to the plate terminal of the detecting valve.

These connections *A*, *B*, *C*, *D*, must be well spaced, and it is advisable to use comparatively stiff wire. One strand of No. 7/22 phosphor bronze aerial wire meets the purpose admirably, sleeving insulation being employed as in the case of all the other wiring.

With the exception of the coil holder, the instrument is now practically finished, and it is left to the constructor's good judgment to add those little details which will help to give a professional appearance to the instrument.

For those interested in building the instrument by three stages, Fig. 2b. p. 679 was prepared. This diagram shows the panel and *only* the wiring connections of a single valve. A few minutes' comparison between Figs. 2b and the full-sized diagram pp. 680 and 681 should enable the reader to realise that the H.F. valve can be added to the panel without disturbing to any appreciable extent the wiring seen in Fig. 2b.

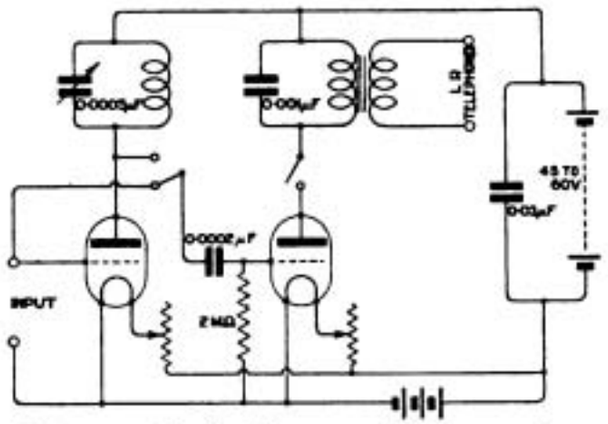


Fig. 7. Circuit diagram with two valves.

The only alterations are :—

The grid leak should be disconnected from the wire connected to terminal *A*, Fig. 2b, and transferred to terminal *E*.

The wire connecting terminal *A* to the grid condenser is to be disconnected at the condenser end, and joined to the grid of the H.F. valve.

The wiring of the H.F. circuit can then be proceeded with. This wiring should be traced and reasoned out from the full-sized diagram, pp. 680 and 681 and Figs. 7 and 2b. The following are the parts required to complete the high frequency valve circuit :—

1 Filament resistance.
1 Valve socket.
1 Two-way switch.
1 0·0005 mfd. variable condenser.
1 Standard plug as shown on panel in Fig. 1.
1 0·03 mfd. fixed condenser.

From the experience gained in the building of the first and second valve in the panel, there should be no difficulty in adding the remaining valve and circuit if the full-sized diagram is again referred to, this time in conjunction with Fig 3, p, 679, and due care is exercised with the wiring of the Dewar switch.

OPERATION OF THE SET.

Before passing to the operation of the instrument a few remarks are thought necessary with regard to the following :— Coilholder and coils, valve adaptor and the alternative use of a non-inductive resistance for the H.F. circuit.

In order that coils of the duo-lateral, Burndept, or similar types may be employed for the aerial and reaction circuit respectively, a coilholder must be provided. This is a device for supporting two or three coils, usually in a vertical plane, as can be seen in Fig. 1, p. 678, one coil being plugged to a stationary position, and the other pivoted, and capable of turning about a vertical axis through an angle of 90 degrees.

There are several designs of coil-holders advertised for sale ready for attaching to instruments. As, however, throughout this article it has been considered that the reader wishes to construct his set as cheaply as possible, with due regard to efficiency, the following suggestion is given for the construction of a coil-holder to accommodate two coils, with space for the addition of a third coil if required.

Two standard coil plugs, as shown in Figure 1, p. 678, should first be obtained, together with an ebonite rod about 6 ins. long by $\frac{1}{2}$ in. in diameter, one ebonite knob, two small brass terminals, and a piece of brass rod, $\frac{1}{4}$ in. in diameter by $1\frac{1}{4}$ ins. long. Having obtained these, prepare a piece of planed hard wood, 4 ins. in diameter by $\frac{1}{2}$ in. thick. By means of a tenon saw cut this into two semi-circular pieces, and if possible smooth the edges left rough by the saw.

Cut off a piece of the ebonite rod, $2\frac{1}{2}$ ins. long, and place a pencil mark on the rod, $1\frac{1}{4}$ ins. from one end, or in other words, at the centre of the rod. At points 9/32 ins. on either side of this mark (in a direct line), bore holes through the rod, $\frac{1}{8}$ in. diameter.

By means of two screws which are provided with the plug, screw the plug to the ebonite rod through holes just bored. A brass terminal should now be suitably cut down to form a pivot and screwed tightly into one end of the rod. This will increase the length of the rod

by about $\frac{3}{8}$ of an inch, the exact increase depending upon the type of terminal chosen for the purpose.

To the other end of this rod, the ebonite knob and $\frac{1}{4}$ in. diameter brass rod are fastened.

A simple means of doing this is to bore a small hole, $\frac{1}{2}$ in. deep, in the end of the ebonite rod, and into this hole screw tightly the shank of a Mark III or similar terminal from which the nuts have first been removed and the total length of the terminal reduced to $1\frac{3}{8}$ in.

The remaining end of the terminal which originally carried a thumbscrew, is soldered into a hole bored to receive it in one end of the $\frac{1}{4}$ in. brass rod.

An easy means of fastening the knob to this brass rod is to drill a hole, 7/32 in. diameter full by $\frac{1}{4}$ in. deep in the knob, force the knob on, and secure in position by means of a 1/16 in. pin passing through the diameter of the knob and rod. The two semi-circular pieces of wood should now be bushed, the bottom one to receive the pivot and the top one to allow the $\frac{1}{4}$ in. rod to pass through it. Simple bushes can be made from 1/16 in. brass strip, measuring 1 in. by $\frac{1}{2}$ in., countersunk in the wood and held by wood screws.

The position of these and the rods carrying the plugs can be gathered by a consideration of the coil-holder shown in Fig. 1.

The stationary plug is secured to the remaining piece of ebonite rod by the same method as was adopted for the moving one, and fastened in a central position between the semi-circular pieces of wood by screws passing into its ends.

Having adjusted the length of this rod to suit the moving one, all that remains is to provide a backing piece of wood to fasten the semi-circular pieces to, and a $\frac{1}{4}$-in. spring washer, to be included with the moving rod, in order to prevent it moving too freely.

After the coil-holder has been screwed in position on the end of the instrument, wire connections are made from the screws of the stationary plug to the reaction terminals and from the moving plug to terminals *A* and *B*.

COILS.

In order that a large range of wavelengths may be covered, it is recommended that for compactness, coils of the duo-lateral or similar type should be employed for the H.F. and aerial circuits respectively. and purchased from firms who guarantee the inductance of each coil supplied.

Possessed of this information, the experimenter can calculate with certainty the range of wavelengths covered with each coil and known condenser.

For those who wish to experiment with basket coils the dimensions of the spider shown in Fig. 8 is given.

The centre is $\frac{7}{8}$ in. by $\frac{3}{8}$ in. thick, the spokes are $\frac{1}{8}$ in. diameter and eleven in number. The complete spider can be constructed of metal with threaded spokes, or the hub may be of ebonite and the spokes of tapered wood, simply pushed into holes drilled in the periphery of the hub.

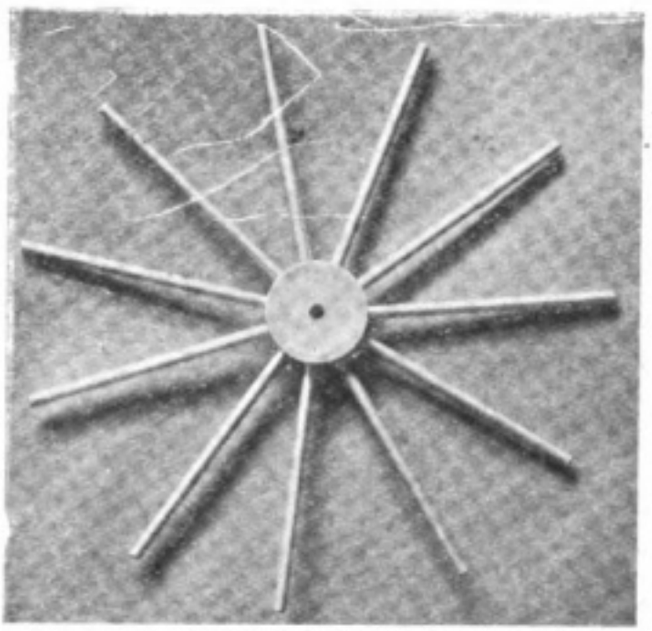


Fig. 8. Former for basket coil winding.

Obviously, if the dimensions of these coils are to be kept within reasonable limits, a wire of small cross sectional area must be employed. The disadvantage of employing a small wire however, is its resistance to high-frequency currents, for, as its diameter decreases, its resistance increases, resulting in damping and loss in signal strength. It is suggested, therefore, that the basket coils should be wound with No. 36 D.S.C. copper wire.

Using this gauge wire, and the above former, a coil wound to a diameter of $2\frac{7}{8}$ in. for use in the H.F. circuit, employed in conjunction with the 0·0005 mfd. condenser functioning near its minimum value, gives a wavelength of 1,050 metres approximately. If, however, this coil is tapped at points 1 in., $1\frac{1}{4}$ in. and $1\frac{3}{8}$ in. radius, wavelengths to the value of 350, 450 and 600 metres respectively are covered.

These values are also obtained with the

condenser functioning near its minimum value.

However, it is reiterated that the purchase of coils is recommended.

VALVES AND VALVE ADAPTOR.

Suitable valves for use with the instrument are :—

A good French or V.24 for H.F.
A good French or V.24 for L.F.
A Qx, Q or captured German valve with cylindrical anode (shown in the photograph) for detecting.

For those who may have purchased captured German valves from the Disposal Board, the valve adaptor shown in Fig. 9 will be found useful.

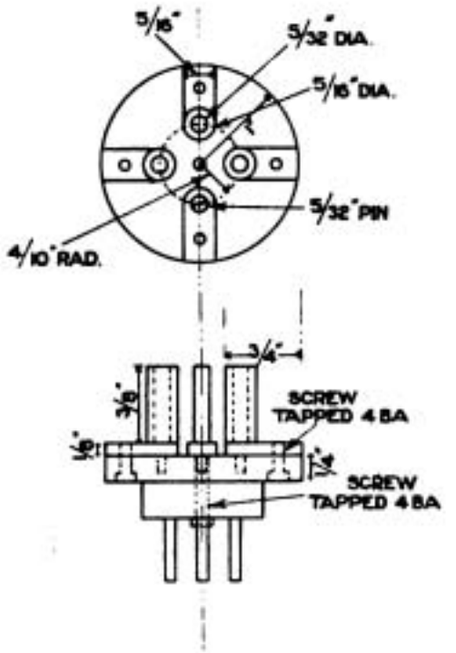


Fig. 9. Details of the adapter for German type valve.

It is mentioned that the lower part of the adaptor is part of a broken French valve, otherwise the drawing is self-explanatory.

THE ALTERNATIVE USE OF A NON-INDUCTIVE RESISTANCE FOR THE H.F. CIRCUIT.

Experimenters who wish to avoid the trouble of tuning the anode circuit of the H.F. valve for wavelengths greater than 1,200 metres, should suitably mount a resistance rod of 0·05 megohms resistance and plug this in, in place of the coil.

This, however, will necessitate the disconnection of the 0·0005 mfds. condenser, which would otherwise shunt the resistance. With the introduction of this resistance, the H.T. voltage must be raised to allow for the voltage drop across the resistance.

For example: Supposing that with the tuned anode circuit, a French valve is employed with 25 volts H.T., the valve functioning about the centre of its characteristic with zero grid potential and 0·7 milliampere flowing in plate circuit.

Now, in order to ensure that the valve shall function on its selected characteristic after the tuned anode circuit has been replaced by a resistance of the value mentioned, the plate voltage must be increased to 60 volts, owing to the fact that 35 volts is dropped across the resistance, viz., $C = 0{\cdot}7\ mA$, $R = 50{,}000$ ohms, $E = CR$.

Therefore $0{\cdot}7 \times 10^{-3} \times 50{,}000 = 35$ volts.

It is evident then, that this 35 volts must be added to the 25 volts which is required to force through the filament anode path the current of $0{\cdot}7\ mA$.

RECEPTION.

As it is the ambition of many experimenters to receive the Dutch concert, a few hints as to the adjustment of the instrument for that purpose may be useful.

The aerial is connected to terminal *A*, and the earth wire in series with a variable condenser to terminal *E*. Suitable inductances are plugged in the coil-holder, their values depending upon dimensions of the aerial in use.

For the H.F. circuit, Burndept Coil No. 200 is recommended, if 0·0005 mfd. condenser is employed.

After the batteries and other necessary components have been connected, the switch on the front of the instrument is placed to neutral, the "two-way" switch turned to the left, and the strap bridging the reactance terminals opened. Proceed to switch the three filaments on (the H.F. valve not too brightly at first).

With the moving coil set at an angle of 45 degrees, rotate the A.T.C. and H.F. condenser simultaneously until the music is picked up. The filament current of the H.F. valve should then be gradually increased and coupling etc., adjusted for maximum signals, taking particular care that the set does not oscillate. If desired, and in order to reduce number of adjustments, the reaction coil can be shorted and the set brought to it most sensitive point (viz., just on verge of oscillation) by gradually brightening filament of the H.F. valve.

As a matter of interest to readers, it may be mentioned that the concert was received well in London on August 6th with the instrument described and a very poor aerial. There were three pairs of telephones in circuit. It was also quite good with two valves and the same number of telephones in use.

For the transition to the "two-valve" position, viz., one H.F. and one detecting, the Dewar switch is turned to upward position (opposite to the position shown in photograph) and the L.F. valve filament switched off. This last movement being optional.

It may be pointed out that the vacant terminals or lugs of the Dewar switch can be utilised for other switching combinations. For instance, for reversing the reaction leads, etc., etc.; however, for the sake of wiring simplicity such refinements have been purposely omitted.

If now only one valve is required, viz., the detecting one, the Dewar switch is turned upwards, the two-way switch to the right, and the leads to the reaction terminals reversed.

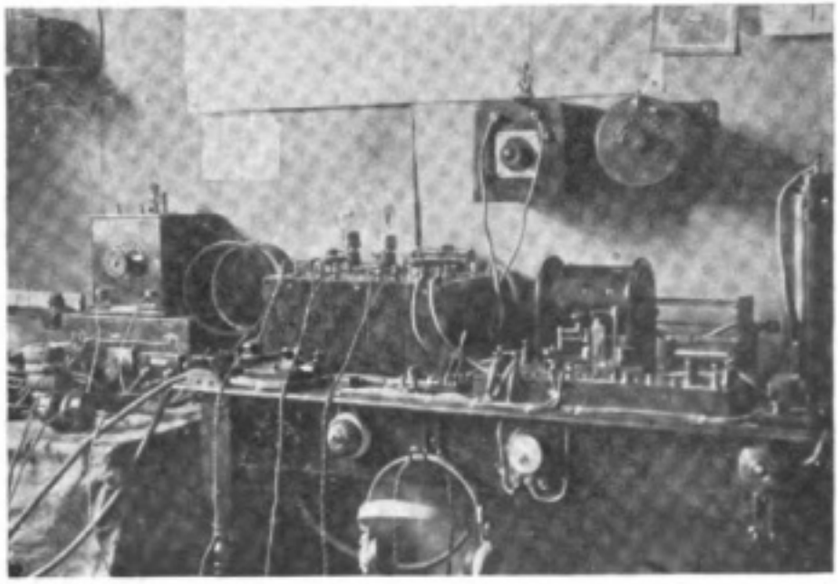
If it is desired to add the L.F. valve behind this one the Dewar switch is replaced to neutral position and last valve filament switched on.

In conclusion, the writer hopes that he has not been over explanatory and trusts that this article may be of use, especially to those amateurs who make use of the "Questions and Answers" column of this journal.

An Experimental Wireless Station

By G. W. MORTIMER.

THE accompanying photograph shows my wireless station at 1, King Street, Yeovil. As it might interest other amateurs I give a short description as follows :—



At the right of photograph is a single valve set with loose coupler, using V24 or "R" valves and also arranged for crystal reception should the accumulators fail at any time. In the centre of photograph can be seen the set I have just completed, using two valves and honeycomb coils for tuning. This set is extremely good, and signals are sometimes too loud to keep the telephones on your head. It is arranged to use either two V 24 or "R" valves. Those seen in photo are one French "R" and Ediswan EC2, this combination giving good results. The two large coils shown on the set are specials for the Dutch concert, etc., the usual coils, eight in number, are seen at the extreme left of photograph in front of the H.T. battery box. On the top of the battery box is a short wave crystal set on which I get ships, etc. All the apparatus is of my own construction with the exception of telephones, which are Brown's 4,000 ohms, I can get all the usual stations, telephony. etc., quite loud.

C

A New Rectifier

By V. BUSH and C. G. SMITH.

The following abstract of a paper presented to the Institute of Radio Engineers, New York, describes an entirely new form of rectifier with cold electrodes. The tube is developed from the phenomenom that in order to produce ionisation there must be sufficient space between electrodes to allow collision to take place. If the electrodes are arranged close together, collision may still take place if the mean free path is extended by the application of a magnetic field.

THE purpose of this paper is to introduce a new form of rectifier. Briefly described, it consists of a pair of electrodes surrounded by a moderate pressure of gas, the conduction between the electrodes being definitely under the control of a magnetic field. The electrodes may both be cold, as thermionic emission is not utilised. The device has no definite current limit, except such as is imposed by the heating due to losses. It is adapted for high voltage purposes and has a very long life.

Only one of the simplest forms of these tubes will be described and its theory developed, for a complete analysis is very involved. However, such theory as is here presented can be quite accurately checked with such a tube of the type to which it strictly applies.

Gaseous conduction between electrodes in a gas at low pressure is usually considered an erratic and unreliable phenomenon. When such conduction takes place in a glass tube with widely separated electrodes, the phenomenon decidely earns its undesirable reputation. The problem in the development of this rectifier has been to bring this conduction under control.

Conduction between widely separated electrodes in a gas at low pressure, assuming that the electrodes remain sufficiently cold to bar effects due to the thermionic emission or vaporisation of the metal, takes place by reason of ionisation by collision. In a gas there is always a certain small amount of spontaneous ionisation and under a potential gradient of sufficient magnitude, the number of ions rapidly increases, for the speed attained by the freed electrons becomes sufficient, so that upon impact with neutral molecules they knock them apart, producing ions and more electrons. The process is thus cumulative until sufficient current flows to reduce the potential between the electrodes to a definite value, depending upon many factors.

In order to produce gaseous conduction proper, therefore, two factors are necessary; first, a potential gradient sufficient to produce ionisation, and second, sufficient distance between electrodes for collision to take place.

If two electrodes are so situated in a gas that they are nowhere separated by a length of discharge path of the order of magnitude of the mean free path of an electron in the gas used, and at the pressure present, and if there is no magnetic field present, then there can be no gaseous conduction proper between such electrodes at any potential difference whatsoever. Ionisation by collision cannot become cumulative, for in the great majority of cases a spontaneously freed electron drops into the anode without impacting with a neutral molecule. The space between the electrodes is thus kept clear of free electrons and ions.

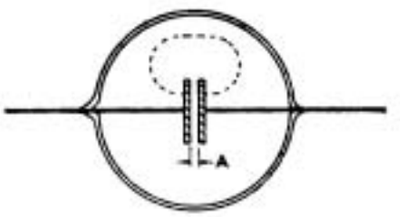


Fig. 1.

The conduction which takes place due to the spontaneous formation of ions is extremely minute, and is the same sort of conduction as takes place between electrodes in air at atmospheric pressure and at potentials below the point of corona formation, which conduction can only be detected with difficulty.

It is, in fact, sufficient to prevent conduction that all lines of electrostatic stress between the electrodes be either short compared to the mean free path of the electron, or else be interrupted by an isolated body capable of accumulating a charge. Very many forms of electrodes may be constructed to utilise this principle, one or two of which will be illustrated in this paper.

The tube of Fig. 1 will conduct at a comparatively low potential if filled with, say, hydrogen to a pressure of 0.1 mm., even although the distance of separation A be much less than the mean free path of an electron in hydrogen at this pressure. The conduction will take place along paths such as the one shown dotted.

Fig. 2.

However, a tube such as shown in Fig. 2 will not so conduct; for the only long lines along which an electron may be propelled by the potential difference are interrupted by the glass walls, which will accumulate a charge and reduce the gradient in the gas to a low value.

Such a tube, constructed with properly cleaned electrodes, will not pass a microampere at a potential difference of ten thousand volts. Of course at very high potential gradients, of the order of magnitude of a million volts to the inch or so, very peculiar effects may be produced; but not gaseous conduction proper.

A tube which insulates by reason of the short path principle may be rendered conducting by the introduction of a magnetic field of proper value, and in direction perpendicular to the lines of electrostatic stress.

When an electron, moving in the short distance between two electrodes, is acted upon by a magnetic field, its path is curved and thereby lengthened. Moreover, the increase in length of path of an electron starting from the cathode is gradual, with increasing magnetic field strength up to a certain value, and after that it becomes very sudden. This sudden increase occurs when the path curvature is such that the electron completely misses the opposite electrode. The electron paths between plane electrodes for various field strengths are plotted in Fig. 3 to render this clear.

The magnetic field strength necessary just to make the electron thus miss the opposite electrode can be calculated. Its value depends upon the potential E between electrodes, their separation a, and the electron ratio of charges to mass m, thus .

$$H = \frac{1}{A}\sqrt{\frac{2Em}{e}} \quad . \quad . \quad . \quad . \quad (1)$$

or, if E is in volts, and a in centimetres, we may insert the value of e/m and write :

$$H = \frac{3{\cdot}35\sqrt{E}}{A} \text{ gauss} \quad . \quad . \quad . \quad (2)$$

for the critical field strength.

Let us now construct a tube such that the distance straight between electrodes is too short to ionise, but such that the path of an electron is just made to miss the opposite electrode sufficiently long to ionise. Assume a high potential in accordance with the short path principle Apply a magnetic field to this tube parallel to the electrode surface. Then when this field is increased to the critical value, the tube will very suddenly conduct freely. The electrons fly in long paths and ionise by impact. The positive ions thus formed drop into the cathode and produce secondary emission of electrons from the surface. The new electrons also pursue long paths and ionise in turn. Since one ion may knock several electrons from the cathode, and each electron may make several ions, the process is cumulative; and the discharge builds up to a point determined by the external circuit.

It may be noted in passing that the critical nature of this phenomenon gives a simple method by which the value of e/m may be checked experimentally.

A rectifier may now be constructed. Construct a short path tube and place it in one of the usual rectifier circuits. Apply to the tube an alternating field and a uni-directional field superposed. Adjust the field such that during one half cycle it is correct for conduction, and during the next half wave, not. The tube will then rectify completely.

This, however, is not the simplest construction. By using curved electrodes instead of

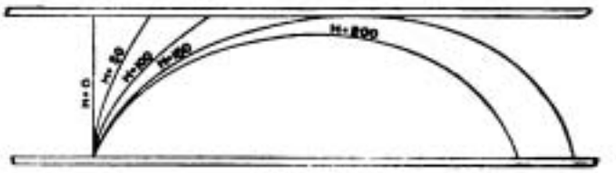


Fig. 3.

plane electrodes, a permanent magnet may be used to supply a uni-directional field, and the alternating field dispensed with.

If concentric cylinders are used for electrodes and suitable arrangements made to render the end paths also short, an axial field of proper strength will render the tube conducting. However, it may be shown, that the critical field strength is now different

for conduction in the two directions. In fact the critical field strengths bear the same ratio as the diameters of the cylinders, that is :

$$\frac{Hh}{Hg} = \frac{g}{h} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Thus for conduction with the outer cylinder negative, the critical magnetic field is smaller than when the inner is negative.

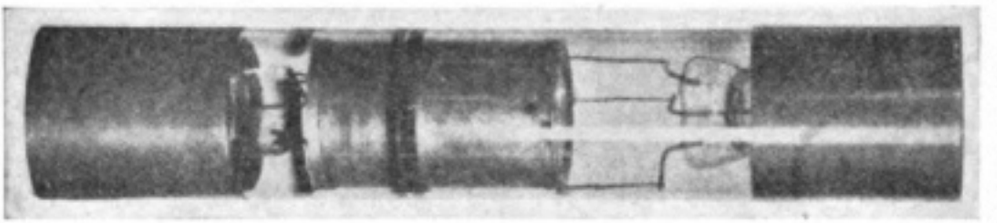


Fig. 4.

A tube arranged with cylindrical electrodes and supplied with a permanent axial field, intermediate between these two critical values, will then conduct in one direction but not in the other. This gives a very simple rectifier indeed.

By suitable choice of diameters and field strength, the tube may be so arranged that it conducts in one direction as soon as the potential across the tube rises to a value sufficient to give ionisation by collision and secondary emission, that is to one or two hundred volts depending upon the gas and electrode material used. It may also be arranged so that when the potential in the opposite direction rises to this same value the field will be already too weak for conduction. The tube will not then conduct in the wrong direction for any value of voltage up to that which destroys the insulation or otherwise allows the tube to flash over.

Certain other benefits may be obtained by the use of non-uniform fields; but the consideration of these effects will be reserved for later treatment.

Another model of the tube is shown in Fig. 4, and in Fig. 5 it is shown supplied with a permanent magnet and pole pieces for producing the axial field. A section of this design is also shown in Fig. 6

The inert, monatomic gases are preferable for filling these tubes, because of their lack of chemical action and low potential drop. Using helium and aluminium electrodes, the drop in the tube is in the neighbourhood of 150 volts. Under these conditions the disintegration of the electrodes is very slight when operating normally.

Since the cooling of the electrodes occurs largely by reason of the heat conductivity of the working gas, it is unnecessary to run the electrodes very hot in order to dissipate a considerable amount of loss. A tube 7 ins. (17·8 cm.) long, of the type illustrated above, will handle 230 milliamperes continuously with the electrodes well below a red heat. There will then be about 40 watts loss in the tube.

The output depends, of course, on the voltage being rectified. At 4,000 volts a current of 250 milliamperes represents an output of 1 kilowatt. Several amperes may be passed through such a tube for a short interval.

The voltage current characteristic of a tube depends largely upon its design. With the arrangement shown above, the voltage drop will rise about 10 per cent. from no load to full load.

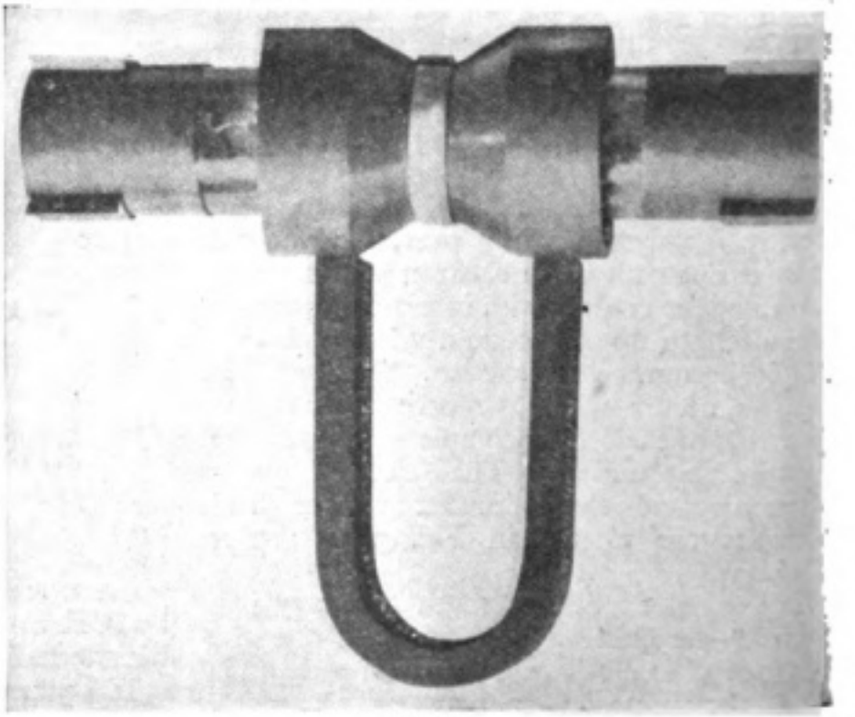


Fig. 5.

The wave form of potential delivered by a rectifier depends, of course, upon the circuit in which it is used. The "S" tube is a complete rectifier, as no appreciable current passes in the reverse direction. A practically constant drop of 150 to 200 volts is inherent in this particular design. By using polyphase connections, or condenser and inductance combinations, the ripple in the delivered voltage may be reduced.

As a rugged, long-lived, relatively inexpensive rectifier there will probably be many uses to which this tube can be put. In particular, it should serve as a convenient source of direct current for use in thermionic valve transmitters, particularly for high powers. It should make also a convenient piece of laboratory apparatus.

This paper is necessarily limited in its treatment to merely an introduction of the device. The authors will very much welcome any suggestions as to ways in which it will be possible to make this new instrument of greatest service to the practice of radio telegraphy and telephony.

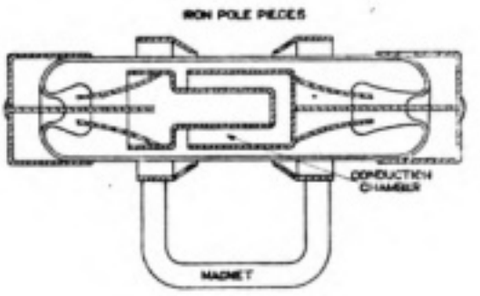


Fig. 6.

A Microphone Amplifier

THE instrument illustrated in Fig. 1, which is now on the market, is deserving of special attention. It is a new type of microphone amplifier, which is particularly suitable for use where it is desired to amplify speech or music before conveying it to a loud speaker. The instrument has the special feature of giving very great amplification without any serious distortion.

The instrument is operated with a 6-volt battery of dry cells, and the only other terminals are those for connecting direct from the output terminals of the wireless receiver and those provided for connecting a loud speaker of 120 ohms resistance. A diagram of the internal wiring of the amplifier is given in Fig. 2.

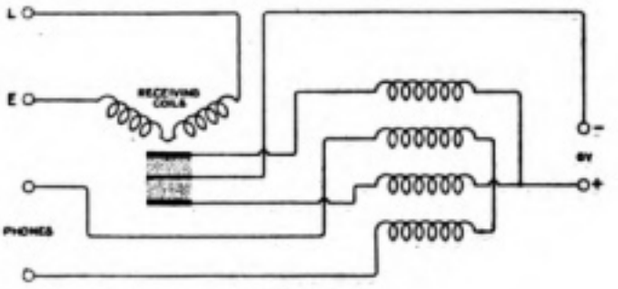


Fig. 2.

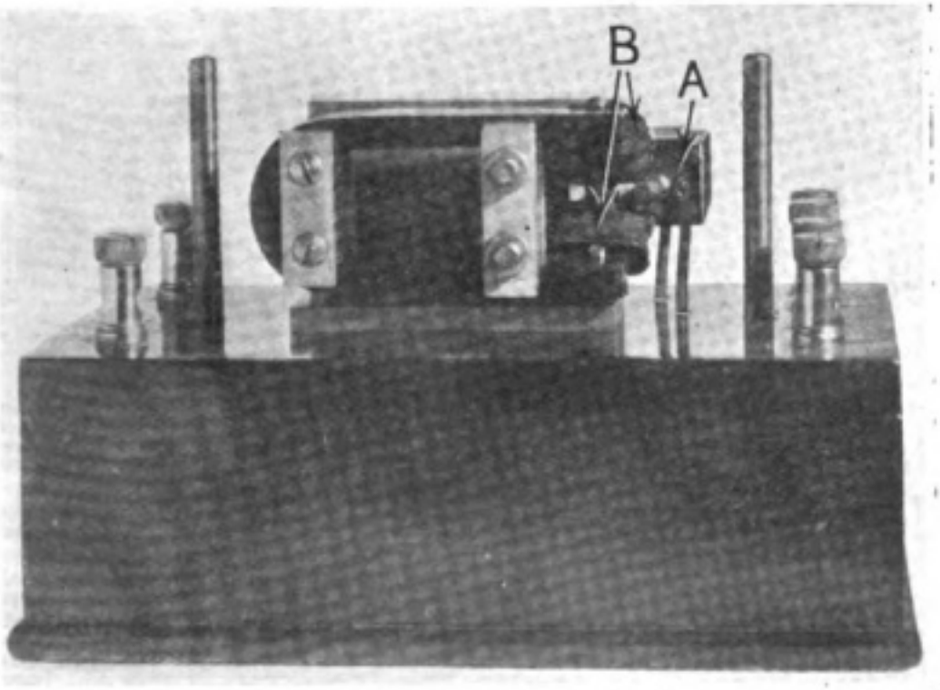


Fig. 1.

The microphone amplifier consists of a differential microphone connected to a reed, which is operated by an electro-magnet. The magnet is adjustable, so that its position can be varied in order to bring it as near as possible to the reed without actually touching.

The Equipment of 2 PV.

By G. SMITH CLARKE.

THIS station is of home construction, and may be described as a "universal" station as far as the wavelength range of the receiver is concerned.

RECEIVER.

In the receiving apparatus one to six valves may be used without the employment of any switches. There are three stages of high frequency amplification, using either transformer, resistance capacity, or reactance capacity coupling, easily interchangable. Next comes the detector valve, followed by two stages of low frequency amplification brought into circuit by means of jacks and plugs.

Condensers for transformer tuning may be plugged in across either primary or secondary.

Long wave tuning is done on home-made honeycomb coils available up to 30,000 metres. Short wave coils up to 500 metres are single layer *Litz* wound.

A switch is provided which gives either loose or direct coupling to the aerial, and a reversing switch is employed for reversing the direction of the reaction coil though reaction is seldom employed when H.F. amplification is used.

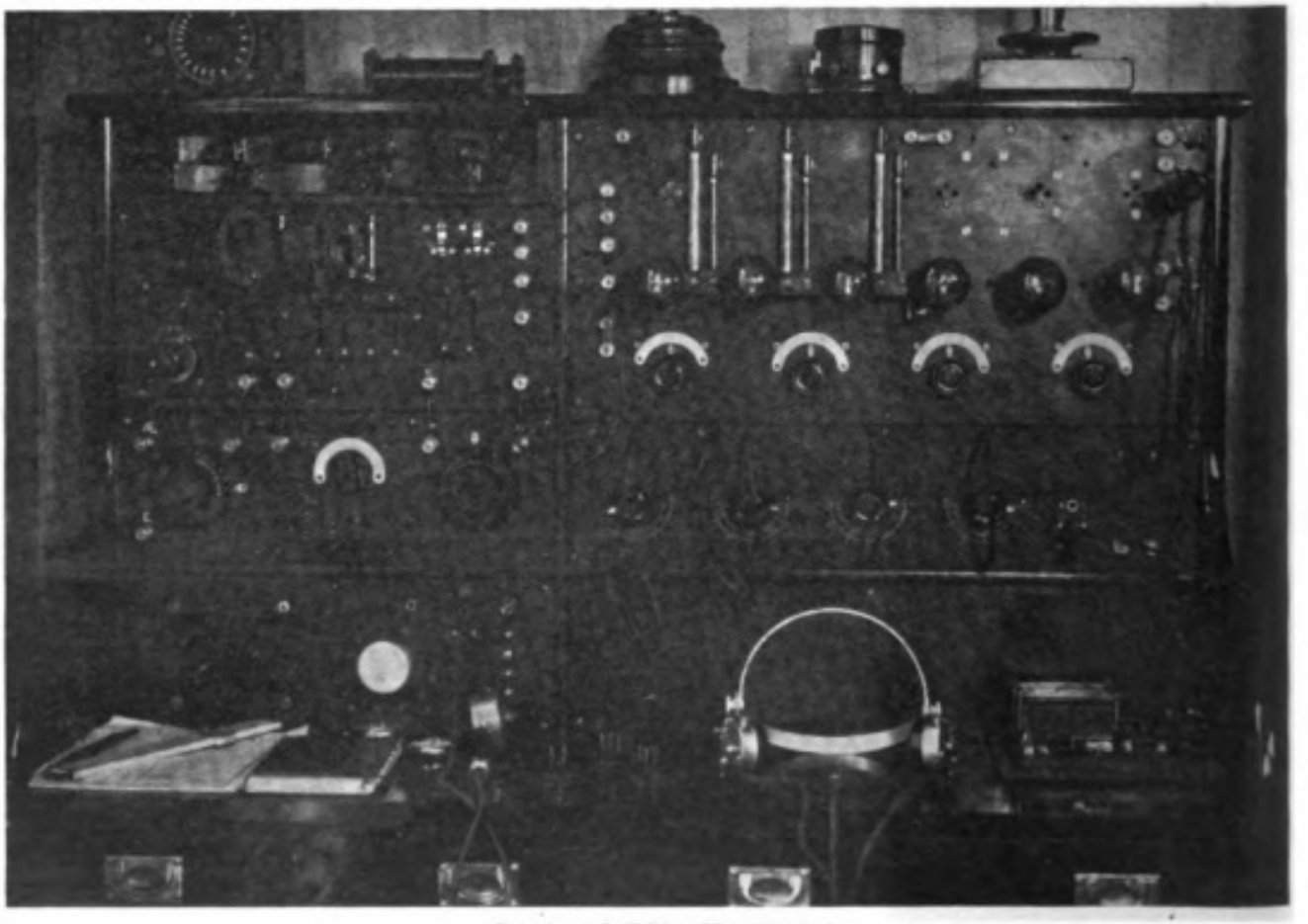
The aerial tuning condenser is of 0·0011 mfds. capacity, and the closed circuit condenser 0·00055 mfds. with a vernier 0·000001 in parallel. The condensers are Sullivan type.

THE TRANSMITTER.

The transmitter is built on the lines of the R.A.F. choke control set. It is licensed for use with artificial aerial only at present.

The circuits in use have been accurately calibrated.

All English and European stations can be read without the use of "phones," the Western Electric loud speaker (rewound to 120 ohms), working directly off the phone transformer. Several American stations can be



Station **2 PV**, *Kenilworth.*

read with phones on table. **FL** comes in with aerial cut off.

Telephony is very loud and clear; on six valves **FL** concerts and weather reports can be heard in the garden. The Dutch concert can be clearly heard 100 yards from the loud speaker, that is, just about as loud as Croydon, but much clearer. I have received telephony from the following amateur stations: **2 AW, 2 QU, 2 OQ, 2 HF, 2 KD, 2 IQ, 2 NA, 2 LG, 2 KQ, 2 SP** (or B), **2 NC, 2 DL, 2 ML, 2 KO, 2 ND, 2 FH** and **2 UY**.

2 PV. *Showing H.F. Intervalve Transformer in position.*

2 MT was very good on 700 metres, but is subject to a great deal of interference on 400 metres. Amateurs on 440 metres are coming in very strongly, while Marconi House on 360 metres is very nearly perfect in all respects.

Ever increasing numbers of "howling" sets are a great nuisance, and I think that at present this is the greatest problem in amateur radio, and one which should receive the earnest attention of every wireless society.

After much trouble with dry cells, I am now using Siemen's H.T.3 Leclanche batteries for high tension supply. These are excellent, and during the six months they have been in use have given no trouble of any sort. I shall never go back to dry cells.

Notes

A Visit from America.

Mr. Milton B. Sleeper, whose name is so well known in this country, as well as in the United States, has recently paid a short visit to England.

There is no doubt that Mr. Sleeper was much impressed with the quality and finish of wireless apparatus of British manufacture, and he expressed regret at being unable to extend his visit to the provinces owing to lack of time. Mr. Sleeper is a keen advocate of closer association between British and American amateurs, and we may be sure that on his part he will do all that is possible to bring this about.

Mr. Leon Deloy in London.

Mr. Leon Deloy, of **8 AB**, Nice, is visiting this country. His programme includes a number of calls on personalities in the world of amateur wireless, even so far afield as Aberdeenshire, where he is visiting Mr. Spence. We understand that after leaving England Mr. Deloy will go to Holland for the purpose of inspecting **PCGG**. We have had the pleasure of meeting Mr. Deloy in the company of Mr. W. J. Crampton.

Radio Telephone Range Tests.

The United States Bureau of Standards is planning to conduct comprehensive tests to determine the effective working ranges of radio telephone communication when using various kinds of transmitting and receiving sets. Preliminary plans have been outlined for this work, and some correspondence conducted in regard to it.

Dutch Concerts.

In view of the fact that changes in the wavelengths, etc., of the *Daily Mail* concerts from the Hague are anticipated, details are omitted from our calendar this week; though it is understood that there will be no interruption of these concerts.

Competition at the Concours Lepine.

Competitions of Industrial inventions are held annually at the Concours Lépine which was founded by the late Prefect of the Seine in 1901. This year wireless will form the subject of one of the competitions. Exhibitions will be held on the Champ de Mars from August 25th to October 2nd, of all kinds of wireless receiving apparatus and of processes of manufacture. Experts are to lecture on wireless subjects.

Berne Wireless Station. The "Leading-in" Insulators for Aerial and Earth Screen and Ordinary Ground Earth.

New American Direction Finding Stations.

Nine American companies interested in the manufacture of radio direction finders met at the Bureau of Standards to confer with the Assistant Secretary of Commerce, the Bureau of Lighthouses, and the Bureau of Standards, regarding the production, cost, installation, calibration, and maintenance of radio direction finders on ships.

It was announced that the Department of Commerce has decided to install the following stations for the purpose of direction finding: Boston, Nantucket, Cape Charles, Columbia River, Puget Sound, and, if funds are still available, Delaware Bay, Los Angeles, and Blunt's Reef. These are in addition to the two new stations at Diamond Shoal (off Cape Hatteras) and San Francisco Light Vessel. Three other stations have been in operation in the vicinity of New York Harbour for over a year at Ambrose, Fire Island and Sea Girt.

As a result of the conference, arrangements will be made through the Bureau of Lighthouses, between the manufacturers of radio direction finders and the operators of steamships for the trial and demonstration of direction finding equipment produced by the several manufacturers under conditions of practice.

Eiffel Tower Weather Warnings.

When the weather reports are received by the Eiffel Tower the forecast is issued locally by bell. Three strokes announce rain, six frost, ten storm or hail. Meteorological reports are issued by wireless telephone daily, at the following hours, 0450, 1215, 1810. The wavelength used is 2,600 metres.

Shipping Conference Report on Wireless at Sea

At the International Shipping Conference three Committees were appointed one of which was to examine the question of life-saving appliances and wireless telegraphy. The reports of these Committees are now issued.

With regard to wireless, it was decided to recommend amendments for the purpose of allowing partial as well as total exemption for coasting and short sea trade vessels, and for permitting of the installation of an automatic calling apparatus under prescribed tests as to efficiency. With regard to the choice of navigational instruments for directional wireless, the Committee think that shipowners may, without risk, be left to choose their own time and method for its adoption, and that the fewer Government regulations that are applied to it the more satisfactory will be its development.

Book Received

TECHNICAL ELECTRICITY. By H. T. Davidge, B.Sc., M.I.E.E., and Robert W. Wutchinson, M.Sc., A.M.I.E.E. (London: *W. B. Clive, University Tutorial Press, Ltd., High Street, New Oxford Street, W.C.* Pp. 514. 8½" × 6". 10s. 6d.)

Wireless Class Formed at Huddersfield.

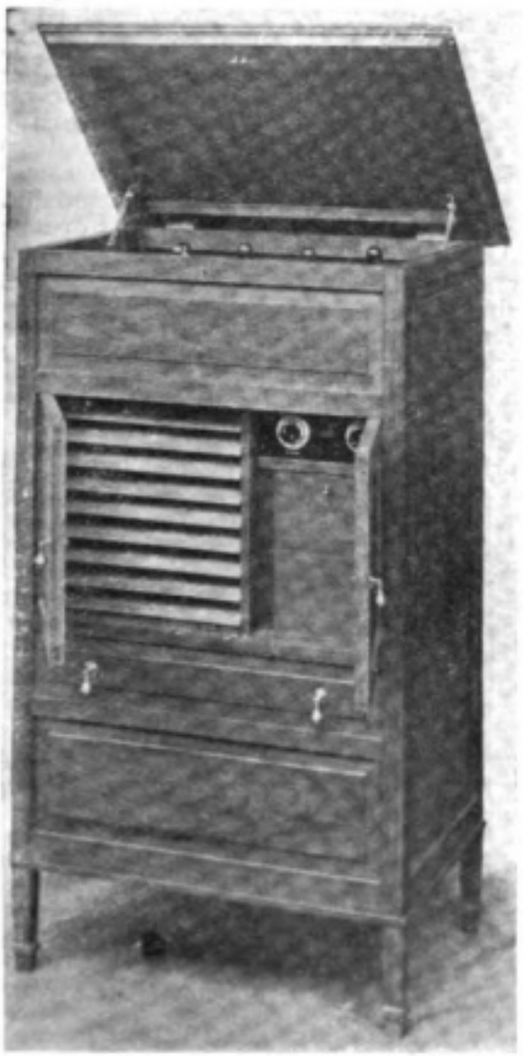
Wireless telegraphy and telephony are to be taught at a special class to be formed at the Huddersfield Technical College providing a minimum of fifteen students agree to attend. Such is the decision of the Education Committee of that town.

Cost of Swedish Station.

A Stockholm report says that the wireless station which the Radio Corporation of America will erect on the West Coast of Sweden is to cost 3,700,000 crowns. It is expected that the station will be completed next year.

French Army Grand Manœuvres.

Experiments are to be conducted in wireless telegraphy and telephony in conjunction with the grand manœuvres of the French Army, which will take place between September 10th and 18th.



A Broadcast Receiver de Luxe.

The accompanying photograph is of a Broadcast Receiver which is being manufactured by Marconi's Wireless Telegraph Company, Ltd. As can be seen from the illustration, the valves and other apparatus are contained in the top where the turntable of a cabinet gramaphone, which the instrument resembles, would ordinarily be located.

Useful Wireless Plugs and Jacks.

The accompanying illustration shows a very useful design of plug to be used in conjunction with jacks of a type of which a number of different designs are marketed.

The use of plugs and jacks gives a very neat appearance to a finished set, and this particular type requires only one hole for fixing in the panel. All sorts of switching can be condensed into small space, and plugs and jacks may be used for such purposes as switching in filament, connecting across different valves, disconnected intervalve transformers at the point of insertion, etc. The jacks illustrated have nickel silver springs with sterling silver contacts, and the plugs, which are soundly constructed, have a special type of grip for taking the flexible leads.

New Companies

Among the new private companies which have just been registered are the following:—Messrs. G. F. Sugden & Co., Ltd., capital £5,000 in £1 shares, electrical engineers, telegraphy, telephony, radio-telegraphy and radio-telephony engineers, etc. Secretary, Mr. G. F. Sugden, 9, Albert Square, Manchester. Scottish Wireless Telephone Supplies, Ltd., capital £1,500 in £1 shares, to manufacture buy and sell apparatus appertaining to wireless installations (telephone or telegraphic), etc. Registered office, 82, Crown Street, Aberdeen. South Wales Wireless Installation Co., Ltd., capital £2,000 in £1 shares. To carry on business as indicated by the title. Secretary, Mr. W. H. Liles, 18, West Bute Street, Cardiff.

Calendar of Current Events

Saturday, September 2nd.

CROYDON WIRELESS AND PHYSICAL SOCIETY.
Meeting.

Monday, September 4th.

ILKLEY AND DISTRICT WIRELESS SOCIETY.
8 *p.m.*—At Regent Café, Cowpasture Road, Ilkley, Morse Practice.

Tuesday, September 5th.

Transmission of Telephony at 8 *p.m.*, on 400 metres, by **2 MT**, Writtle, near Chelmsford.

Friday, September 8th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
8 *p.m.*—Lecture on "Automatic Telephony," by Mr. H. Mortimer.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
8 *p.m.*—At Erith Technical Institute, General Meeting and enrolment of members.

Secretaries of Societies are reminded that Notices of forthcoming Meetings must be received at least ten days before the date of publication of the issue in which the Notice is to appear.—[ED.]

Wireless Club Reports

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

The Wireless Society of Hull and District.*

Hon. Secretary, 16, Portobello Street, Hull.

On August 14th, Mr. J. Nicholson gave a most instructive lecture on "Accumulators, their Use and Abuse." The chair was occupied by Mr. Hy. Strong, Acting Vice-President, and there was a fairly good number of members present. At the outset the lecturer apologised for not being in a position to impart some information on the subject that he had specially wished to obtain, that is with regard to the process of the manufacture of the plates, etc., but he hoped to do so in the future. After speaking about the various component parts of a modern type of accumulator, he then dwelt at some length upon the treatment which this article should be given if one wished to obtain the best out of it. He related a number of cases in which accumulators had been completely ruined by the first charge and emphasised the fact very strongly to all present that it is the first charge given to this article which determines its future usefulness. Mr. Nicholson knows his subject well as he daily comes in contact with all classes of this work.

The lecture proved very instructive to all present, and a number of members joined in the discussion which followed.

Mr. Nicholson was accorded a vote of thanks for his lecture.

Several new members were elected, including the first lady. They were accorded a hearty welcome.

Meetings of the Society are now held on the second Monday and the fourth Friday in each month, at the Signal Corps Headquarters in Park Street, where intending members will be welcomed.

Radio Experimental Association (Nottingham and District).*

Hon. Secretary, Mr. F. E. Bailey, 157, Trent Boulevard, West Bridgford, Notts.

A monthly general meeting of the above Association was held on July 27th, in Room 74, Mechanics' Institute, Nottingham.

Mr. Carpenter had consented to lecture during the evening, and very kindly continued his lecture on "Wireless during the War," dealing this time, however, with C.W. work only. From the drawings and diagrams which Mr. Carpenter presented, it was evident that he had spent considerable time in compiling same, and the lecture was most interesting and instructive. The lecturer clearly explained the functioning of each component part of the C.W. sets used chiefly in France during the war.

Mr. Carpenter also exhibited a German transmitting and receiving set combined, and explained details of construction which were very interesting.

At the close of the meeting Mr. Thornton proposed a hearty vote of thanks to the lecturer, in which all heartily concurred.

The next meeting will be held in Room 74, Mechanics' Institute, Nottingham, at 7.30 p.m. on Thursday, August 31st.

Any persons in the Nottingham district who are interested in Radio-telegraphy and telephony, and are not yet members, will receive full particulars on application to the Hon. Secretary.

Wireless Society of Highgate.*

Hon. Sec: Mr. D. H. Eade, "Gatra" 13a, Sedgemere Avenue, East Finchley, N.2.

On Fridays, July 21st and August 4th, Mr. J. F Stanley, B.Sc., gave the fifth and sixth of his series of lectures on the theory of wireless. In these he dealt very fully with the valve and its action, outlining the electron theory and then going on to deal with characteristic curves. He showed how by operating the valve on various points of its curve, rectification or amplification could be obtained. After going thoroughly over this ground, Mr. Stanley explained and contrasted amplification at high and low frequencies, and finally described the special methods of reception necessary to receive continuous wave signals.

On July 28th, Mr. F. L. Hogg gave the second of his lectures on the construction of wireless apparatus. He dealt with the various methods by which a one-valve set could be increased to form a multi-valve set, and described fully the various types of high and low frequency amplifiers.

Membership of the Society is still increasing and there are now over 50 members. Meetings are still being held regularly each Friday evening at the Highgate Literary and Scientific Institution, South Grove, Highgate, N., and will continue throughout the summer; and as soon as the holiday season is over the autumn programme will be arranged, and should prove of considerable assistance to members, especially those who are comparatively beginners in the subject.

The Honorary Secretary will be pleased to receive enquiries regarding membership, or will be pleased to see intending members at the Institution on Friday evenings between 7 and 9.30 p.m.

Stoke on Trent Wireless and Experimental Society.*

Hon. Sec. Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of this society on Thursday, August 17th, Mr. R. W. Steel (Asst. Hon. Sec.) was appointed as third member of the Technical Committee. It was decided to appoint another member on the Working Committee, and as there is a fairly large Students' section, to have a Students' representative on the Committee. Mr. Schofield was accordingly elected as the Students' representative.

A resolution was passed to co-operate with the

Y.M.C.A. and assist them in every possible way on the occasion of a lecture and demonstration on Wireless which they propose to hold in November. The Society also proposes to hold an Exhibition and Demonstration late this year, or early in the new year.

Arrangements are to be entered into to secure the services of lecturers from several Wireless Societies during the coming season.

Several members complained of the interference caused by some local amateurs, who when listening-in to wireless concerts, cause their sets to "oscillate" and so interfere with the reception of the concerts by other amateurs in the district. It was thought that these amateurs were doing a great deal of harm to amateurs in general, and, if the practice continued the Postmaster-General would prohibit the use of regenerative circuits altogether. This needless annoyance was, no doubt, not caused purposely, but was due to the ignorance of the owners, for while a set is oscillating it is impossible to receive properly. If these unwitting defaulters consulted their friends who had wireless receiving sets and knew how to use them, or joined a wireless society, they would soon learn how to avoid this trouble, with satisfaction to themselves, and to those with whom they were interfering. It was suggested that, with the aid of direction finding apparatus, to locate these offenders and to warn them of the nuisance they were causing, and if the practice continued after that, to report them to the Postmaster-General. It was decided to send an official protest to the Wireless Society of London.

It was much regretted that up to the present the necessary permission to proceed with the erection of the aerial had not been received. It is hoped that this will be remedied in the near future

The meeting closed after a little buzzer practice

Stockton and District Amateur Wireless Society.

Hon. Secretary, Mr. W. F. Wood.

The usual monthly meeting was held in the Concert Hall in the Malleable Workmen's Institute, Stockton, on Thursday, August 10th, under the presidency of Mr. J. Mulcaster, supported by Mr. S. G. Marston, Vice-President, and members of the Committee. After the usual business had been transacted the President distributed the prizes given by members of the Society for the most expert readers of the Morse code, open to members under the age of eighteen years, and which were deservedly won by Mr. R. Burnand and Mr. J. E. Laven.

The rest of the evening was taken up by a lecture given by Mr. W. B. Ward (of the Middlesbrough Wireless Society) on "High Frequency," which was illustrated by apparatus kindly brought specially by the lecturer for this meeting.

A vote of thanks was proposed by Mr. Mulcaster and seconded by Councillor Elliott which was enthusiastically endorsed by the many members present.

The Beckenham and District Radio Society

Secretary: Mr. J. F. Butterfield, 10, The Close, Elmers End, Beckenham.

The above Society is now in full swing. Although such a short time has elapsed since the inaugural meeting over thirty members have been enrolled, and many applications for membership are being received. At a general meeting held on Thursday, August 17th, it was decided to hold the meetings at 114, High Street, Beckenham (at the side of the "Dorothy" Tea Rooms), on Thursday evenings at 8.15 p.m.

A Committee was appointed to draw up Rules and also to arrange a syllabus of Lectures and Demonstrations.

On Saturday, August 19th, the Society gave a very successful demonstration at the Annual Fete of the Beckenham Allotment Society held at the Technical Institute, when by Special Permission of the P.M.G. Lieut Walker (2 OM), Brentford, kindly transmitted music at various intervals which were received perfectly and with marked satisfaction by a very large number of "listeners-in" of all ages.

This Society bids fair to be very popular in the district, many applications for membership being received at this demonstration. A junior section has been formed for those under the age of 18. Ladies are also welcomed as members.

All applications for membership should be addressed to the Hon. Sec.

Barnoldswick Wireless and Technical Society.

Hon. Sec. Mr. J. Balderston, 6, Clough Terrace, Barnoldswick.

A meeting of the above Society was held on August 16th at the Gladstone Liberal Club. At the termination of the usual 30 minutes buzzer practice, a Lecture was given by Mr. A. G. Petty, B.Sc., entitled "Magnetism."

The lecture was delivered to a very enthusiastic audience, and was augmented throughout by very interesting and highly instructive experiments. The members are exhibiting a keen appetite for technical knowledge. Rapid progress is anticipated, and thanks to the fact that several of the members are skilled in scientific matters, the provision of suitable lectures does nor present any difficulty.

The Secretary solicits applications for membership from any gentlemen in the locality.

Bridlington and District Wireless Society.

Hon Sec. Mr. M. Horspool, Darley, Marton Road, Bridlington.

The first meeting takes place at the Liberal Club, Quay Road, Bridlington, at 8 p.m., on Thursday, August 31st. All who are interested are invited to attend.

Fulham and Chelsea Amateur Radio and Social Society.

Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W. 6.

A meeting was held on August 15th. The minutes of the previous meeting were passed and the rules of the Society read, each rule being dealt with separately and passed unanimously, except rule 10. A suggestion that the entrance fee from a continuing visitor, if finally becoming a member, should be deducted from his account was agreed upon.

A visitor, Mr. Witts, asked as to the liberty of a visitor speaking at any meeting, and Mr Martin (the Financial Secretary) suggested an addition to rule 15, which was carried and will appear in the rules.

Mr. Cox was elected Treasurer. Mr. Martin, Financial Secretary, Messrs Saunders, Hawthorn, Johnson and Reginald Wiggins to the Committee.

The electing of one lady for the Committee was postponed until sufficient ladies were present.

Mr. Mather and Mr. Butterworth were elected Auditors.

All the above elections were passed unanimously. The meeting then closed with a vote of thanks to the Stanley Ward Conservative Club for once again loaning their room.

The nett receipts for the evening were £4 17s. 6d. Members enrolled, 37 gentlemen, two ladies, and 4 juveniles. From Fulham 20, Chelsea 12 and outside area 11.

St. Barnabas Wireless Club

Hon. Secretary. Mr. B. H. Hardy, 26, Pound Lane, Epsom.

This Club has changed its name from the Epsom and District Radio Society to St. Barnabas Wireless Club.

On August 7th, Bank Holiday, a Fete was held at Woodcote House, Epsom, in aid of the Epsom and Ewell Cottage Hospital, and the St. Barnabas Wireless Club gave Demonstrations in Radio Telephony from 3 p.m. until 8 p.m.

The set used on this occasion was a five-valve (1 H.F., 1 Rect., 3 L.F.) receiver loaned to the Club by a member, Mr. H. Penfold, the results obtained being highly successful. Unfortunately the clubs loud speaker went out of action immediately before the demonstration with the result that about eight pairs of phones had to be utilised in its place. With this arrangement, however, 150 to 200 people were able to listen-in during the course of the afternoon to telephony including the two excellent Marconi concerts at 5 p.m. and 6 p.m.

It is hoped that the efforts of the Club added to the success of the Fete.

The club holds meetings on Mondays and Thursdays from 8 to 10 p.m. in the Parish Room, Hook Road, Epsom.

Otley and District Wireless Society.

Hon. Secretary, Mr. N. Weston, 24, Guycroft, Otley, Yorks.

The meeting on Thursday, August 17th, was not very well attended, due no doubt to holidays.

In the absence of the Chairman, the Hon. Sec. opened a discussion on type of set to be built for the Club's use. After an interesting discussion it was decided to atart on a five-valve set, 2 H.T, rectification and 2 L.T, with a multiple tuner. The scheme is an ambitious one, as even transformers are to be wound by amateur members. It is earnestly requested that all members endeavour to find more suitable quarters than those at present occupied, as facilities for proposed aerial are restricted.

Bishop's Stortford and District Amateur Wireless Association

Hon. Secretary, Mr. J. Cooper, Halfacres, Bishop's Stortford.

A meeting was held at Halfacres, Bishop's Stortford, on Friday last, when Mr. W. S. Filby occupied the Chair. A paper was given by the Secretary, Mr. J. Cooper, entitled, "Notes upon the Construction of a Simple Receiving Station." This was illustrated by blackboard sketches and dealt with aerial and earth systems, tuning apparatus and crystal rectifiers. Parts of the apparatus described were passed round for inspection, and it was shown that any amateur with ordinary mechanical skill could make up an efficient set capable of receiving distant morse signals, the Writtle concerts and telephony within a radius of 30 miles. The apparatus designed for use with the crystal was such as could be adapted later for use with valves, and this conversion will be the subject of a subsequent lecture. On the motion of Mr. Attree, seconded by Mr. Rose, a vote of thanks was accorded Mr. Cooper for his paper.

Communications should be addressed to the Hon. Secretary.

The Durham City and District Wireless Club.

Hon. Secretary, Mr. Geo. Barnard, 3, Sowerby Street, Sacriston, Durham.

The fourth meeting of the above was held at headquarters (Y.M.C.A., Claypath), on Friday, August 18th. The meeting was well attended, several new members were enrolled. It was very pleasing to note the presence of lady members, and also to hear that more are coming along. The chair was very ably taken by the Rev. T. H. Perkins, of Shadforth.

After the minutes were read and passed a most interesting lecture was given by Mr. Geo. Barnard, the Hon. Secretary, on "The Production of High Frequency Oscillations." He confined his remarks chiefly to the "spark" method, leaving the more advanced "valve" transmission to be discussed at a future meeting. After pointing out clearly the difference between static charges of electricity and electro-dynamics, he demonstrated the effects of static induction and described thoroughly the action of a condenser.

Frequency, amplitude, wavelength and damping were shown diagrammatically upon the blackboard. Inductance and capacity were explained in a most elementary fashion, the lecturer using several helpful analogies. Open and closed oscillatory circuits were shown upon the blackboard. The methods adopted to vary the amount of inductance and capacity, hereby varying the wavelength produced, were also shown.

The lecturer was heartily thanked. After the announcements a most lively discussion took place. Questions were asked concerning the last lecture on "The Electro-Magnetic Theory," and also upon the lecture just given. Atmospherics were discussed, and the secretary pointed out the advantage of a "double pole change-over switch," so that the apparatus could be disconnected from the aerial at will, at the same time connecting the aerial to earth, the aerial when so connected acting as a first-class lightning conductor.

Mr. Sargent, F.R.A.S., of the observatory, Durham, has consented to give a lecture at some future date.

It was decided to hold the meetings every Friday. The fourteen days interval, however, would still be adhered to between the important meetings, leaving the alternate Fridays for Morse buzzer practice, demonstrations and discussions of minor importance.

The meetings are still open for intending members. It is hoped shortly to organise a field day also a social evening. Another meeting held on Friday, August 25th, consisted of buzzer practice, five-minute speeches and small demonstrations with apparatus kindly lent by Mr. S. Kelly (Hon. Treasurer). The merits of a free library for the members will also be discussed.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.

In view of the serious interference which an oscillating receiver can cause to all other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of this issue.

We strongly urge readers who are making or using sets of the usual reacting type to either (1) reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate ; or (2) to cut out their reaction entirely.

"C.L.B." (South Norwood) *makes enquiries about four previous questions submitted.*

These questions were dealt with in reply No. 44 of this series.

"J.B." (Dublin) *asks (1) For criticism of a four-valve set. (2) If any advantage would be gained by using a grid potentiometer as well as, or in place of a grid condenser. (3) How to arrange for reaction in a resistance capacity circuit given to "W.D." on page 303 of June 3rd issue. (4) What telephony and Morse stations should be heard on four valves.*

(1) Quite O.K. (2) Potentiometer might with advantage be added to the first two valves, condenser and leak being retained for the third. (3) Put the reaction coil in the anode circuit of the third valve and couple it to the loading coil. (4) Not many at present. You might hear **2 LO, 2 MT** and **PCGG** with an open aerial, but hardly with a frame.

"CAUTIOUS" (Essex).—We regret that we cannot advise you on questions relating to patents.

"R.G.W." (Wimbledon) *asks (1) If H.F. variable transformers give the best all-round efficiency. (2) For a circuit to fulfil certain requirements. (3) Using a 6-volt accumulator what is the minimum number of filament resistances required.*

(1) Quite a good method, but not capable of covering as long ranges of wavelength as either resistance capacity coupling or interchangeable plug-in transformers. (2) A suitable circuit is shown in Fig. 7, page 438, July 1st issue, which includes the switching arrangement asked for. (3) One only is needed, although an additional separate control to the rectifier is sometimes useful.

"C.L.W." (Johannesburg).—(1) Two H.F. and one detector would be best, but we know of very little telephony in prospect which will have an effective range of 1,000 miles. (2) The use of resistance-capacity coupling saves the provision of a number of interchangeable transformers to cover various wavelengths, but it is very insensitive below 1,000 metres.

"A.L.W." (Sheffield) *asks (1) With reference to a reply to "L.H." (Mansfield), in June 10th issue, what would be a suitable A.T.I. (2) If a potentiometer referred to in the reply is correctly connected. (3) Data for making the transformer in the same diagram. (4) Range of set described, and if it would receive* **2 MT** *and* **PCGG.**

(1) 9" × 6" of No. 22. (2) Potentiometer is quite correctly wired in. It need not be added if zincite-bornite is used. (3) For the intervalve transformer use a core ½" × 4" of iron wires, with windings of 1 oz. and 3 ozs. of No. 44. An additional telephone transformer of normal type must be provided if L.R. telephones are to be used. (4) Up to about 30 or 40 miles from a broadcasting station. This set is unsuitable for **2 MT** or **PCGG** at the disiance. The circuit of Fig. 3, page 501, July 15th issue, is much better.

"IRIS" (Derby).—The aerial arrangement submitted appears to be the best that can be done in regard to the tram lines, but we are afraid that induction may be bad, particularly with a five-valve set. We do not think you will be near enough to any broadcast station to get good results on a single valve set.

"M.G." (Clifden).—We are afraid your requirements are rather vague. We cannot give detailed instructions for making a set in these columns, but the circuit might be as in Fig. 1, page 404, June 24th issue. A.T.I., 9" × 6" of No. 22. Coupling coil, 3" × 3" of No. 22. Closed circuit coil, 7" × 5" of No. 26. Condenser, 0·0005 mfds. Crystal—carborundum. Aerial as long and high as possible, up to 100'.

"A.W.M." (Peckham) *has a Type 2846, serial 74, Marconi Wireless Set, and asks if it is possible to convert it into a crystal receiving set.*

We are unable to identify this set from the figures you give, which do seem possible to use. If you will let us have some description of the instrument, giving as much electrical information as possible, we shall be pleased to advise you.

"W.B." (King Williamstown) *asks* (1) *For a diagram to convert a type 16 Marconi crystal set into a one-valve set.* (2) *If 220 volts A.C. transformed down to 8 or 3 volts to put through a motor-car induction coil would be suitable for short range transmission.* (3) *If there is such a thing as being screened from a station, the cause of it and if it can be overcome.* (4) *If his crystal battery terminals should be shorted when no battery is used.*

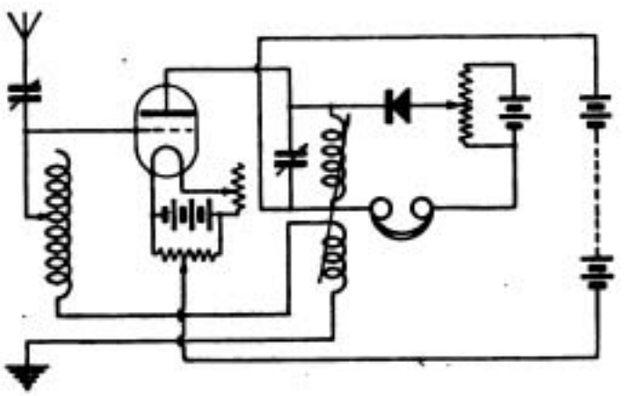


Fig. 1.

(1) Alter the set to the diagram shown (Fig. 1). (2) Probably, but we cannot give exactly voltage to step down to, as this would depend on the winding of the coil. (3) Screening does occur in special cases as, for instance, by the presence of a mountain mass between transmitter and receiver. In other cases cause may be very difficult to ascertain, and when ascertained it may be difficult to remove. (4) Present arrangement of crystals is O.K. It is not necessary to short the battery terminals when no battery is employed.

"R.G.P." (Salford) *asks* (1) *Winding data for certain slab inductances.* (2) *If a variometer tuner is suitable for receiving telephony with a three-valve amplifier.* (3) *Winding details for certain H.F. transformers.*

(1) With a series condenser of 0·001 mfds. the coils should have the following number of turns—25, 50, 80, 125 and 150. (2) Yes. (3) We cannot give the exact data, as the values vary considerably with slight differences in the way the wires fit on. Try ebonite formers 1½" diameter, with windings varying from 30 turns per coil to about 220, winding one coil over the other with insulation of varying thickness of paper.

"OSMOSIS" (Leeds) *asks* (1) *Amount of No. 26 wire and size of former for H.F. inter-valve transformers of broadcasting wave.* (2) *For diagram of a one-valve telephone transmitter for five miles range.* (3) *Where to purchase a Johnson-Rahbek loud speaker.* (4) *How to listen-in on his own transmission with a telephone transmitter.*

(1) About 40 turns on a former 5½" diameter for each winding, windings separated by two or three layers of paper. Exact adjustment must be made by experiment. (2) See diagram (Fig. 2).

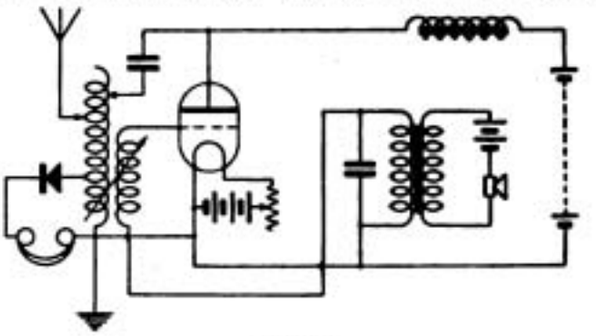


Fig. 2.

(3) We do not think this instrument, which is covered by patents, is on the market, at any rate in this country. (4) Crystal and telephones might be tapped across a few turns of the A.T.I. as shown in the diagram.

"A.C.M." (Brazil) *asks* (1) *How to add slab inductances to the Marconi 70a tuner to obtain a wavelength up to 20,000 metres.* (2) *How to insert a crystal in place of a "Q" valve in the Marconi 55F amplifier.* (3) *Address of agent for reliable firm of American wireless telegraphy instrument makers.*

(1) The tuner is not suitable for alteration in this way without opening up and introducing suitable coils in each circuit. It would be much simpler to make an entirely fresh tuner for the purpose. (2) This also cannot be done without extensive structural alterations to the instrument. You might, of course, tap off a lead to the anode of the last H.F. valve through a crystal and telephones and back to the H.F. positive. (3) We do not know of agents holding stocks of American goods.

"G.B." (Acton) *asks* (1) *For a diagram of his two-valve circuit and panel.* (2) *If it would receive* PCGG.

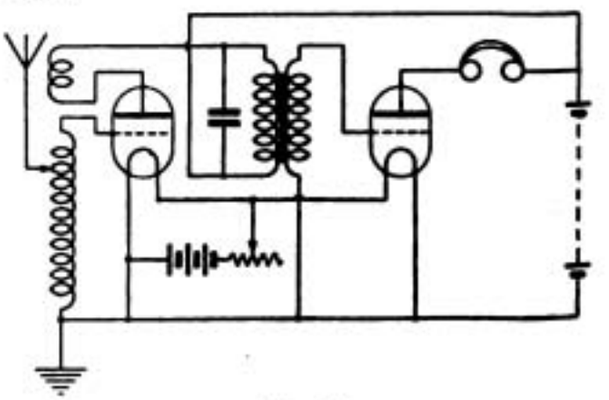


Fig. 3.

(1) We cannot say how your panel *is* wired up, but it *might be* wired as in the diagram (Fig. 3), which gives the complete circuit as requested. (2) It should do so on the new power to be used.

"H.W.P." (Birmingham) *is having difficulty in short wave reception, and asks* (1) *For alterations in the connection of his three-valve receiver, to admit of either one valve being used alone, or all three.* (2) *For criticism of his circuit and way of getting improvement in the reception of amateur telephony.* (3) *Switching arrangements for connecting aerial tuning condensers either in series or parallel.* (4) *Probable reason why he does not receive signals sufficiently loud for operating a loud speaker.*

(1) See Fig 4. (2) Your diagram is rather involved and somewhat difficult for us to follow. Why have you connected your two condensers in parallel? A closed circuit condenser is much too large for use as a Vernier. The smaller condenser might be used with advantage for tuning reaction circuit and should be bridged across its ends. I think your main trouble is due to inability to tune critically, mainly because your plate circuit is not provided with a tuning condenser. Ebonite extension handles on the condensers would facilitate critical tuning. (3) This is shown in the diagram. For short wave telephony reception it is essential that you should connect the variable condensers in series with the aerial tuning inductances. (4) Your aerial is not very high, and is lower than both house and tree, which is not the best arrangement. Cannot you arrange to erect a light mast on the roof, as shown on p. 260, May 27th issue? And cannot you arrange to erect a two-wire aerial?

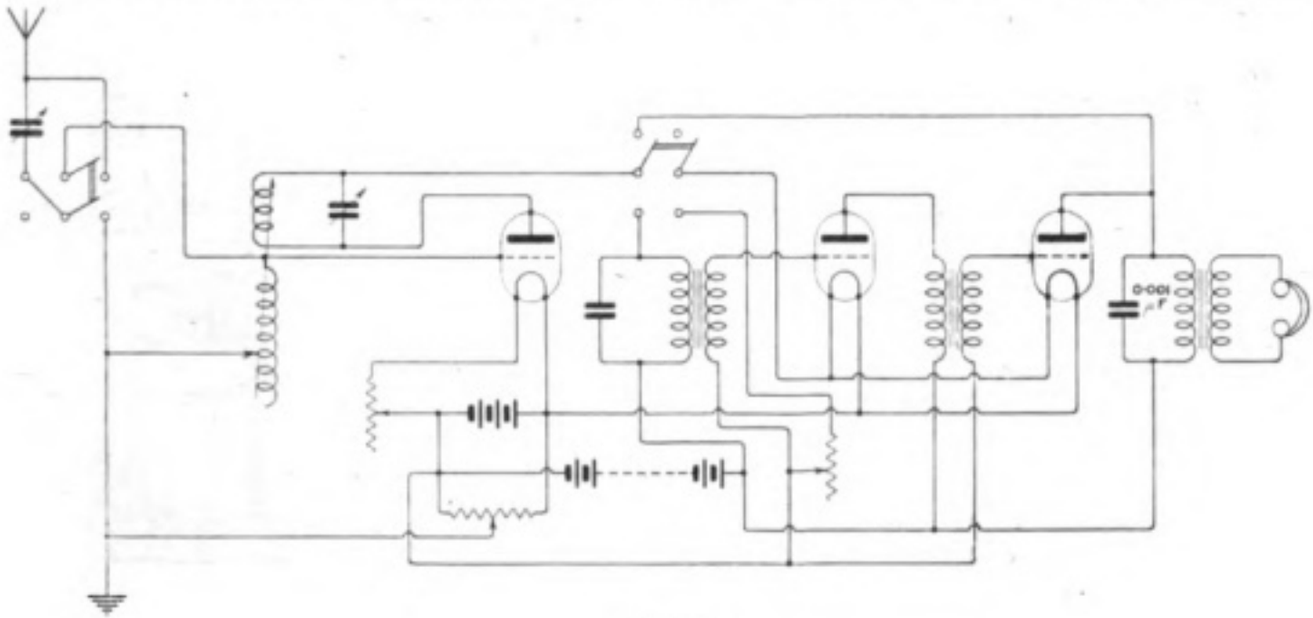


Fig. 4.

"J.H.C." (W.4) *asks* (1) *For an explanation of the process of "tuning in."* (2) *Whether a low frequency valve amplifier can be used for increasing the strength of signals in an ordinary telephone receiver (not wireless).*

(1) To completely describe the process of "tuning in" signals is rather beyond our scope. If you could find a friend who could give you a few minutes' tuition, you would easily grasp the whole process, and the help that you would gain from him would be far more than we could give you in ten pages. In brief, you should insert tuning coils in the three-coil holder whose wavelength ranges tally with one another. The filaments should be of brightness nearly equal to that of the usual metal filament lamp. Condensers must be moved until signals are heard, and then further varied to improve the signal strength Increases in the value of the aerial tuning condenser should be accompanied by increases in the value of the reaction tuning condenser and closed circuit tuning condensers. The reaction coil should be moved away from the closed circuit coil as far as possible, as this will eliminate re-radiation, and at the same time probably produce greater signal strength, and finally, readjustment of the various condensers may be made during reception. (2) Yes. A 3 or 4-valve low frequency amplifier can be connected in place of the ordinary telephone receiver of the ordinary land line telephone, and the output terminals connected to the loud speaker as you propose; or if it is only your desire to produce speech of great intensity, a microphone battery and step-up induction coil are connected in series. The secondary of the coil is taken to the grid of the first low frequency valve the remainder of the connection being as is usual in a low frequency amplifier. For producing speech by this method of intensity considerably above that of the ordinary voice, you will require at least five valves, and as a result there may be some distortion, unless specially designed intervalve transformers are used. Of course, telephony is always considerably distorted by the loud speaker itself.

"J.E.R." (Kingsbury) *wishes to make a crystal set and asks* (1) *If the coil in the Reinartz Tuner can be oval or rectangular, using the same quantity of wire as given in the issue of May 13th.* (2) *If a crystal could be used with this tuner and valve added later.* (3) *Can celluloid be used as an insulator.* (4) *Would three wireless stations within five miles give a beginner any trouble.*

(1) Yes, if desired. The wavelength range will come out slightly different according to the shape employed. (2) No, not at all effectively. (3) Celluloid is not a very good wireless insulating material, but may be used if nothing better is available. (4) Probably not, at any rate on a

crystal set, but we should advise using a two-circuit loose coupled receiver.

"A.T.I." (Ealing) *asks* (1) *Of what height must his aerial be to be efficient.* (2) *If a twin or single wire aerial is the better.*

(1) The aerial must not be less than 20′ high, preferably 30′. *N.B.*—You cannot use reactance with a crystal set. (2) Use a twin wire, 7/24 or similar size of silicon bronze or galvanised steel will be suitable.

"T.H.B." (Holyhead) *gives a list of parts and asks if they can be made into a set; if so for suitable dimensions.*

0·0005 mfds. condenser. Potentiometer former, 6″ × 1″ wound with No. 36 Eureka. Tuning inductance, double slide, 9″ × 6″ of No. 22.

"A.W.S." (Tooting) *asks for criticism of a circuit and whether the values employed are correct.*

The circuit is O.K. and the values are quite suitable except that the parallel A.T.C. should not be used at short wavelengths.

"C.F.H." (Nottingham) *asks* (1) *For a circuit diagram of a five-valve receiver embodying* 2 *H.F.,* 0 *rectifier, and* 2 *L.F.* (2) *A diagram of a seven-valve receiver using* 3 *H.F.,* 1 *rectifier, and* 3 *L.F.*

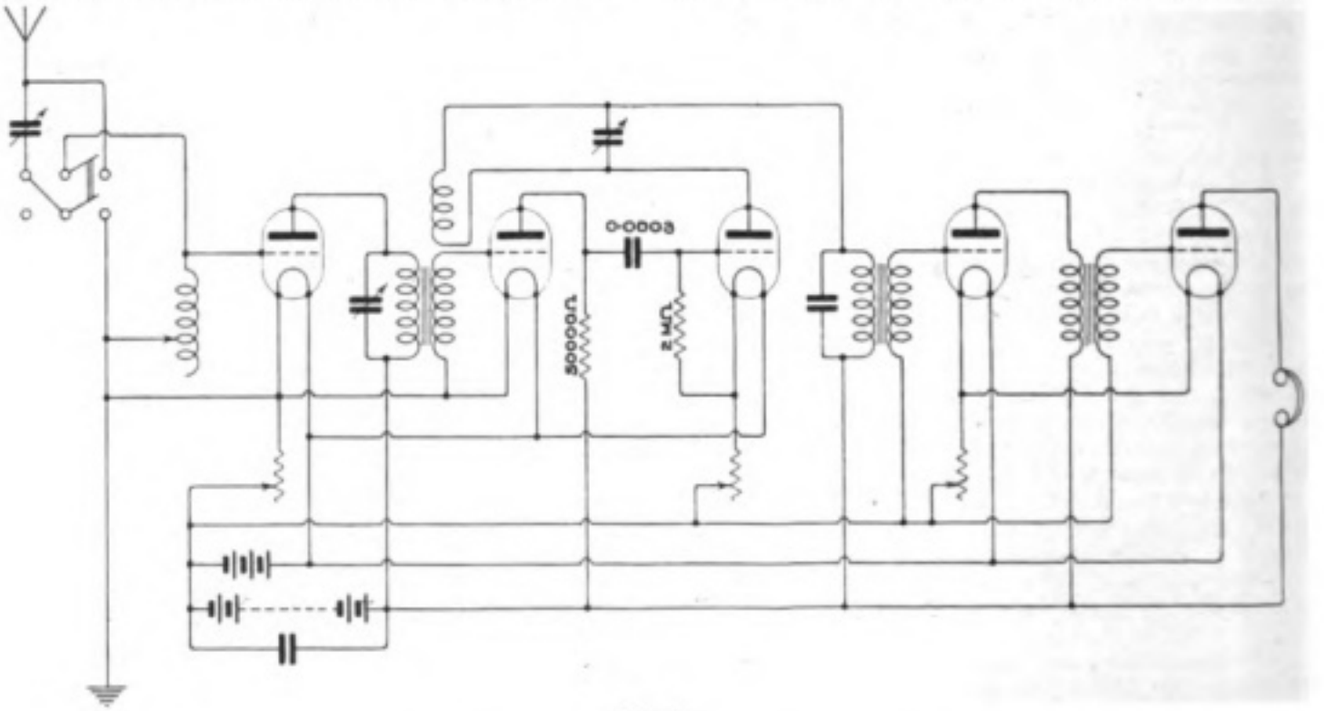


Fig. 5.

(1) See Fig. 5. (2) The method adding H.F. and L.F. circuits is easily apparent.

"V.H.T.L." (Hampstead) *asks* (1) *The name of a wireless society in his district.* (2) *The maximum wavelength of his aerial when connected to a tuning coil consisting of* 167 *turns,* 4¼″ *in diameter.* (3) *The dimensions of a loading coil required to tune to* 6,000 *metres.* (4) *Why it is that he is able to hear all of the more important London amateur stations (and particularly* **2FQ**), *and yet is unable to receive the transmissions from Marconi House as loud as from the amateurs.*

(1) The nearest Society would probably be Highgate Wireless Society, and the address of the Secretary is Highgate Literary and Scientific Institution, South Grove, Highgate, N. (2) Your set will probably not tune beyond 1,700 metres. When the aerial tuning condenser is connected in parallel the reaction coil with its tuning condensers will probably tune to 2,500 metres. (3) To load the aerial we would recommend you to use a number of basket coils, assembled along an ebonite tube, and spaced from one another by about ¼″. If these coils have an internal diameter of 2″ and an external diameter of 4″ and are wound with No. 26 D.S.C., you will require from 8 to 10 to load your aerial to a wavelength of 6,000 metres. The closed circuit need not necessarily be further loaded, as it will probably function aperiodically, but if you want precise tuning in this circuit, and are desirous of working with fairly loose coupling between aerial and reaction circuits, it will need to have a few basket coils connected in series with it. (4) We cannot understand why you are able to receive amateurs' stations located in various parts of London, and yet have difficulty in receiving **2LO**. In our experience **2LO** can be received in London on the simplest type of crystal set, whilst if more than a few miles away, for many of the amateurs you mention a single valve receiver at least is required. Make two special basket coils for short wave work, consisting of 44 turns of No. 26 D.S.C., and having a mean diameter of 2¾″. Bridge the reaction coil with a tuning condenser, and place one over the other to give reaction effects, and we think you will find it difficult to miss the signals which you complain you are unable to receive successfully.

"J.R." (Newcastle-on-Tyne) *asks* (1) *For criticism of a crystal set.* (2) *For criticism of aerial.* (3) *If certain* 2,000 *ohm telephones are suitable for telephony.* (4) *What concerts he should hear.*

(1) O.K., except that the potentiometer should be wound with eureka, or similar wire, instead of copper. Range probably up to about 3,500 metres. (2) Not good. Bring down lead from the end of the aerial nearest to the house. (3) Yes. (4)

Probably none until the broadcasting station at Newcastle starts operations.

"F.T.G." (Kensal Rise) *is constructing a long range multivalve receiver, and asks* (1) *for a circuit diagram comprising two H.F. valves, one detector and one L.F., with series parallels for the aerial tuning condenser, switching for arranging either transformer or resistance capacity coupling between the H.F. valves, separate filament resistances for each valve, separate potentiometer control where necessary and switches to cut out* (a) *one H.F. valve;* (b) *one H.F. and one L.F. He also requires values of condensers and resistances.* (2) *Particulars for the construction of the high frequency interchangeable transformers.* (3) *Details of construction of the low frequency transformer and telephone transformer.* (4) *The best type of valves as H.F. detector and L.F. amplifiers.*

(1) See diagrams Figs. 6 and 7. (2) Use 1" polished ebonite rod as a former on which to wind the transformers. Four valve legs can easily be screwed into one end by making tapped holes. If you are desirous of using transformers of various values and having them interchangeable. Where more than one H.F. transformer is used, it is essential that they shall all have exactly the same values, or otherwise one transformer will filter out signals on wavelengths on which the other will operate best. Wind on the required number of turns for the wavelength required in the form of a single layer, and insulate primary from secondary with a single layer of empire cloth. As an approximate guide, 600 turns of No. 40 S.S.C. give 600 metres. Make primary and secondary windings both in the same direction, and the two leads passing from one end of the transformer are taken to grid and plate. (3) The bobbin should measure $1\frac{3}{4}$" long by $1\frac{1}{4}$" in diameter. The core, which should consist of fine soft iron wire, should have a diameter of 5/16 of an inch, and the primary should be wound to a depth of $\frac{3}{4}$" with No. 46 S.S.C., and the secondary up to $1\frac{1}{4}$" with No. 48 S.S.C. The core wires should be bent back along the sides of the transformer, those from one end being intermeshed with those from the other. For the telephone transformer wind the primary of the same

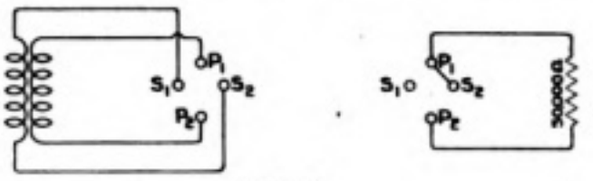


Fig. 7.

dimension as just given, but with No. 48 S.S.C., and the secondary also to the same diameter, but with No. 34 S.S.C.

"J.H.J." (Rotherham) *asks* (1) *Whether his circuit is suitable for the reception of telephony with a single head telephone receiver and "R" valves, and* (2) *the capacity of the variable condensers in aerial and reaction circuits.*

Your circuit is incorrect. The amplifier is built up on the resistance capacity principle, and you should therefore include high resistances of the order of 50,000 ohms in the plate leads. Resistance capacity coupling, however, is not efficient for use on short wavelengths, and you will be well advised to use a single valve receiver with tuned reaction circuit, followed by one low frequency amplifier, and if this does not satisfy your requirements, you might add one stage of high frequency amplification. (2) For short wave reception, the aerial tuning condenser should have a maximum value of 0·001 mfds., and a small blocking condenser of value of about 0·001 might be connected in series with it to provide fine tuning. The condenser which bridges the plate circuit should have a value of 0·0005 mfds. Both condensers should be of the air dielectric type.

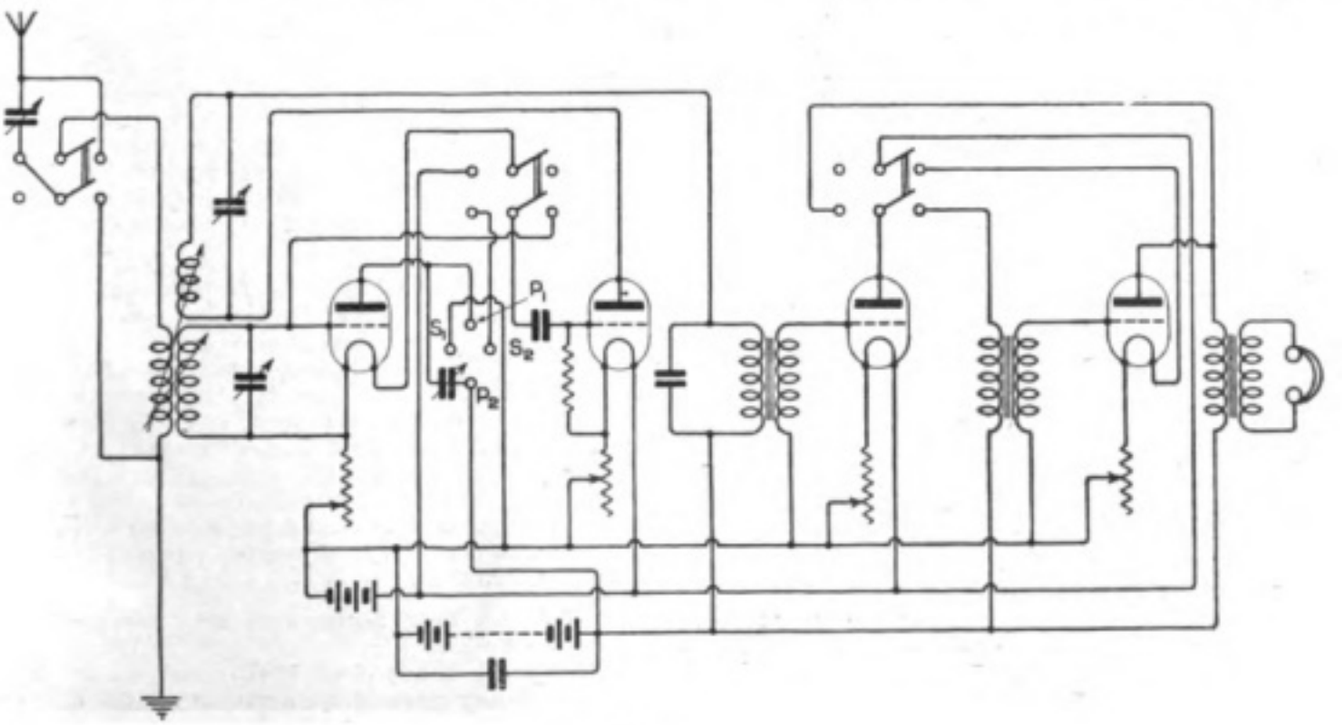


Fig. 6.

"J.D.B." (Kintyre) *asks if a circuit which he submits, consisting of the usual tuned aerial circuit with coupled plate circuit, is suitable for the reception of C.W., and with the addition of amplifying valves, broadcasted telephony. (2) Whether the addition of one H.F. and one L.F. would permit of reception from* **PCGG** *and* **2MT.** *(3) If not, how many valves would be required, and (4) Suitable circuit.*

(1) Yes. (2) and (3) Yes. (4) See Fig. 8.

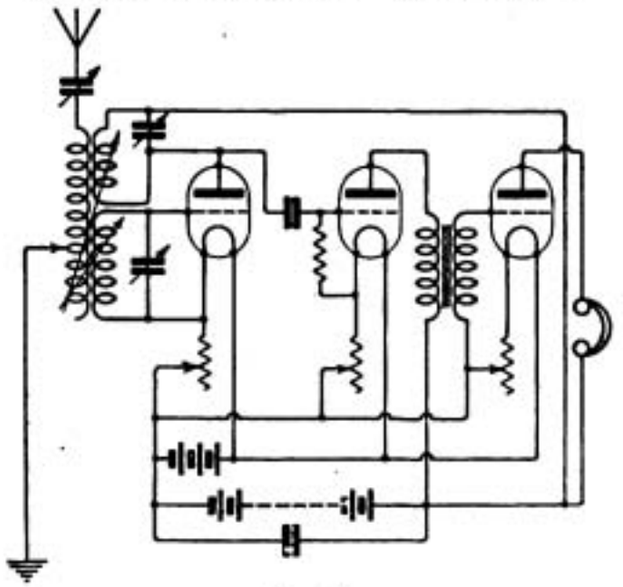


Fig. 8.

"ELECTRON" (Gloucester) *asks (1) If the enclosed diagram of circuit is correct. (2) If the Writtle and Paris music can be received in Gloucester. (3) How to make a telephone transformer for 300 ohm telephones. (4) What value grid leak to use with this circuit.*

(1) Yes. (2) Possible, but doubtful in the case of Writtle. (3) Use a core of ½" × 4" of iron wires; for the primary winding 3 ozs. of No. 44 and secondary 6 ozs. of No. 32 (No. 28 is too thick). (4) About 1 megohm. Adjust by experiment.

"J.L.S." (Huddersfield) *asks (1) With reference to a five-valve circuit why is No. 5 called a "telephone transformer," and Nos. 3 and 4 L.F. transformer. (2) Where he can obtain the plugs and jacks. (3) Types of coils and condensers recommended to use with his set.*

(1) We cannot say without detailed information, but unless the set is to be very inefficient it is probably designed for H.R. telephones. There is no hard and fast distinction between inter-valve and telephone transformer. (2) Try the makers of telephone apparatus, such as the G.E.C., or various wireless dealers advertising in this magazine. (3) Any of the normal types should be satisfactory.

"RECORDER" (Isle of Man) *has trouble with his relay and asks for advice.*

Your aerial is very poor. Your single 73′ wire would probably give better results than the combination. There are various possible explanations of the unsteadiness of your circuit, *e.g.*—(1) Variation in voltage of either battery. (2) A disconnection, partial or complete, in one of your grid windings. (3) A soft valve. (4) Leaky windings of your relay. Almost all arc stations work on a double note in the way you mention for Leafield. This is because they signal by making a slight change of wavelength, not by switching on and off their power.

"L.R.H." (Birmingham) *asks (1) If the diagram submitted is suitable for a beginner and correct. (2) What wavelength range would a certain winding give. (3) What type and capacity condenser should he use.*

(1) Quite O.K. and suitable. (2) About 1,200 metres. (3) Variable, air di-electric. Capacity about 0·0005 mfds.

"A.L." (New Brighton) *asks if a certain circuit is correct.*

The circuit shown is quite O.K. except that when the A.T.I. and A.T.C. are in series the first valve is tapped across both. The valve should be tapped across A.T.I. only, and this should be on the earth side of the A.T.C.

"T.K.R." (Norwich) *asks the gauge of a sample of wire and whether suitable for an aerial. (2) Whether crystal circuit sketched is correct.*

(1) No. 7/26 cable The wire is quite suitable, but we do not care for the braided cotton covering for an aerial, as it is liable to lead to dielectric losses and is very unsightly. (2) Quite O.K.

"AMPLIFIER" (Folkestone) *encloses a diagram of a three-valve circuit and asks where the reaction condenser should be introduced.*

The circuit shown is O.K., except for the direct connection between the first grid and the last plate. The reaction condenser should be introduced in this lead, and can be fitted with a series switch if desired.

"G.J." (Leicester) *asks for advice as to installing a one-valve 10-watt transmitter.*

Your question is too general for us to assist you much. We might say apply to the P.M.G. for a licence, buy a set from a reputable maker and erect as large and unscreened aerial as possible and then start work, but this is possibly not the advice you require. If you will let us know the *actual points, e.g.* (type of circuit, price, method of construction, insulation or adjustment, type of aerial, etc., etc.) in which you are in difficulty, we should be happy to advise, but a treatment of all the *possible* questions arising out of your enquiry would require about one complete issue.

"B.A.W." (Ealing) *asks for criticism of one-valve set. (2) Capacities for various condensers in it. (3) If it can be made of mica and foil.*

(1) Circuit is O.K. except that when the plug is inserted in either II or III the corresponding grid winding should be broken, and all valves not in use should have their filament current switched off. (2) *A* and *B* 0·0005 mfds. *C* and *D* 0·001 mfds. (3) *A* and *B* should be variable, of air dielectric. *C* and *D* might be mica and foil, say 4 mil. mica 5 sq. cms. of overlap per pair of foils, and four foils.

"J.A." (West Somerset) *asks two questions about his aerial.*

(1) By all means erect a 40′ mast at B. The raising of any part of an aerial is almost always advantageous, whatever the general configuration of the land or aerial may be. (2) We should prefer the single one.

"C.H.T." (Mildenhall) *asks for a diagram of ...-valve set suitable for reception of short wave ...ony, for making use of several components ... on hand.*

Fig. 9.

We recommend you to add one high frequency valve and an additional note magnifier, as shown in the circuit diagram, Fig. 10. We regret we cannot advise you on questions relating to patents, and the circuit we recommend to you obviously embodies

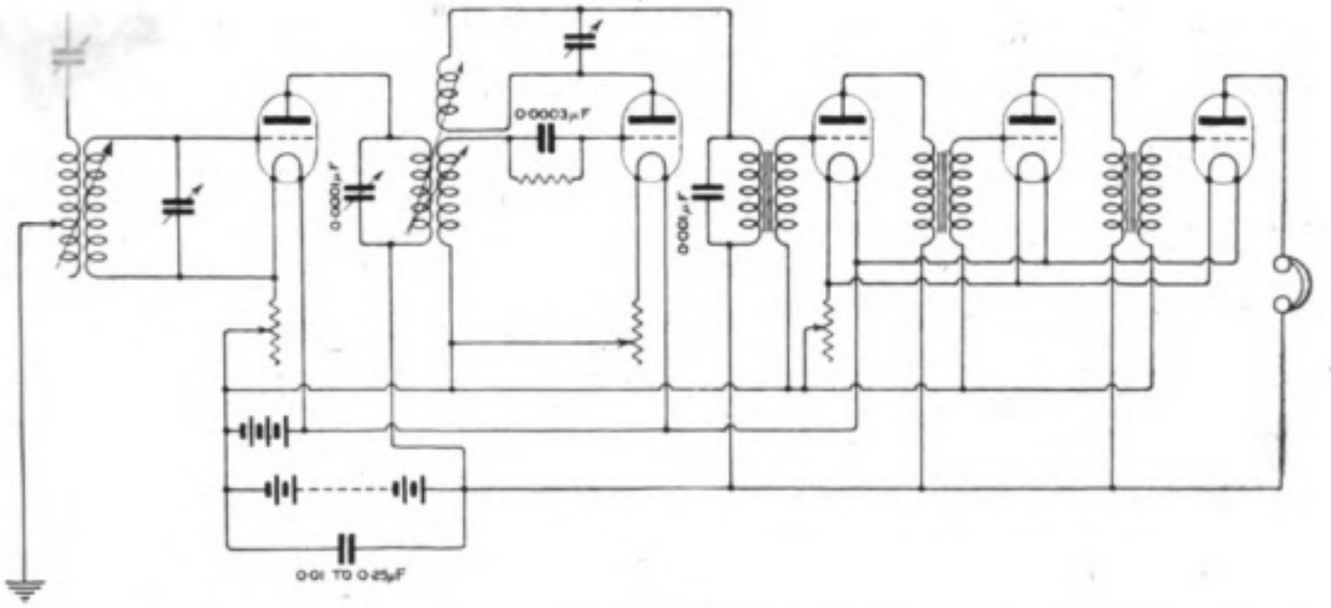


Fig. 9.

"H.A.H." (Rotherham) *has a two-valve receiver consisting of the usual detector to oscillator valve, followed by one note magnifier, and asks how to add two additional valves in the most efficient manner, and whether the circuit we recommend would infringe Marconi patents. He also asks for times and wavelength for transmission by the various stations.*

the use of patents held by the Marconi Company, but we believe that the Marconi Company will have no objection to you making use of their patents for experimental and research purposes. A statement on the subject appeared on page 479 of the July 15th issue. The list of regular transmissions which we publish from time to time has been revised and accompanied the issue of August 5th.

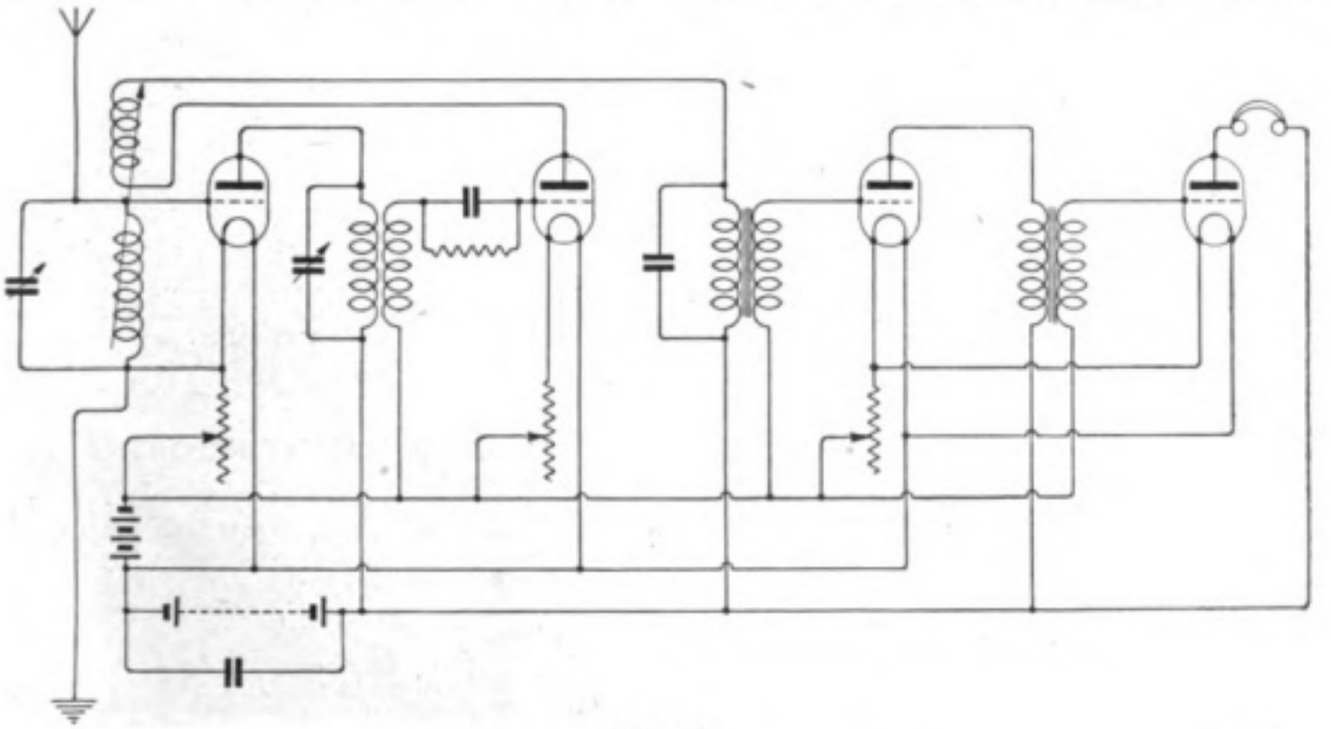


Fig. 10.

"RADIX" (Nottingham) *asks* (1) *For criticism of a circuit sketched.* (2) *If an H.F. transformer and telephones would give better results.* (3) *Where can he obtain a chart of wireless stations and their wavelengths.* (4) *If a certain arrangement of aerial is satisfactory.*

(1) The circuit is incorrect. Alter as in diagram given to **J.S. (Liversedge)** below. (2) Yes, it should definitely improve results. (3) See chart in issue of August 5th, 1922. (4) No, this is undesirable.

"J.S." (Liversedge) *asks* (1) *For criticism of a circuit.* (2) *How to add two L.F. valves.* (3) *For dimensions of a loose coupler to tune down to between* 150 *and* 600 *metres with a* 0·001 *mfd. condenser.*

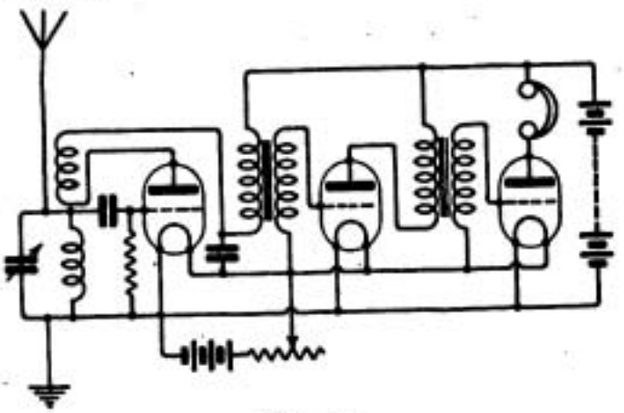


Fig. 11.

(1) Circuit is quite O.K. except that a parallel condenser of 0·001 mfd. is highly undesirable for short waves. (2) See diagram (Fig. 11). (3) 0·001 mfds. is too big, and 0·0005 mfds. for the closed circuit dimensions might be primary 5" × 3" of No. 22, and secondary 5" × 2½" of No. 24.

"R.E.B." (Bristol) *asks* (1) *If a certain arrangement of his aerial is O.K.* (2) *If a tramway system will interfere with his reception.* (3) *If he will be able to receive* **2 MT** *with his aerial.* (4) *How many valves will be required to receive* **2 MT.**

(1) It would be better to bring the aerial lead outside the building as close as possible to the instruments, staying it as far as possible from the walls all the way. The bathroom waterpipe might be used for the earth, but under the circumstances an earth buried outside the receiving room would probably be better. (2) It may give some induction trouble, particularly if much amplification is employed. (3) Probably, especially if modified as suggested. (4) Three valves should be sufficient.

"A.S." (Bayswater).—(1) See Fig. 2, page 313, May 13th issue. (2) Core ½" × 4" of iron wires, H.R. winding 3 ozs. No. 44, L.R. winding 6 ozs. No. 32. (3) Range would probably be up to about 20,000 metres. You should get all the larger European stations, and American stations under favourable conditions.

"D.W.T." (Cambridge) *sends a characteristic of a valve and asks* (1) *Best grid potential for* (*a*) *oscillation,* (*b*) *rectification,* (*c*) *amplification.* (2) *How the grid potential is applied.*

(1) (*a*) Almost anywhere. (*b*) Without grid condenser about minus 4, *i.e.*, the lower bend of the curve. From the characteristic the valve would appear bad as a rectifier. (*c*) About zero, *i.e.*, the straight part. (2) By means of potentiometer across the L.T. battery, with additional series cells if necessary.

"J.D.B." (Greenock) *submits a single valve circuit for criticism and asks* (1 & 2) *If two-valve will be sufficient to enable the Dutch Concert to be heard at Greenock, or if three valves will be necessary.* (3) *What arrangement of valves to use.* (4) *Indicate additions necessary to circuit to obtain H.F. amplification.*

(1) No. The side of the closed circuit condenser remote from the grid of the valve should be connected to the negative end of the filament battery. (2) At least three valves will be required for satisfactory results. (3) One H.F., one detector and one L.F. is a very good arrangement. (4) Fig. 2, page 304, June 3rd issue, shows a very good circuit for a complete receiver, the first valve of which is arranged for H.F. amplification, the same arrangement being suitable for your set.

"E.T." (Seaham Harbour) *asks* (1) *For a diagram of a two-valve note magnifier to be added to a single valve panel with switch mounted on the note magnifier, to use either one or two valves.* (2) *Name of the station on* 2,600 *metres, having a carrier wave and audible* 20 *feet away from the telephones with a two-valve set.*

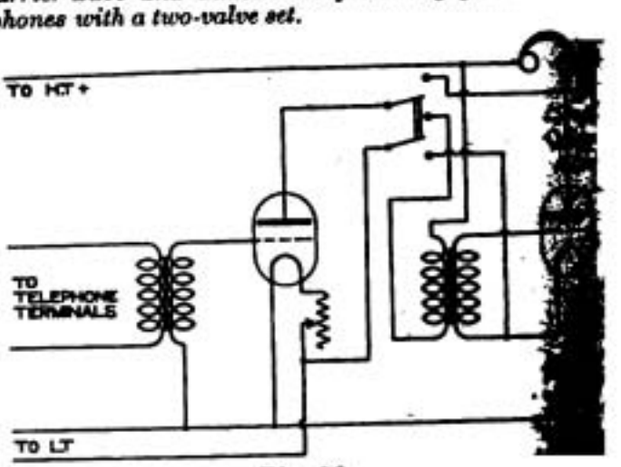


Fig. 12.

(1) See diagram (Fig. 12) (2) Information is rather limited to reply with certainty. It might be **FL**, but we should hardly expect this station to be so strong at such a distance.

SHARE MARKET REPORT.

Prices as we go to press, August 25th, are :—

Marconi Ordinary	£2	6	0
,, Preference	2	2	6
,, Inter. Marine.. ..	1	9	6
,, Canadian		10	6
Radio Corporation of America :—			
Ordinary	1	3	6
Preference		14	3

9th SEPTEMBER, 1922. THE PRICE 6D. NET.

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VOL. X. No. 24. SEPTEMBER 9TH, 1922. WEEKLY

Meteorological Wireless Codes.

By W. G. W. MITCHELL, B.Sc., F.R.A.S., F.R.Met.S.

METEOROLOGICAL CODES.

1. The information reported in weather telegrams may conveniently be classified and referred to subsequently under the following six headings :—

(*a*) Surface observations, including barometric pressure, wind force and direction, temperature, visibility, humidity and amount of cloud.
(*b*) Upper-wind observations, including height, direction and force of the upper winds.
(*c*) Upper-air temperature and humidity.
(*d*) Reports from ships at sea (surface observations).
(*e*) Information regarding ice conditions.
(*f*) Forecasts.

2. Definitions in meteorology—*cyclone* and *anticyclone*.

The terms " cyclone " and " anticyclone " are so frequently used in weather reports that it is thought better to deal with them in a separate paragraph. Other terms, the meaning of which is obscure, will be explained as they occur. On the weather-maps published in the daily newspapers, places of equal barometric pressure (reduced to sea-level and latitude 45° for standard comparison) are joined by lines known as *isobars*. They are analogous to the contour lines on a map of land areas. The isobars enable us to readily see the shapes of the areas of high and low pressure. Areas of high pressure are called anticyclones or " highs," and areas of low pressure, cyclones or depressions or simply " lows." Where the isobars are packed closely together, the barometric gradient is steep and the winds powerful. Now it might appear at first as though the air would blow across at right angles to the isobars from places of high pressure to " lows." Any such conditions would, however, be very short-lived, for in an interval of time, measured only perhaps in seconds, the " low " would become a high pressure area and *vice versa*. The effect of the earth's rotation under the moving

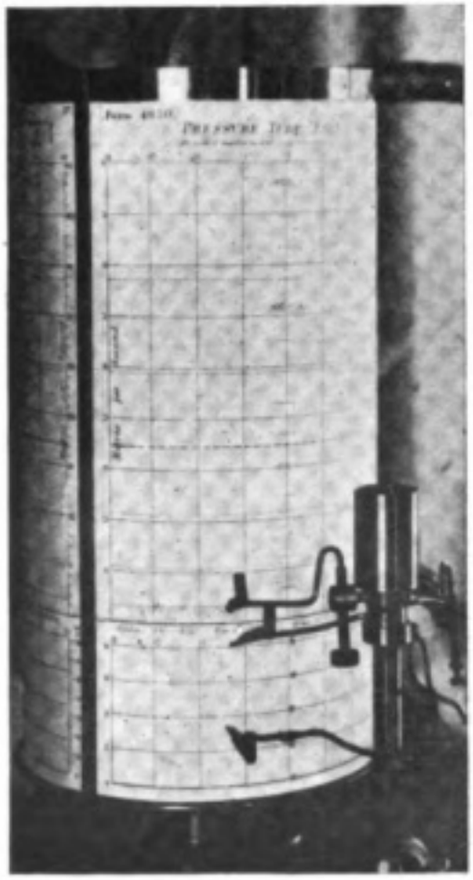
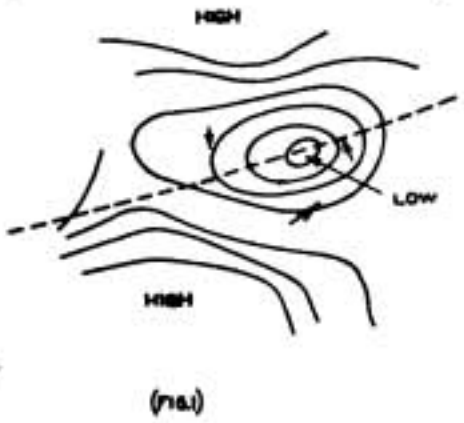


Fig. 1. *Dine's High-pressure tube anemometer gives a continuous record of the direction and velocity of the wind. Every gust (however small) is recorded by the upper pen, whilst the lower, answering to the movements of the vane outside, records the direction.*

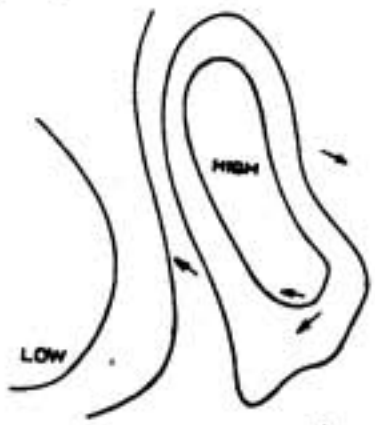
Fig. 2. NATURE OF WEATHER TO BE EXPECTED.

(Fig. 1.)—Cyclone. Typical Arrangement of Isobars. North of the equator, the wind blows round the depression counter clockwise in accordance with Buys Ballots' Law. Strong winds are associated with closely packed isobars, in which case the depression is deep. Rain near the centre of the "low" especially heavy rain on the north-east side with dull and overcast sky to the east and south-east. Depressions usually come up from the south-west or west and move across towards the north-east or east. Signs of approaching cyclone, fall of barometer, strong south or south-west wind, overcast and cloudy sky. Signs of passing of cyclone, wind changes to north or north-west and increases in strength, barometer rises. Small arrows show wind direction.—N.B. The broken line shows the track of the observer. For the other positions, conclusions must be drawn from the diagram.

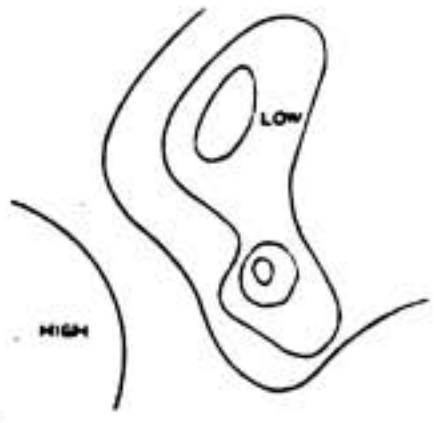
(Fig. 2.)—Anti-cyclone. In the case of an anti-cycle, the isobars are usually further apart and therefore winds are lighter than those associated with cyclones. Usually fine and bright weather, seldom any rain and then only light showers, some cloud. Anti-cyclones very often cover a very large area. Their chief characteristic is that they move but slowly and irregularly, often remaining about for weeks at a time, whereas all the phenomena associated with a cyclone may be passed through in 24 hours.



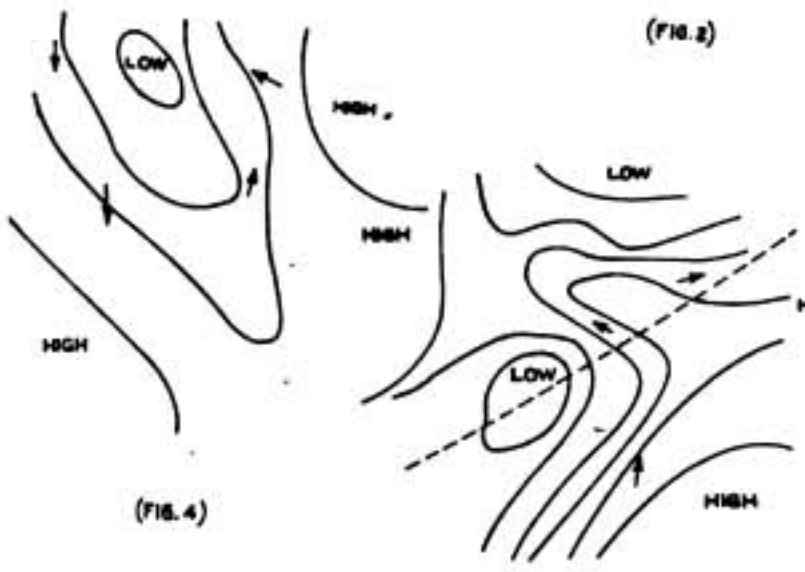
(FIG.1)



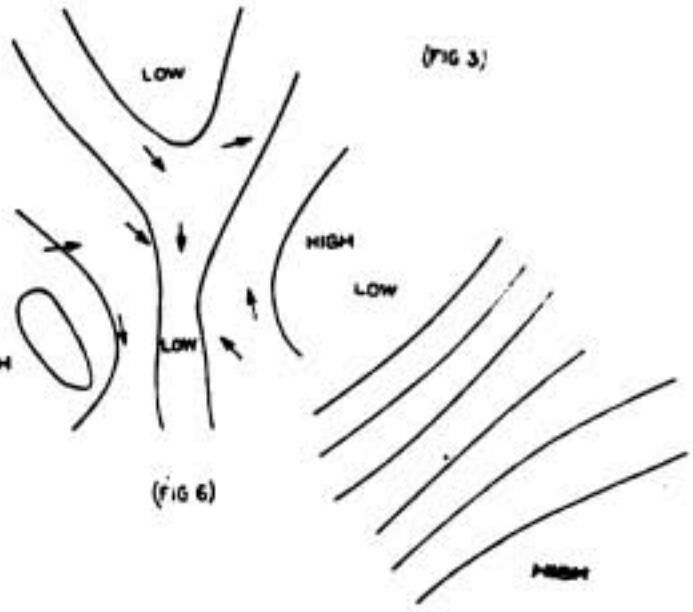
(FIG.2)



(FIG 3.)



(FIG. 4)



(FIG 6)

(FIG. 5)

(FIG 7)

(Fig. 3.)—Secondary Depression. A secondary is usually found on the southern side of a "low," and when associated with a deep depression the secondary often causes strong winds by crowding together of the isobars. Heavy rain and thunderstorms are frequent.

(Fig. 4.)—V-shaped Depression. A more elongated "secondary." Signs of approaching V-shaped depression—strong southerly winds, much cloud and very heavy rain, with very marked change as the central portion of the depression passes over. Then rapid clearing of sky and falling temperature and change of wind from a northerly direction. The central portion is often a region of very heavy squalls.

(Fig. 5.)—Wedge. The long arrow points to a wedge of high pressure between two "lows." Signs of approaching wedge. A very rapid "clearing up" of weather and fall of wind after the passage of a depression. Sequence of weather changes during passage of wedge. Front of wedge, extremely fine weather with light winds from north, then as central line of wedge passes, a change of wind from a south or south-west direction followed by rain and clouds associated with the approaching "low." The weather is often comparatively calm as the central portion of the "wedge" approaches.

(Fig. 6.)—The "Col." The typical "col" is a narrow straight "pass" between two anti-cyclones. This region is the meeting place of winds from many different directions and consequently fog in cold weather and thunderstorms in hot weather are the phenomena associated with this type of isobar arrangement.

(Fig. 7.)—Straight Isobars. An arrangement of isobars not frequently met with in these latitudes. The weather experienced is usually cloudy and rainy on the "low" pressure side and fine and warm on the high pressure side.

air causes the latter to be apparently deflected to the right in the northern hemisphere. Thus the wind blows almost along the direction of the isobars and reaches the "low" by a kind of spiral course. In the case of an area of high pressure, the wind blows round the area of high pressure in a clockwise direction to the line joining the centres of high and low pressure.

Buys Ballots' Law conveniently summarises these issues thus: "stand with your back to the wind, the low pressure area will be on your left hand." This applies only to the northern hemisphere, the reverse is true in the southern hemisphere.

Although the cyclone and anticyclone are the chief arrangements of isobars met with, there are other typical shapes. These are illustrated on page 746, together with a brief description of the weather associated with each type.

3. Having outlined the different types of weather associated with *typical* arrangements of isobars, the next step will be to give the codes used in the weather reports issued by the central meteorological service. The amateur will then be in a position to de-code these (where necessary) and gain information several hours in advance of the approaching weather.

The "general inference" (page 612, *The Wireless World and Radio Review*, August 12th) is in plain language and needs no further comment at present.

CODED FORECASTS FOR DISTRICTS. A specimen forecast in code is given below, together with a brief explanation. For full information as to the method of decoding reference should be made to M.O. Publication, No. 244, "Forecast Code for the Abbreviation of Weather Forecasts transmitted by Telegraphy or Radio-telegraphy," which may be obtained from H.M. Stationery Office, Kingsway, price 1s.

Fig. 3. Strato-cumulus clouds, taken from an aeroplane 5,000 ft. above the earth, and at 1,000 ft. above the cloud level.

Group 999, England and Southern Scotland, taken collectively (appended to the "general inference" issued at 2000 G.M.T.).

SPECIMEN. (For decode *see* Fig. 4.)

09218. Baltic 16508 20042 19299 22457 22455 32024 40405 52427 90447 91501

09[illegible]5 Monday 1800 G M T	Baltic	Depression centred over. Spreading in direction of. Towards east.	30042 Conditions prevailing now, i.e., not a forecast. S W Ireland.	99209 Secondary depression. Circulation of wind increasing—no marked change of pressure near centre of depression. No specification of direction.	32457 Forecast for 24 hrs. S E. England.	32455 Forecast for 24 hrs. S W England
32024 Wind from S W To W.	40405 Mod. wind. Fresh wind.	32477 240° 27 m/hr. at 2,000 ft.	99447 Mainly overcast, base of cloud 1,000- 2,000 ft. at first.	98501 Rain. Slight. Occasional. Local.	98358 Cloudy. base of cloud 2,000-3,000 ft. Later.	98521 Rain. Passing showers. General.
99990 Thunderstorms No specification. Local.	80000 Slight haze No specification.	80500 Slight mist or haze locally. No specification.	32463 24 hours. Northern England and Southern Scotland	32024 Wind From S.W. to W.	40304 Gentle breeze or moderate wind.	32048 260° 28 m/hr.
98546 Cloudy. 1,000-2,000 ft. varying irregularly	98501 Rain, slight or occasional. General.	98521 Rain Passing showers. General.	99990 Thunderstorms. No specification. Local.	80000 Slight haze. No specification.	80500 Slight haze or mist. Locally. No specification.	The remaining 7 groups are "check" groups for the purpose of correcting any errors of transmission.

Fig. 4. Decode of Specimen Message.

90358 91521 91990 87000 86500 22463
32024 40304 52628 90346 91501 91521
91990 87000 86500 00800 81304 65885
97113 26885 95— 70639

The "check" groups are obtained by writing down in vertical columns the preceding groups :

	(*a*)	
09218	0	First group of check figures.
16508	0	
20042	8	
19299	0	
22457	0	
22455	8	Second group of check figures.
32024	1	
40405	3	
52427	0	
90447	4	
91501	6	Third group of check figures.
90358	5	
91521	8	
91990	8	
87000	5	
86500	9	Fourth group of check figures.
22463	7	
32024	1	
40304	1	
52628	3	
90346	2	Fifth group of check figures.
91501	6	
91521	8	
91990	8	
87000	5	
86500	9	Sixth group of check figures.
(*b*) 70639	(5)	Seventh group of check figures.

The figures comprising the first six check groups, are obtained by adding the horizontal columns and writing down the terminal figure of the sum thus obtained (i.e., $0 + 9 + 2 + 1 + 8 = 20$; check figure=0).

Similarly the seventh group is the terminal figures of each vertical column. The figure (5) of the sixth group is the "Key" figure. It is the terminal figure of the vertical column (*a*) of check figures and it must agree with the terminal figure obtained by adding the horizontal row (*b*). The key figure serves as a "check" on the check figures.

Now suppose an error of transmission (or reception) occurs in the group 19299 and instead of this, 19499 is received. The error is first detected on adding the horizontal columns, the check figure 2 not agreeing with that transmitted in the check group. Any one or more of the figures 1, 9, 4, 9, 9, might be wrong, but the error can usually be placed by adding the vertical columns and noting the disagreement with the figures of the seventh check group.

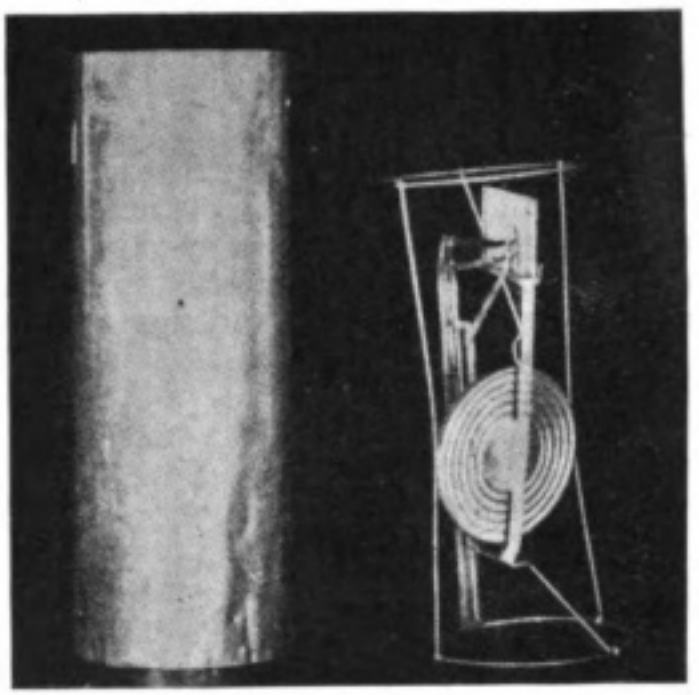


Fig. 5. The ingenious recording meteorograph used for making temperature, barometer and humidity readings in the upper air. The whole apparatus weighs but a few ounces and is carried by a small balloon.

COMPLETE DECODE OF ABOVE MESSAGE.

Weather report based on obesrvations on Monday at 6 p.m. (18h. G.M.T.). Depression over the Baltic spreading East. Secondary depression off South-West Ireland. Forecast for 24 hours for Southern England—wind between S.W. and W., moderate or fresh, 27 m.p.h. at 2,000 feet from 240°. Mainly overcast at first with lowest cloud at a height of 1,000-2,000 feet, slight occasional rain, cloudy (cloud 2,000-3,000 feet) with passing showers later perhaps thunderstorms. Visibility good but slight local haze. Forecast for 24 hours for North England and South Scotland, wind between S.W. and W., light or moderate, 28 m.p.h. from 260° at 2,000 feet. Cloudy (lowest cloud 1,000-2,000 feet) varying irregularly in amount, slight occasional local rain or passing showers perhaps thunderstorms. Visibility good but slight local haze.

On the Amplification of High-Frequency Currents

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

The general outline of the following article is based on a lecture delivered to the North London Wireless Association on January 30th, 1922, during which the apparatus referred to was demonstrated to the meeting.

ALTHOUGH historically the use of a thermionic valve for the amplification of high-frequency currents was effected at least as early as it was used for a similar purpose in audio frequency circuits, this aspect of the whole subject of valve amplification has on the whole received much less attention by radio amateurs in this and other countries than has its use for low frequency or note magnification. There are doubtless many reasons contributing to this state of affairs, but it will suffice to refer here only to the most important of them.

In the first place the low frequency amplifier possesses, from the amateur's point of view, the great advantage that it can be used for signals of any wavelength. In many spheres of commercial radio work the receiver is called upon to function almost exclusively on one wavelength, or at least on a very narrow band of wavelengths, so that in such cases high frequency amplification, with the greater selectivity that it can be made to introduce, is not only practicable but very valuable; with the large wavelength range necessary to meet amateur and experimental requirements, however, the problem becomes more complex.

In the first place, therefore, I propose to make a few remarks about amplification in general, and then to deal rather more in detail with the particular problem of high frequency amplification over a large range of wavelengths.

It will be no use at the moment to refer to the other properties of valves, and to the construction of valves in general, but I would like, however, to draw your attention to the fact that the valve, that is the three-electrode valve as we all know it, in any of its forms is an amplifier in three distinct senses. It can be a voltage amplifier or a current amplifier as well as an energy amplifier, and to a certain extent one can choose in which form to utilise the output energy. In reality the valve is always an energy amplifier, because the energy in the output circuit is drawn practically entirely from the high tension battery, whereas the energy put in is not required to do more than to effect changes in the potential of the control electrode or grid. Fundamentally, therefore, the valve is an energy amplifier, but it is essentially a voltage operated device, since it has for its input circuit that joined to the grid or control electrode, which circuit is always of high resistance. We can, however, choose whether we take the output energy either in the form of voltage variations with small currents or current changes with smaller voltages. If we have a valve working under normal conditions, we apply, usually, the input energy in the form of voltage changes and require the output energy not in the form of current changes, but where we are concerned, as we usually are in receiving circuits, with the use of more than one valve in cascade for amplification, or where we require one valve for high magnification followed by another valve for detecting purposes, as the second valve in the case must be operated by voltage changes rather than by current changes, we require the output to be in the form of voltage changes. Hence, in all these cases which cover the essential requirements of most receivers both the input and output circuits of the valves are required to be arranged so as to deal with the energy in the form of voltage changes. It should not be forgotten, however, that the energy magnification is all important, as without it we should not gain anything by high-frequency amplification beyond what we could get by an ordinary high-frequency transformer, and when using note magnifiers to operate a loud-speaking telephone, it is the energy amplification which is vital. In the latter case we want the final output to be in the form of current changes instead of the voltage changes which are wanted at all the other stages of the amplifier. In this case the extra

energy is required to bring into operation the large mass of the loud-speaking telephone, and where such loud-speaking telephones are required for producing sounds to be audible over large areas, this extra energy has to be obtained by using larger valves or more valves in parallel for the end stages of the amplifier. To fill a very large hall with sound by means of valve amplifiers and loud-speaking telephones it is not uncommon to use firstly ordinary valves and then two or more valves in parallel for the next stages, and then to pass that output energy on to a 5-watt transmitting valve or even to a 50 or a 100-watt valve so as to get in the final plate circuit very much larger energy changes.

For our purpose, where we are using the valve as an amplifier between the aerial (input) and the detector (output) circuits there is one factor of fundamental importance connected with all valves which gives us a measure of the effectiveness of the valve. The factor to which I refer is the voltage amplification factor of the valve. Primarily that factor is a constant of the actual physical construction of the valve rather than of the circuits used with it, but those circuits must be properly suited to the valve if the voltage factor of the valve is to be utilised to best advantage. The voltage factor of the valve represents the maximum possible voltage amplification that we can get with the valve in question by applying our initial energy (be it from an incoming signal or from a land-line telephone, or of any other form) to the grid circuit of the valve, and arranging the plate (output) circuit for maximum voltage changes. The effective amplification that we get in practice does not necessarily equal the maximum possible in the valve. In many cases it is far lower, and in practice the effective amplification is often a more important quantity to consider in high frequency than it is in low frequency amplification, since the former presents the greater difficulties.

The voltage factor is primarily connected with the characteristic curves of the valve, and its value can be deduced from these characteristic curves if we have the means of plotting out a series of such curves for the valve in use. Fig. 1 shows a series of four such curves connecting the anode current I_a with the grid voltage V_g, for four different values of the anode voltage from the high-tension battery. Suppose we have our operating point at the position marked by C in Fig. 1, we have the voltage AC on the grid with current OX flowing from the high-tension battery, through the plate circuit of

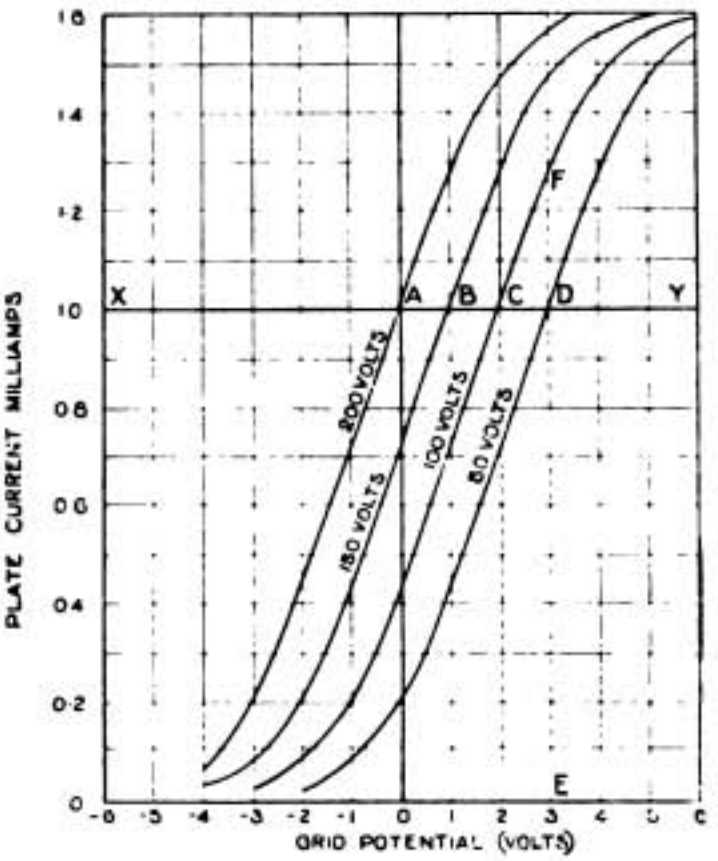


Fig. 1. Valve Characteristic Curves to illustrate Voltage Factor.

the valve. If we increase the grid voltage a small amount such as to OE the anode current will increase from ED to EF. The same would apply to whatever curves we take. We can bring the anode current down again to its initial value by reducing the voltage of the anode from the value corresponding to the curve passing through C to the value corresponding to the curve through D, and the ratio of the amount by which we must reduce the anode voltage when we increase the voltage of grid by a certain amount, the ratio of those voltages necessary to maintain the anode current constant is the voltage amplification factor of the valve. Hence, if we can draw out three or four characteristic curves we have the means of getting the maximum voltage amplification factor of the valve off those curves. In the case of the curves shown in Fig. 1 an increase of the grid voltage by 1 volt produces the same effect as a change of 50 volts on the anode—that is to say, the voltage amplification factor of the valve having the characteristics plotted in this figure is 50.

There are, however, two disadvantages attached to that method. Firstly, the plotting

out of curves is rather laborious, and secondly, a number of costly instruments, milliammeters and high resistance voltmeters, etc., are required. There are, however, simple methods of measuring the voltage factor by means of a single operation; in other words it is possible to devise an instrument, such that if you plug your valve into it and make the necessary adjustments, it is possible to read off the voltage factor of the valve directly from a scale. The general principles of one such method I described recently in *The Wireless World**, but it may be of interest if I here briefly describe the arrangement as the measurement is one which is of fundamental importance. Figure 2 shows an instrument built up to operate upon this principle.

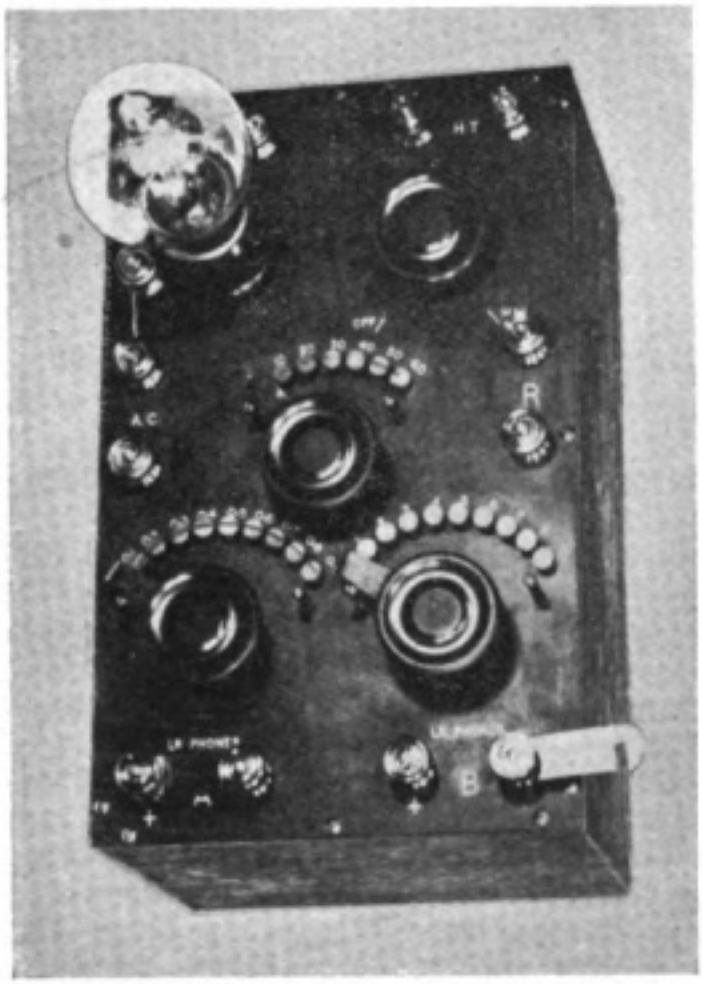


Fig. 2. Photograph of voltage-factor meter.

It has on top a holder for the valve, which is provided with the usual filament battery and filament resistance, and is connected up with a high-tension battery in its plate circuit, in series with a pair of telephones. The grid and anode circuits are also connected to the ends of a potentiometer, Fig. 3, the filament connection being taken to the slider. This potentiometer is also joined across some suitable source of audible frequency A.C. If we have it available, this may be a

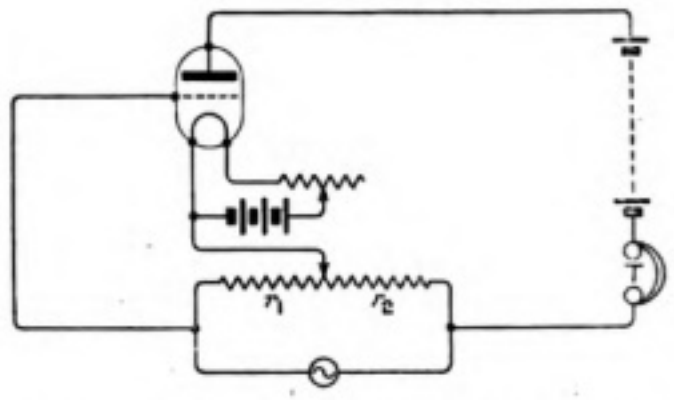


Fig. 3. Connection of voltage-factor meter.

300 or 400 cycle alternator, such as is often available in laboratories, but for private experimental purposes the use of a buzzer with a transformer is quite good. A little iron-cored telephone transformer with a buzzer and battery in series with its primary makes quite a useful arrangement for this purpose (Fig. 4). Alternatively a valve oscillating at an acoustic frequency can be employed, with the advantage that it gives a source of audible frequency of practically sine wave form and a pure note in the telephones. It has, however, the disadvantages that, firstly,

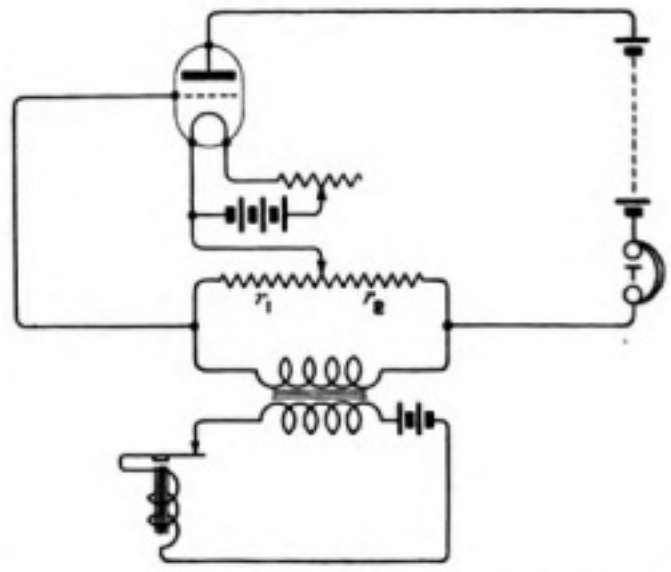


Fig. 4. Connections of voltage-factor meter using Buzzer as A.C. source.

if only one valve is used it is difficult to get sufficient energy from it to operate the set satisfactorily so as to get good signals in the telephones, and secondly, the transformer necessary to provide the retroaction to make

* *Wireless World*, 9 pp. 675–677, Feb. 4th, 1922.

the valve oscillate at this frequency has generally a large stray magnetic field which often causes very serious errors. Similar remarks, however, apply to many arrangements of buzzer, so that in practical work the source of A.C. should be some distance away and connected to the instrument by two parallel wires close together. If we arrange the apparatus in this manner, light up the valve and put a suitable high tension battery in the plate

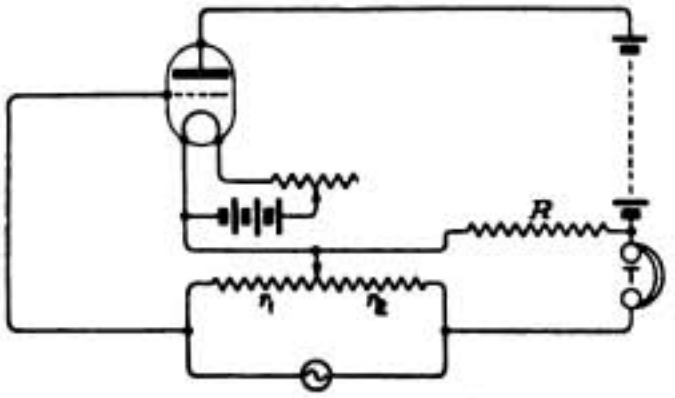


Fig. 5. Connections of voltage-factor meter as arranged for measuring the internal resistance of the valve.

circuit, a sound will be heard in the telephones due to the current flowing through them from the A.C. source. By adjusting the slider of the potentiometer (Fig. 3), a point will be found where the sound in the telephone practically disappears. If this is a uniformly wound potentiometer the ratio of the two lengths on each side of the slider is equal to the ratio of their resistances, and the voltage factor is given by the same ratio, viz., r_2/r_1. In the instrument shown (Fig. 2) I have made the resistance marked r_1 in Fig. 3 a fixed one of value 1 ohm and the point of connection of the filament to the resistances is also fixed, but I have the anode tapping point variable. This tapping point is marked so as to be direct reading to give the voltage amplification factor of the valve in use. The instrument can be used for lecture demonstration with a two-valve note magnifier and loud speaker to render the telephone sounds audible over the room.

Another constant of the valve, viz., its internal plate-filament resistance, can also be readily measured by this same apparatus. The circuit arrangement is slightly different, as an extra high resistance must be included in part of the anode circuit (Fig. 5). A resistance of the order of 20,000 to 50,000 ohms is suitable, and an ordinary type of anode resistance rod will work quite well. I have used this instrument on an anode resistance rod which is marked 50,000 ohms, but it is desirable to actually measure the value of the rod used on a Wheatstone bridge, as these resistances sometimes change and so render the marked values inaccurate. This particular resistance actually measures 68,000 ohms, although it is marked 50,000. By connecting this resistance on to two terminals provided for it when designing the instrument we get the desired connections for measuring the internal resistance of the valve. This constant of the valve is an important one, since for most efficient operation of the valve it is usually necessary to arrange the output circuit to have an impedance approximately equal to the internal resistance of the valve. The formula for calculating the resistance from the readings of the instrument is :

$$R_a = \frac{R(\nu r_1 - r_2)}{r_2}$$

where ν is the voltage amplification factor of the valve. In the instrument shown the resistances have been adjusted so that the formula simplifies to

$$R_a = R\left(\frac{S_1 - S_2}{S_2}\right)$$

where

R_a = the internal resistance of the valve ;
R = the large external resistance connected to the instrument ;
r_1 & r_2 = resistances marked with these symbols in Fig. 3 ;
S_1 = reading on scale of instrument when R not connected ;
S_2 = reading on scale of instrument when R is connected.

As an example of the measurement, a resistance of 20,000 ohms was connected to the terminals marked R on the instrument, and a new balance position for silence in the telephones was obtained at 2·7, the original reading before R was connected being 8·0. Hence, in this case the internal resistance of the valve $R_a = 20{,}000\left(\frac{8 - 2{\cdot}7}{2{\cdot}7}\right) = 40{,}000$ ohms approximately. If the temperature of the valve is altered, different values of this resistance R_a will be obtained, so that you can by this method very easily take a series of resistance values at different temperatures, and at different high tension voltages or under almost any other desired conditions. Hence, by means of this instrument we can very easily determine two factors which are

of great importance in connection with the use of the valve as an amplifier, whether for high or low frequency.

To pass on to the methods by which the voltage amplification of the valve can be utilised for the amplification of high frequency currents or rather for the amplification of high frequency energy, the most important thing to be considered is the coupling between the stages of the amplifier, and between the last high frequency valve and the detector. I have fitted up a circuit to arrange different ways of coupling the stages of the high frequency amplifier to show them in operation, and for this purpose I have a two-valve

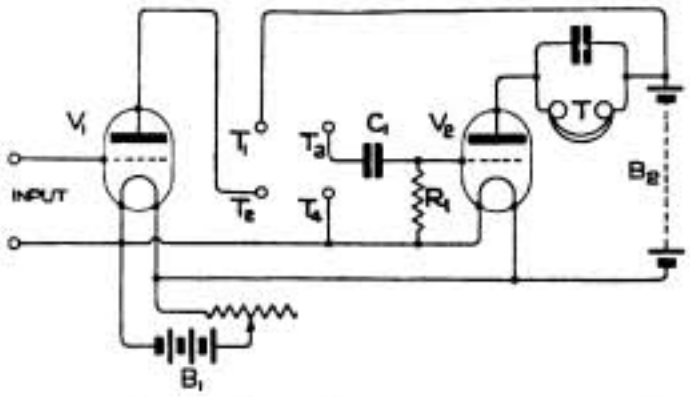


Fig. 6. Connections of Experimental Amplifier Panel.

arrangement provided with terminals to which various intervalve couplings can be connected. Incidentally it is a useful point to remember, in connection with the design of amplifying receivers for experimental work, that the valve holder and filament connections and the necessary leads to the high and low tension batteries can be mounted upon a board and kept quite distinct from all the rest of the apparatus. The coupling unit for use between any two valves can also be kept distinct, if desired, so that it becomes a simple matter to build up any type of amplifier. Fig. 6 indicates the scheme diagramatically. For simplicity two valves only are shown, with common anode and filament batteries B_2 and B_1 respectively for the two valves. The first is a high frequency valve, and the second one may be either another high frequency valve or a detector valve. The input is taken to the first grid and the filament as usual, and if V_2 is a detector valve we may have our telephones T in its plate circuit with the usual small bypass condenser. If we want to add any note-magnification stages, the coupling transformer will be put in place of the telephones. For the detector valve it is generally desirable to put a grid leak and condenser in its grid circuit, but rectification with a potentiometer can be arranged if preferred.

Any desired intervalve coupling unit can be connected into the four terminals marked T_1, T_2, T_3, T_4. For example, suppose we want to use a resistance-capacity coupling, the anode resistance should be inserted between T_1 and T_2, and the coupling condenser between T_2 and T_3, leaving T_4 free. In this case, the separate coupling condenser can evidently be suppressed, and the existing grid condenser (if of suitable capacity) can be used for the coupling. Again, suppose we wish to use a transformer coupling, all that is necessary is to connect the primary winding of the high-frequency intervalve transformer between T_1 and T_2, and its secondary between T_3 and T_4. Thus in a few minutes almost any one of the different types of intervalve coupling can be tested.

[Demonstration apparatus was arranged on the lecture table on these lines to show the operation of different types of intervalve coupling.]

I would now like to draw your attention to a method of coupling two valves which is probably the most direct that it is possible to have. The arrangement was, I believe, originally devised by A. Blondel, in France, as a means of coupling valves primarily for low frequency currents or for the amplification of small *direct* currents. As, however, the method

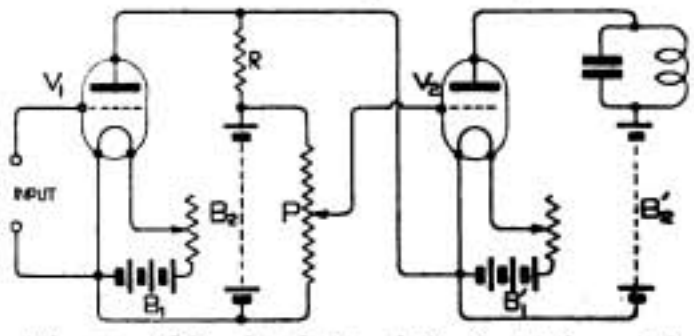


Fig. 7. Circuit of Blondel's Amplifier with "Potentiometric" coupling.

of coupling the valves directly gives a result which is practically independent of the frequency, apart from the effects of stray capacities, we can use the method for high frequency as well as for low. The arrangement is sketched in Fig. 7. In this diagram a resistance R is joined in the anode circuit of the first valve V_1, in series with the usual H.T. battery B_2. A potentiometer resistance P

is shunted across the battery B_2 with its slider connected to the grid of the second valve V_2. The potential changes across R and the portion of P tapped off by the slider are therefore applied directly to the second valve. We can look on that circuit in another way by considering it as a Wheatstone bridge, as shown in Fig. 8. The ratio arms are made up of the two parts of the potentiometer marked P_1 and P_2 respectively. The other arms are made up of the fixed resistance R and the anode circuit of the valve V_1. The H.T. battery B_2 is joined across the ends of P_1 P_2 (as also shown in Fig. 7), the input circuit is connected to the grid of V_1, and the grid circuit of the second valve takes the place of the usual "galvanometer arm" of the bridge. By adjusting the slider of the potentiometer P (Fig. 7), *i.e.*, adjusting the ratio of P_1 to P_2 (Fig. 8), the bridge can be balanced, and there will then be no potential in the "galvanometer arm"

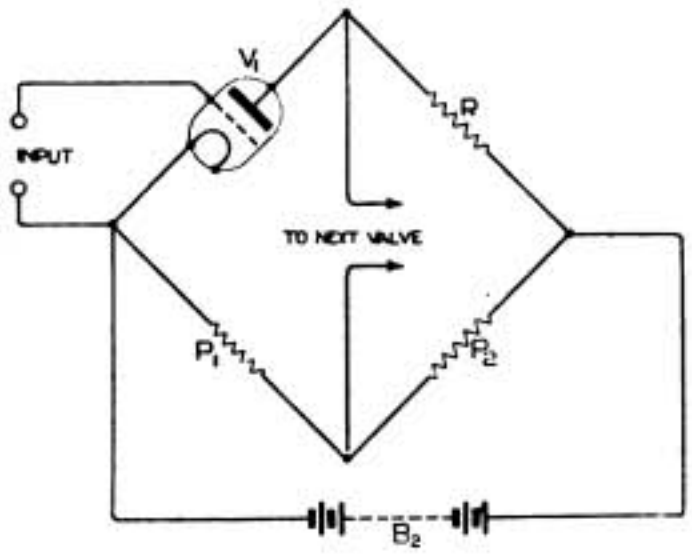


Fig. 8. Bridge Amplifier Coupling.

due to the bridge battery B_2—*i.e.*, under these conditions there will be no steady D.C. potential (from B_2) applied to the grid of the second valve.

The coupling between the valves is not in this arrangement affected by the frequency of current applied to it, because there is in the coupling no circuit of an oscillatory nature. There will, of course, be a limit to the amplification obtainable with such an arrangement, at the higher frequencies, on account of the capacities between the various parts of the circuit. Such stray capacities may cause an appreciable loss of amplification with very high-frequency currents, *i.e.* with wavelengths of the order of 150 to 200 metres, and on such wavelengths the problem of amplification becomes very much more difficult.

This direct coupling has the disadvantage of requiring two separate low-tension batteries and two separate high-tension batteries. The circuit sketched in Fig. 7 is the original scheme of Blondel's amplifier, but if we rearrange the circuit we can dispense with the use of two filament batteries. For this purpose we need merely to shift the resistance R to the other bridge arm and interchange the positions of the battery and galvanometer arms of the bridge, as shown in Fig. 9. The two valve filaments are then

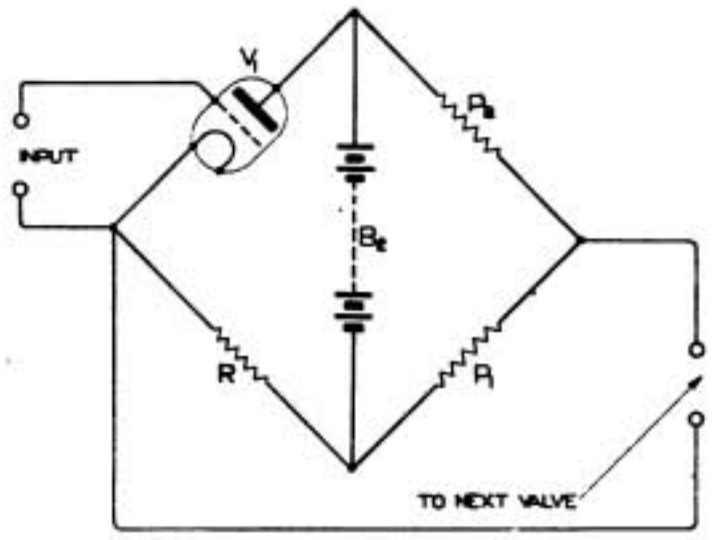


Fig. 9. Modified Bridge Amplifier Coupling.

joined together, and can therefore be fed from a common battery, as shown in Fig. 10.

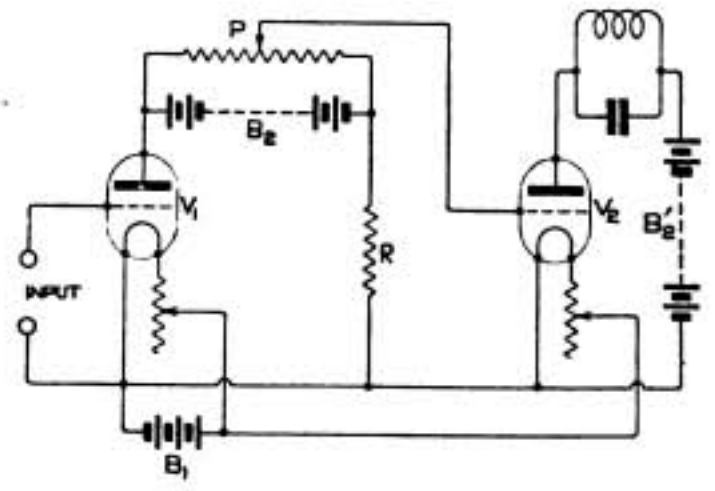


Fig. 10. Simplified Blondel Amplifier using common L.T. Battery.

This change, although two H.T. batteries are still required, is a simplification that enables the arrangement to be used for experimental purposes. The use of a common L.T. battery in this manner should reduce the stray

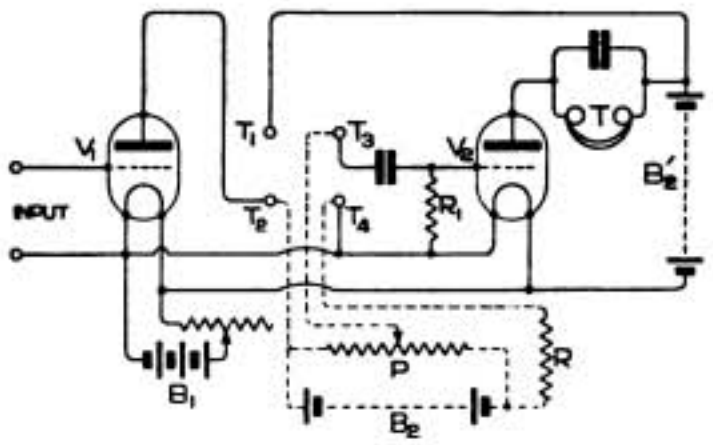


Fig 11. *Connections of Fig.* 10 *adapted to Experimental Amplifier Panel.*

capacities and enable the method to be employed for higher frequencies. This method can be adapted to the experimental amplifier panel outlined in Fig. 6, by leaving the terminal T_1 disconnected, and connecting a second H.T. battery and resistance R between T_2 and T_4 (Fig. 6). A potentiometer connected across the extra H.T. battery has its slider connected to terminal T_3, which is joined to the second valve V_2. These connections, adapted to the panel sketched in Fig. 6, are shown in Fig. 11.

(*To be concluded.*)

Some Notes on the Transmissions from Writtle (2 MT).

By CAPTAIN P. P. ECKERSLEY.

INTRODUCTION.

IT is the intention of this article to summarise the many reports on the Writtle transmissions, to give advice to the more amateur amateurs on a basis of really safe working, and to explain a little some of the difficulties at the transmitting end.

THE BROAD PRINCIPLES OF WIRELESS TELEPHONY.

The basic principle of wireless telephony is the radiation of a continuous electromagnetic wave of frequency n, which has superimposed upon it much lower frequencies p_1, p_2, p_3, p_n, resulting in the final emission of a complex band of frequencies n, n_1, n_2, n_3 . . . . n_n.* The frequencies n_1, n_2, n_3 . . . n_n, are grouped about the "carrier wave" of frequency n. The state of affairs at any instant might be represented by the diagram shown in Fig. 1, which shows a bunch of resonance curves for the various frequencies n, n_1, n_2, n_3 . . . n_n. In the middle stands the carrier wave, and grouped about it are the side waves caused by the voice modulation.

When this complex disturbance arrives at a receiving system tuned to the frequency n of the carrier wave, currents are set up in the receiving aerial proportional to the heights of the resonance curves of Fig. 1. It is the inter-heterodyning of the various frequencies which, when suitably detected, produce intelligible speech or music in the receiving apparatus.

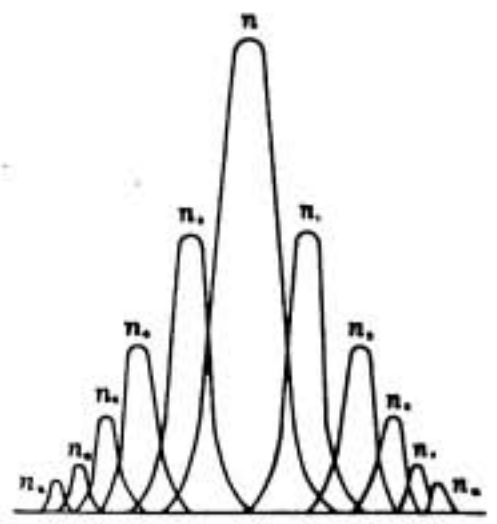


Fig. 1. *Resonance curves for various frequencies.*

THE BEST ADJUSTMENT OF RECEIVING SYSTEMS.

It will be realised, therefore, that the adjustment of the receiver, apart from its arrangement, has a great influence on the quality of the received speech or music.

REACTION.

Consider first the effect of reaction. If intensive reaction is used, it will be obvious that undue prominence will be given to the carrier wave and the lower frequencies, while the higher frequencies will be dwarfed to insignificance beside them. Many may have noticed how, if reaction is pushed to the limit, the mellowness of really good speech is lost, albeit the intensity is enormously increased. This applies especially to signals

* *Vide* Proc. Electrical Engineers. Vol. 58, No. 293, July, 1920, a paper on "Duplex Wireless Telephony," by the author. Appendix.

which are initially weak and can only be detected by the furious use of reaction.

The best adjustment for getting really good quality (assuming, of course, a good transmitter, without which no good results can be obtained), is to use such magnification as to give a moderate signal without reaction, and to bring up to R.9 intensity by applying judicious reaction, but not to the oscillating threshold.

This is a counsel of perfection; it is realised that valves are expensive, high frequency magnification a pitfall in many hands, low tension batteries of big capacity are things of profit only to the local garage, and that many difficulties stand in the way of the enthusiastic but impecunious amateur.

It cannot too strongly be emphasised that the use of intensive reaction is wrong theoretically and morally. Many and many a good concert is spoilt for others by those unskilled and unscrupulous people who will use reaction circuits up to and beyond the reaction threshold, thereby causing squealing heterodyne notes in nearby receivers, and so completely spoiling other people's pleasure. Anyone purposely making their set oscillate will fail to get good results and will prevent the possibility of others getting good results. Even though a system is used where reaction is applied to a coupled circuit tuner, the system will still re-radiate if made to oscillate.

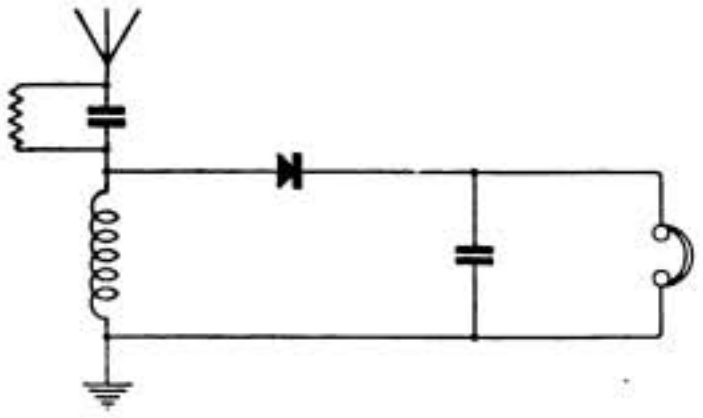


Fig. 2. Circuit for plain aerial reception.

THE TUNER.

Consider again Fig. 1. It will be realised that sharpness of tuning has a tendency again to give undue prominence to the lower frequencies. If the signal is loud enough, therefore, better quality may be obtained by mistuning slightly. This will mean that only half of Fig. 1 will be received, but this gives perfectly good results in practice.

SOME DISCUSSION ON THE ARRANGEMENT OF CIRCUITS.

Having suggested some general principles for the best adjustments, it might be helpful to many to discuss particular arrangements of receiving circuits.

It is extremely difficult to generalise on this subject because conditions are so very variable, one wants only to hear Writtle perhaps, and lives 100 miles away, another wants to receive any station between 15 and 25,000 metres, and lives 3,000 miles away from one station and 20 miles from another. It will be assumed, however (and it is trusted with some justification), that Writtle is the centre of attraction. To clarify the subject, let us take under appropriate headings, stations distant between 1 and 10 miles, 10 and 50 miles, 50 and 100 miles, 100 and 200 miles, and stations further than 200 miles.

Before starting, it is realised that the enthusiastic band of "one valvers" living sometimes 400 miles away will be shocked at the conservatism of the remarks, but this article is intended to give sound advice on something like a commercial basis for new amateurs who are not particularly skilled, and want to hear the concerts comfortably.

STATIONS WITHIN 10 MILES. (Assuming a full P.M.G. aerial.)

Crystal or single valve every time. A crystal may give rather weak stuff at 10 miles, but there are several installations distanced 30 miles who have received our concerts very well—40 miles is about the record. The tuning circuits with a crystal need not be elaborate, because jamming will be non-existent. The great thing to be realised in crystal reception is that a crystal is a potential operated device, and that the inductance connected across it should be as large as possible. If plain aerial reception is used, as shown in Fig. 2, and it is desired to receive 400 metres, it is best to use a series condenser in order that the inductance may be made large. This, however, can be carried too far because the series condenser, if made too small, prejudices sensitivity, albeit the extra inductance enhances it. Thus the experimenter should choose a nice balance between the two variables.

It is better, of course, to use coupled circuit for crystal reception at short waves with a P.M.G. aerial, because the secondary circuit can be made of very large inductance with a correspondingly small condenser to tune it.

While on the subject of receiving at close ranges, amateurs are warned very strongly against the prevalent disease of valveitis. By this is meant the use of too many valves for the given strength of signal without due precautions being taken. So often one hears of an installation with a full P.M.G. aerial direct coupled, four tuned high frequency magnifications, one detector and six note magnifiers (all R valves), and an ordinary ear piece thrust into a jam tin to make a loud speaker, station distant from Writtle 2½ statute miles. This is, of course, an exaggeration, but it indicates a frequently met with trend of development, which leads to the very worst results and gets " Broadcasting " a very bad name through no fault of those commercially interested. The use of too many valves always results in distortion, since saturation may easily be attained, or commoner, heavy grid currents clip off the tops of the intenser disturbances to the detriment of good quality. The question of loud speakers is a subject in itself. For the present it should be clearly understood that there is an intensity of signal which the usual receiving valve will not deal with properly, and there is a limit to the capabilities of the earpiece itself. The only excuse for using a lot of valves is when jamming at a different, but close, wavelength is likely to be experienced when very loose coupled tuners can be used. These will cut down sensitivity in proportion largely to their selectivity, and so the use of more amplification becomes necessary. Too great note magnification with iron transformers is a frequent source of trouble. Never use more than two note magnifiers and in general use only one. There is nothing so prejudicial to good quality as the usual design of note magnifier. So many amateurs seem to like signals to be extra loud and not to care a hang about quality. A robust receiving system with judicious reaction mistuned to give R6 signals is my ideal.

STATIONS BETWEEN 10 AND 50 MILES.

Full P.M.G. aerial. A single valve and reaction is probably the best arrangement up to 50 miles, but at the limit of range the addition of one note magnifier should make a simple, cheap and easily adjustable set. We have many and many a report of single valves being successful at 100 miles and more, but I cannot help feeling that the signals cannot be exactly loud, and that the adjustments must be critical, that the least jamming must spoil results, and that the sets may inadvertently slop into oscillation; the most selfish of sins in this broadcasting world. For real safe working at 50 miles then, a single valve might just do, but the addition of a note magnifier is certainly advisable. Jamming may begin to get troublesome at this range, but it is fundamental that if selective tuning circuits are to be used, the sensitivity must suffer. We have had reports of single valve reception at St. Austell, in Cornwall, and a few words have been heard on a single valve at the Forth Bridge.

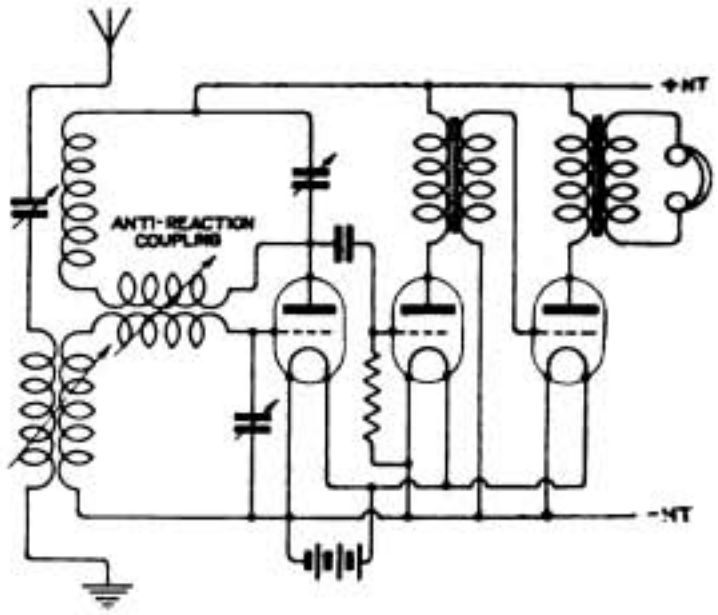


Fig. 3. A suggested circuit for telephony reception.

STATIONS BETWEEN 50 AND 100 MILES.

At 100 miles the difficulties are vastly multiplied. Jamming is the chief source of trouble, especially as many amateurs live at about 100 miles distance on the sea coast (say the Channel) and are keen on receiving Writtle, but are often prevented from getting results because of the interference from ship installations working in the narrow waters.

Coupled circuit is therefore advisable, and loose coupling should be used. To get good sensitivity the amplification must be fairly good. I suggest that tuned anode with one rectifier and one note magnifier is as good an arrangement as any, but great care will have to be taken to prevent the set from oscillating. It might be best to apply an anti-reaction arrangement between the tuned anode circuit and coupled circuit, this being *reduced* as more reaction is required. The basic diagram of connections is shown in Fig. 3. This is a typical circuit that would give good results. It is put forward as a suggestion. but there are plenty of other circuits that would do equally well probably. The idea of

these remarks is to indicate the type of tuner and amount of amplification advisable.

STATIONS AT OVER 100 MILES DISTANCE.

For really good results high frequency amplification is advisable at this range. High frequency amplification may be done in all sorts of ways. It is a subject beset with pitfalls and "doctors disagree" on the question, so "'tis folly to be wise." My own impression is that for amateurs some form of tuned high frequency magnification is advisable, but beyond that I will not commit myself lest heated argument should arise.

SUMMING UP.

It may be said that the arrangment of the receiver must be chosen to suit the particular conditions under which reception is to take place. The usual tendency among amateurs is to use too little amplification at large ranges, and too much at short ranges, although the latter tendency is less marked than the first. It is very admirable to get results on single valves at long ranges, but the tendency for such sets to re-radiate is not in their favour, and the necessary small amplification gives little scope for using selective tuning.

With regard to the competition in connection with our transmission of August 15th, it has been somewhat difficult to choose the winners. One hundred and sixty replies were sent in, and the top marks came very close together.

After mature consideration, however, it has been decided to award the prizes as follows :—

1st prize C. W Clarabut, The Bedford Physical and Radio Society. Beechcroft, Beverley Crescent, Bedford.

2nd prize. J. P. Beeson, Southwell, Notts.

3rd prize. C. G. Williams, 22, Scholar Street, Sefton Park, Liverpool.

A Portable Receiving Set

By A. LOVERING.

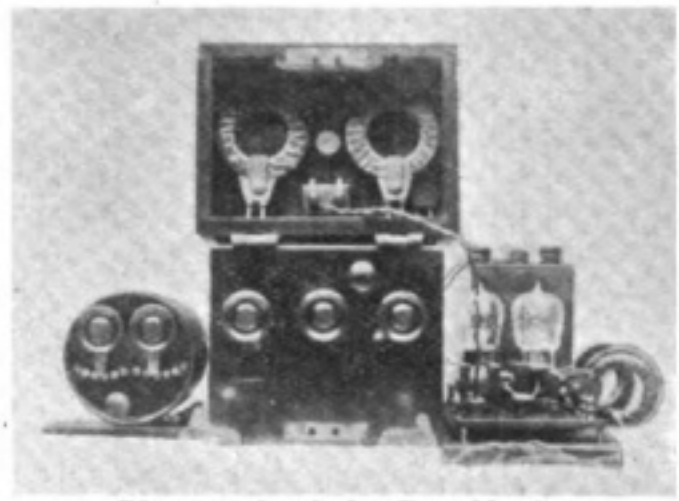
THE following description and accompanying photograph of a portable set which I have recently finished will perhaps be of interest to other readers.

The set is entirely self-contained, with the exception of the low tension battery. Two valves are used, the circuit being a standard two-valve low-frequency one. By using a flexible lead with a plug (coming from the transformer primary), one or two valves can be used as desired.

I think the photograph is more or less self-explanatory.

The two sides of the box are hinged at the bottom and the deep lid closes down over the knobs on the front panel. The centre knob is the filament resistance, and those on either side are primary and reactance tuning condensers respectively. The smaller knob immediately above is the main aerial circuit condenser. Shunted with this is the smaller one already mentioned, which is used for the more critical adjustments, the total capacity of the two being about 0·0013 mfd.

All three condensers are sliding, the problem of "space" being always uppermost. The two smaller ones are operated from the knobs by cranks, this giving fairly sensitive adjustment. Besides having the coil holders, transformer, and an "off" switch for the second valve, the panel on the right is fitted with a series-parallel switch for the A.T. condenser.



Photograph of the Portable Set.

For waves above 2,000 metres I use a set of five slabs, taped and fitted plug mountings. By using either one or two coils in the aerial circuit, and by working either series or parallel condenser as the case may be, I have practically a complete range of wavelengths up to 26,000 metres.

The loose coupled tuner on left is used for waves below 2,000 metres. I can get down to approximately 4,000 metres on this.

The 30-volt H.T. unit is accommodated in the lid, likewise the two larger coils. Of course, telephones are taken from headbands to facilitate packing.

The set was primarily designed for long range work, and by testing out in progressive stages of making, I have arrived at fairly good results. I originally intended having an H.F. transformer for the short waves, but space would not permit.

A Universal Unit System

By 2 CM.

THE Unit system is almost essential to the experimenter who is limited as regards time and money. It avoids the continual scrapping and reconstruction of apparatus, and provided it is properly designed, it enables almost any circuit to be tried without complex switching.

The system described in this article has been designed not only to be universal, but also to be simple of construction. It requires

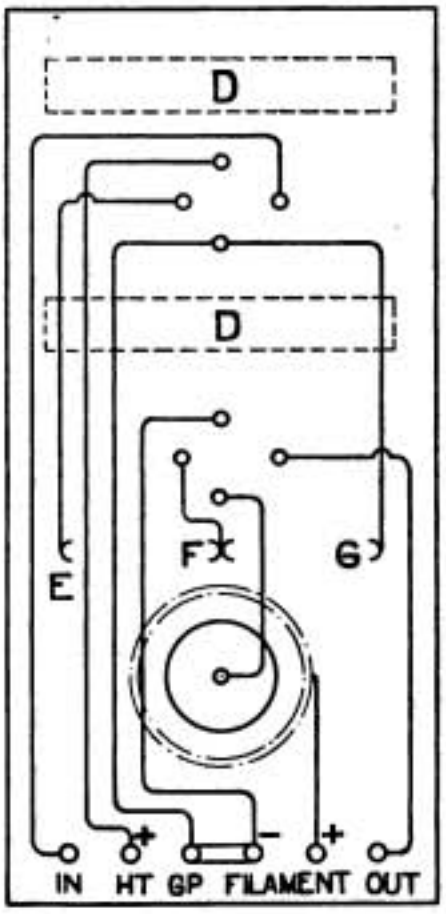


Fig. 1. The Main Valve Unit.

no elaborate woodwork or boxmaking, and may be made either in ebonite or hard wood. The latter is quite satisfactory for wireless reception purposes, provided it is well dried and varnished.

The main valve unit is shown in Fig. 1, and is simply duplicated for any number of valves. It consists of a baseboard, resting on two strips of wood ($\frac{3}{4}$ in. deep) at the back and front, thus giving space underneath for all the permanent wiring and the filament resistance. The front valve holder is for the valve, while that at the back of the unit takes the intervalve pass-on. This may consist of a high frequency transformer, as shown in Fig. 2 at *A*; a resistance-capacity as *B*, or an iron core intervalve transformer as *C*. Two battens *D* (shown dotted in Fig. 1)) are screwed to the base to support this transformer, which is mounted on wood and may be boxed in with a wooden or sheet metal cover if desired, the prong-plug being on the underside of the transformer platform.

Clips *E*, *F* and *G* are for the purpose of introducing a grid condenser and leak if it is desired to detect on the particular valve, the combined condenser and leak being clipped between *E* and *F*, or, if leakage is desired direct to the filament negative (or to a potentiometer, via terminal *GP*), the condenser alone is put between *E* and *F* and the leak between

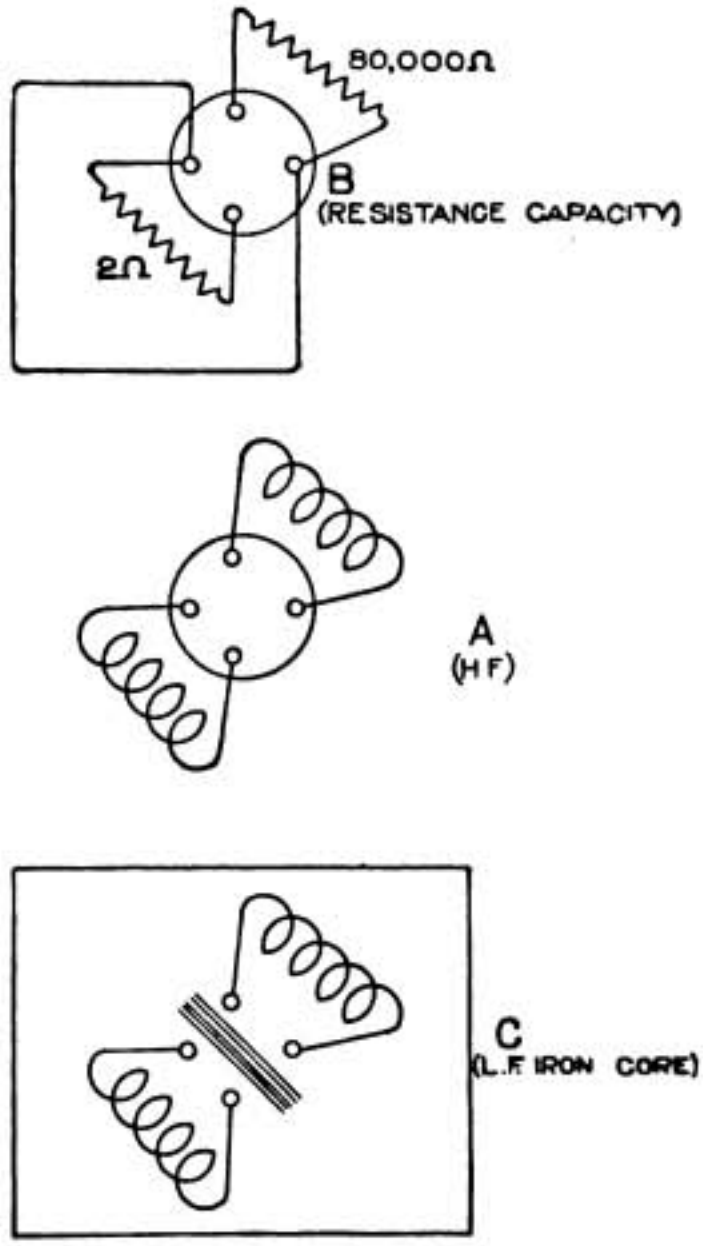


Fig. 2. Showing interchangeable couplings.

F and *G*. Normally, when the valve is acting as an amplifier, clips *E* and *F* are shorted by a metal bar put in in place of condenser.

The terminal *GP* on the valve unit, which is normally bridged to filament negative, is for the purpose of controlling the grids if it is desired to put a negative potential on them when using a high voltage on the plates, or for separate control when the valve is in use as a detector.

are required. The primary tuning and secondary tuning inductances *K* and *L* are normally close together, but units may be separated if coupling is found to be too tight when using more than one H.F. valve between. Low frequency valves are put in by switching on their filaments and putting switch *M* to an appropriate position. Thus any number of valves may be used without disturbing the wiring of the set.

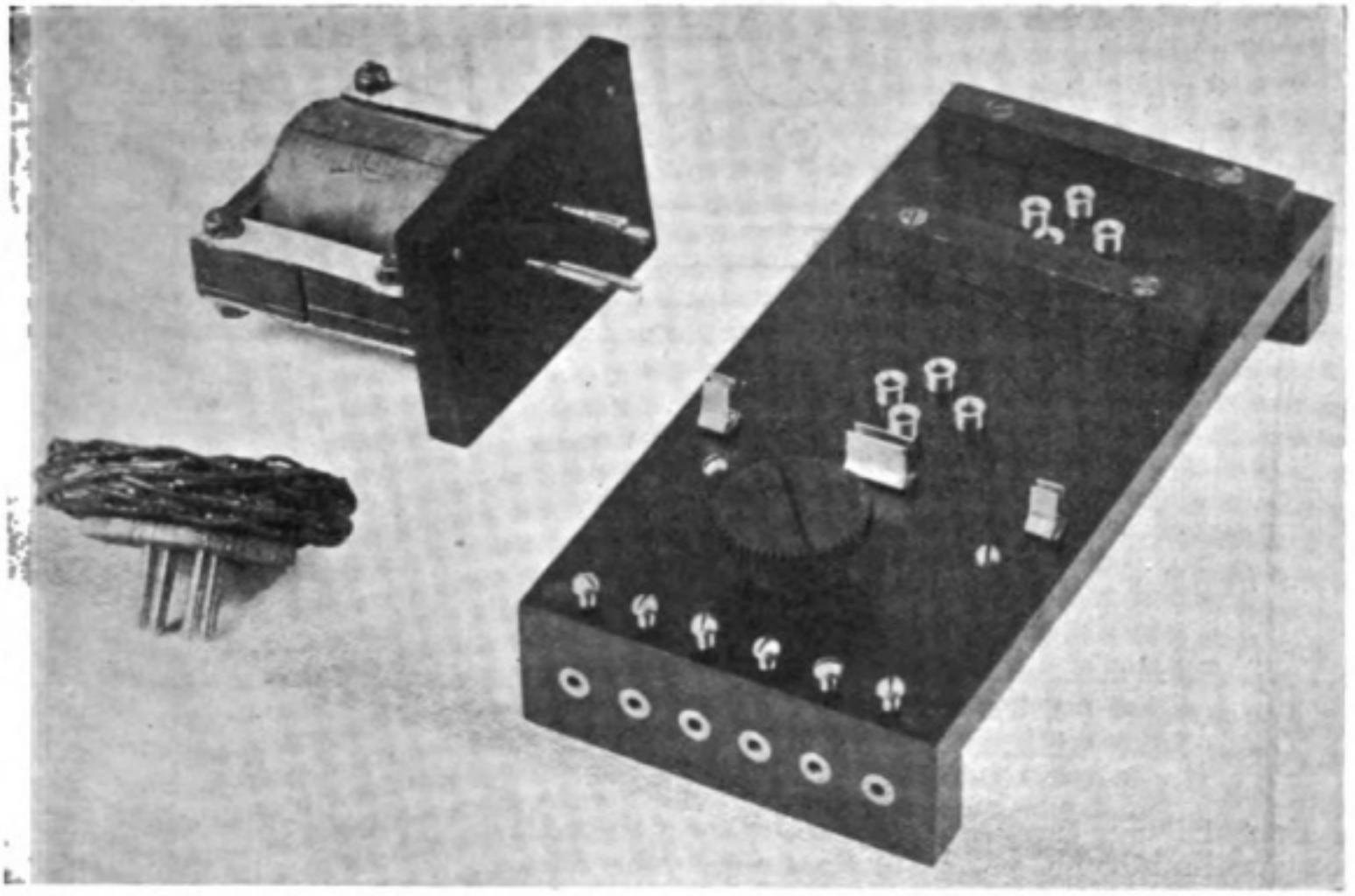


Fig. 3. Showing the main unit. It will be seen that the terminals consist of ¼ in. brass rod, drilled ⅛ in. and let into the front of the unit. An ⅛ in. Whit. screw is tapped into the side of the tube to grip the wire, the head coming through the top of the unit. This construction saves a great deal of space, and enables prong plugs to be used if desired for connections. The photograph also shows the Iron Core Transformer (cover removed) mounted for plugging in, and a high frequency pass-on which is used alternatively.

The complete arrangement is shown in Fig. 4. It will be seen that the units requiring adjustment are placed to the front of the table, while the valve units are out of the way at the rear. This arrangement enables adjustment to be easily made and also allows of the circuit being easily changed as occasion demands.

The arrangement shown gives two valves, high frequency, crystal detection, and three valves low frequency. The plug *H* is plugged in in the place of transformer at *I* or *J*, depending on whether one or two H.F. valves

If it is desired to utilise more units for high frequency it is only necessary to bridge terminals " in " and " out " at *N* and transfer leads *O* and *P* to one of the corresponding positions to the right.

For valve with grid condenser detection, the high tension battery is disconnected from the secondary tuning unit and the lead *Q* transferred from " out " to " H.T.+," thus giving the standard circuit for the purpose. The crystal point is, of course, taken off and, if if the high tension positive is connected to

terminal " Out," the blocking condenser will be connected across the primary of the first intervalve transformer.

Many other connections are possible and will easily be arranged as occasion arises.

may be spaced to any desired degree if reaction is troublesome. " Dis " transformers may be instantly replaced with others or with resistance-capacities, which when demonstrating, is an important point.

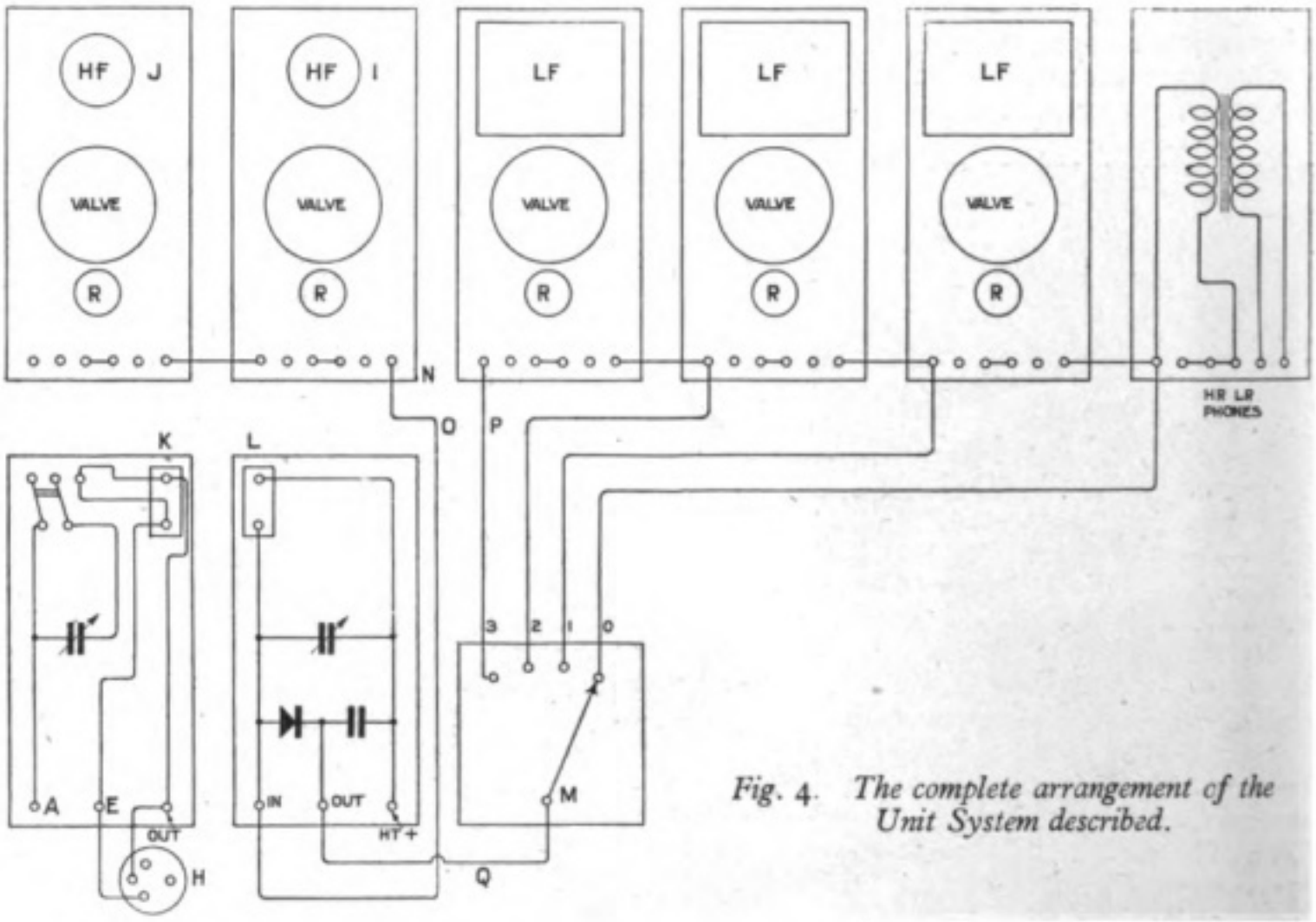


Fig. 4. The complete arrangement of the Unit System described.

Once the units have been made, they may be boxed in if desired or may be made up in any convenient form (either vertically or horizontally) as they take practically no more space than any similar multivalve amplifier. They have the additional advantage that they

In addition to being a great convenience to the advanced worker, this system will enable the beginner to extend his apparatus as funds permit, and will necessitate no remaking as he advances towards his "*n*th" valve amplifier.

Development of Radio Broadcasting in the United States

By M. B. SLEEPER.

The author of the following article, Mr. M. B. Sleeper, is so well-known amongst amateur circles in America, that it is felt that the following account of the development of Broadcasting in America cannot but prove of special interest at the present time, coming from one who has watched the growth in the popularity of wireless from inside. Mr. Sleeper has just returned to America from a visit to this country.

ALTHOUGH Radio Telephone Broadcasting was conducted with a regular daily and nightly programme from the Westinghouse station at Pittsburgh, Pa., for many months prior to the summer of 1921, the interest in broadcast reception was only felt locally. Almost a year ago, experimenters, particularly in the New England States and New York, suddenly awoke to the fact that the centre of radio had formed around Pittsburgh, and an investigation of radio manufacturers' sales revealed that quietly, under the stimulus of radio telephony, that section had outstripped all others in receiving sets *per capita*.

Right at that time the Dempsey-Carpentier bout was held in New Jersey. Without any public announcements the Westinghouse Company had erected and perfected the operation of a ½-kW. telephone set at Newark, New Jersey, just across the Hudson River from New York. Just before the contest was to take place, notice was given that the fight returns would be broadcasted, blow by blow, from Newark, now so widely known as WJZ.

It was a most appropriate time to catch the attention of the public, for interest in the bout was keen. In public places and private homes thousands of people were intensely thrilled by the reception of each detail, given out by radio, even to the ringing of the gong and the applause of the spectators.

New York, acting characteristically as a distributing centre, sent out the news of this achievement far and wide through the mediums of the newspapers and travellers from other cities who witnessed, or rather heard, the demonstration. At that time, too, WJZ took up the reporting of baseball games and, later, football. Facilities of the *Newark Call* newspaper were made available to the operator, who despatched by radio résumés of press reports. Then a daily programme was adopted. Music was sent out each hour on the hour, starting at 10.0 a.m. In the evening a special entertainment, starting in the bed-time stories for the children and ending with music or singing by the best known artists, was scheduled.

The radio business, always slow between June 1st and September 1st, started up with a jump. Before the dealers knew what had happened their shelves were empty. Insistent demands for broadcasting stations came from all sides, but no company was prepared to turn out heavy duty equipment. Then, as always, the experimenters set to work. In different cities all kinds and types of transmitters were erected for radio shops, department stores, newspapers, furniture stores, and similar companies. Anything that would speak was called a broadcasting station.

By Christmas there was no such thing as a rush order, or perhaps it should be said that all were rush orders. In January it almost seemed that only through personal friendship with the manufacturers could dealers get supplies. February brought offers of premium prices. And so it went.

The first real radio show was held at New York City in March, 1922. Instead of the scattered attendance of 1921, thousands of people came to learn of this new wonder. Thousands, too, were unable to obtain admission. Radio companies were formed all over the country, dozens of them every week. Magazines sprouted on the news-stands like mushrooms. nnouncements of radio shows in other cities followed in quick succession. At electrical stores where, six months back, the buyers had refused to talk with radio salesmen, established wireless departments which in many cases exceeded in volume all

their other business. It became quite the usual thing to sell £200 worth of apparatus a day over the counter. Equipment appeared in the windows of drug stores, hardware stores, millinery and tailor shops, seed stores, pawnshops, and, of course, department stores took it up. Some enterprising radio companies arranged to stock and operate radio sections in department stores, paying 10 per cent. for the space and accommodations. They had the special advantage of being able to get the supplies.

During this time conditions in the air became badly muddled. Those who were interested in hearing the broadcasting complained that different telephone stations interfered with each other, or were interfered with by experimenters on 200 metres and commercial stations at 600 metres and above. Others carrying on long distance or DX transmission and relay work at 200 metres complained that telephone stations made their work impossible.

Before long however, by Government regulation through the Department of Commerce, which controls radio as the Post Office does in England, and the co-operation of radio clubs, particularly those affiliated in the American Radio Relay League, the difficulties became quite well adjusted. Between Messrs. Warner and Schnell, Editor of *Q.S.T.* and Traffic Manager of the A.R.R.L., respectively, the experimenters were made to realise that they could not interfere in the legitimate broadcasting if they did not respect the rights of the telephone on the air. Since telephone stations generally close down by 10 p.m., sufficient time is left for the "Boiled Owls" to carry on their DX work. Then came the arranging of broadcasting schedules, with the result that one station follows another all day and all evening, thus replacing with continual entertainment the irregular interference of the spring. These schedules are planned in cities where two to six broadcasting stations are in operation.

The expense of broadcasting too, has worked itself out. Obviously it would be too great an undertaking for one company to operate any number of stations. Such expense must be borne by the individual company and charged off as advertising, as there is no Government support. Neither is there a charge for transmitting licences. No receiving licence or regulations are imposed. Consequently the Western Electric Company, by agreement with Westinghouse and General Electric, the only concern building telephone transmitters under full patent protection, has and is making sets to sell to such companies as can afford to carry a broadcasting station in their advertising appropriations. In that way those corporations profit by the sale of the sets, and reap a double profit through the sale of apparatus to experimenters.

Perhaps the greatest hardship to the public and the legitimate companies are the "bootleg" manufacturers who, seeing a chance to profit by the under-production of equipment, copied various standard advertised instruments and cut the prices. That situation has largely taken care of itself. The dealers, anxious to get goods about the time the boot-leggers were showing samples, ordered far and wide, assuming that deliveries would be slow. Those concerns got into full production about May, just before buying stopped for the summer months of June, July and August. Right at that time dealers cancelled all their orders except those placed with reputable companies, whose goodwill they will need this fall. The boot-leggers were thus caught with big stocks and no market, bills to pay and no accounts to collect. As a result they went out of business by the dozen in all parts of the country.

Here, then, you have a sketch of broadcasting and developments from it, viewed by the public and the manufacturer. If there is here a suggestion or two for the English radio man, I shall feel that I have to a small degree repaid those who have made my stay in England so pleasant and interesting.

Notes.

The Radio Club d'Algerie.

The Secretary of the above Club, Mr. A. Moisan, Boulevard Carnot, Algiers, will be pleased to receive communications from British amateur societies. His Club is at present interesting itself in particular in problems of static interference. It is proposed to publish a journal of the Society next October.

Society Formed at London County Hall

As the result of a meeting held at the new County Hall, a wireless society has been formed which is seeking affiliation with the Wireless Society of London. Mr. S. E. MacKeown has been elected President, and the Hon. Secretary is Mr. H W. Fuller. The membership comprises those members of the L.C.C. staff at the County Hall who are interested in wireless matters. The Society meets monthly in Room 38 on the first Tuesday, at 5.30 p.m.

Edinburgh Society's New Station.

A transmitting station, 2FT, has been equipped by the Edinburgh and District Radio Society. C.W. and telephony transmissions are conducted on 150-200-440 metres.

Herschel Centenary.

On August 25th, at Slough, the centenary of the death of Sir William Herschel was commemorated. As first President of the Royal Astronomical Society and a great scientist he is remembered with profound respect by all.

Weather Reports for Canadian Farmers.

Broadcasted weather reports are to be furnished by the United Farmers of Ontario for the benefit of farmers generally. Transmission will be effected from the headquarters in Toronto. Market reports will also be sent out in this way.

Broadcasting from Arlington for U.S. Shipping Board Vessels.

It is announcedthat Arlington (NAA), immediately after broadcasting the time signal, will give the call letters of all ships for which Arlington has traffic, and, at the conclusion of the broadcasting schedule, will broadcast messages for those vessels previously designated.

Saint Assise in Operation.

Trouble in Ireland has affected cables to America and the result is pressure on the French-American communications. Saint Assise is reported to have risen to the occasion by speeding up to full working order and transmitting a million words a day.

A High Power Station Wanted.

Tristan da Cunha, a British possession in the South Atlantic, is 1,700 miles from the nearest inhabited land, and is in need of an installation which will place the island with its 120 or so inhabitants in communication with the outside world. This lonely spot is midway between Cape Horn and the Cape of Good Hope, A receiving set has been given by the South African people, and meteorological equipment has been introduced, but no means of transmission is as yet available. A system of communication across the South Atlantic, using Tristan da Cunha as a link station, would overcome the islands difficulty, but the cost would hardly justify the experiment, unless some further purpose could be served by the station.

British Association Meeting. September 6th to 13th, 1922.

During the meeting of the British Association this year, a temporary branch of the Meteorological Office, Air Ministry, will be opened at the Guildhall, Hull. Synoptic weather charts will be prepared daily and exhibited, together with forecasts based on them, on a large specially constructed blackboard in the Reception Room of the Association. In addition a "Local Daily Weather Report," containing the morning's synoptic chart with forecasts and local weather information, will be duplicated, and copies posted in the various buildings occupied by the Association and in certain prominent places in the City.

These reports will be prepared solely from data contained in the routine weather messages issued broadcast daily by wireless telegraphy in Great Britain and other European countries. For the reception of these messages an ordinary standard receiver will be installed consisting of a single rectifying valve and two low frequency amplifying valves with variometer tuning circuits. Members of the Association will be admitted to the room in which the messages are received and will be able to see the whole process of reception, decoding, construction of weather charts and preparation of forecasts.

It is hoped that this demonstration will be of assistance to many who may wish to receive this up-to-date weather information, either through interest alone or for its practical use or in the case of Colleges, Schools, etc., for educational value.

Exhibition at the Central Hall, Westminster.

A wireless exhibition was opened on Saturday, September 2nd, at the Central Hall, Westminster. The exhibition closes on September 8th.

The exhibits include wireless apparatus and parts, whilst a considerable number of wholesale suppliers of wireless accessories are represented.

Competitions are being run in connection with the exhibition, one of which consists in attempting to solve a crime by means of wireless, and another is a competition in operating speed.

The organisers of this exhibition are Messrs. Dale, Reynolds & Co., Ltd., of 46, Cannon Street, E.C.4., who are to be congratulated on the large attendance which the exhibition is drawing.

Correspondence

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—With reference to Mr. Harris's article entitled "Wireless Without an Aerial," which appears in the August 26th issue of *The Wireless World and Radio Review*, the attention of experimenters should be drawn to the danger arising from using ordinary types of aerial condensers in the manner there described. Many of the ordinary patterns of variable air condensers have short-circuit positions at one or both ends of the scale, so that a dead short circuit of the supply mains might easily occur if the condensers are not handled carefully. Small specks of dust on the condenser plates are also liable to cause a flash over on 200 volts circuits. The only safe way of experimenting in this direction is to employ condensers properly designed for this use, and having high insulation resistance. Fixed condensers can be used in lieu of two of the variables described, leaving the tuning to be effected by the series condenser in the ordinary way.

PHILIP R. COURSEY,
Chief Engineer, Dubilier Condenser Co., Ltd

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—As one greatly interested in the wireless telephony movement so prominently before the public at the present time, I am anxious, before installing one of the many receiving apparatus now on the market, to know somewhat definitely the prospects of the wireless telephony service in the immediate future.

I have made inquiries of several manufacturers of and retail dealers in wireless telephone receiving

apparatus, and I have read a good many paragraphs in the daily press on the subject. The net result I have arrived at is that in return for a considerable outlay on the purchase of apparatus, erection of aerials, etc., I may have the great privilege of hearing nightly concerts, bed-time tales—whatever they may be—occasional lectures on subjects of interest (to whom?) and on Sunday sermons of an undenominational nature not likely to cause offence to any religious sect. No prospects of receiving any news of real interest such as important foreign and home news, election results, parliamentary news, stock market closing prices, foreign exchange rates, racing or other sporting results, is even hinted at; in fact, in one instance, I was told (with what amount of accuracy I do not know) that broadcasting centres were definitely pledged not to distribute anything in the nature of daily news. This reduces wireless telephony receiving apparatus to the level of an ingenious toy somewhat inferior to the gramophone, and I, for one, am certainly not inclined to incur the expense of £100—the amount of the estimate for installing the wireless telephony receiving apparatus in my country house—for the very doubtful privileges offered. I do not care for indifferent music; the lectures I prefer to read (or not) in my daily or weekly paper; and even the inoffensive sermon does not strongly appeal to me.

Surely an epoch-making invention such as wireless telephony can be put to more useful purpose and have a greater commercial utility. Why not make it a means of rapidly disseminating real news, or would this infringe the vested interest of the press, such as the introduction of the railway locomotive did to the mail coach business, or the reaping machine to the agricultural industry some time ago?

ENQUIRER.

[The question of the broadcasting of news items, etc., is one which we understand the Government now has under consideration, and the decision which will be arrived at will no doubt depend largely upon the attitude of the press.

The cost of installation of a wireless receiving station, as quoted by Enquirer, does not seem to us to be a reasonable average estimate.—ED.]

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—In recent issues of your paper you have published letters from various amateurs reporting successful reception, but in nearly every case you fail to give an idea of the location of the station.

For instance, in last issue you publish a letter from an amateur who receives Croydon without H.F. amplification. If this gentleman is up North here (except Aberdeen) it is very good reception, but if he should be down in the Midlands it is nothing to shout about.

A short time ago a correspondent reported good reception of the Halifax telephony. Our heads went up in the air for about a week until we found that we could have reached the man with a decent sized megaphone, he only being a short distance away.

If your correspondents do not wish to have their addresses published, at least the town could be inserted. To those of us who specialise in long distance reception it is not much use to read of an amateur hearing **2KD, 2GU,** or **2YF,** if there is no indication as to whether he is 10 or 100 miles away.

I should like to raise another point on which I have written you before, and that is, to ask amateurs transmitting to say who they are. Up North here on changing over we always start "Hello **2AB, 2CD** replying ..... **2CD**over."

Down South of us, the practice seems to be "Hello, old bean, your speech is **O.K.** changing over," and "Well, I'm shutting down now, call you up to-morrow," giving no indication as to whether the experimenter is transmitting well, 100 miles away, or badly, 10 miles away.

A few Sundays ago I heard a magnificent musical programme on about 950 metres. At the conclusion a request was made that listeners-in would send reports as to reception, but during the whole 35 minutes of the programme there was never the slightest indication given as to who the experimenter was.

By the way, is there any hope that the P.M.G. will prohibit the use of reaction to the "ether abusers." We could equip a splendid drum and fife band in Halifax and district.

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

Book Received

RADIO RECEIVING FOR BEGINNERS. By Rhey T. Snodgrass and Victor F. Camp, London: *Macmillan and Co.* Pp. 100 7¼" × 5¼".)

Calendar of Current Events

Friday, September 8th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

8 *p.m.*—Lecture on "Automatic Telephony," by Mr. H. Mortimer.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

8 *p.m.*—At Erith Technical Institute, General Meeting and enrolment of members.

RADIO EXHIBITION AND WIRELESS CONVENTION, CENTRAL HALL, WESTMINSTER.

(*Last Day of Exhibition*).

Sunday, September 10th.

Daily Mail concert from the Hague (**PCGG**) 8 to 9 p.m. B.S.T., on 1,085 metres.

Monday, September 11th.

HORNSEY AND DISTRICT WIRELESS SOCIETY. Lecture on "Practical Construction of an Amateur Receiving Station." By H. Davy.

Tuesday, September 12th.

Transmission of Telephony at 8 p.m. on 400 metres by **2 MT** (Writtle).

Thursday, September 14th.

Daily Mail Concert, 8 to 9 p.m. (as above).

Wireless Club Reports

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

Wireless Society of London.

The New Session of the above Society is about to commence, and announcements will appear in due course.

Applications for affiliation or for membership should be addressed now to the Hon. Secretary, Mr. L. H. McMichael, 32, Quex Road, N.W.6.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of this Society on Thursday, August 24th, it was announced that permission to utilise the mast over the "Dew Drop" Inn to support the free end of the aerial had been refused by Messrs. Worthington. A fresh scheme is being devised, and this is being left in the hands of the Technical Committee..

An interesting discussion took place on several points raised by some of the newer members concerning the working of their apparatus.

The proposed Exhibition which the Society hopes to hold in Hanley at the end of the year or the beginning of the new year was discussed, and enquiries are now being made to find a suitable hall in which it can be held.

An interesting programme is being drawn up for the next few weeks. A demonstration was held a few days ago with the aid of an indoor aerial and the Society's three-valve set.

Wolverhampton and District Wireless Society.*

A meeting of the above Society was held at Headquarters, 26, King Street, Wolverhampton, on Wednesday, August 23rd, when a lecture was given by Mr. D. P. Baker on "Tape Recording by Wireless."

The lecturer dealt very ably and lucidly with the subject, explaining the necessity for rectification and the use of two relays to operate the inker, also demonstrating with the actual apparatus and with diagrams. It was evident the lecturer had had considerable experience in recording. The meeting was well attended, and the members present were greatly interested. It is hoped to secure the services of Mr. Baker again at an early date.

The resignation of the Secretary, Mr. G. W. Jones, was tendered and received with regret, Mr. Jones feeling reluctantly compelled to relinquish the secretarial duties owing to pressure of business. The meeting passed a very hearty vote of thanks to Mr. Jones for his past services, special reference being made to his work as one of the founders of the Society.

The newly appointed Secretary is Mr. J. A. H. Devey, 232, Gt. Brickkiln Street, Wolverhampton, who would be glad if correspondents would kindly note.

Wireless and Experimental Association.*

On Wednesday, August 23rd, The Wireless and Experimental Association, at the Central Hall, Peckham, had the pleasure of listening to a very interesting and instructive lecture by Mr. F. H. Haynes, on the Johnsen Rahbek Loud Speaker. Starting from the very beginning, the lecturer went through every point of the construction of the apparatus, giving enough of the theory to enable his listeners to appreciate the various parts and their uses.

Full instructions were given to enable one to cut and polish their own agate cylinders—if they had the right sort of agate. The necessity for a polarising battery to make the apparatus sensitive to weak signals was well brought out.

The Association's installation engineer was unfortunately not present, and the wireless receiving set not available for purposes of demonstration of the capabilities of the loud speaker, but a couple of orators and a songster in another room made up a scratch broadcasting programme, though they did not tell the tale of the stuffed dog.

The lecturer afterwards demonstrated the use of the Neon tube as a generator of oscillations, and more than one present had an idea that it might be very useful in the installation of an Armstrong receiving circuit.

The meeting closed with a cordial vote of thanks to the lecturer.

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

North Middlesex Wireless Club.*

The 97th meeting of the Club was held on Wednesday, August 23rd, at Shaftesbury Hall, Bowes Park. Before the meeting was formally opened, Mr. Holton gave a lecture to the more elementary members who had assembled on the subject of aerial construction. He explained the reasons for the different types of aerials, and showed why the single wire type was to be preferred for receiving short waves, although the two-wire type was better for longer waves. Mr. Holton answered many questions put to him and cleared up several knotty points.

The meeting was then formally opened by the Chairman taking the chair at 8.30, and calling on Mr. A. J. Dixon for his talk "Commercial Wireless Instruments and How they Work." Mr. Dixon explained the principles on which the Magnavox, the Brown loud speaker, the Brown head receiver, and several other well-known instruments work. The Chairman, Mr. Evans, also contributed to the evenings discussion, and the meeting closed by a vote of thanks moved by the Chairman to Mr. Dixon.

Several new members were enrolled, and the

Librarian was kept busy attending to the demands of members for books.

Particulars of the Club may be obtained from the Hon. Secretary, Mr. E. M. Savage, "Nithsdale," Eversley Park Road, N.21.

The East London Radio Society.*

A very successful and well attended meeting was held in the Society's lecture hall in Woodstock Road, on Tuesday, August 22nd, 1922, at 7.30 p.m.

The meeting opened with the usual buzzer practice.

Mr. J. Lipowsky lectured upon the construction of a cheap and efficient loud speaker, using mechanical connection between an ordinary earpiece and a gramophone reproducer. This idea proved so novel and efficient that we hope to pass on full detailed account through the medium of this journal for the benefit of all amateurs at an early date.

In conclusion the speaker was bombarded with many questions relating to telephones and loud-speakers' generally, all of which he dealt with in a very able manner to the satisfaction and enlightenment of everyone present.

Several new members were accepted and the meeting closed with a hearty vote of thanks to the lecturer and the Chairman at 10.15 p.m.

The Hon. Secretary, Mr. L. E. Lubbock, King George's Hall, East India Dock Road, Poplar, invites inquiries from all interested amateurs in the East London district.

The Southend and District Wireless Club.*

Hon. Secretary, Mr. D. L. Plaistowe, 21, Oakleigh Park Drive, Leigh-on-Sea.

On August Bank Holiday last, a very interesting and successful event took place at the Rectory Grounds, in Leigh-on-Sea.

The exhibition and demonstration of reception on Club Members' apparatus, was well attended by the public, and messages and concerts, etc., were intercepted from **2 LO, 2 LZ**, and many other local stations, in spite of the atmospheric conditions which were absolutely abnormal here.

To obtain results on the short aerial in use at the time it was necessary to add capacity in large amounts in series with A.T.I. and this cut down the efficiency of the circuit so much that signals on the Brown loud speaker were not loud enough to be heard all over the tent, so that the five-valve circuit with 2 H.F. will be used on a future occasion, so as to have some reserve of power to cope with changed conditions.

Messrs. Bridge & Son, showed a very compact and efficient three-valve receiver of the unit system, and their exhibition of component parts was of interest to many that evidently were just commencing reception of W.T.

A single valve portable receiver by the Leigh Wireless Stores was much admired, and in fact all club members that were in connection with the trade had made a good show in spite of short notice. It is hoped in October next to give a large exhibition, and to admit the public to a radio concert on proper lines which, being held in a building, should be successful, as it is difficult to carry the sound far in the open air or in a tent.

Members of the Sheffield and District Wireless Society photograph in the Blue John Mine, Castleton, to which a visit was paid recently for the purpose of conducting underground experiments.

A general meeting was held on August 18th, at Club Headquarters, St. John's Ambulance Depot, in Queen's Road, Southend.

Mr. Davies took the chair in place of Mr. Mayer who was unable to attend owing to business. The meeting opened at 8.10 p.m., and the Chairman called on the Hon. Secretary to read the minutes of the previous meeting. After the approval of the same, and following business arising therefrom, he called on Mr. Plaistowe to give his lecture on "The Fleming Valve and the Electron Theory in General."

The method of taking the characteristic curve was given, and the usual description of the popular theory of electronic action explained.

After a hearty vote of thanks Mr. Jackson was called upon to talk on "Direction Finding." He explained very concisely the method of procedure and gave a typical instance and working by trigonometry. A general discussion then took place on the subject of the lecture, and Mr. Jackson was plied with questions which he very ably dealt with.

The meeting was declared closed at 10 p.m.

In common with most wireless societies at the present time we are being inundated with queries and demands for particulars of membership from people who are just commencing the reception of signals, etc., on apparatus purchased from some firm or other. We shall be very pleased to have them in the Society as members when we commence our winter session on October 6th.

In the past the Club of course consisted of "pre-boom" experimenters who all more or less had at least a knowledge of the fundamentals of electricity, so that it was no difficult matter for them to understand wireless theory and practice.

The people to-day, however, do not appear to have at all an extensive knowledge of electricity but yet are keen enough to purchase a "set" and commence operations, usually to the accompaniment of whistles, moans and shrieks, and other phenomena. In this town, particularly, there is too much of this sort of thing going on at the present time, and we want to help these people, and in doing so help ourselves.

Accordingly, we invite all amateurs in Southend and district to come along on October 6th to the Club-room and give their views in writing to the Hon. Secretary, so that the future policy of the Club can be adapted to suit the needs of the times.

Ramsgate, Broadstairs and District Wireless Society.

Joint Hon. Secretaries, Mr. F. Harrison, Rochester Cottage, High Street, St. Lawrence, Ramsgate, and Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs.

The following gentlemen have kindly consented to become Vice-Presidents:—Hon. E. C. Harmsworth, M.P. (Thanet), Lieut.-Col. Sir T. B. Robinson, K.C.M.G., K.B.E., Sir Cecil Hertslet, K.B.E., J.P., Sir Edward Rigg, C.B., C.V.O., I.S.O., H. Bing, Esq., J.P., Rev. F. G. Ridgeway, M.A., James Emery, Esq., H. C. Flowerdew, Esq., W. G. Riddle, Esq., C. F. Grossmith, Esq.

Following an informal meeting held in July, a committee meeting was held on August 24th, at Ramsgate, under the chairmanship of the President, Mr. H. C. Norman, B.A., for the purpose of drawing up the rules and discussing the necessary details for the formation of the Society. The Committee of Management, composed of Messrs. H. C. Norman, B.A., E. Guy, M.Sc., E. P. Pester, B.Sc., C. E. Hume, P. F. Weeks, M.B.E., P. E. Stanley (Ramsgate), P. F. Cotton and F. C. Marshall (Broadstairs and District), considered the necessary rules and details for the formation, which were finally agreed and adopted. It was decided to divide membership into three sections: "Members," "Associates," and "Student Associates." Subscriptions to be 10s., 5s. and 2s. 6d. per annum. "Members" having two votes and the privilege of bringing a friend to meetings, etc., once a month. "Associates" having one vote but not the latter privilege. "Student Associates," being junior members still attending school. A full programme of weekly meetings is being arranged, of which either of the Hon. Secretaries will be very pleased to give full information. The list of members is increasing rapidly and much encouragement is being received locally. The first meeting will be held during September, at the close of the holiday season.

Bishop's Stortford and District Amateur Wireless Association.

Hon. Secretary, Mr. J. Cooper, Halfacres, Bishop's Stortford.

Owing to increasing attendances the monthly meeting of the above was held at the Institute, Bishop's Stortford, on Friday, August 25th. There was a good attendance of members and visitors, presided over by Mr. W. A. Field, and a lecture was delivered by Mr. L. G. Attree, upon "Accumulators." The lecture which was full of technical information was delivered in a manner readily understood by the tyro, and dealt with the types, voltage, capacity, etc., best suited to radio work. Mr. Attree, whose experience of his subject is an exceedingly wide and long one, insisted upon the superiority of glass containers over those of celluloid or even of ebonite, and emphasised the need of care and maintenance in order to obtain maximum results. A vote of thanks, proposed by the Vice-President and seconded by Mr. Filby, was accorded Mr. Attree for his instructive lecture.

Communications should be addressed to the Hon. Secretary.

Coventry and District Wireless Association.

Hon. Secretary, Mr. J. E. Bolus, Iona, 14, Coundon Road, Coventry.

A meeting of the above Society was held at the Club Room, Charlesworth Buildings, 128, Much Park Street, Coventry, on August 23rd, 1922, for the purpose of enrolling members into the Society which was reconstructed at the last meeting.

The Chairman, Mr. A. M. Sidley, addressed the meeting and pointed out the absolute necessity for a Radio Club in Coventry, and said that judging from the attendance there that evening amateur wireless appeared to be very popular in Coventry.

The Committee had been into the matter of entrance fees and annual subscriptions, and have fixed them at 5s. and 10s. respectively for senior members, and 2s. 6d. and 5s. for juniors.

There were 42 members enrolled, and it is hoped that this number will in the near future be considerably increased.

The club room is open to all members on any night, and arrangements are being made for a work bench and also a library of periodicals and technical books to be installed as soon as possible.

The Secretary will be pleased to give any further information on request; notices of lectures, etc., are published in the local newspaper, and are also shown in the various electrical contractors shops throughout the town.

Newark and District Wireless Society.

Hon. Secretary, Mr. Geo. T. Sindall, 6, Beech Avenue, Hawtonville, Newark, Notts.

The above Society will resume their meetings for the winter session on Wednesday, September 20th, at the Magnus Grammar School, at 7.30 p.m.

The Committee are hoping to make this session a greater success than the last, and hope all interested will make an effort to come along and join them, whether they are in possession of receiving sets or not.

A transmitting licence has been applied for, and in the event of this being granted much interesting work can be looked for which will be of great benefit to local amateurs.

Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

This Society, which was recently founded, has now a membership of over 30, and is anxious to increase its numbers still further. Full particulars can be obtained from the Hon. Secretary at the above address on receipt of a stamped addressed envelope.

A full meeting was held on Friday, August 18th, and a programme was formed for future meetings.

It was arranged that the Club set should consist of three valves—one high frequency, one detector, and one low frequency. Mr. Pugh consented to make the panel, while Mr. Webster volunteered to make the cabinet to hold it. The whole of the Club members meet every Friday to construct various items to include in the set, which it is hoped will be in use by September 11th.

On Tuesday, August 22nd, the members present enjoyed music and speech from **2 OM** and **2 FQ** as well as Morse signals from various stations, including loud signals from **GFA**, and a two-valve set loaned by Mr. Webster for the evening. Other members have kindly consented from time to time to lend their sets for demonstration purposes.

The Walthamstow Amateur Radio Club.

Hon. Secretary, Mr. R. Cook, 49, Ulverstone Road, Walthamstow, E.17.

The Society is now well established and the membership is still steadily increasing, and an Assistant Hon. Secretary was appointed a short time ago in order to cope with the increasing business of the Club. On August 23rd, Mr. Tyler gave a lecture to the advanced members of the Club on "Ionization of Valves," and Mr. Webb lectured to the more elementary members on the approximate cost of constructing a valve panel and the necessary apparatus used.

The Committee are hard at work arranging the lectures for the Winter sessions.

The Secretary will be pleased to welcome any prospective member. Meeting nights, every Wednesday, from 7.30 p.m. to 10, at the Y.M.C.A. Church Hill, Walthamstow, E.17.

The Durham City and District Wireless Club.

On Friday evening, August 25th, the fifth meeting of the above was held. It proved to be a very enjoyable and intensely interesting evening for the members.

The Morse buzzer class, conducted by Mr. G. Nurthen, assisted by Mr. W. Rushworth, was quite exciting, the ladies particularly enjoying themselves.

After Morse practice the Hon. Secretary, Mr. Geo. Barnard, gave a short lecture on "Diagram Interpretation," using 22 diagrams upon the blackboard to represent various apparatus. These diagrams were copied by the members.

After the announcements, the Chairman, Mr. S. Kelly (Hon. Treasurer), commenced the question period by asking the Secretary to review briefly the last lecture on the relationship between inductance and wavelength of a closed oscillatory circuit. At the request of a lady member Mr. Barnard gave a condensed explanation of the function of a crystal detector in a receiving circuit. Mr. R. W. Holmes at this point drew and explained the curve representing the relationship of the resistance offered by a crystal to the E.M.F. applied.

A lively discussion then followed. Several new members were enrolled. There was no time to discuss the merits of a free library.

Mr. Ainsley, of the Henley Cable Co., is the lecturer for the next meeting, which is to be held on Friday, September 1st, at headquarters (Y.M.C.A., Claypath).

Intending members are always welcome.

The Wireless Society of Liverpool.

Hon. Secretary, Mr. C. L. Lyons, 76, Old Hall Street, Liverpool.

A highly successful meeting of the above Society was held on Thursday, August 24th, at the Royal Institution, Colquitt Street, Liverpool.

Special arrangements had been made with The Ashley Wireless Telegraph Co., Ltd., of Renshaw Street, Liverpool, whereby they would transmit telephony and musical items from their experimental station, **2 KH**, the same being received on a five-valve receiving set of their own manufacture (2 H.F., 1 Rect., 2 L.F. valves).

The programme commenced promptly at 8 p.m., and continued until 9.30, there being six-minute transmissions with intervals of five minutes duration each. The receiving set was operated by Mr. C. G. Williams, of Messrs. Ashleys (who is also a prominent member of the Society and on the Advisory Committee). The whole of the items were received extremely satisfactorily (especially in consideration of the fact that the set was worked in conjunction with the Society's indoor aerial which is of but moderate dimensions) and were made clearly audible to all present through a "Brown" loud speaker. The programme was very varied, containing amongst other items, selections from Gilbert and Sullivan, "Annie Laurie," "The Policeman's Holiday," a "Pot-Pourri" and then inimitable Tom Foy in a speaking record.

The five-minute intervals were occupied in answering the questions deposited previously in the question box, Mr. S. Lowey rendering great assistance, illustrated with very clear blackboard diagrams.

The next General Meeting of the Society will be held at 7.30 p.m. on Thursday, September 14th, at the same address, and all amateurs or interested persons of either sex are extended a hearty invitation.

A meeting of the General and Advisory Committee has also been arranged for September 7th, for the purpose of arranging an interesting and instructive winter syllabus. All intending members are therefore advised to apply at once to the Secretary for application forms, so that none of the special meetings which are being arranged, will be missed.

Proposed Wireless Society for Tottenham and District.

Will all interested please communicate with Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, Tottenham, N.17.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receive can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set set up oscillations or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"R.M." (Coventry) *wishes to obtain a temporary post as operator next summer, and asks (1) If he could acquire sufficient theoretical and practical knowledge by self-preparation. (2) What books are recommended for studying purposes.*

(1) Theoretical knowledge, yes; practical efficiency, very unlikely. Moreover, we think it unlikely that you would get a berth under these conditions, as the supply of thoroughly qualified operators appears to be at least equal to the demand. (2) We should recommend Bangay's "Elementary Principles" and his "Oscillation Valves" for a start, and more advanced books and the P.M.G. handbook later.

"L.S." (Stretford) *has a set of which he encloses a diagram, which gives no results, and asks for assistance.*

The set appears fairly good although results are poor. Condenser D should go from the other side of reaction coil to earth, and should be about 0·001 mfds. The reaction coil should couple with secondary instead of the primary, and should be small enough to slide right inside it. Examine all aerial and earth connections and insulation very carefully.

"W.V." (Fulham) *asks (1) For an efficient two-valve receiving circuit which can be constructed at reasonable cost, and covering a wavelength range of 180/200 metres, with values of capacities, resistances, etc., and (2) Whether this will work satisfactorily in a horizontal position.*

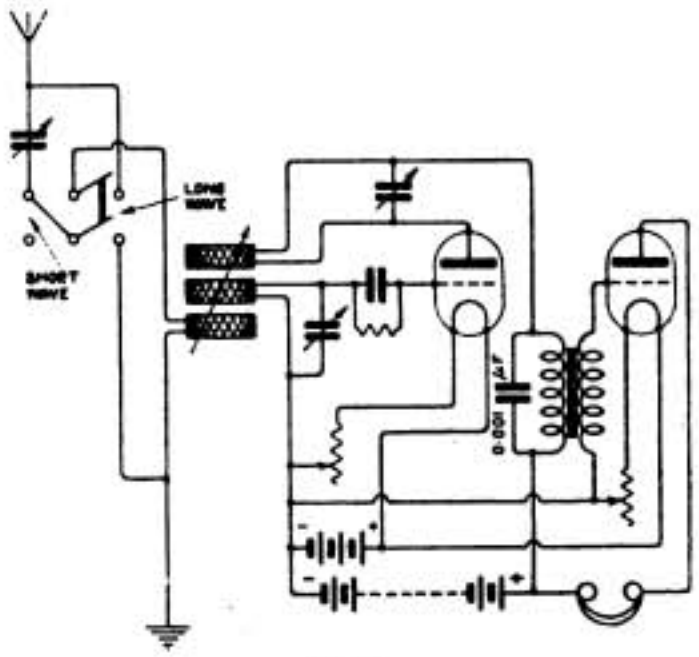


Fig. 1.

(1) See Fig. 1. (2) Receiving valves are usually so constructed that they can be operated in any position. This does not apply to large transmitting valves and rectifying valves however.

"W.G.A." (Southampton) *asks two questions relating to winding coils for his set.*

(1) The A.T.I. internal diameter 1", external 7". For the reaction coil 4" internal, 5" external diameter, wound with the same wire. (2) It is impossible to give at all accurate values. In this case we should recommend tappings at equal numbers of turns from the inside to the outside.

"C.E.P." (Battersea) *asks* (1) *Will four solo receivers of 750 ohms each, connected in series, be efficient for telephony.* (2) *What current does a zincite-bornite combination need.* (3) *What additions does he need to a list of apparatus to make a crystal detector and valve amplifier.* (4) *For a diagram of a circuit for use with the above.*

(1) Yes, if of good make. (2) No polarising E.M.F. is necessary with this combination. (3) For the simplest type of circuit two batteries, L.F. and H.F., grid condenser and leak and L.F. inter-valve transformer. (4) See Fig. 2, page 336, June 10th issue, omitting the potentiometer and battery.

"J.W.A." (Northallerton) *is contemplating the construction of a three-valve receiver, and asks* (1) *The best simple circuit for making use of three valves for reception of spark, C.W. and telephony, up to wavelengths of* 3,000 *metres.* (2) *Whether the apparatus will be suitable to operate a loud speaker.* (3) *Whether resistance capacity or transformer coupling is recommended, and* (4) *The capacities of the various condensers.*

screw back until the point is reached where signals reappear.

"P.K." (Paris) *asks* (1) *If he should hear English stations with a two-valve set.* (2) *What English stations will he be able to hear.* (3) *If any English station sends telephony like* **FL.**

(1) and (2) You should hear some of the larger stations, such as Leafield, Carnarvon, etc., but probably not any telephony. (3) There is no corresponding station at present.

"_____" (Bayswater) *encloses a sketch of circuit and asks* (1) *If A is a grid leak, and if so what should be its value for Mullard "Ora" valves.* (2) *If one variable condenser is sufficient.* (3) *What is to be connected at points D and C on the sketch.* (4) *Which of three coils should he use for reactance, and which for primary and secondary.*

(1) A is a grid leak. Its value should be about 2 megohms. (2) One variable condenser is sufficient for a simple single circuit set. It should be used in series with the A.T.I. for short waves, and in parallel for long waves. 0·001 mfds. is O.K. (3) Connect at B a 40-volt H.T. battery, positive

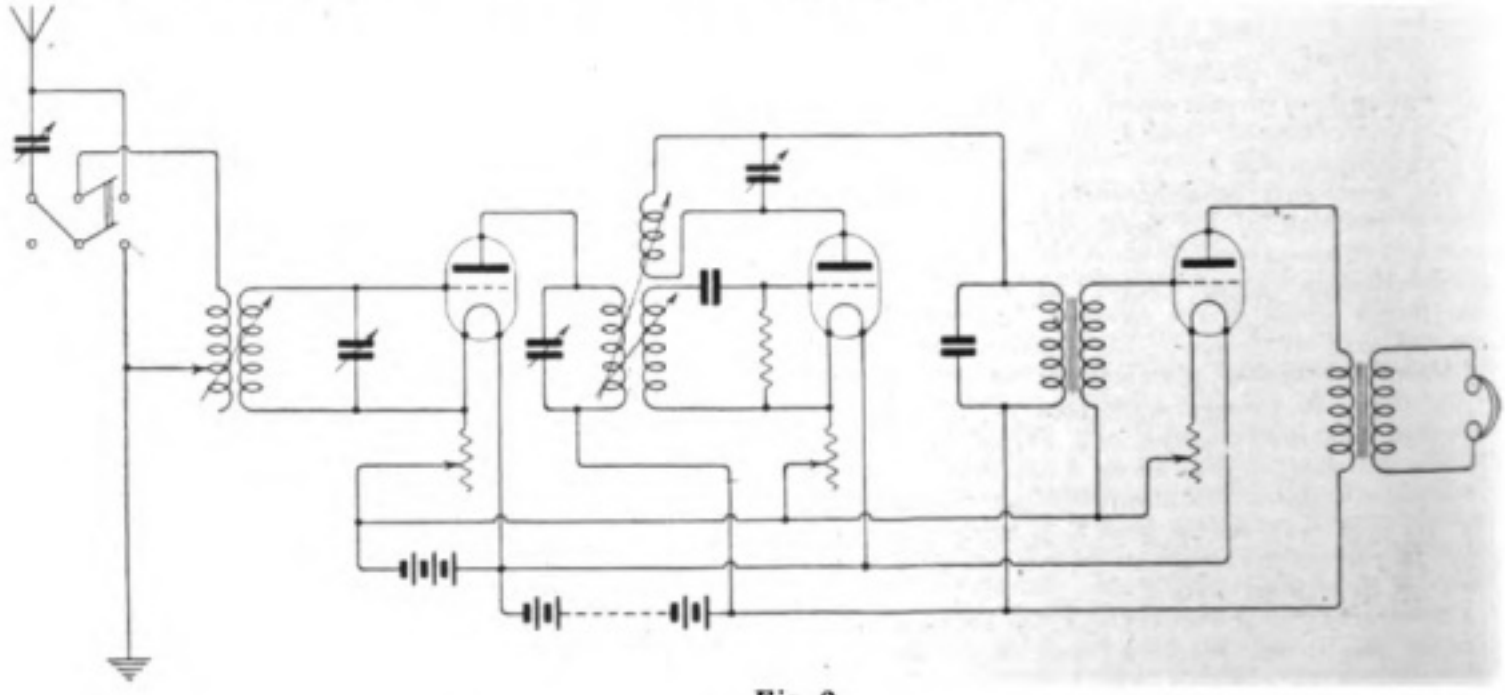


Fig. 2.

(1) See circuit, Fig. 2. For reception on wavelength up to 450 metres you had better make a special set of coils. (2) No; the addition of one or two stages of low frequency amplification is required. (3) As you do not require to receive on wavelengths above 3,000 metres, transformer coupling will be found satisfactory. (4) These are indicated in the diagram.

"R.C.W." (Clapham) *asks for details for adding one amplifying valve to the school set in the October 29th issue.*

The simplest way of doing this would be by adding an additional valve as L.F. amplifier, for which you would only require an inter-valve transformer and the extra valve and socket. The transformer might be 1 oz. and 3 ozs. of No. 44 on a core $\frac{1}{2}'' \times 4''$ of iron wires. The circuit may then be as in Fig. 3, p. 738, September 2nd issue.

"J.D." (S.E.18) *asks how to adjust Brown's "A" type telephones.*

To carry out the adjustment, screw up until a click is heard and signals become inaudible, then to the anode of the valve. At C connect a pair of H.R. telephones. (4) If the stated coil is used in the closed circuit the next larger may be used for the primary and the next smaller for the reaction.

"K.P.S." (Marlborough) *refers to the simple C.W. and telephony transmitter described on page* 292, *June 3rd issue, and asks for winding details of the induction coil for use on a wavelength of* 400 *metres.*

A suitable value for the inductance would be 40/50 turns of No. 20 D.C.C. on a 3" diameter former. We cannot give the exact number of turns as this will depend on the capacity of the aerial which may lie anywhere between fairly wide limits.

"C.M." (Camberwell) *asks if the Marconi* $1\frac{1}{2}$ *kW. ship set is still the same as that given in the* 1918 *edition of Hawkhead, and if not what are the most important alterations that have been made.*

The standard rotary converter, asynchronous spark set, is obsolete, although very large

numbers are still in use. It has been superceded by quenched spark set, with a motor alternator as source of power, and also by a C.W. valve set.

"R.S.M." (Croydon) *asks* (1) *Why do crystal detectors rectify.* (2) *If celluloid varnish is any good as an insulator.*

(1) If you wish to know *how* the actual process by which it works we are afraid we can give you little help, as the action is really not understood and various theories are in existence. We really understand as much about it as we know why such and such a crystal is black, or any other colour. On the other hand most elementary text-books give simple explanations of the process, which give some idea of the action. (2) We have not had extended experience with this material for the purpose, but such work as we have done would point to it being satisfactory.

"NOTSEW" (London) *sends a sketch of his set and asks* (1) *What would be the maximum distance from which amateur telephony, high power telephony and high power telegraphy would be received clearly.* (2) *Are any improvements possible in the set sketched.* (3) *On what wavelength Croydon now works.* (4) *What would be the difference in wavelength if a* 0·0005 *mfd. condenser is used instead of a* 0·001 *mfd.*

(1) Amateur telephony, perhaps 20 miles; Broadcasting telephony, 40 to 50 miles; telegraphy, almost any distance, depending on the power of the transmitting station. (2) A condenser (0·001 mfds.) across the telephones is very desirable. (3) Not very different from 900 metres.

"PIP" (Manchester) *refers to the American short wave receiver described in the issue of June 3rd, and asks* (1) *What is the value of the variable condensers in the diagram* (a) *in the grid circuit of the valve and* (b) *across the telephones, and if these should be variable.* (2) *If there is no grid leak in this circuit.* (3) *Would this receiver be suitable for receiving broadcasting.* (4) *What is the highest wavelength from which this set would receive telephony.*

(1) (a) 0·0003 mfds.; (b) 0·001 mfds. Neither need be variable, but the grid condenser may be with some advantage. (2) A leak should certainly be introduced between the grid side of the condenser and the filament. (3) Quite. (4) No definite limits. Should be O.K. up to say 1,200 metres.

"LITTLE LEVIS" (Ilkeston) *asks* (1) *For a list of apparatus for constructing a set capable of receiving telephony* 150 *miles.* (2) *Would a certain type of aerial be O.K.* (3) *Which of two aerial systems is preferable.* (4) *Which is the best receiving set on the market.*

(1) If you wish to receive **FL** or similar stations at this distance, your set may be quite simple, say three valves. If, however, you wish to receive broadcasting stations at this distance you will require at least three valves, with tuning coils, two variable condensers, H.F. and L.F. transformers, batteries, grid condenser and leak, telephones and variable filament resistance. (2) Yes. (3) 40 ft. high and 40 ft. long single wire. (4) We cannot answer this for obvious reasons, but the best sets, costing say £35 to £50, of most of our advertisers are all very good.

"T.L.H." (Cardiff) *asks* (1) *For advice as as to how to stop his set oscillating.* (2) *If he can receive broadcasting without any alteration to wiring.* (3) *If it would be of any benefit to connect the H.T. battery in series with the L.T. instead of in parallel.*

(1) Try reversing the windings one at a time, also vary the positions of the transformers, or fit each transformer into a closed iron box; also make sure that your reaction coupling is not too tight. (2) Yes, provided that your H.F. transformers and tuning coils are O.K. (3) Your present arrangement is not a parallel connection, as only the negative ends are common. There is very little difference in action between the two ways shown.

"R.St.Q.L." (Harlech) *asks* (1) *If a three-electrode thermionic valve can be used as an amplifier on an ordinary telephone circuit in conjunction with a loud speaker.* (2) *If so, would the ordinary wireless type do.* (3) *What circuit would be suitable and what accessories needed to amply the current from an ordinary telephone with induction coil.*

(1) and (2) Yes. (3) The circuit should be an ordinary L.F. amplifier, with a special input transformer with its primary adjusted to suit the conditions of the telephone line. *N.B.*—The making of any experimental modifications of this nature on the Post Office system is illegal without express permission from the P.M.G.

"G.A.M." (Kensington) *sends a sketch of his set and asks* (1) *If the grid leak and condenser will act as reaction between the secondary and the valve.* (2) *If he could receive a wavelength of* 250/3,000 *metres with this set.* (3) *For criticism of circuit.*

(1) No, you will not get any reaction in this way. (2) If your coils are wound with about No. 26, you should get this range, but 0·001 mfds. is too high a value for the grid condenser. (3) The set would work as shown, but would be better with the variable condenser across the secondary, and with a slider to the primary. The addition of a reaction coil would also give greater sensitivity.

"J.M.G.W." (Godalming) *sends sketch of his set and asks* (1) *If the circuit is correct.* (2) *If one lattice coil will do for a reactance for the set. If so, what should be its inductance in mhys.* (3) *What size series condenser should be used to tune to* 300 *metres.* (4) *If telephony from* **FL, 2 MT, GED, 2 LO,** *and* **GEG** *could be heard.*

(1) Quite O.K. (2) Yes, about 1,000 mhys. should be sufficient. (3) About 0·0002 mfds. should be satisfactory. (4) **FL** probably, **2 MT** possibly, **GED** and **GEG** doubtful, **2 LO** yes.

"RED SUEZ" (s.s. "Mansourah") *sends sketch of circuit and asks* (1) *If it will operate with reaction.* (2) *If it would operate with heterodyne.* (3) *If it would be difficult to operate.* (4) *If it would operate off common batteries.*

(1) Yes. We think the scheme suggested should be quite satisfactory. (2) Certainly. (3) The circuit might need very careful adjustment for successful results, but we have no actual experience of its behaviour. (4) We can see no reason why it should not.

"J.G.B." (Brighton) *sends diagram of set and asks* (1) *If values for H.T. and L.T. are correct.* (2) *If he should hear* **2 MT** *and* **PCGG.** (3) *If tramways, which run about twenty yards from the house, will affect reception.*

(1) Circuit is quite O.K., but you should interchange the 0·003 mfd. grid condenser and the 0·0005 mfd. anode bye-pass condenser. (2) Reception of **PCGG** and **2 MT** on a single valve set

at Brighton are both very unlikely. (3) You may have considerable trouble through induction from trams.

"CENTIGRADE" (Bury) *asks* (1) *If a valve amplifier may be used with crystal set.* (2) *If he would be able to receive telephony from* **FL** *with a crystal set made as shown in the "Amateur Mechanic."* (3) *If zincite-bornite is the best crystal to use.*

(1) Yes. (2) Unlikely at such a distance, but not impossible with a really good aerial. (3) Zincite-bornite is one of the most sensitive combinations. (4) Ordinary valve 4 volts, 0·5 to 1 amp. Low temperature valve, 2 volts, 0·1 to 0·4 amps.

"F.P.O." (Liverpool) *asks for a diagram arranged with switches for effecting* (*a*) *A.T.C. series parallel*; (*b*) *L.T. and H.T. on and off*; (*c*) *Crystal reception only, valve H.F. magnifier followed by crystal rectifier.* For circuit see Fig. 3.

Separating them would then gradually reduce the wavelength to about 850 metres. (3) There is no suitable formula in existence. (4) No, it will not tune up to the wavelength.

"J.O.B." (Westcliff-on-Sea) *asks* (1) *What is the advantage, if any, in using a crystal detector with a local potential, such as zincite-bornite, over one without any potential.* (2) *Why he gets no results with a certain circuit sketched.* (3) *If better results can be obtained by using a crystal detector and valve amplifier.* (4) *How tuning is performed without a sliding contact.*

(1) Zincite-bornite does not require a local potential. In general the crystals which require applied local potential are more steady but somewhat less sensitive than those which do not need it. (2) The circuit appears O.K. and we can suggest no reason from the diagram for it not working, except

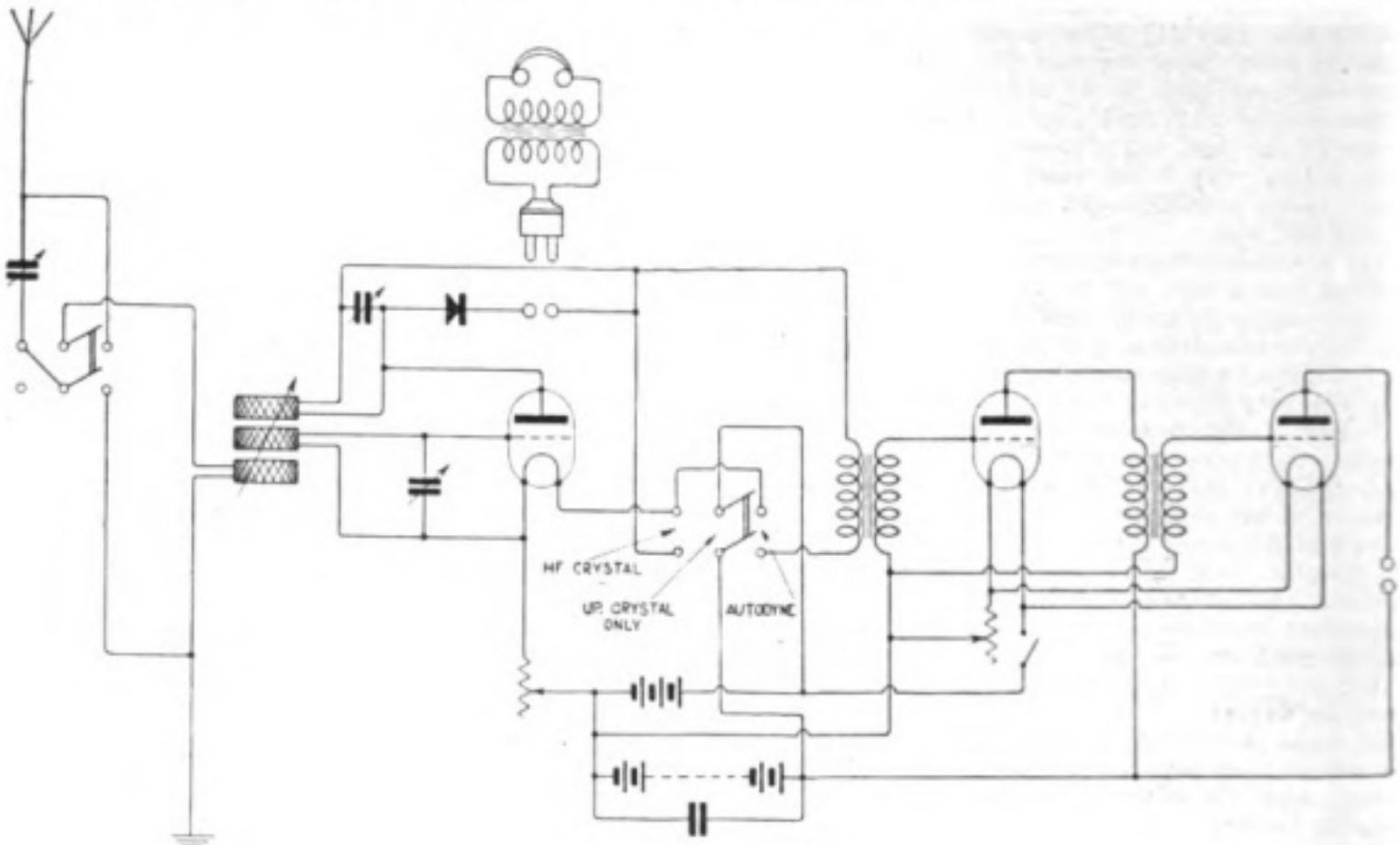


Fig. 3.

"2 BAH" (Dartford) *asks* (1) *For a formula for calculating the wavelength of a single layer coil for use in a wavemeter.* (2) *If two pancake coils placed parallel and concentric are connected in series so that the induction is maximum, what is the effect of separating the coils.* (3) *For a formula for calculating a self capacity of single layer and pancake coils.* (4) *If it would be possible to hear* **FL** *with the crystal circuit sketched.*

(1) It is impossible to calculate the wavelength of a coil used in this way, as the wavelength depends on the self capacity of a coil, which cannot be calculated. A true inductance coil having no self capacity would have no wavelength. (2) As above, a good coil has no wavelength. If, however, the coils would each tune the circuit to 600 metres, placing the two together in the circuit would give a wavelength of approximately 1,200 metres. that 4 volts is rather a low value for the filament battery for this valve. (3) See Fig. 3, page 501, July 15th issue, for a suitable circuit. (4) Tuning can be carried out by a variable shunt condenser, or by a variometer action between two coils connected in series.

"L.S.G.H." (Fulham) *asks for a diagram of connections for a five-valve set.*

Circuit should be as in Fig. 5, page 62, April 8th issue, with additional H.F. and L.F. valves switched in exactly the same way as shown, if desired.

"W.S.F." (Darlaston) *asks* (1) *If a sample of wire will be suitable for a telephone transformer for Sullivan's telephones used in a valve set; also if a certain sample of tinplate will do for a core.* (2) *What size former should be used to wind certain specimens of wire upon, and how many turns of each should be used.*

(1) The sample of tin might be used, but will be inefficient, especially for telephony in comparison with stalloy iron. If used, it will be better to put tissue paper between sheets. (2) The wire is too thick, even for L.R. winding, but if used try about 2,500 turns.

"J.E.W." (Great Berkhampsted) *sends a sketch of his single valve set, and asks* (1) *Why he gets no results.* (2) *What should be the maximum and minimum wavelength.* (3) *What is the approximate capacity of the variable condenser.*

(1) We can see no reason why the set should not work. It would, however, be improved by the addition of some reaction. (2) We cannot say, as you do not give the dimensions of the A.T.I. former, but from the length of wire used the maximum is probably several thousand metres. (3) 0·00035 mfds.

"C.S.H." (Harlesden) *sends a sketch of his set and asks* (1) *What is its wavelength range.* (2) *Capacity of two certain condensers.* (3) *If a certain coil is suitable for use with a two-valve resistance capacity coupled set, and also with the set in his diagram.*

(1) Approximately 6,000 metres. (2) Condenser No. 1, 0·0007 mfds., No. 2, 0·00015 mfds. (3) Yes, but in your sketched circuit it is better to put the reaction coil on the anode side of the inter-valve transformer.

"H.H.T." (South Kensington) *asks* (1) *For a diagram of connections for a four-valve receiving set, with loud speaker, range from 150 to 25,000 metres.* (2) *What valves are recommended for this set.* (3) *Winding data for transformers.* (4) *If the inductances and condensers could be made as shown in "A long range Receiving Set," of Vol. 8.*

(1) See Fig. 7, page 438, issue for July 1st. (2) Any good modern type will do. Cylindrical tube valves of "V.24" type are electrically somewhat more efficient than French type, but for certain purpose are, perhaps, not mechanically so good. (3) In order to cover such a large range you will have to have a number of H.F. transformers, the windings of which must be determined experimentally. For the L.F. transformers, the values usually quoted may be used. (4) They might be, but we do not particularly like this arrangement. We should recommend a three-coil holder with a set of honeycomb coils.

"L.J.B." (Sheffield) *sends diagram of a crystal set he is using with an indoor aerial and asks why he cannot get signals.* (2) *What crystal to use.* (3) *If 60 ohm telephones can be used.* (4) *If using German silver wire for his potentiometer explains lack of signals.*

(1) and (4) Circuit is quite correct and use of an indoor aerial is the only apparent reason for loss of signals. (2) Carborundum is perfectly satisfactory (3) Yes, if a telephone transformer is used, but your circuit does not show one.

"F.J.A." (Mile End) *asks* (1) *How he could construct a set of basket coils and what number of pins and turns to use.* (2) *How can he make reaction coils for these.* (3) *How many fixed and moving vanes are necessary to construct a 0·001 mfd. variable condenser.* (4) *In what text-book can he find similar practical information.*

(1) Any reasonable odd number of pins may be used, say between 9 and 19. The number of turns will depend on the wave-range required, which you do not state. (2) Reaction coils may be made in the same way as tuning coils. (3) It depends on the size and spacing of the plates. If the plates are 4" diameter spaced 1 mm. apart, 17 fixed and 16 moving will be required. (4) See Alan Douglas' Text-book on the "Construction of Valve Sets."

"OZONE" (Kensington) *asks* (1) *From what places in the British Isles and Europe are concerts and other information sent out for reception, and on what wavelengths.* (2) *For details of a complete valve circuit for receiving telephony.*

(1) The most important are Writtle **(2 MT)** on 400 metres, Marconi House, London **(2 LO)** on 360 metres. (This is experimental at present.) Eiffel Tower on 2,600 metres. Nauen on 3,100 metres **(POZ).** The Hague **(PCGG)**, 1,050 metres, and a number of small power stations in the London District. (2) The four-valve set, of which descriptive articles started in the issue of July 15th, should be very suitable for this work.

"E.D.B." (South Croydon) *asks for a switching arrangement to cut out the last valve in the diagram on page 37, April 8th issue when required.*

Arrangement may be as in the diagram in which only the altered parts are shown (Fig. 4).

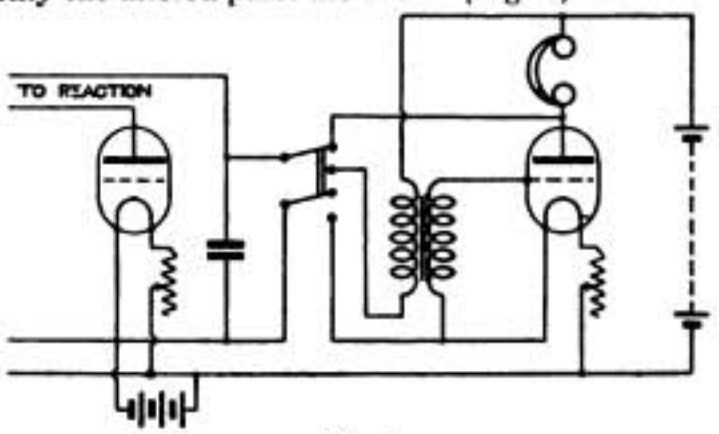


Fig. 4.

"J.H.K." (Mortimer) *asks* (1) *For a diagram of a good one-valve circuit.* (2) *If an "Ora" valve will give good results in this circuit, and should it be hard, medium, or soft.* (3) *What length of wire and what resistance, using No. 26 S.W.G., would be suitable for a filament resistance.* (4) *If a German "A.E.G." valve would give as good results as the Mullard "Ora."*

(1) See Fig. 2, page 537, issue for July 22nd. (2) Yes; hard. (3) About a couple of feet will be necessary, resistance of which would be 5 ohms. (4) We cannot say.

"DART" (Devon) *asks* (1) *If a certain method of constructing an aerial would give any results.* (2) *If so, how many valves would be required.* (3) *What is the approximate range of the 10-watt transmitting power usually granted by the P.M.G.*

(1) It is very unlikely that results of any use will be obtained. (2) At least five valves would probably be necessary. You have a difficult problem to solve. (3) The range varies enormously with locality and conditions. 10 to 20 miles might be an average figure, but much greater distances could be obtained under specially favourable circumstances.

"L.D." (West Ewell) *asks why he cannot get any telephony with his set.*

You give practically no useful information to enable us to say what is wrong, *e.g.*, you do not

state the diameter of coils, material of formers or type of circuit. We see no reason why there should be anything wrong with the coils, but from your remark on howling we should imagine that you are using one as reaction, and that the coupling is too tight.

"W.J.T." (Norbiton) *asks* (1) *What is the wavelength, call sign and time of working of the station at Cairo working with Leafield.* (2) *Who is the arc station on about 6,800 metres, louder than Leafield.* (3) *If* **2 MT** *has reduced his power since operating on 400 metres.* (4) *Particulars of how to make a loud speaker using a Skinderviken microphone button.*

(1) **SUC.** We are unacquainted with programme of working. (2) Probably Northolt. (3) No; but is quite likely that the shorter wavelength does not carry so well over London, although we have received no systematic reports to this effect. (4) This could probably be arranged on the lines of the sketch, but the loud speaker itself would be quite distinct from the microphone and of normal type, but with windings adjusted to suit the resistance of the microphone through a transformer if necessary. A diagram of a simple microphone relay will be given in an early issue.

"P.E.P." (Warrington) *asks* (1) *If a two-wire aerial instead of a single wire would compensate for lack of height at one end.* (2) *If a long earth wire would be detrimental to the working of a single valve receiver.*

(1) The addition of a second wire will not compensate for lack of height. (2) This length of earth wire will weaken signals considerably. Cannot you connect it to a waterpipe nearer the house?

"A.R.O." (Chester) *asks* (1) *Where he can obtain a valve of the low temperature type, and at what price.* (2) *If certain wires would be suitable for telephone transformer for 120 ohm telephones.* (3) *If so, how much would be required.* (4) *If a certain diagram is correct for deriving H.T. for an "R" valve from a 210 volt D.C. main.*

(1) This valve will be handled by the Marconiphone Department of the Marconi Company. No supplies are yet available for distribution to the public. The price will probably be £2. (2) They might be used for the L.R. windings, but are undesirable even for this. (3) About 6 ozs. for the L.R. winding. The H.R. winding should be 3 ozs. of No. 44. (4) No; better to put three lamps in series and tap the required H.T. across one of them.

"M.R.C." (Alexandria) *asks* (1) *If we know of any wireless amateur in Egypt or Alexandria.* (2) *If any telephony can be heard in Alexandria with a seven-valve amplifier.* (3) *If the Wireless Society of London accept affiliation of foreign members living abroad.* (4) *Where can he find information for constructing a tuner with range 600/25,000 metres to be used with an amplifier and a seperate heterodyne.*

(1) We do not know of an experimenter to whom we could refer you. Why not advertise in a local newspaper? (2) We do not think this is at all likely, but we believe the question of establishing broadcasting stations in that part of the world is under consideration. (3) We think it is most probable that the Society would consider this. Apply to the Secretary for full information. (4) If you already have a suitable amplifier the construction of a tuner should afford you little difficulty. Make or buy a three-coil holder and use a set of honeycomb coils, tuning both the aerial and secondary circuits with variable condensers.

"R.J.K.H." (Walton-on-Thames) *asks* (1) *Why, on pressing the key of a simple valve transmitter, the valve filament decreases in brilliancy slightly.* (2) *What qualifications are necessary to become a member of the Wireless Society of London.*

(1) Without a knowledge of the circuit employed it is not possible to say exactly, but one possible cause is a decrease of potential along the filament of the valve due to an increase in the plate filament current. The plate filament current runs out through filament back through the circuit to the plate, and if in opposition to the filament heating current may give the effect noticed. (2) You should apply for full particulars to the Secretary of the Society.

"ERIN" (Upton Manor) *asks* (1) *How he can remedy howling.* (2) *If it would be possible to receive The Hague and Eiffel Tower telephony with a Mark III Tuner loaded with a proper coil.* (3) *Which of two samples of wire would be better for lengthening the aerial.* (4) *If it would improve signals to use insulated wire as per sample attached.*

(1) Howling is evidently due to too much reaction; do not use so much. (May we remind you that whenever your set howls in this way, you are spoiling the reception of every other amateur within a range of perhaps two miles). (2) The wavelength of the closed circuit should also be brought up to the desired values. (3) Either should be quite satisfactory. (4) No. The 7/22 would be slightly the better of the two.

"A.F.W.A." (North Woolwich) *asks* (1) *The number of turns for four coils.* (2) *To what wavelength will a coil* $10'' \times 1\frac{1}{4}''$ *tune with a certain aerial.* (3) *For winding data for a certain H.F. transformer.* (4) *If a variable condenser is necessary if there are four tappings in the H.F. transformer primary.*

(1) For 400/600 metres, 100 turns. For 500/1,000 metres, 150 turns. For 900/1,500 metres, 250 turns. 1,500/3,000 metres, 400 turns. These should be approximately correct, but the exact value should be determined by experiment. (2) About 1,200 metres. (3) It is very difficult to predict this at all accurately. Try about 200 turns for each winding, with taps at 30, 60 and 100, but considerable adjustment may be found necessary. (4) This would be desirable for the range suggested.

"E.H.W." (Madeira) *refers to the article on the American short wave receiver in the issue of June 3rd, and asks* (1) *If there would be any advantage in winding the coils with a coil winder.* (2) *If it would be better to use a telephone transformer instead of connecting the telephones in the H.T. circuit.* (3) *If a telephone transformer is used should the variable condenser be connected across the transformer primary or across the telephones.* (4) *What type of transformer would suit the instrument.*

(1) Not for short wavelengths. (2) It can be done, but there is no appreciable advantage. (3) Across the primary. (4) Any normal type of telephone transformer will do.

"FLAX" (Pershore) *asks* (1) *For details of telephone transformer for Brown's 120 ohm telephones.* (2) *If L.R. telephones with transformer*

are as suitable for one, two or three-valve sets as H.R. telephones.

(1) Use a core 4"×½" of soft iron wires. For the L.R. winding, 6 ozs. of No. 32, and the H.R. winding, 3 ozs. of No. 44. (2) L.R. telephones are quite suitable. They are slightly less sensitive but somewhat less liable to break down.

"ACK EDWARD" (Ferndale) *refers to the Armstrong super-regenerative circuit recently described, and asks* (1) *Winding data of the inductances L.1, L.2, L.3, L.4 and L.5.* (2) *For the capacities of the variable and fixed condensers in the secondary circuit Fig.* 1. (3) *The capacity of the variable condenser in the oscillator circuit.*

(1), (2) and (3) The values of inductance and capacity in L.1, L.2 and L.3 circuits, should be those normally used for short wave work. The L.4 and L.5 circuits should have constants suitable for about 30,000 metres. The best proportion should be determined by experiment with the particular valves used. We consider that it is unlikely that an amateur will be able to get a circuit like this to work satisfactorily unless he has sufficient experience to construct circuits from the above data. See page 648, August 19th issue.

"N.H.E." (Fouroaks).—It is preferable to put the rectified oscillations through an earlier valve for re-amplification. For one of the various possible circuits see Fig. 5. A 1/3 transformer as suggested will be suitable.

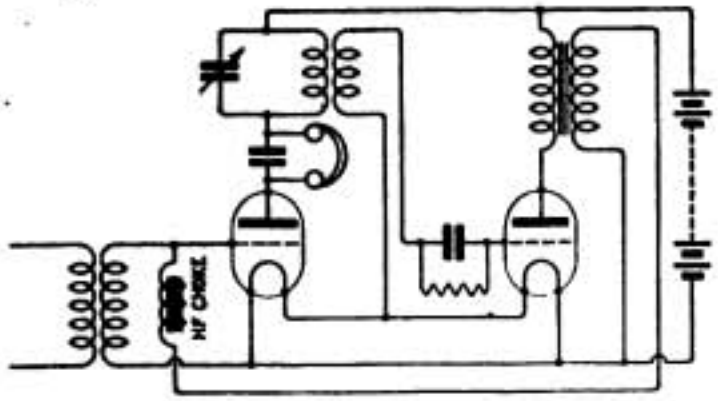


Fig. 5.

"R.S.C." (Bath) *asks for directions and a diagram for making a set with a range of* 500/800 *miles.*

We are afraid your requirements are too vague for us to help you much. For instance, the range depends on the transmitting stations power. You could get 800 miles on Eiffel Tower with a crystal, while there is no set in existence capable of the distance on short wave broadcasting telephony. For all round purposes you might adopt a three-valve set described by Harris in the issue of July 15th, and the following numbers. The aerial should be as high and as long as possible, subject to the P.M.G.'s restrictions of a maximum length of 100 ft.

"R.A." (West Derby, Liverpool) *refers to the Armstrong circuit, and asks* (1) *If the two inductances L.4 and L.5 must be of the same wavelength as the A.T.I. or does the condenser tune them to any wavelength.* (2) *Could the tapping at the top of the secondary be taken to the top of the A.T.I. instead.*

(1) The inductances of the L.4 and L.5 need not be the same as that of the A.T.I. For satisfactory work the circuits in which they are placed should oscillate on a wavelength considerably longer than that on which signals are being received, say 30,000 metres. For this purpose these coils should therefore be considerably larger than the A.T.I. (2) The tapping could be taken to the A.T.I. as you suggest, but results will not probably be so good. You will also probably get curious re-radiation results.

"E.M." (Ipswich) *asks where he can obtain single layer inductances for the set described on page* 471 *of July* 15*th issue.*

We do not know of any makers who are turning out coils exactly suitable for this set, as in general anyone using a set prefers to wind his own coils—a quite easy matter. You could, of course, obtain suitable formers from most dealers, or you might obtain the finished coils to order from such firms as advertise their willingness to make up articles to clients' specifications.

"M.B." (N.19) *asks for advice in the construction of his aerial.*

Your aerial might be run across the roof as suggested, but it will not be very efficient unless its supporting masts are fairly high, as the effective height will only be approximately the height of the wires above the roof, and not the height above the ground. See Article on Aerial Construction on page 259, May 27th issue.

"D.G.N." (Harpenden) *asks* (1) *If a circuit using reactance capacity for H.F. amplification is more efficient than a circuit using a plug in the H.F. transformers.* (2) *If a single layer coil or various proprietary types are most suitable for short wave reception.* (3) *For winding details of certain coils.* (4) *If there is any definite ratio between the primary and the secondary of honeycomb coils.*

(1) There is very little to choose between good examples of these two types. (2) For short waves we prefer single layer coils, the remaining types are all of approximately the same efficiency on short waves. (3) In order to tune to 11,000 metres, the A.T.I. should be 6" long, wound with No. 22; closed circuit, 5" of No. 24; reaction, 4" of No. 28. (4) No.

"C.W.N." (East Croydon) *asks* (1) *What is the wavelength range of a certain aerial loading coil.* (2) *The wavelength range of a certain loose coupled tuner.* (3) *What capacity air condenser is needed to tune "STI" coil to* 3,500 *metres.* (4) *If he would get better results on long wavelengths by using "STI" coils wound with No.* 26 *or No.* 28 *wire with more tuners.*

(1) The inductance should be 6,000 mhys. This will tune the P.M.G. aerial to about 2,250 metres. (2) The inductance should be 2,000 mhys. (3) 0·002 mfds. (4) Yes.

"E.J.B." (Bath) *asks* (1) *For a diagram of a four-valve set for receiving telephony and C.W. up to* 10,000 *metres.* (2) *The values of inductance capacity, etc., for this set.* (3) *What is the best type of valve to use.* (4) *If a* 220 *volt main, with suitable resistance, will answer as H.T. instead of usual dry cell battery.*

(1) See Fig. 7, page 438, July 1st issue. (2) The A.T.C. 0·001 mfds., secondary condenser 0·0005 mfds. For tuning we should recommend a set of honeycomb coils with the number of turns ranging from 30 to 750. (3) Any good class valve now on the market should be O.K. (4) D.C. mains

can be used if desired, the method being as given in the issue for June 17th issue.

"H.F.C." (Birmingham) *encloses a diagram of his four-valve circuit and asks* (1) *For criticism.* (2) *For full details of constructions of the four transformers in sketch.* (3) *For the names of three of the most distant stations this set will receive.*

(1) The set is O.K., except that too much L.F. amplification is used. We should prefer the circuit of Fig. 7, page 438, issue for July 1st. (2) We regret we have not the required information available. (3) You should hear London and other British broadcasting stations at similar distances; also the higher power stations FL and probably PCGG.

"T.M." (————————) *asks* (1) *For winding data for a tuner, wavelength* 180/700 *metres.* (2) *If a certain arrangement of aerial will give increased range and louder signals on wavelengths over* 1,000 *metres.* (3) *Number of foils as per sample required for the condensers described; also a formula for calculating their capacity.* (4) *If a certain transformer would be any use as an intervalve or telephone transformer.*

(1) The A.T.I. 6" × 4" of No. 22, with four tappings, say about ¼ lb. of wire. Closed circuit 5" × 2½" of No. 28 with four tappings. Reaction 4" × 3" of No. 22 with two tappings. (2) We cannot say as you do not describe the present aerial. Probably not much difference. (3) Your samples have not come to hand. For formula see reply to **"Radio 3 UC,"** August 5th. The area of overlap means "the area (measured on one side only) of the part of each piece of mica which has foils on both sides of it." The formula will enable you to determine the capacities required. (4) Impossible to say from the few particulars supplied. If you could let us have sizes of wire and resistances of various windings we could advise you.

"JUST COME UP" (Halifax) *refers to the four-valve set described in the July* 15*th and* 22*nd issues, and asks* (1) *How to connect the two instruments together.* (2) *What coils to use from* 180 *ms. up to the Dutch concert.* (3) *The respective uses for stand-bi and tune.* (4) *If the primary coil is between the reactance and the secondary.*

(1) Connect the detector terminals of the tuner to the input terminals of the amplifier, and the reaction terminals on the two instruments together. (2) Use coils with about 40 turns on each for the shortest lengths, and about 120-150 turns for the Dutch concerts. (3) "Stand-bi" is used for finding the required station, as the receiver in this condition is much less selective than when on tune side. When the desired station is found it is generally best to switch over to tune, in order to get the extra selectivity. (4) The secondary should be between the primary and the reaction coil.

"J.H.D." (Hollingbourne Manor) *asks if the amplifier described by Mr. Campbell Swinton in the issue of June* 25*th is suitable for short wave telephony.*

The circuit suggested should be quite satisfactory for your purpose. The reason for the increased spacing required is probably that your coils themselves are bigger than the originals. Possibly poor results with PCGG are due to the inefficiency of the H.F. transformers at this wavelength, although the transmitting station is not very good at the time of writing.

"E.H.L.S." (New Jersey) *asks* (1) *For a diagram of a three-valve receiver with a range of* 150/15,000 *metres.* (2) *What kind of valves should he use with this receiver.* (3) *Where he can obtain French "R" valves.* (4) *What should be the voltage of the H.T. battery for this set.*

(1) See Fig. 1, page 435, July 1st issue, but omitting the reaction there shown. (2) Any standard hard valve on the market will be suitable. (3) We are afraid we are not sufficiently conversant with the sales position in the U.S.A. to advise you. You might consult the Radio Corporation of America, but you will probably find some difficulty in getting these valves in the U.S.A. (4) It depends on the voltage of the valve used, which will be stated by the makers or vendors. The values vary from 30 to 80 volts.

"TYRO" (Chelsea) *sends a diagram of his single valve set and asks* (1) *How to add a four-valve amplifier with H.R. telephones or loud speaker; also capacities of condensers, types of valves, etc.* (2) *If a second variable condenser in parallel with the secondary coil would improve results.*

(1) In view of the drastic alteration proposed it would be best to scrap the present panel and incorporate the components in a five-valve set on the lines of Fig. 1, page 570, issue for July 29th. Suitable values for the component parts have been repeatedly quoted. (2) The condenser, as suggested, would not greatly improve results, but a fixed condenser across the telephones would be desirable.

"P.H." (Esher).—Full information for the construction of a set of the type you require with four valves will be found in the issues for July 15th and 22nd.

"RECTIFIER" (Tottenham) *asks what battery voltages to employ with "Ora" valves.*

Forty volts should be sufficient for the plate, and 4 volts for the filament, but a 6-volt battery allows rather more latitude for filament lighting.

SHARE MARKET REPORT.

Prices as we go to press on September 1st are:—

Marconi Ordinary	£2	5	0
,, Preference	2	2	6
,, Inter. Marine	1	9	0
,, Canadian		10	0

Radio Corporation of America:—

Ordinary	1	2	0
Preference		14	0

h SEPTEMBER, 1922. THE PRICE 6D. NET.

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VOL. X. No. 25. SEPTEMBER 16TH, 1922. WEEKLY

The Unit System as applied to a Wireless Receiving Installation

By W. FORBES BOYD.

THE great advantage of the unit system as applied to the design of Wireless apparatus is the flexibility that the system offers.

This system, where each section is designed separately, should present an attractive feature not only to the novice who prefers to build up a receiving set gradually, but also to the experienced worker who desires to increase amplification with additional valves or experiment with a particular section to improve signal strength.

As is well known, a wireless receiving set can be divided into two sections :—

(1) Tuner Section.
(2) Amplifier Section.

TUNER SECTION.

Originally it was arranged that the tuner section would be as described in *The Wireless World and Radio Review*, July 29th, 1922, but a more simple type of tuner has been designed and is described below for the benefit of those who wish to keep the size of the set to a minimum, or who require a tuner with the smallest number of complications.

The tuner section is therefore described as one unit, and has an open oscillatory and reaction circuit only. If a closed oscillatory or loose-coupled circuit is required in addition, it is a simple matter to embody this as a separate unit.

AMPLIFIER SECTION.

The amplifier section, consisting of the valves and their attendant accessories, can be arranged to include any number of valves, but for the purpose of explanation, and to give a variety of the uses of the valve, a four-valve amplifier is described below made up as follows :—

(1) High Frequency Amplifying Unit.
(2) Rectifying Unit.
(3) Low Frequency Amplifying Unit.
(4) Telephone Unit.
(5) Terminal Unit.

DETAILS OF TUNER SECTION.

Reverting back to the tuner section; in order that this section should be reasonably narrow in width, it was decided that the plug-in method of obtaining different wavelengths by means of aerial inductances and reaction coils should be adopted, and in order that reaction should be obtained at short wavelengths the single layer coil in the form of flat pancakes is introduced for coils up to 75 turns. Beyond this range the standard duo-lateral coil is used.

The advantage of a series condenser being established for reaction at short wavelengths, and in order that only one variable condenser be used in the aerial circuit, experiments were made to retain the variable series condenser, and at the same time embody a fixed condenser so as to increase the range of wavelength covered by the variable condenser.

It was found that a 0·001 mfd. variable condenser in the earth lead and a 0·001 mfd. *fixed* condenser between aerial and earth gave these results, and whilst this arrangement scarcely alters the minimum wavelength for a particular inductance it increases the maximum wavelength about 60 per cent. as compared with the series condenser only.

Different values of fixed condensers were tried, *e g.*, 0·0005 and 0·002 mfd., but it was

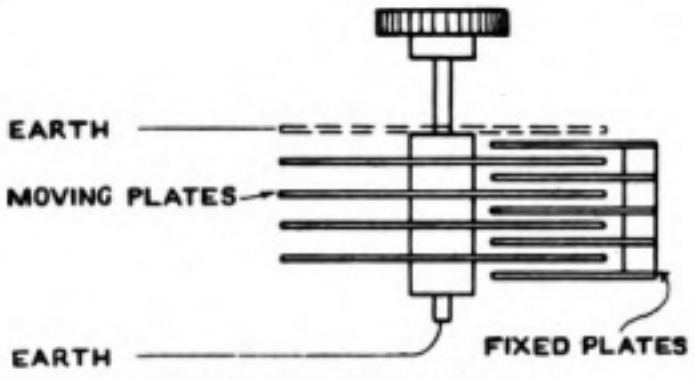


Fig. 1. *Variable condenser.*

found that whilst the former was satisfactory, giving critical adjustment for telephony, the wavelength range of the variable condenser was rather small, and when using the latter, it was impossible to critically tune-in telephony owing to the adjustment of the variable condenser being too coarse, and so a 0·001 mfd. fixed condenser is recommended.

The only other point of special interest in connection with the tuner unit is the shield over the variable condenser.

It is well known that the capacity effect of the hand in operating a condenser alters the tuning, and is especially noticeable with telephony where critical tuning is essential.

The reason for this is obvious when reference is made to Fig. 1.

Usually a variable condenser is manufactured with the fixed system overlapping the moving system, and the common practice is to connect the moving system to the earthed side of the circuit.

Now, when the hand is brought near the condenser it is equivalent to supplying another earthed plate to the moving system as shown dotted, consequently the capacity of the condenser is altered with a corresponding alteration in the wavelength.

The result is that very annoying characteristic of condenser tuning when a signal may be perfect with the hand on the condenser knob, but weakens or even disappears when the hand is taken away. And so a shield is introduced on the face plate of the panel which permanently provides the extra capacity to earth with the result that there is not the slightest difference in tuning, no matter in what position the operator's hand is.

Apart from these features the tuner unit introduces no special points.

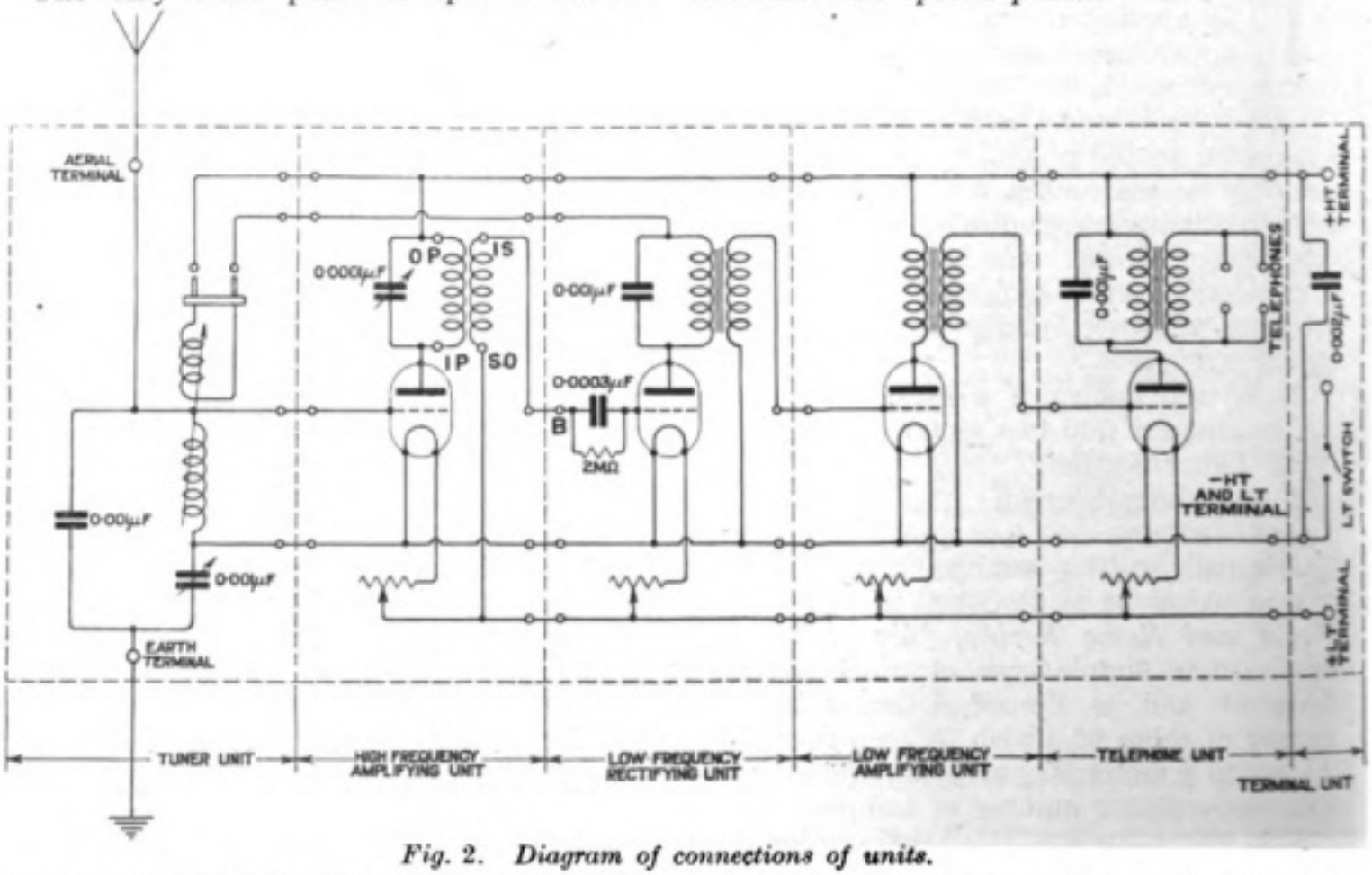


Fig. 2. *Diagram of connections of units.*

A small or vernier condenser is provided below and in parallel with the 0·001 mfd. variable condenser on the tuner unit for final adjustment, but in practice it has been found unnecessary, since the screening plate overcomes all critical adjustment troubles.

Fig. 2 shows a diagram of connections of the tuner with four-valve amplifier units, and Fig. 3 gives the principle dimensions of the tuner unit, whilst Fig. 4 shows a photographic view of this unit.

In general, the units are designed to fit into the instrument section of a short wave tuner box and a width of $2\frac{3}{4}$ ins. was chosen as a general width of panel so that four of them would just fit into the box. With the tuner unit it was found necessary to increase the width to $4\frac{1}{4}$ ins., but it will be found that this odd dimension is brought to a multiple

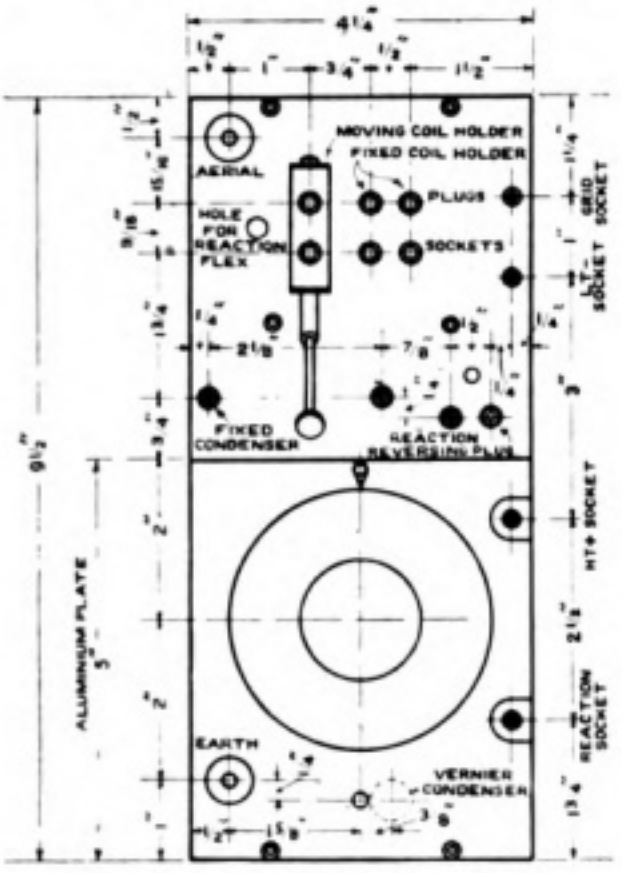


Fig. 3. Dimensions of tuner unit.

of $2\frac{3}{4}$ ins. by the terminal unit which is $1\frac{1}{4}$ ins. wide.

Adjacent panels are connected by means of small brass hoops or links which fit into link sockets on each panel, thus providing not only electrical, but also mechanical connection between panels.

DETAILS OF THE AMPLIFIER SECTION.

It has been stated above that for purposes of explanation four different types of amplifier units will be described, although of course it must be understood the unit system is adaptable for any method of valve coupling including resistance and reactance-capacity coupling, but in this article the more usual double wound transformer coupling is described.

The allocation of the various parts of the amplifier next comes under consideration, and perhaps this is the most important part in the design of any amplifier.

Usually the amateur designs an amplifier by sketching on paper how he can allocate the various items on a panel and giving no thought to the final connecting up of these components.

The result is that there is a maze of connections at the back of the panel with innumerable crossing of leads which gives a maximum number of leakage paths due to the condenser effect of the adjacent leads.

In this design the connections are considered first and positions of the various parts of apparatus are secondary.

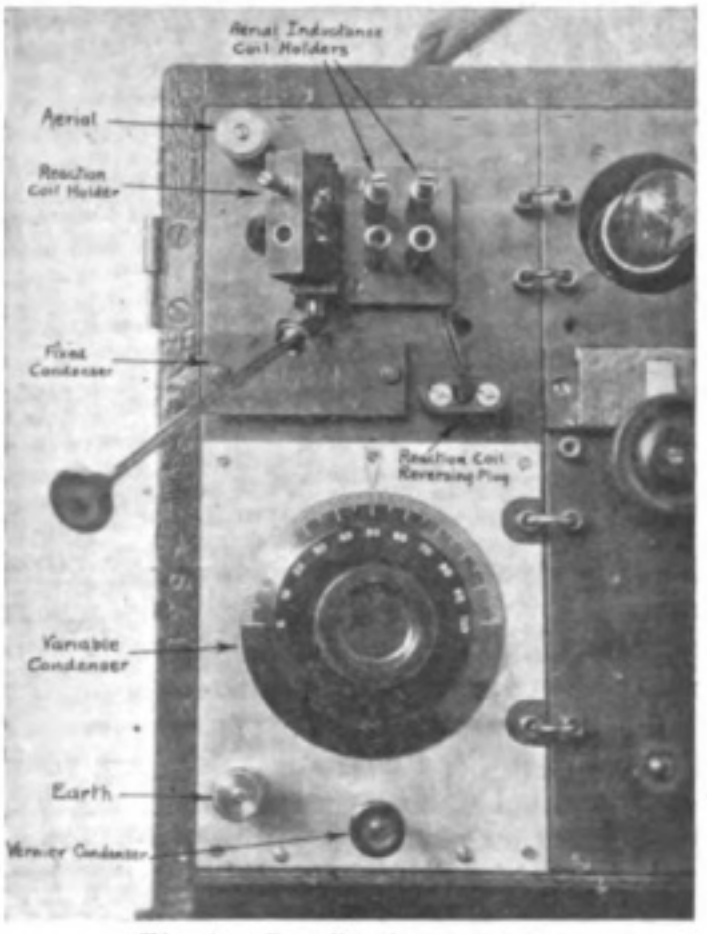


Fig. 4. Details of tuner unit.

If we look at the diagram Fig. 2 and take the telephone unit it will be seen that it is an advantage that :—

(1) The Grid Link be near the valve.
(2) The L.T. Negative Link be near the valve.
(3) The L.T. Positive Link be near the filament resistance.
(4) The H.T. Positive Link be near the transformer.
(5) The Phone Plugs be near the transformer.

Of course, in designing on the unit system, it is necessary to consider all the types of units that may be introduced, and keep in mind that certain parts which are not variable, such as the valve and iron core transformers, be placed as far away as possible from parts

which are variable, such as filament resistances, condenser on H.F. unit, etc.

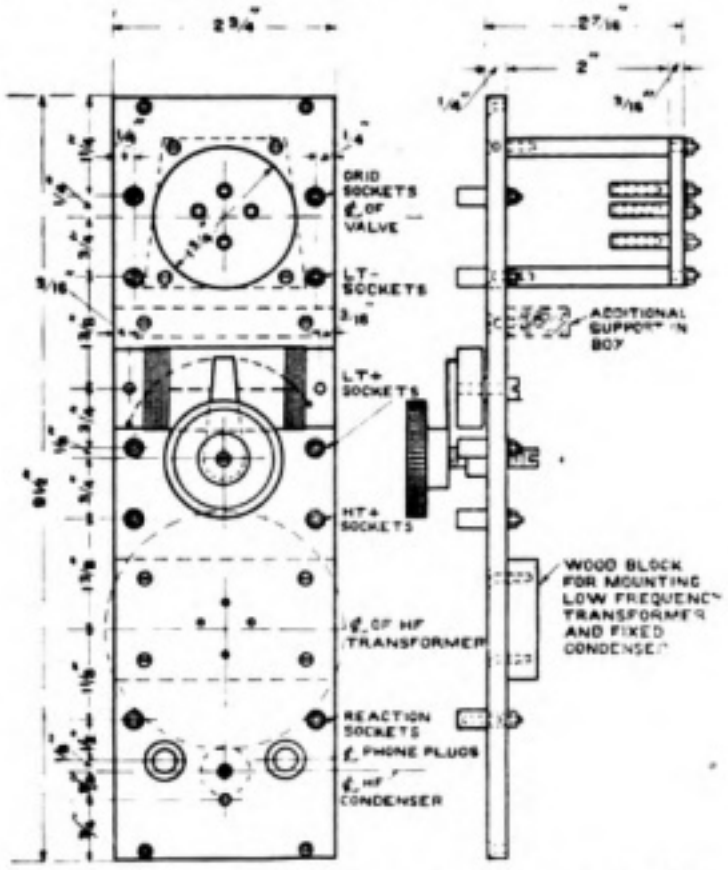


Fig. 5. Showing position of apparatus on panels.

Considering all these points, a composite drawing is evolved as shown in Fig. 5, which shows the position of *all* the apparatus on the various panels, whilst Fig. 6 shows the drilling of each respective panel.

It will be noticed that the valves are sunk below the level of the panel and yet not too far down to prevent the use of the " R " type of valve. This allows the lid of the box to be shut with the valves in place, and also it is an advantage that the

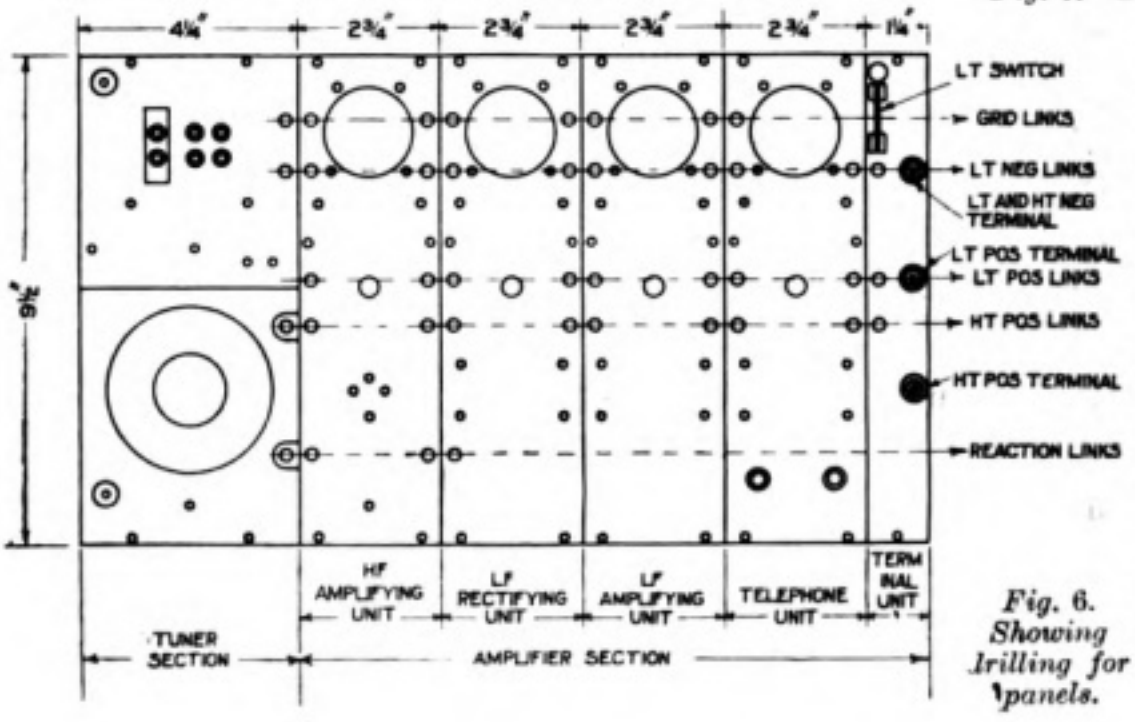


Fig. 6. Showing drilling for panels.

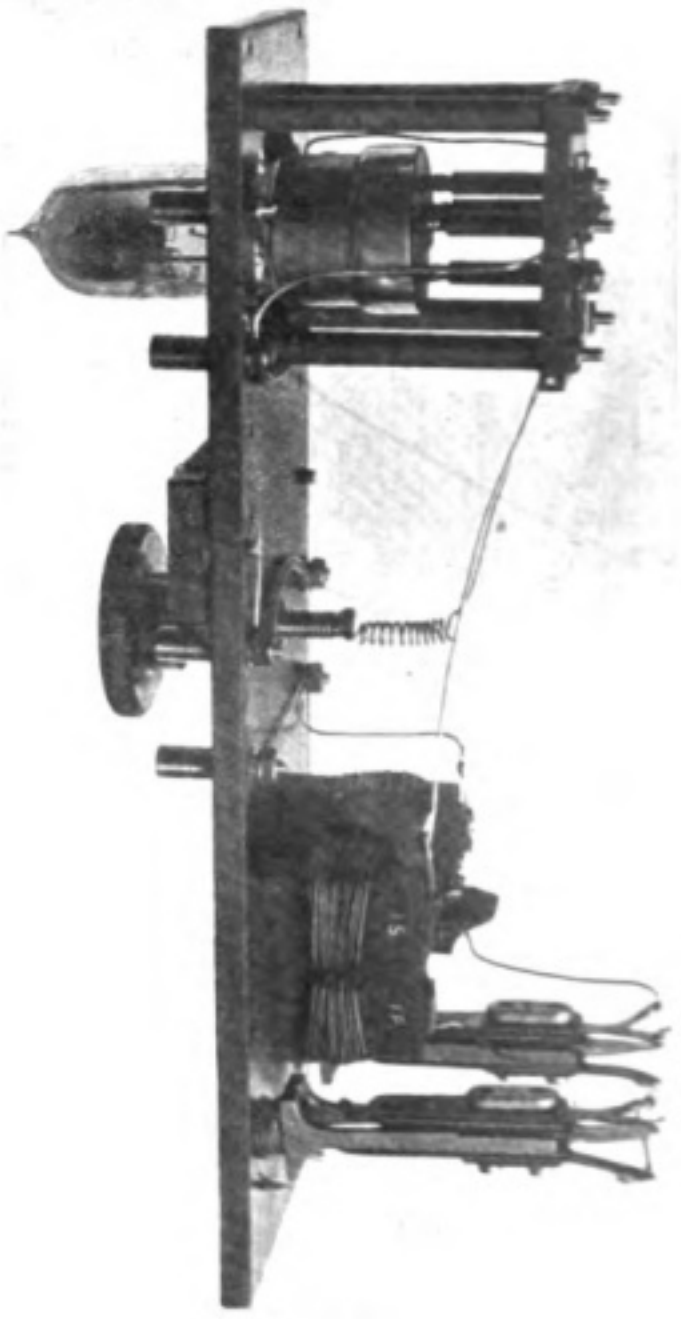


Fig. 7. Details of telephone unit.

connections from the valve leg sockets to the filament resistance and the transformer are in a different plane, or in other words are much lower than those connections immediately at the back of the panel. Thus, where any crossing does occur there is a distance of about 2 ins. between the leads.

Fig. 7, which gives the details of the telephone unit, shows this clearly.

(To be concluded)

On the Amplification of High-Frequency Currents

(*Continued from page 756.*)

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

A very simple modification of the arrangement shown in Fig. 11, page 756, gives us an amplifier which was invented by L. B. Turner, and called the "Kallirotron." The Kallirotron amplifier is actually this inverted Blondel amplifier (Fig. 10) with a back coupling. Turner's Kallirotron, as described by him* is shown in Fig. 12. In this case the two valves are coupled together by the same scheme as that just described, except that the potentiometer is not used, and an extra battery B_3 is employed, so that the grid of V_2 can be brought to the same potential as its filament, just as was done with the potentiometer in Fig. 10.

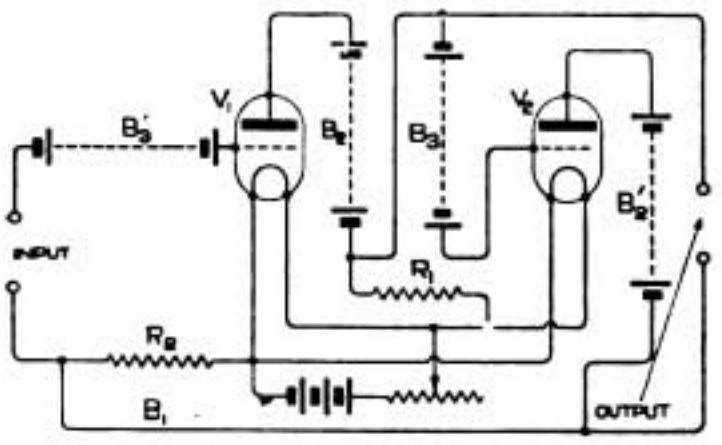


Fig. 12. Turner's Kallirotron Amplifier.

The Kallirotron also uses an exactly similar coupling from the anode circuit of the second valve back to the grid circuit of the first one, V_1. This therefore provides a back coupling from the second valve to the first for the amplified energy, so that it can be reamplified by the valves.

The Kallirotron, as described by Turner, is primarily a very sensitive amplifier, giving enormous amplification with two valves, an amplification of several thousands, since by reason of the back coupling effected by the resistances the apparatus can be got to the point where regenerative amplification is taking place, without it tending to oscillate readily, since there is nothing in the coupling in the nature of an oscillatory circuit, and there need be no oscillatory circuit connected to the anode of the second valve.

We thus see that Turner's Kallirotron and Blondel's amplifier, turned upside down in the manner here described, are identical except for the addition of the back coupling in the former. They form two rather uncommon methods of coupling two valves to enable them to amplify high frequency currents, and for that reason I have drawn your attention to them.

A scheme has been patented recently by Mr. Gossling, of the General Electric Company, slightly modifying this style of arrangement, so as to use one high tension battery only, but the circuits are much more complicated and involve the use of constant current resistances to keep constant the currents flowing round parts of the circuit. It is not an amplifier that can easily be set up for experimental purposes.

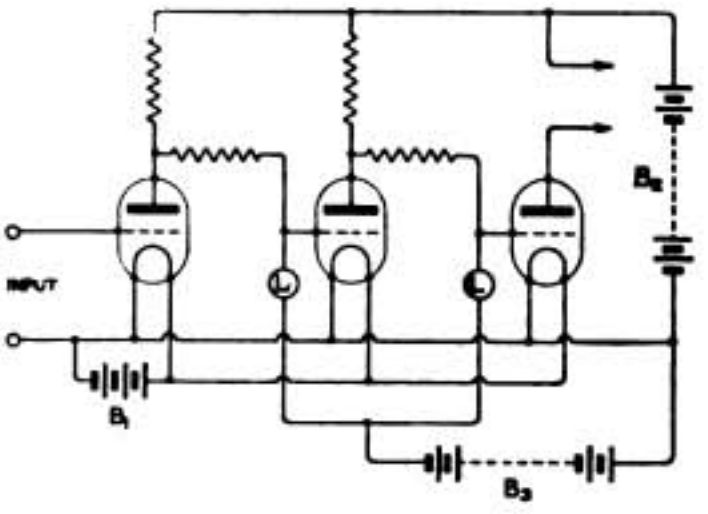


Fig. 13. Gossling's Amplifier, using common batteries. L, L, = current limiting devices such as saturated valves.

A diagram of one of these arrangements is reproduced in Fig. 13.

The next arrangement I wish to refer to is a very common form of coupling used between

* *Radio Review.* 1, pp. 317—329, April, 1920.

two or more valves for the magnification of high frequency currents—viz., the resistance-capacity coupling which is sketched in Fig. 14. By putting an anode resistance between the terminals T_1 and T_2 of Fig. 6, and joining T_2 and T_3 we obtain the desired circuit. The anode resistance may be of the order of 50,000 to 100,000 ohms, and the leak from 1½ megohms to 4 or 5 megohms, according to the valve in use. Loss of amplification at high frequencies, to which I referred just now, also occurs with this arrangement. It is due to the stray capacities which must exist between different

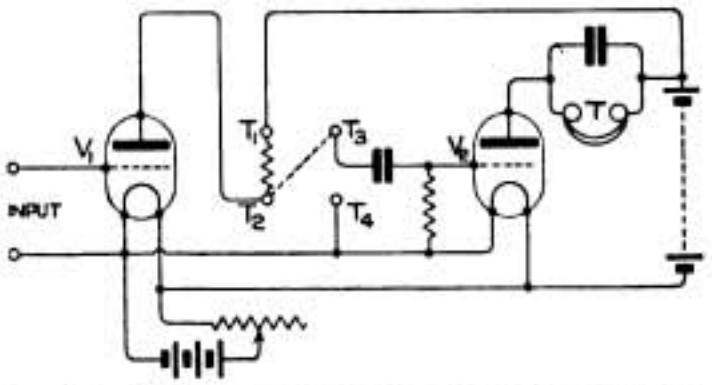


Fig. 14. Resistance-Capacity Coupling arranged on experimental amplifier panel.

points in the circuit. Any capacity across the anode resistance will shunt off the high frequency currents from that resistance, and will prevent their being passed on to the next grid. The H.T. battery should not have any appreciable resistance, but it is usually advantageous to shunt it with a condenser of one or more microfarads, so that the high frequency impulses will go through the condenser rather than through the battery.

It may be asked why it is necessary to have an anode resistance if its use creates difficulties. The reason, I think, will be obvious if we consider what it does in the circuit. If we apply a voltage to the grid of the first valve and if its anode is connected to the H.T. battery with no resistance in series, when the grid is made positive, the internal resistance of the valve will be lowered and a larger anode current will flow, but the anode potential is held constant by the battery and there is no point in the anode circuit where we can find an amplified change of voltage. In order to operate the second valve we need to so arrange the first that it will amplify the voltages applied to its grid so that these amplified voltages can be applied to the grid of the next valve. We can obtain the desired result by keeping the anode current constant, then whether we make the first grid positive or negative, we shall then get the corresponding changes in internal resistance of the valve repeated in the voltage changes across the terminals of the valve. Although the valve has a characteristic which is not entirely linear, and is therefore in consequence often said not to obey Ohm's Law of Current = Voltage divided by Resistance, this law applies rigorously for any given point on the characteristic, and the anode current is dependent upon the total resistance of the anode circuit, since the applied voltage from the H.T. battery is constant. The anode circuit resistance is partly made up by the valve and partly by the resistance of the outside circuit. If the internal resistance of the valve at any instant is R_a the voltage across the valve will be the anode current I_a multiplied by this resistance. Now if we can put in the circuit anything to keep the current practically constant, any change in R_a, the effective resistance of the valve, such as may be caused by changes in the grid potential applied to the valve, will be repeated in the voltage across the valve and will be applied to the grid of the next valve by means of the coupling condenser.

Supposing we want to keep this anode current constant, how can we do it? If we make the total resistance in the circuit constant, of course the current will remain constant. But here we have a constant supply voltage and a variable resistance, so that we cannot actually maintain the current quite constant, but we can get somewhere near it. If we make the remaining resistance in the circuit very large compared with the resistance of the valve, we can keep the current nearly constant. For example, if the valve has an internal resistance of 40,000 ohms, and we put in series with it four million ohms, the total resistance would be 4,040,000 ohms. If, then, this 40,000 ohms became 30,000 or 20,000, or even 60,000, it would only make one or two per cent. difference to the whole resistance value, and we would get the anode current almost constant. Any changes in the internal resistance of the valve would then be repeated as variations of voltage across the valve. Well, that could be done, but other points must be considered. Supposing that valve was passing a current of 1 milliampere, what voltage must be put in the anode circuit if we have to get 100 volts on the valve with one milliampere passing through the above-mentioned anode resistance? We should want 4,040 volts, which would be rather unpractical. Hence, when we are using resistance coupled

amplifiers we have to make a compromise, since we cannot put anything like 4 megohms in the anode resistance, and we must put something of the order of 50,000 or 60,000 ohms so as to limit the total voltage which must be put into the anode circuit in order to get the necessary current through it. Then when we change our grid voltage we shall get a change in the anode voltage, but it will not be as big as if there were a very large series resistance. It is therefore not possible to hand on a voltage change to the next valve without introducing some loss in amplification, or in other words, the voltage amplification that will be obtained is less than it theoretically would be were the anode current maintained constant, by the voltage that is dropped by the current change through the series resistance.

Hence there are some practical disadvantages in the resistance-capacity coupling, and on that account attention has been given on many occasions to obtaining some other coupling method. The great advantage of the resistance-capacity coupling is that there is no part of the intervalve coupling which varies with the frequency (other than stray capacities), so that the amplifier is suitable for use on most frequencies, except when the stray capacities become troublesome.

By fitting up one of these amplifiers and connecting a variable condenser across the anode resistance, it is easily possible to demonstrate this loss in amplification due to the shunting off from the anode resistance of the high frequency amplified current changes. With very short wavelengths the loss due to that condenser becomes more and more important, because the current which it draws off from the resistance is proportional to the frequency.

In practical work with short wavelengths a means is wanted of getting over this difficulty. What we require is a method which will make the valve capacity and other stray capacities useful rather than harmful. We can do this if we make the capacity either tune or help to tune a circuit. This cannot be done with a resistance in the anode circuit, but if a coil is used instead of a resistance the circuit can be tuned. This effect can be obtained with a transformer coupling. For this we do not want a grid leak if the transformer is connected to the terminals T_1, T_2, T_3 and T_4 in Fig. 6, so that one coil is in the plate circuit of the first valve, and the other coil is in the grid circuit of the second, just like an ordinary transformer-coupled low frequency or note magnifying amplifier, except that a transformer suitable for the high frequency currents must be used. These connections are shown in Fig. 15.

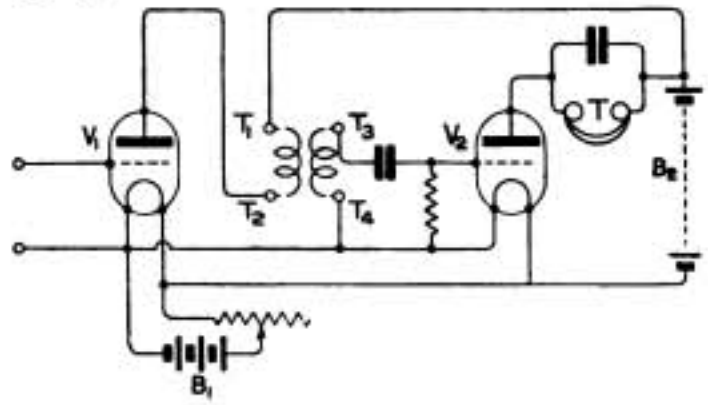


Fig. 15. Transformer-Coupled H.F. Amplifier adapted to the experimental panel.

Consider the effect of the valve capacity, which will behave as a condenser across the transformer winding. Obviously we obtain a tunable circuit, and therefore there will be maximum voltage across the transformer winding for one particular frequency.

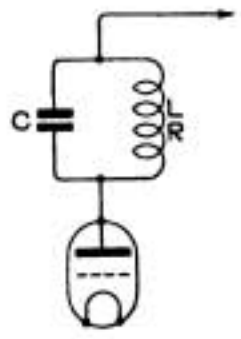


Fig. 16. "Parallel Resonance" or "Rejector" Circuit in the anode circuit of a valve.

The effective resistance of a parallel circuit of this type (Fig. 16) is an important quantity, because such a circuit at the frequency to which it is tuned behaves simply and solely as a non-inductive resistance. I do not know whether you are familiar with the vector representation of currents and voltages, but probably most of you have heard the statement that if you put an inductance in an A.C. circuit it makes the current lag behind the voltage, while if you put a condenser in it makes it lead the voltage, so that in the case of the parallel circuit sketched in Fig. 16, relative to the voltage across that circuit, the current through the inductance is lagging, and the current through the condenser is leading. Actually the inductance has some resistance,

and the current does not lag at exactly 90° from the voltage; it lags at some less angle, such as 80° for example, as sketched at ϕ_1 in Fig. 17. The vector representing the current through the condenser leads on the voltage by the angle ϕ_2 which, with good condensers, is to all intents and purposes 90°. If we find the resultant of these two vectors by the usual parallelogram method, we find that its length is much less than either of the other current vectors, and that it is much more nearly in phase with voltage than is either of the other

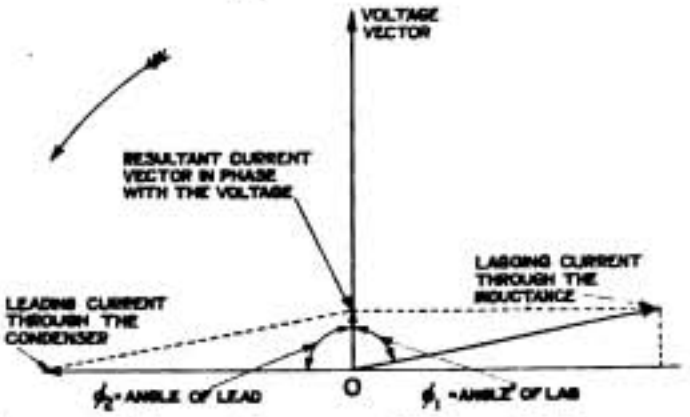


Fig. 17. Vector diagram of "Parallel Resonance Circuit."

current vectors. Obviously, therefore, it is possible to adjust the value of the leading vector representing the current through the condenser by altering its capacity until we arrive at a resultant vector which is in phase with the voltage. When that is the case the circuit is said to be tuned, or in resonance with the supply frequency. The total current through the circuit is then in phase with the voltage, although the currents in each branch of it are not in phase. I think by reference to Fig. 17 you can see that if this inductance is a bad one as an inductance, that is to say, it has a high resistance, and therefore does not make the current lag very much (such, for example, as when its resistance is approximately equal to its inductive reactance), then the resultant vector is quite large for a given voltage on the circuit. If the resultant current is large, the circuit has not a large effective resistance, although we have an inductance with a high resistance. If the inductance is good, so that it makes the current lag nearly 90° on the voltage, the resultant is very small, and the better we make our inductance, the less will be the size of the resultant vector. If we could get a perfect inductance we should have no resultant current flowing through the whole circuit, or in other words the effective resistance of the circuit would be infinite.

Actually the effective resistance of the circuit is represented by $R' = L/CR$, R being the resistance of the coil, L its inductance, and C being the capacity of the condenser. That indicates that the higher the ratio of the inductance to the capacity the bigger is the effective resistance of the whole circuit, and if the ratio is small, the effective resistance of the whole circuit becomes smaller. Hence, if we use a good inductance, *i.e.*, a coil of low resistance and tune it by the valve capacity, or by the valve capacity plus a small variable condenser put on in parallel, we get an arrangement which, at a certain frequency, offers a very high resistance to the flow of alternating current through it, although as regards the D.C. high tension battery it is offering very little resistance. Hence we can in this way keep the steady voltage on the anode of the valve at its normal value, almost identical with the voltage of our battery, whereas at the particular wavelength to which the circuit is tuned, the effective resistance becomes very large, and therefore the changes in current flowing through the circuit become very small, and consequently a maximum alternating (H.F.) voltage is built up across the coil. Hence, under these conditions, if there is a maximum of voltage across the primary of the transformer there will likewise be a maximum of voltage across the secondary winding, since in all ordinary transformers of this type the coupling between the two windings is a close one.

Many types of high frequency intervalve transformers have been built for use in this manner. Those Mr. Campbell Swinton described recently at the Wireless Society of London were of this type, and were designed to operate on a range of wavelengths with a small tuning condenser across one of the windings.

In all these transformers, however, the two wires are wound close together so that actually these transformers act very little as true transformers. They are called transformers and wound as transformers, but they do not behave as transformers. To obtain true transformer action the two coils must be well separated out so that it is possible to tune the secondary as well as the primary, and in that way to build up in the secondary much higher voltages than we could obtain without such tuning. Thus by making this intervalve coupling like an ordinary loose coupled tuner with primary and secondary

circuits both tuned, obviously we shall build up in the secondary circuit, when using a very small capacity, a maximum voltage and thus get large voltage amplification between the two stages of the amplifier.

When the two coils are wound as in the Sullivan and many other makes of H.F. transformer, and as in the transformers described by Mr. Campbell Swinton, the windings are so tightly coupled that they act as one circuit, and tuning one circuit tunes both. It does not much matter whether you tune only one circuit or tune both circuits simultaneously to get the desired wavelength, the result is the same. Thus when building up such an H.F. intervalve coupling transformer, it is not possible to tune up one of the circuits, or to adjust one of the circuits to the desired wavelength until the second winding is in place and joined up. For instance, with a transformer of this type adjusted to give maximum amplification on 600 metres, it will be found that the wavelength of the primary circuit alone, even when connected to the valve and other capacities, will be only 150 to 200 metres before the secondary winding is put on. Therefore an amplifier of this type must always be adjustedwhen thetransformers

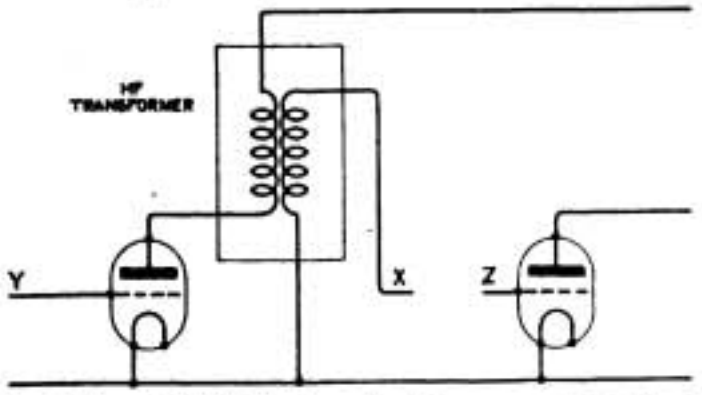


Fig. 18. *Method of adjusting wavelength of H.F. intervalve transformer.*

etc., are connected properly in circuit. A simple way of effecting this tuning is to take out the second valve from its socket and take back the wire X (Fig. 18) from the grid connection Z of the second valve, to the connection Y of the grid of the first valve. The first valve will then oscillate, and its wavelength can be measured, so that the transformer windings can be adjusted accordingly to give the desired wavelength. It is a very simple way to do it, and it works quite well in practice.

On account of the close coupling between them, the two windings thus behave as one coil, and although some of the energy is handed on to the next valve by ordinary transformer action, a considerable portion of the whole available energy is handed on by the electrostatic capacity between two windings.

In this case, therefore, we can obtain similar results by using one winding only and tuning it by means of a small variable condenser when, as I said just now, we get a maximum voltage built up across the coil

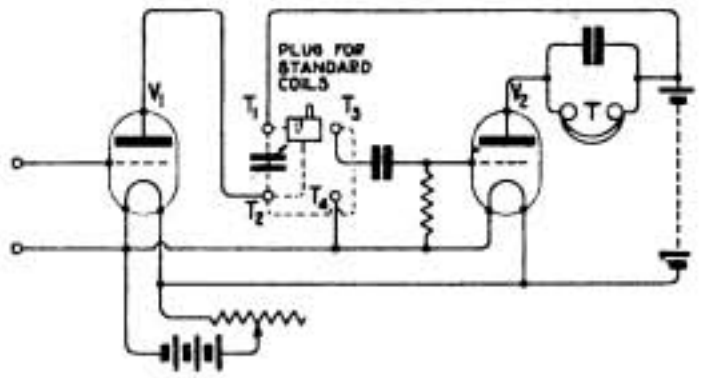


Fig. 19. *Arrangement of H.F. amplifier with interchangeable plug-in coils.*

when it is in tune with the working frequency. We then have only one circuit, one coil to tune, and can build up across it a voltage which is the maximum that it is possible to obtain, being limited only by the amplification factor of the valve, and the resistance of the coil winding. This, then, is a further simplification in the evolution of a simple high-frequency amplifier. With this change, however, we must once again introduce our grid leak, but the grid leak is not a very complicated piece of apparatus and it will do for all frequencies, and hence, whatever coils we use in the plate circuit of the valve, the result may come out in the end cheaper than having a series of special transformers. This is the case for the reason that you need not have any special coils for this purpose, but simply plug in to the anode circuit of the valve any convenient coil, such as a Burndept, or a Duolateral, or similar coil, and thus easily build up an amplifier in this simplified form. With the experimental panel arrangement that has already been described, the grid condenser and grid leak can be left in position and an ordinary standard coil plug connected in the anode circuit with a small variable condenser across it, as shown in Fig. 19. This condenser can have any desired value, but it is advisable to keep its maximum value small, say, 0·0001 to 0·0002 microfarad. We can then plug in any one of our standard coils into the circuit and make up an amplifier that will amplify any frequencies we like. It will amplify frequencies up to the highest

it is possible to get in wireless circuits, and the maximum possible amplification can be obtained in this way.

With an amplifier of this type it is possible to demonstrate the physical reality of the above-mentioned expression for the effective resistance of the circuit by using a variable condenser of the ordinary type with a considerable range of capacity in the anode circuit of the valve and various plug-in coils. Either a large coil and a small value of condenser can be used or a small coil and a bigger condenser capacity, and the difference in the amplification often becomes quite pronounced, the small coil with the larger capacity giving weaker signals.

I have not so far said anything about introducing a reaction coil into the amplifier. This is easily done by inserting a suitable coil in the plate circuit of the detecting valve and bringing it back to couple on to the aerial circuit. It may also be pointed out that one need not with such an arrangement react back to the aerial circuit, but when using a tuned anode circuit of the type just described we can couple the reaction coil with our intervalve coupling coil and so make the detector valve oscillate without worrying so much about radiation from the aerial circuit.

One slight disadvantage of this type of amplifier is that some extra means is necessary for preventing self-oscillations of the high frequency valve. With most valves, tuning of the anode circuit to the same wavelength as that to which the grid is tuned, causes the valve to set up oscillations continuously, the reaction being provided by the inter-electrode capacities of the valve. The amplifier must therefore be stabilised, either by applying a positive voltage of 3 or 4 volts to the grid of the H.F. amplifying valve, or by dimming the filament, or by providing some form of *reverse* magnetic reaction to stop the oscillations. Either the first or the last of these methods is usually the more satisfactory.

Before concluding, I would like to refer to the additional problems which are involved in very short wave amplification. A great deal has been published about them and I thought it might be of interest to draw your attention to them.

As I have just indicated, the tuned anode H.F. amplifier can be made to amplify any frequency within reason so that it will amplify both long wave and short wave signals, provided the proper coils are used. Its one disadvantage in practical use is its selectivity; it mainly amplifies for the frequency to which it is tuned, and gives very little amplification for other wavelengths. When there is much jamming, this additional selectivity is useful. The tuning range can be broadened out a little and made to cover a wider band of wavelengths by using high resistance coils, which lowers the effective resistance of that circuit and broadens out the amplification over a wider range of wavelengths. The total amplification is somewhat reduced by this means, but at the same time it is broadened out so as to enable searching to be carried on over a wider range of wavelengths. The effective resistance of the circuit can be lowered by winding the coil of resistance wire, or by connecting a suitable resistance in series or in shunt to the coil. For many experimental purposes it is rather useful to connect up both a resistance-capacity coupling and this other tuned anode one, then if we want to search over a range of wavelengths we can switch in the resistance, and then when the signal is found we can make our arrangement much more selective and cut out some of the jamming if any is present.

For the amplification of very short wavelengths the arrangement which one can unquestionably recommend is either this tuned anode or the tuned transformer used in conjunction with the principle of Armstrong's supersonic heterodyne, that is to say heterodyning the incoming signals not to give an audible note in the telephones as one ordinarily does, but heterodyning to a much higher frequency, and then amplifying this intermediate frequency by some other form of radio-frequency amplifier. Thus for the reception of 200 metre signals, we can set our heterodyne to about 214 metres, thus giving us a beat note or heterodyne note frequency of 100,000 cycles. We cannot hear a note of 100,000 cycles, but it is an oscillation of 3,000 metres wavelength. Thus with this scheme we can heterodyne our incoming signal to a longer wave signal and then amplify it in the ordinary way, finally obtaining an audible note with a second separate heterodyne.

I do not know whether the members present have seen the description of the apparatus used by Mr. Godley, the American who was sent over here in connection with the Transatlantic Tests, but he used such a scheme with a nine-valve amplifier, the first one being a detector valve and the next one a high frequency oscillator, using the remaining set of valves for the long wave amplification, for detection

of the long wave signals with a note magnifying valve at the end.

This Armstrong super-heterodyne does enable you to get very high amplifications on very short wavelengths, and although amateur experimenters in this country have up to the present mostly confined their transmissions to 1,000 metres, there are considerable advantages in the prevention or reduction of jamming between various stations in using the shorter wavelengths round about 180 metres, which most of us are licensed to use. If we should develop the use of such wavelengths it might be important to consider such a scheme as the Armstrong super-heterodyne.

Is News by Wireless Really Wanted?

By CAPTAIN IAN FRASER.

NEWSPAPER reports from America, and evidence from various quarters in this country, make it clear that in the not far distant future the broadcasting of wireless telephony to thousands of homes will become a feature of life in England. Mr. Kellaway's statement in the House of Commons the other day indicated that a settlement of the dispute that had arisen between the Post Office and the various firms who desired to manufacture wireless receiving sets was in sight, and this of course brings very near at hand the day when broadcasting in the United Kingdom will become a reality.

Without doubt there will be a boom in this country in the sale of wireless receiving sets, and a gallant attempt will be made by the firms who undertake broadcasting to supply an interesting and useful service of news, concerts, etc.

I write this article because I believe that the profuse publicity which has been given to this new development in the science of wireless telephony has led the man in the street to an entirely wrong conception of its usefulness. I believe that the novelty and wonder of receiving news from a distant source without any visible means of connection between the sender and the receiver has filled people with an exaggerated view of the value and usefulness of such a service.

That news can be transmitted and received simultaneously in thousands of homes I know, of course, and that the reception, with only a moderate outlay for apparatus, can be really good, I know too, from personal experience. But I venture to think that when calculating the development of a news service by wireless telephony one very important factor has been overlooked, and this factor occurs to me with unusual emphasis on account of the fact that I have been compelled to receive all my news by means of the ear instead of by means of the eye for the past five years. I was blinded at the battle of the Somme in 1916, and since that time, though I have kept very closely in touch with the news of the great world outside, I have had it brought home to me every day what a clumsy and inefficient organ the ear is for this purpose, as compared with the eye. And yet I who have had to listen for my news have had two great advantages over him who proposes to hear it through a wireless telephone receiver. Firstly, I am able to have the newspapers read when I desire to hear them, and not at a particular time, such as would be imposed upon the listener to a broadcasted news service which at best could only be convenient to the majority of the listeners, and not to the individual. Secondly, my reader can pick out the particular newspapers which I like to hear, and by reading through the headlines and waiting for me to say yes, or no, before proceeding with the article or paragraph, can approximate in some measure to the efficiency and facility with which a sighted person glances at his paper and chooses what he wishes to read. I have a Secretary who can read to me at from 240 to 250 words a minute. There are probably quite a number of people who can read aloud well at this speed, but there are not many who can listen to it, and take in what is being read. People who can see are not used to having books

or newspapers read aloud to them, and without long practice I do not believe the ear and brain could be expected to take in information read at anything like this rate. However, supposing with practice the many thousands of people whom we are lead to believe are going to receive their news by wireless telephony attain this speed, they will still be spending twice or thrice as much time in gathering any particular piece of news than would be required if the eyes were used.

I do not deny that there may be some hundreds of people living in the country who desire to hear some particular piece of news which the broadcasting station will send them at a particular time, and who—desiring it sufficiently much to make them put up with the inconvenience of listening to it, or perhaps not being able to obtain a newspaper for some hours after the event—will become regular users of the system. For example there will undoubtedly be a regular service announcing the winners of races, and as there are no regular evening papers in the depth of the country there will be a number of people who would be willing to install a wireless telephone receiver for the purpose of receiving this information earlier than would otherwise be possible, with the additional attraction, of course, of having concerts available in their homes.

But, comparatively speaking, these people will not be very numerous, and I am therefore strongly of the opinion that when the initial interest has evaporated it will be found that the news service by wireless telephony is not wanted.

The acceptance of this theory would lead to a reduction of the estimate which would otherwise be made as to the number of wireless receiving sets which will remain in use after the first novelty which led to their installation has passed away. But it by no means indicates that there is nothing in the idea of broadcasted wireless telephony.

In my view there will always be a demand for broadcasted wireless telephony, if a really first class concert, and occasional lectures and perhaps speeches by eminent politicians or others on matters of interest and importance are supplied.

And this will be much more the case when the science of amplified or loud-speaking telephony reaches a stage when it is possible to throw the speech or music received by the wireless instruments into a small sized drawing-room or sitting-room without much cost or difficulty. At the present time this stage has not been reached, for whereas instruments for the reception of wireless telephony with headphone can be purchased for a few pounds, the outlay is two or three times as much if a volume of sound comparable with that given by an ordinary gramophone is desired.

With the best amplifying apparatus concert items can be produced as loudly or even more loudly than by gramophone, and rather more perfectly, for there is usually an entire absence of the mechanical noises which take away from the perfection of the best gramophone record. Further, with the concert item transmitted by wireless telephony there is, I think, a curious psychological effect. Though it does not sound very different from the rendering of a record by a gramophone, the listener has nevertheless a feeling that there is more vitality about it. This is probably so because he is conscious of the fact that almost at the moment of listening the living artist is performing, whereas with the gramophone, however good it may be, there is ever present the thought that the particular rendering to which he is listening is not new, and is not a thing of the present. If one were permitted to use the phrase in connection with the mechanical production of the human voice or the strains of an instrument one would say that there is more personality in the wireless concert item than the gramophone record.

Experimental Station Design

Continued from page 719, September 2nd, 1922.

These articles, which appear in alternate issues, are intended not only to be a complete guide to those new to wireless, but to give explicit details on the construction of all the components of the Experimental Station. Actual designs will of necessity in some instances be somewhat crude, in order that they can be made up without elaborate workshop equipment. Practical working instructions are given where necessary for the help of those unacquainted with the more simple processes of instrument making. Of course, where good workshop facilities exist, the designs may be readily modified.

Economy is made an essential feature, bearing in mind always that where low-priced component parts can be obtained their use has been embodied in the designs. For those who do not desire to make their own apparatus, the descriptions will assist them in selecting the equipment for their stations.

The information contained in the first few articles under this heading is to help those new to wireless and whose first aim is to build a simple set capable of receiving broadcasted telephony, and consequently may cover ground already familiar to many readers. The succeeding instalments, however, advance by easy stages, and in the course of the series the construction of an elaborate station will be evolved.

XII.—HIGH FREQUENCY AMPLIFIERS.

SUGGESTED methods for incorporating the high frequency transformers already described, in high frequency amplifiers are shown in Figs. 1 and 3. Easy modifications can be effected for making use of any particular type of transformer, though with transformers of bigger external diameter than those shown a larger ebonite panel will have to be used in order to obtain sufficient spacing to prevent inter-action, which is a common

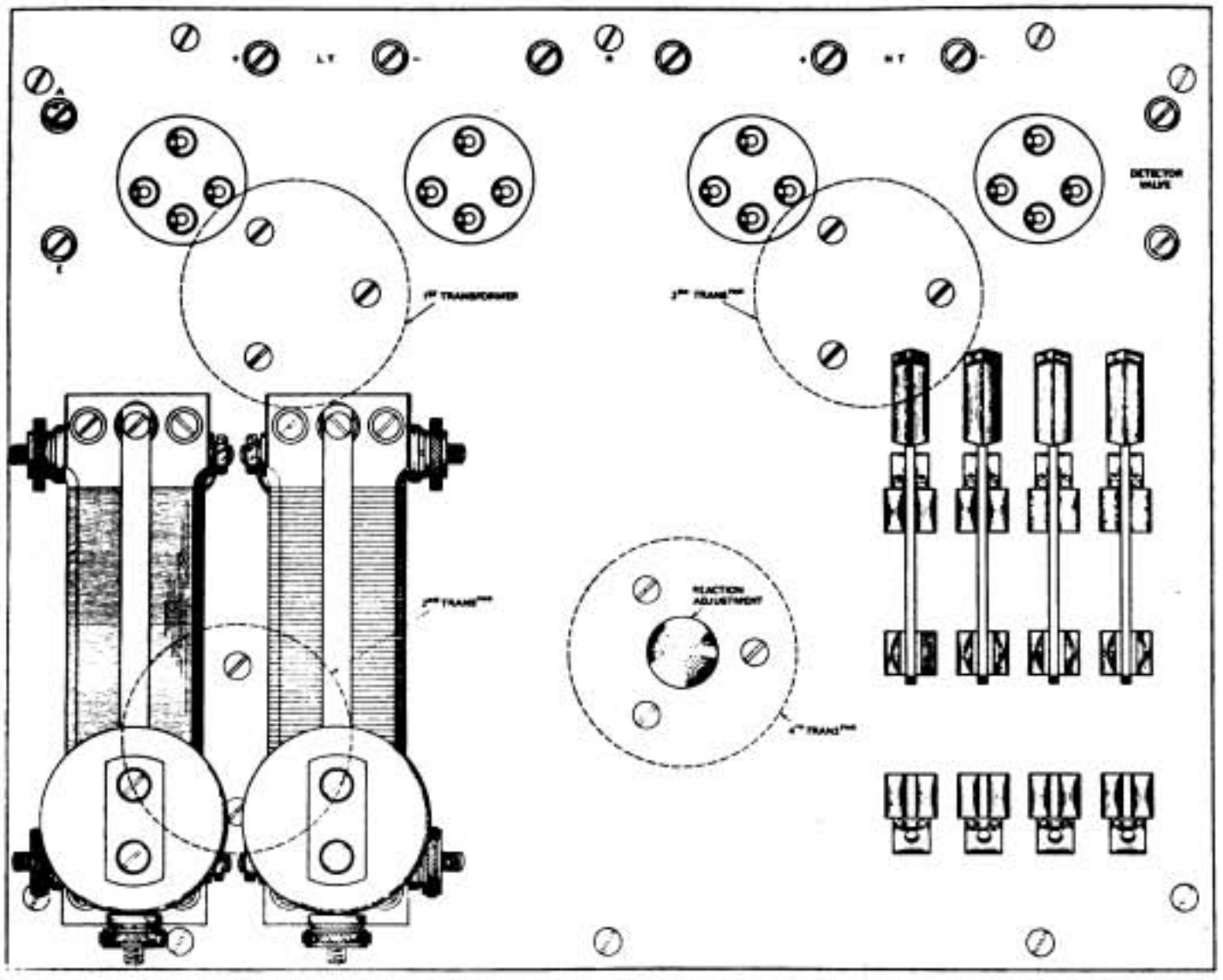


Fig. 1. Lay-out of panel of H.F. Amplifier provided with valve switching and reaction designed for use with " R " valves. Scale ½ actual size.

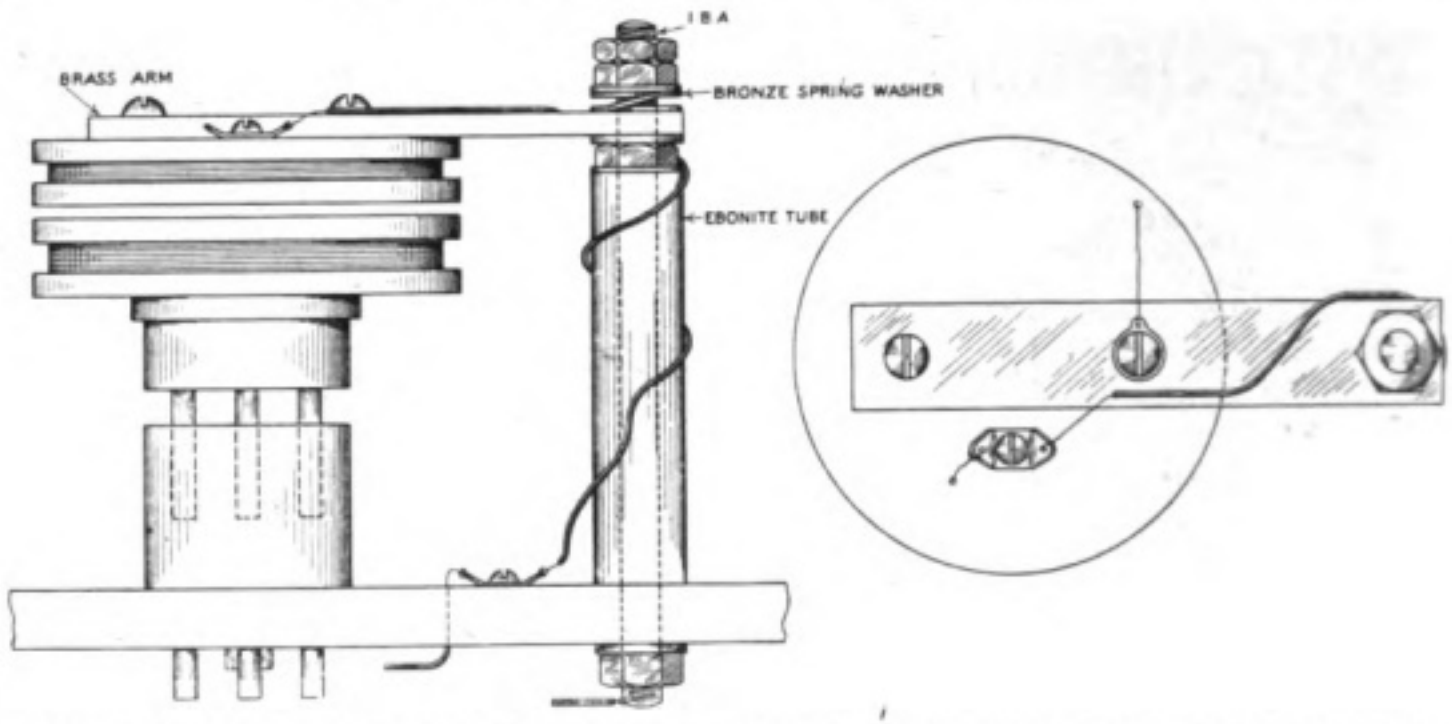


Fig. 2. Front and side views of plug-in transformer with swinging reaction coil. Scale ½ actual size.

cause of parasitic noises. The drawings are made to scale, and the transformer spacing is ample for the types shown. If many stages of amplification are to be employed, the reader is advised to use transformers of small diameter in order to limit the dimensions of the panel on which they are to be mounted. Panels of the sizes illustrated may be $\frac{5}{16}$ in. in thickness, but should any increase in area be necessary the thickness of the ebonite should be correspondingly increased to $\frac{3}{8}$ in. Other modifications may be necessary when purchased components are made use of, should they differ in size from those shown. For instance, should purchased rheostats be larger in diameter, they should be laid out on a sheet of paper and carefully measured in order to ascertain the increase in length and breadth of the panel, and careful consideration given to margin and spacing, if symmetry is desired.

The design given in Fig. 1 is for the use

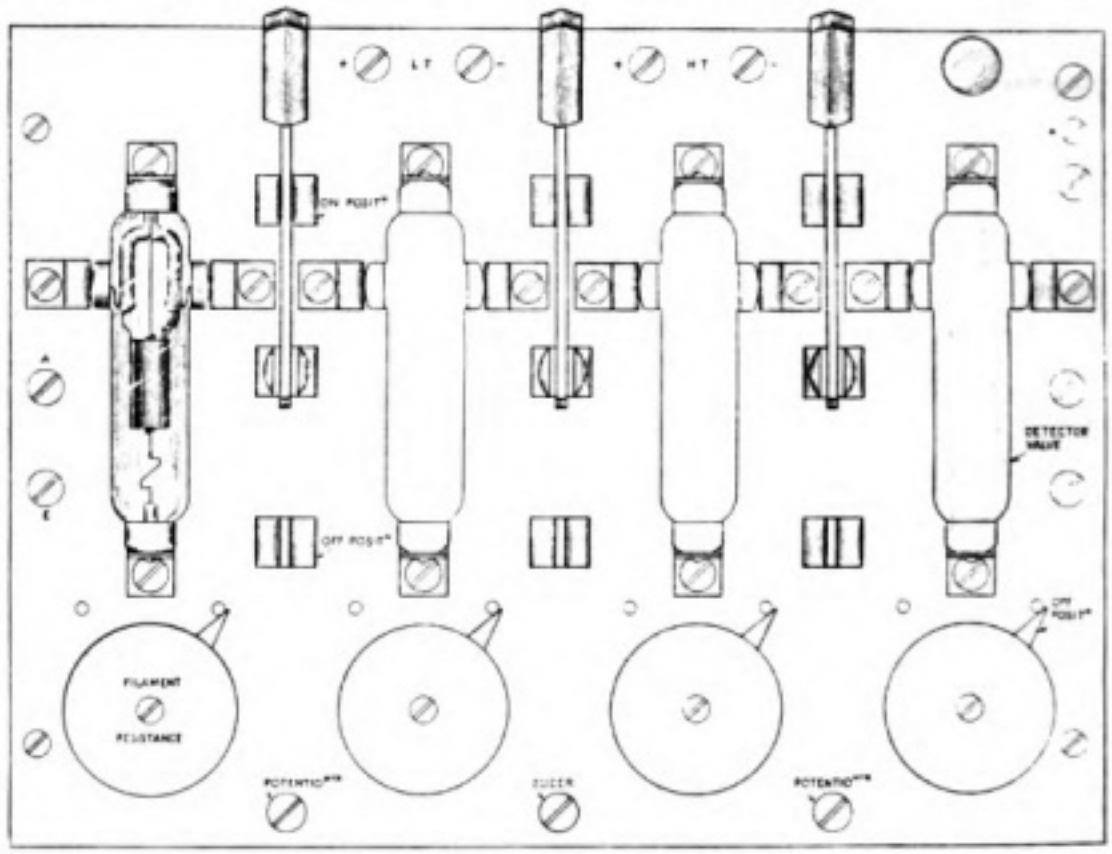


Fig. 3. 4-Valve amplifier using valves of the "V 24" type, and having separate filament control for each valve. Scale ⅛ actual size.

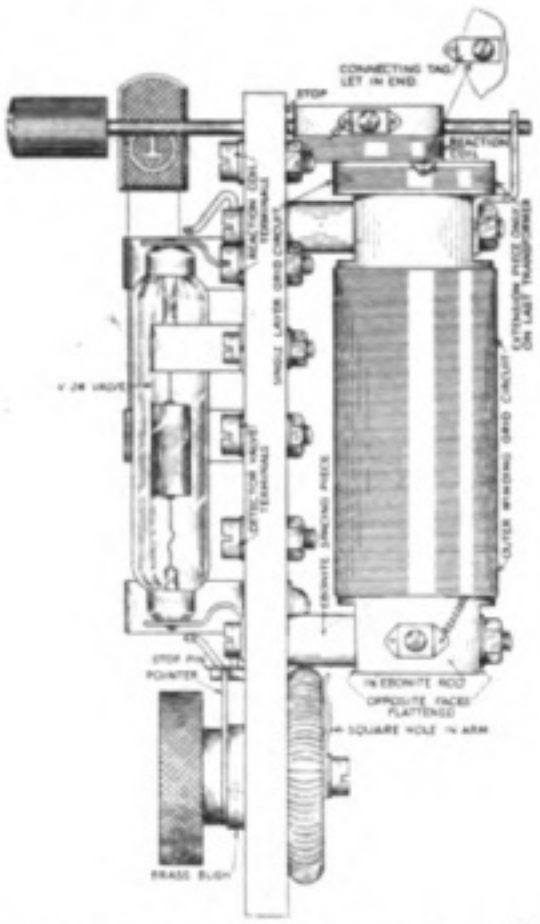


Fig. 4. Side view of Amplifier employing "V.24" valves. Scale ¼ actual size.

of valves with the "R" type socket, and it is intended that it should form the lid of a shallow box, that is, the amplifier will be operated in a horizontal position. Its transformers are shown in Fig. 6, page 718, only the last one in circuit being fitted with sliding reaction coil. Scratch marks are made on the brass rod which operates the reaction to indicate the extent of coupling of the reaction coil. The filament current of all valves is controlled by a rheostat common to all, and a potentiometer is fitted for controlling the grid potentials which is a very essential feature in the design of a multi-valve H.F. amplifier. Its critical adjustment will not only result in maximum amplification, but will give additional control for the elimination of howling. With certain types of valves, however, it may not be found essential, but when omitted, terminals should be fitted to permit of its introduction. For this purpose the transformer secondary leads must be joined together and taken to a terminal which can be strapped across to another terminal which is connected to the junction between filaments and filament resistance, the resistance being connected in the negative lead of the battery. The rheostats and switch parts shown are of well-known types, the latter having been removed from their china bases. The four switches in the four-valve set provide for throwing all valves out of circuit in any order, but where it is desired to keep reaction always in circuit it will not be necessary to switch off the last valve, and consequently one switch less than the number of valves only, will be needed.

The wiring up may be very much simplified by omitting the switches, but the use of a varying number of valves is always a great convenience, particularly where filament current is a consideration, and moreover, switching permits of the testing of valves and transformers

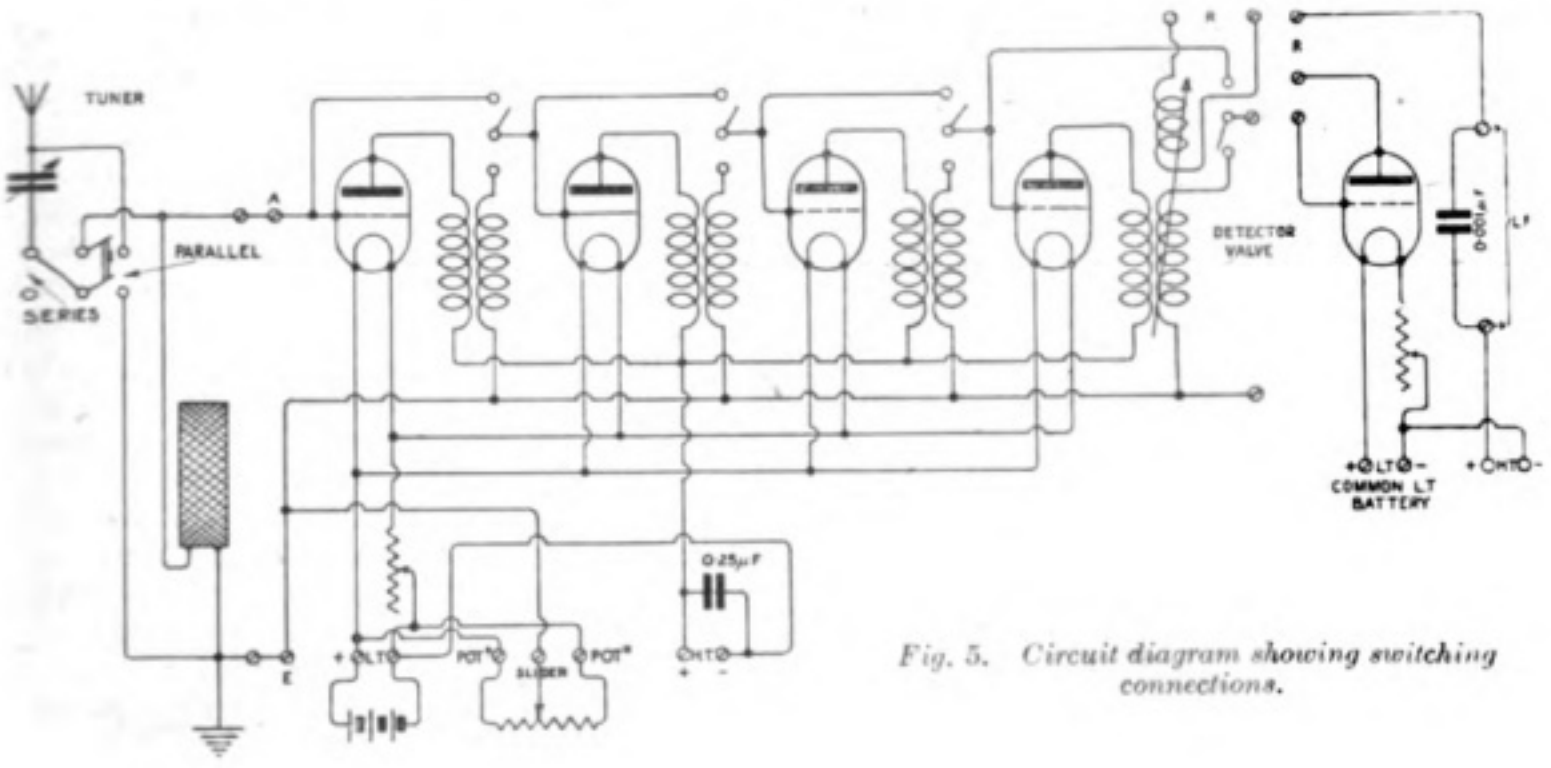
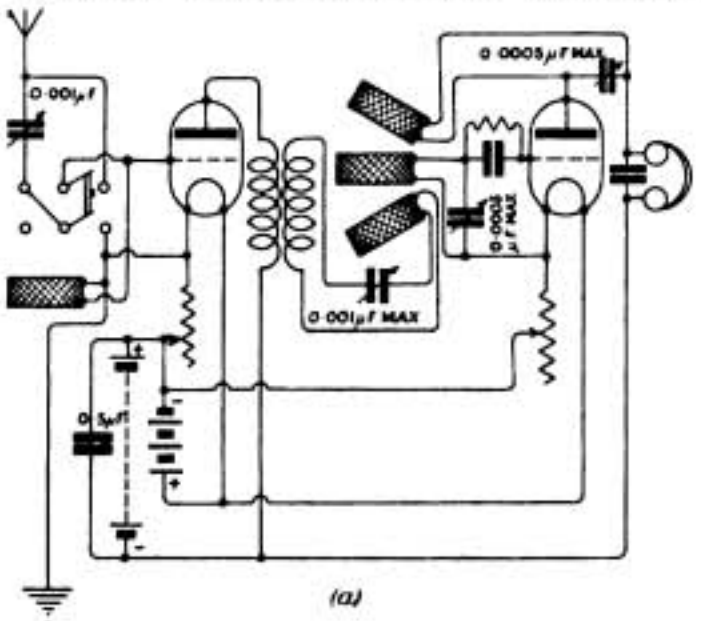


Fig. 5. Circuit diagram showing switching connections.

one against another. When making use of the interchangeable transformers of the plug-in type, the panel may be operated in a vertical position, and an ebonite top piece with valve holders may be arranged to take the valves, whilst those on the front may now carry the transformers. A method of arranging reaction in this case is shown in Fig. 2. It consists of a bracket carrying a swinging brass arm, to which is attached either a slab inductance or a turned ebonite disc with groove to carry a winding. The pillar consists of a piece



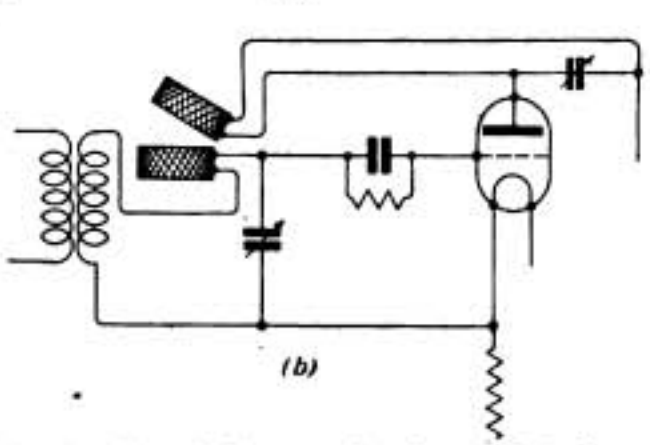


Fig. 6. Circuit diagram showing method of arranging reaction after H.F. amplification.

of ½-in. ebonite or fibre tube with ¼-in. hole through which is passed a piece of ¼-in. brass rod. Washers and nuts clamp it securely to the panel, whilst an additional nut and spring washer serve to make a friction turning point for the arm. The spindle may serve to carry contact from the coil to the internal connections of the instrument together with a flexible lead wrapped round arm and pillar and passing through a hole by its base. In mounting this on the front of the panel the arm should be vertical at the position of half-coupling so as to obviate any tendency it may have to drop round owing to insufficient friction.

Fig. 3 is a design suitable for use with valves of the " V24 " type, which are specially intended to function efficiently in high frequency amplifying circuits. Separate filament control is arranged which has the advantage of allowing for individual adjustment for each valve, and in addition, the brightness of filaments left in the circuit will not fluctuate when other valves are switched off. Filament resistances should always have an " off " position. The transformers used are similar to those shown in Fig. 2, page 716. To take up less space, the transformers are arranged parallel to the face of the panel, and are attached by means of long 3 B.A. screws, which also serve to attach the spring clips for holding the valves. The clips can be made from No. 22 × ⅜ in. wide phosphor bronze strip. The dimensions of the transformers are as shown in the drawing, there being sufficient length for winding up to 600 turns of No. 40 S.S.C. in a single layer. In spite of the very tight coupling between primaries and secondaries, it is advisable to make the inside winding the plate circuit to prevent inter-action between the transformers. The side view (Fig. 4) shows the method of mounting the transformers, and in particular, the sliding inductance for providing reaction. This consists of a small piece of circular ebonite carefully drilled right through to carry the adjusting rod which is held in place by a set screw or pin. It slides over the end of the transformer, making light contact in order to prevent it turning. A piece of stiff brass held down under the nut which clamps up the transformer forms a bracket to act as a guide for the rod. Flats are filed on opposite faces of the transformer formers, and spacing is effected by small pieces of ebonite tube. If the reader cannot obtain screws sufficiently long for holding the transformers he will, of course, tap a piece of $\frac{3}{16}$-in. brass rod with a 2 B.A. thread and use nuts at both ends. In the transformer shown it is the outside winding that is the grid circuit, which is extended so as to be coupled to the reaction coil. The reaction winding should consist of a single layer of No. 42 S.S.C. for use on short wavelengths, and be extended as near to the edge as is possible. A convenient way of terminating the lower end of this winding is to make a hole vertically through its former connected to a slight recess on the under side. The lead can be sealed in with a little hard wax. If the reaction effects are too great,

even at the position of minimum coupling, a few turns may be removed from the top end of the transformer or, alternatively, the end portion may be wound with slightly heavier gauge wire. If insufficient coupling is obtained, though this is improbable if the right type of valve is used, it can be increased by very cautiously piling the end turns of both transformer and reaction coil.

Fig. 5 is the wiring diagram showing the joining up of the switches. Using transformers operative over a wide band of wavelengths, very little is gained excepting, perhaps, a step-up of potential when only a few turns are used in the aerial circuit for tuning. With this type of circuit, as with crystal circuits, where there is no reaction directly coupled back, a certain amount of efficiency is lost by the use of a series condenser, though, of course, circumstances may be such that its use is essential to tune down to a desired wavelength. Instead of providing reaction in the amplifier itself, the amplified oscillations may be passed to an inductance to which is coupled a reaction inductance. In this case, the secondary of the last transformer is only about one quarter the turns of its primary, and the coupling between primary and secondary, somewhat loosened by increased spacing. F.H.H.

Electrons, Electric Waves and Wireless Telephony

A SERIES OF ARTICLES BY DR. J. A. FLEMING, F.R.S., SHORTLY TO COMMENCE IN THIS JOURNAL.

DR. J. A. FLEMING requires no introduction to readers of this journal. His work in connection with "wireless" stands out so prominently that his name is associated with almost every phase in the development of the science.

In addition to his most unusual scientific capabilities, Dr. Fleming is at the same time extraordinarily popular as a lecturer. It would be difficult to imagine a more enthusiastic audience than that which filled to overflowing the lecture theatre of the Royal Institution on the occasion of the series of lectures delivered by Dr. Fleming last Christmas, the subject being "Electric Waves and Wireless Telephony." These lectures dealt in succession with waves in various media and concluded with a delightfully clear exposition of the propagation of electric waves in the aether and wireless telephonic speech.

At the present time, with the prospect of a wonderful development in the popularity and usefulness of wireless telephony resulting from the advent of broadcasting, there is probably no subject which is calculated to make a stronger appeal than a lucid explanation of wireless telephony introduced with an explanation of wave formation and an insight into modern views on the nature of atoms, electrons and the aether—that hypothetical medium invoked as a basis for the propagation of wireless waves.

It is with considerable pleasure, therefore, that we are able to announce that the lectures delivered before the Royal Institution are to form the basis for a series of articles which this journal has been fortunate in securing from the pen of Dr. Fleming, entitled "Electrons, Electric Waves and Wireless Telephony."

The series will be commenced in the issue of *The Wireless World and Radio Review* for October 7th, which will be the first number of the second half-yearly volume. This series will form the distinctive feature of the volume and there is no doubt that it will constitute one of the most attractive contributions yet made to wireless literatue.

The articles will be elaborately illustrated with figures and diagrams, and whilst they will cover the subject in the fullest detail, the gradual development from one phase to another will ensure that even the new reader is never carried out of his depth.

The Damp-Proofing of Coils and Formers

By G. P. KENDALL, B.Sc.

ONE of the most important factors in the efficiency of a receiver is the proper damp-proofing of the tuner windings and formers, for upon this depends the constancy of the results obtained. Many of those annoying vagaries of fluctuating signal strength of which beginners sometimes complain can be laid at the door of damp in the coils or the tubes upon which they are wound. It is therefore a matter of considerable importance to make a correct choice of an insulating and proofing agent, and to use an effective method of impregnation.

Those amateur constructors who can afford to use ebonite tubes for their inductances will find it a fairly simple matter to render their windings damp-proof. The former itself being impervious, all that is necessary is to impregnate the cotton or silk covering of the wire, and shellac varnish is perhaps the most convenient agent. It gives very good results, provided that it is thoroughly dried by baking, and that varnish of good quality is used. This last should be noted; the varnish should be obtained from an electrical firm, and not from an ordinary paint and colour merchant, whose product may have very poor insulating properties.

The necessary baking of the varnished coil should be done about ten minutes after the application of the shellac, and should be carried out in a *moderately* hot oven. Care must be taken not to overheat the coil, lest the ebonite tube be damaged or the varnish scorched.

Most amateurs, however, regard ebonite tubes as much too expensive for ordinary purposes, and therefore use cardboard ones. The substitution is justifiable, and does not lead to appreciable loss of efficiency *if* tube and winding are properly impregnated. Shellac is not quite so suitable in this case, since it is difficult to get it to soak well into the cardboard. Paraffin wax is the better material for treating formers of this type, because the tube with the coil upon it can be soaked in a bath of the melted wax until throughly impregnated. To obtain the best results with this material there are one or two points to be noted, however. First, care must be taken not to heat it too fiercely or it may "scorch," or, when melted, boil. Should it be allowed by accident to boil, take it off the fire and keep it away from lights until it has stopped (it gives off considerable quantities of inflammable vapour when boiling). Second, it should be realised that it is possible by means of the wax bath to expel moisture from the cardboard and the covering of the wire and to replace it with wax, provided that the wax is heated to a temperature above the boiling point of water. If it is raised to, say, 130° centigrade the water will be driven out as steam, bubbles of which can be seen rising through the wax. When the bubbles come to an end the process is complete and the coil can be taken out, drained as completely as possible, and put aside to cool.

The careful worker uses a thermometer for these operations, but for the benefit of those who do not possess a suitable centigrade thermometer, and do not care to go to the expense of buying one, it may be as well to explain that the desired end can be attained fairly well by heating the wax in some form of double boiler, such as a jam-pot standing in a saucepan. If the outer vessel is filled with very strong brine and kept boiling briskly, a temperature will be reached in the inner one which will be capable of expelling moisture if given time.

The preceding notes have particular reference to single-layer windings, and they should not be applied too literally to all coils. It is very difficult to bake the moisture out of some types of multi-layer coils, such for example as those produced by pile-winding, and for these the wax bath should be used. In general, the experimenter must use his judgment to decide which is the method best suited to a particular case.

It should be remembered that all the insulating materials used for impregnation purposes have a fairly high dielectric constant, and hence they increase the internal capacity of the coil somewhat. To keep this objectionable increase down as much as possible be very sparing with your varnish and wax; use only just sufficient varnish to completely impregnate the covering of the wire, and in the case of wax, drain off as much as you can when lifting out the coil.

The Wireless Society of London

RESUMPTION OF MEETINGS AND WORK IN HAND.

WEDNESDAY, September 27th, is the date fixed for the opening meeting of the new session of The Wireless Society of London. The meeting will be held at 6 p.m. on this date at the Institute of Electrical Engineers, Victoria Embankment.

During the summer vacation, although general meetings have not been held, it should not be supposed that the activities of The Wireless Society of London have been curtailed The Officers and Committee have met together, as occasion required, and have kept in view many points of general interest, and have taken every step necessary to keep in touch with the events which have been happening during the past few months.

At the General Meeting to be held on September 27th, it is hoped that Senatore Marconi will be present to address the meeting. Senatore Marconi, who is at present in Italy, has promised to be present if he returns to England in time.

BUSINESS OF THE OPENING MEETING.

Among the matters which will receive special attention at this meeting will be the subject of Broadcasting, and also the forthcoming All-British Wireless Exhibition to be held at the Horticultural Hall from September 30th to October 7th.

The President, Admiral of the Fleet Sir Henry B. Jackson, has promised to make an announcement with regard to certain resolutions passed at the recent Conference held in Brussels, at which Conference he represented Great Britain.

FUTURE MEETINGS OF THE SESSION.

The Society is again indebted to the Council of the Institute of Electrical Engineers for having kindly placed the Lecture Hall of the Institute at the disposal of the Society for their monthly lectures.

Arrangements have been made for lectures to be held in that building on the fourth Wednesday in each month until the close of the new session in June, 1923 Particulars of lectures to be held will be announced as far in advance as possible

On October 25th, a joint lecture will be given by Mr. R. S. Smith Rose, and Mr. R. H. Barfield of the National Physical Laboratory, the subject of the lecture being " The Effect of Underground Metal Work on Radio Direction Finders."

THE ALL-BRITISH WIRELESS EXHIBITION.

Some further information regarding the All-British Wireless Exhibition, and the arrangements made by this Society in connection therewith, may be of interest. A special room at the Horticultural Hall has been placed at the disposal of the Society for the purpose of short popular lectures on wireless each afternoon and evening during the period of the Exhibition.

The Hon. Secretary will appreciate the offer of assistance in this direction from any member of the Society or affiliated societies who is not already in correspondence with him on the subject.

This room will serve also for the purpose of social meetings for members of this Society and members and officers of affiliated societies.

The Hon. Secretary of the Wireless Society of London will appreciate a notification beforehand from the Hon. Secretaries of Societies who may arrange for parties to visit the Exhibition.

AFFILIATION OF SOCIETIES AND ENROLMENT OF NEW MEMBERS.

The Committee are pleased to report that many new societies and clubs have applied for affiliation and have been accepted.

The Hon Secretaries of new societies and clubs are asked to write for particulars of affiliation to the Hon. Secretary, Mr. L. McMichael, 32, Quex Road, N.W.6, and the same invitation is extended to those who are desirous of becoming Members or Associate Members of the Society.

Since the last session the following societies have been accepted for affiliation. :—

Middlesbrough and District Wireless Society.
Ilford and District Radio Society.
Shrewsbury and District Radio Society.

Ramsgate, Broadstairs and District Wireless Society.
Redhill and Reigate Wireless Society.
Durham City and District Wireless Club.
Smethwick Wireless Society.
Bishop's Stortford Wireless Society.
Radio Club de Brussels, Belgium.
Malta Radio Society.

In addition, a large number of new members and associate members will be balloted for at the General Meeting on September 27th.

AMATEUR TRANSATLANTIC TRANSMISSIONS.

In connection with Amateur Transatlantic Transmissions, the Society has certain announcements to make. By way of introducing the subject it may be of interest to quote from a letter received by the Hon. Secretary of the Wireless Society of London from Mr. F. H. Schnell, Traffic Manager of the American Radio Relay League.

The following is a quotation from Mr. Schnell's letter :—

"In view of the success of our Transatlantic Tests of December, 1921, we desire to conduct another series of tests to include transmission from American and Canadian Amateur Stations, and, if possible, the reception of signals from British and French Amateur Stations

"Arrangements can be made with the Dutch Amateurs for reception and with the French Amateurs for both transmission and reception.

"I am taking the liberty of writing the Wireless Society of London with the purpose of determining with what British organisation arrangements should be made to handle the tests in England."

In view of this application on the part of the American Radio Relay League for the co-operation of the Wireless Society of London in the conduct of Transatlantic transmissions, the Committee of the Society has undertaken to co-operate in the arrangements for the transmission, which will be controlled by amateurs in this country.

It is understood that the Manchester Wireless Society has already made good progress with the erection of a station for Transatlantic amateur communication, and that they will shortly be in a position to conduct preliminary tests.

Arrangements are being made by the Wireless Society of London for transmissions by amateurs to take place from a station in or near London, and further announcements regarding this matter will be made shortly.

A committee has been appointed to deal with this subject and the names of those who will serve on this committee are: Major H. Hamilton, D.S.O., Commander C. F. Phillips, A.M.I.E.E., Mr. P. R. Coursey, B.Sc., A.M.I.E.E., Mr. G. G. Blake, M.I.E.E., and Capt. Norman Lea, B.Sc., A.M.I.E.E.

Mr. W H. Shortt has resigned from the Committee of the Wireless Society of London, as, having left London, he finds it impossible to give the necessary time to the affairs of the Society. The Committee have invited Mr H. S. Pocock, who is the Editor of *The Wireless World and Radio Review*, the official organ of the Wireless Society of London, to fill the vacancy on the Committee.

All communications regarding the Society should be addressed to the undersigned :—

L. MCMICHAEL
(Hon. Secretary, Wireless Society of London),
32, Quex Road, W Hampstead, N.W 6.

Air Race Reports.

BROADCASTING BY 2LO AND RECEPTION EVERYWHERE SUCCESSFUL.

FROM all over the country letters and telegrams from amateurs describing their reception of the air race reports pour in. There is not a doubt that the arrangements were satisfactorily carried out and reception was possible, so clearly that all the excitement of the race could be enjoyed. Reports were made by the Air Ministry on behalf of the Royal Aero Club from various places along the 800 miles course, which ran through Birmingham, Newcastle, Glasgow, Manchester, Bristol and back to Croydon. The reports were received at the Marconi Broadcasting station, and within a few minutes of their reception were broadcasted.

As far as the wireless arrangements were concerned, both as regards transmission and reception, the event was highly interesting. This was broadcasting. Moreover, it was broadcasting of news but a few minutes old. As an experiment there was complete success, but, of course, these are early days in broadcasting, and what may be possible in the near future is but foretasted as yet.

It must be borne in mind that the event reported did not take place on a small field. A report of a football match which could be watched and the information provided by one person from one instrument would be a very much more simple problem than that of reporting during progress the events taking place on so large a course as was covered by the aeroplanes competing for the King's Cup.

In the first place considerable organisation was necessary. But although the scheme was a big one, complications were avoided as far as possible. Of course, like all new things, there was a certain amount of experiment in the effort, and the Air Ministry and 2LO were working on new ground. Fortunately, atmospheric conditions in most places did not seriously interfere with the reception, and from the reports which were asked for, of the transmissions, it is obvious that a good deal of keenness prevailed.

One telegram from Diss, in Norfolk, stated that the transmissions had been duly heard on a simple crystal set, using a P.M.G. twin aerial. Considering the distance this was an excellent performance. Another receiver at Whittlesey, a boy of 16, also obtained the hourly reports on a single valve set. Letters from Leeds and Birmingham congratulate the broadcasting station, but congratulation is also due to those who received, for good reception of telephony broadcasting depends largely upon the efficiency of the receiving set.

From Cheshire a letter was received from a man with a home-made set using a Mullard "Ora" valve. He says his aerial is about 80 ft. long and averages about 18 ft. high only. It has the usual two wires spaced 6 ft. The apparatus is mounted on an old box and ebonite is conspicuous by its absence. His grid condenser consists of two pennies with waxed paper between. He received the details of the race so clearly that to use his own words :—"If the speaker had been, say, one of my personal friends I feel sure I could have identified him by his voice."

An amateur at Hull reports that the 5 o'clock transmission was slightly interfered with by an arc station, and that repetitions were very useful for that reason. The set used in this case had one valve, and the aerial sloped from the roof of the house to a point 10 ft. above an out-house. The average height of aerial was 25 ft All of the other transmissions were received without trouble.

A report from Brighton states that reception was made on one V.24 valve and a Reinartz tuner. The aerial in this case was 60 ft. long including lead-in, twin wire spaced only 2 ft. apart, the horizontal portion being 30 ft. above ground.

From Southsea, Hants, a letter was received from an amateur who used a single valve H.F. amplifier and crystal detector, aerial twin 50 ft. long 25 ft. high. He heard the transmitted progress of the race very clearly until he was badly jammed by a very loud spark station on 300 metres.

Another letter of interest states that the writer received the reports strongly and clearly at Leytonstone with a short indoor aerial. His crystal set is contained in a safety razor case measuring $1\frac{3}{4}$ ins. by $1\frac{3}{4}$ ins. by $\frac{1}{2}$ in., but the parts would comfortably fit in a case half that size. Two 42 S.W.G. enamel wire basket coils, $\frac{7}{8}$ in. in diameter are the tuning unit, and results are surprisingly effective.

How the Air Race results were broadcasted from 2LO.

Air racing has hitherto been difficult to follow. Machines started from the ground at given times according to their handicap, and they were soon out of range of the best field glasses. There was an air of expectancy tinged with a mixture of hope and doubt, but the race could not be watched. At certain points along the route observations were made, the competing aeroplanes were singled out, the time of their passing accurately noted and a few privileged persons heard on the telephone how things were progressing. The vast majority of people had no means of gaining intelligence of the race until the newspapers published the result, or the result of a part of the race.

On Friday and Saturday of last week the race for the King's Cup proved that any number of people could "watch," as it were, the race from start to finish.

At the Royal Aero Club a special receiving set was erected for the occasion

Notes

Cost of Wireless on Trawlers.

A deputation from Hull is seeking the consideration of the Admiralty in respect of the requirement to install apparatus on trawlers. It is stated that the cost of upkeep will be £900 a year, and in view of the present state of affairs in the fish trade the question is serious.

Reception of Air Race News at a Fete.

A fête which was held in aid of the funds of the St. Pelagia's Home, was provided with a receiving set from which was obtained the broadcasted reports of the air race round Britain.

Reduction in Price of Valves.

It is gratifying to observe from the advertisement columns of this journal the very substantial reduction in the price of valves which is announced by manufacturers. One might have been justified in fearing that the increased demand for wireless apparatus would have resulted in an upward tendency in prices, so that the news is all the more welcome.

Landlords and Wireless Aerials.

From notes which have recently appeared in the daily press it is apparent that in some instances the attitude of landlords towards the erection of aerials on buildings will not be an encouraging one.

A reasonable attitude for a landlord to adopt would be to obtain an undertaking that any damage resulting from the erection of an aerial would be made good by the tenant. Beyond that it is difficult to see any reason for landlords to interfere.

For those unfortunate amateurs who may be domiciled in a building owned by the London County Council, it appears that the method of erecting the aerial and many other details must first receive the approval of the council, whilst amongst other formalities a deposit of £1 must be left with the council as security against damage.

Concerts by 2 LO on September 16th.

Marconi House Broadcasting Station will transmit concerts on Saturday, September 16th, at 5–5.50 p.m., 6–6.30 p.m., and 7–7.30 p.m.

These transmissions will be for the Southgate Fête, in aid of the Royal Northern and Passmore Edwards Hospitals, and a fête in aid of the Croydon General Hospital.

French Wireless Telegraphy Congress.

A congress was opened a few days ago at Marseilles Colonial Exhibition to discuss matters relating to wireless telegraphy in France and her colonies, and the colonies among themselves.

Norwegian Regulations for Foreign Vessels.

According to the *Anglo-Norwegian Trade Journal*, the following regulations regarding the use of wireless stations on vessels belonging to foreign powers not at war, while in Norwegian territorial waters in times of peace, have been approved by Government resolution, and came into force on September 1st.

1. In Norwegian territorial waters wireless telegraph or telephone stations on foreign vessels may not be used, except by special permission, unless for the following purposes:—

(*a*) Communications concerning vessels in distress or for the prevention of accidents.

(*b*) Communications with the nearest Norwegian coastal station, and

(*c*) Communications with other ships' stations when each vessel is at least 10 nautical miles distant from the nearest Norwegian coastal station.

In the cases of (*a*) and (*b*) communication must at once be stopped on request from the Telegraph Administration, the Naval Department, or a station belonging to either of these authorities.

2. In Norwegian ports where there is a state wireless station and within certain prohibited districts laid down by the Norwegian authorities (regarding which information may be obtained from the nearest state coastal station), the ship's station may not be used except for communications as under 1 (*a*), unless special permission has been obtained.

3. Application for permission to use a station in Norwegian territorial waters for other communications than above-mentioned should be sent to the Telegraph Administration (Telegrafstyret), which will give its decision after consultation with the Naval Administration.

4. (This paragraph concerns war vessels).

5. When a ship's station is used while in Norwegian waters this must be done with the observance of the provisions of the International Telegraph Convention and its regulations.

6. The foregoing regulations remain in force only when Norway is not at war, and are applicable only to vessels of nations not at war.

Correspondence

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

Sir,—I beg to call your attention to a letter addressed to you and published in *The Wireless World and Radio Review*, of August 19th, from Mr. T. S. Skeet, of Leicester.

Mr. Skeet informs you that he heard **2PF** working to me on an indoor aerial. This is rather a wonderful feat, especially as I do not remember ever having the pleasure of working to **2PF**.

On referring to my log I find I was working to **2PS** of Nottingham on the date mentioned.

Evidently Mr. Skeet has made a mistake.

LEONARD M. BAKER
(operating **2FN**).

Calendar of Current Events

Saturday, September 16th.

Concerts by **2 LO** on 6.30 metres at 5—5.30, 6—6.30, 7—7.30 p.m. See also Note on this page.

SOUTHWARK WIRELESS TELEPHONE ASSOCIATION. At King's Hall, London Road, S.E.1. Home-made crystal set competition.

Sunday, September 17th.

Daily Mail Concert from The Hague (**PCGG**), 8 to 9 p.m. B.S.T., on 1,085 metres

Monday, September 18th

IPSWICH AND DISTRICT WIRELESS SOCIETY. At 55, Fonnereau Road, Ipswich. Lecture by Mr. Stanley Lewis.

BOROUGH OF TYNEMOUTH Y.M.C.A. RADIO AND SCIENTIFIC SOCIETY. 7.30 p.m. Annual General Meeting.

Tuesday, September 19th.

Transmission of Telephony at 8 p.m. on 400 metres by **2 MT** (Writtle).

Wednesday, September 20th.

NEWARK AND DISTRICT WIRELESS SOCIETY. 7.30 p.m. At Magnus Grammar School. First Meeting of Winter Session.

Thursday, September 21st.

Daily Mail Concert from The Hague (**PCGG**). 8 to 9 p.m. B.S.T., on 1,085 metres.

Sunday, September 24th.

Daily Mail Concert as above.

Monday, September 25th.

IPSWICH AND DISTRICT WIRELESS SOCIETY. At 55, Fonnereau Road, Ipswich. Sale and exchange of apparatus.

Tuesday, September 26th.

Transmission of Telephony at 8 p.m. on 400 metres by **2 MT** (Writtle).

Wednesday, September 27th.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY. At 111, Station Road, Redhill. Lecture on "Phones and Loud Speakers," by Mr. White.

Thursday, September 28th.

Daily Mail Concert, 8 to 9 p.m. (as above).

RADIO EXPERIMENTAL ASSOCIATION (NOTTINGHAM AND DISTRICT). At Room 74, Mechanic's Institute. Discussion on Mr. Ford's lecture on "Radio Measurement." Subscriptions due.

Friday, September 29th.

WIRELESS SOCIETY OF HIGHGATE. At Highgate Literary and Scientific Institute, South Grove, Highgate, N.6. Annual General Meeting, election of officers, annual report, etc.

Wireless Club Reports

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

The Wireless Society of Highgate.*

Hon. Secretary, Mr. David H. Eade, "Gatra," 13a, Sedgemere Avenue, East Finchley, N.2.

The Annual General Meeting of the Society will be held at the Highgate Literary and Scientific Institution on Friday, September 29th, 1922, at 7.45 p.m.

The agenda is as follows:—(1) Election of officers. All the Society's officers retire, and are eligible for re-election. The following officers do not wish to stand for re-election to their respective offices: Mr. D. H. Eade, Hon. Secretary; Mr. L. R. Rowlands, Hon. Treasurer; Mr. L. Grinstead, Vice-Chairman. It is further proposed that the Committee should be increased by the addition of two more members. Proposals for filling these vacancies and proposals for the Society's officers should be sent to the Hon. Sec. as soon as possible. (2) Annual report and statement of accounts. (3) New headquarters for the Society. (4) Future policy of the Society. (5) Any other business.

Members are requested to let the Secretary know whether they will be able to be present.

The East London Radio Society.*

Hon. Secretary, Mr. L. E. Lubbock, King George's Hall, East India Dock Road, Poplar.

A meeting was held on Tuesday, August 29th, 1922, in the Society's Lecture Hall, in Woodstock Road.

Although the attendance was not so large as the previous week there was a fair number present. After the usual half-hour's buzzer practice the evening was devoted to open discussion for the benefit of the newer members. The Society's apparatus was laid on the table together with one of the member's crystal set, and a large number of matters were dealt with by the Society's expert and many members just starting were relieved of their difficulties. The meeting closed at 10 p.m. after a hearty vote of thanks to the chairman.

All interested amateurs in East London are invited to communicate with the Secretary.

Radio Experimental Association (Nottingham and District).*

Hon. Secretary, Mr. F. E. Bailey, 157, Trent Boulevard, West Bridgford, Notts.

A general meeting of the above Association was held on Thursday, August 31st, at the Mechanics Institute, Nottingham.

The lecture for the evening was entitled "Radio Measurements." Mr. Ford, the lecturer, exhibited expert skill and a convincing manner.

He had brought with him a considerable amount of apparatus used for calculating various measurements, and his explanations of the respective instruments were ably and clearly put before the audience. The lecturer illustrated the method of calculating unknown resistances by means of the Wheatstone bridge. The finish and construction of the lecturer's apparatus was deserving of special praise.

It was illustrated that many calculations, seemingly difficult, can be accomplished quite successfully with fairly simple apparatus, care and accuracy only being necessary to ensure successful results.

Commencing October 12th, meetings will be held at the new headquarters.

The next meeting will be held on Thursday, September 28th, in Room 74, Mechanics Institute, when a discussion on Mr. Ford's lecture will take place. It should also be noted that subscriptions fall due on this date, after which the new winter session commences.

The Hon. Secretary will be pleased to meet at the meeting any amateurs in the district who are not members.

Wakefield and District Wireless Society.*

Hon. Secretary, Mr. Ed. Swale, 11, Thornes Road, Wakefield.

A meeting of the above was held at the Y.M.C.A., Grove Road, on Friday, September 1st, the chair being taken at 8 p.m. by Mr. Wrigley, who called upon Mr. Burbury jnr., to deliver his lecture on "The Two-valve High Frequency Amplifier," which is designed to obviate interference, to meet with future requirements of the P.M.G., viz., prohibition of interference.

Questions were asked, followed by a lengthy discussion regarding various circuits, and valve oscillation, thereby energising the aerial, which proved very interesting to all.

A hearty vote of thanks was accorded to Mr. Burbury, jnr.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society.*

Hon. Secretary, Mr. G. J. S. Littlefield, 37, Borough Road, North Shields.

On Monday, September 18th, at 7.30 p.m., the Annual General Meeting of the above Society will be held in the Y.M.C.A. Buildings, Bedford Street, North Shields.

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

The above Society opened its winter session on Wednesday, September 6th, 1922, at headquarters, the Y.M.C.A., Woolwich.

Two new features are being inaugurated, which should be of great assistance to beginners. A series of elementary lectures has been arranged on the construction and use of the fundamentals of a wireless set, *e.g.*, aerials, earths, inductances, condensers, crystals and valves, and will be given

in a most simple way by one of the members, Mr. Houghton, from 8 to 8.30 p.m., each Wednesday evening. Also a buzzer class for beginners will be held from 7.30 to 8 p.m. on each evening. For the more advanced there is a six-valve set in operation, and much telephony and music are generally obtained. An attractive series of lectures and demonstrations is being arranged for the monthly meetings, which are held on the last Friday in each month.

Enquiries as to conditions of membership will be welcomed by the Hon. Secretary.

Burton-on-Trent Wireless Club.*

Hon. Secretary, Mr. A. J. Selby, 66, Edward Street, Burton-on-Trent.

A most enjoyable and interesting afternoon was spent by the members on Saturday, August 26th, in a visit to the Burton electricity power station.

Mr. T. Hall, the borough electrical engineer, conducted the party and explained the whole working of the plant. The boilers were examined and the methods of coaling the fires were explained. The steam turbines and electricity generators were next visited and the working of them explained. The rotary converter, which converts the alternating current to direct current, to run the tram-cars, attracted much interest. Switchboards to the tram service were inspected.

At the instrument and testing shops it was seen how the electricity meters were tested and set accurately to a standard meter. Especially interesting was a new type of power switch designed by Mr. Hall, which is to be installed at all the large works where electricity is used. With this switch it is possible to change over in case of a breakdown of the electricity main to another main without having to send to the power station for a man from there to come and alter the connections to the mains. The switch is so constructed that there is no danger whatever in the operation of changing over to the new main.

Mr. Hall was bombarded with questions, which he very ably answered.

Mr. A. J. Selby proposed a very hearty vote of thanks to Mr. Hall, and Mr. L. G. A. Sims seconded. The vote was heartily endorsed.

Mr. Hall suitably replied.

Otley and District Wireless Society.

Hon. Secretary, Mr. N. Weston, 24, Guycroft, Otley.

At the fifth meeting of the above Society, at Queen's Hall, Otley, on August 31st, further component parts of proposed five-valve amplifier were examined, the two air core H.F. transformers being voted very neat and efficient. A vote of thanks was unanimously passed to Mr. A. Gibson for his skill in winding. It will only be a matter of a week or two before the set is in operation. A further lecture was given by Mr. N. Weston, on induction, primary cells and H.F. oscillating waves. A series of valve set lectures will be delivered by Mr. H. Johnson at a later date. It is earnestly desired that members of similar societies who would give advanced lectures to the above Society would communicate with the Hon. Secretary. Thanks are rendered for the way the local paper has helped the publicity campaign for the above. A number of members have not quite got to the action stage. It is requested that they come forward at an early date. Lectures are given each Thursday at Queen's Hall until further notice.

Barnoldswick Wireless and Technical Society.

Hon. Secretary, Mr. J. Balderston, 6, Clough Terrace, Barnoldswick.

A meeting of the above Society was held on August 30th, at the Gladstone Liberal Club. Preceded by the usual 30 minutes "buzzer" practice, a lecture was given by Mr. G. Balderston, entitled "Electro Magnetism." The lecture was delivered to a most appreciative audience. Another meeting took place on Wednesday, September 13th.

Ipswich and District Wireless Society.

Hon. Secretary, Mr. F. T. G. Townsend, 46, Grove Lane, Ipswich.

An interesting excursion under the auspices of the above Society took place on August 26th, when, by kind permission of the Great Eastern Railway Co., a party of 20 members visited the Company's land station at Parkeston Quay. The party was met and escorted round the station in relays by Mr. Child, the resident engineer, and all appreciated his kindness, and also that of the operator in charge, who spared no effort to demonstrate his set. Tea was afterwards partaken of at Dovercourt and the return journey made by train *via* Manningtree, where a two hours' discussion took place—thanks to an engine breakdown.

The winter session is opening with a lecture by Mr. Stanley Lewis on September 18th.

There will be a sale and exchange of apparatus on Sept. 25th. Local non-members are invited on any Monday evening at 55, Fonnereau Rd., after Sept. 11th.

Swinton and District Amateur Radio Society.

Secretary, Mr. Geo. T. Bultitude, "The Slade," Swinton, near Rotherham.

The inaugural meeting of the above Society was held on August 25th, when a good number of amateurs attended. The Secretary (*pro tem.*) explained that he had been pressed by interested wireless students to call the meeting. Mr. A. Hammerton presided. The meeting resolved to inaugurate a Radio Society.

The Hon. President and Vice-Presidents were nominated. The Committee elected were :—Messrs. Woods, Oxby, Finn, Henson, Greenfield, Twigg, Hammerton and Trowbridge. Mr. A. Hammerton was elected as Treasurer. Mr. Geo. T. Bultitude, Secretary and Librarian. The fixing of fees and subscriptions was adjourned for the Committee to decide at the meeting on September 4th. New members will be welcomed at the weekly meetings.

Southampton and District Wireless Society.

Hon. Secretary, Mr. T. W. Cutler, 24, Floating Bridge Road, Southampton.

A general meeting of the above Society was held on Wednesday, August 23rd, for the election of officers for the ensuing three months; all the old officers were re-elected. Elaborate plans are being made for the benefit of the members for the coming winter months and a competition is being held within the next few weeks. Dr. MacDougall has offered a substantial prize for the best single valve set made by any member of the Society. A committee is being appointed to make the

necessary arrangements. Arrangements are also being made for a lecture every other week and followed the next week by a demonstration on various sets.

The membership is steadily increasing, a large percentage of new members coming in from the country districts. Any amateur in Southampton and district requiring particulars of the above Society can have same by applying to the Hon. Secretary.

Redhill and District Wireless Society.

Hon. Secretary, Mr. J. S. B. Clarke, 41, Hatchlands Road, Redhill.

A meeting ot the Society was held on August 2nd, when an excellent lecture on aerial systems by Mr. Ross was read by Mr. W. Pope, M.I.R.E., Mr. Ross being unavoidably absent.

The paper gave practical methods of erecting aerials and will be of great value to the members. The half-yearly list of lectures which has just been issued includes the following items:—September 27th, "'Phones and Loud Speakers," Mr. White; October 11th, "Condensers," Mr. Edwards; October 25th, "Inductances," Mr. Pescett; November 8th, "Tuning"; November 22nd, "Operating," Mr. Ross; December 6th, "Gadgets," Mr. Clarke; December 20th, "Calculations"; January 3rd, 1923, "Direction Finding."

It is particularly requested that members will support the Society by attending these lectures, which will be found to benefit both the beginner and the more advanced amateur.

Questions can be placed in the "Question Box" in the wireless room any time during the week and will be answered by a competent member of the Society during the discussion following the lectures.

Halifax Wireless Club and Radio Scientific Society.

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

The club-room is now open three nights a week with a steward in charge and members and others interested are turning up well.

The syllabus for the winter session is in course of arrangement and includes, apart from lectures for members, a "Popular Lecture," and a "Sale and Exchange, with Demonstrations."

All in the district who are interested, are advised by the Society to pay a visit to this latter event, and full details of the sale will be sent to anyone interested.

Membership steadily increases and associates are also coming in well.

Fulham and Chelsea Amateur Radio and Social Society.

Secretary, Mr. R. S. V. Wood, 46, Hamble Street, Fulham, S.W.8.

A general meeting was held on August 30th at 8 p.m. at the Social Centre, Townmead Road, Fulham (headquarters for a period of three weeks, where a meeting is held each Wednesday at 8 p.m.).

The minutes of the previous meeting were read and accepted.

Mr. Hawthorne kindly took over the management of the Morse class, which was conducted satisfactorily. A discussion was invited from the remaining members as to the best or phenomenal results obtained on any aerial, insulating being especially dealt with by the Secretary.

Numerous interesting items were discussed and the Secretary gave his experience on one and two valves, and answered a number of questions. New members were proposed by Mr. Cox and seconded by Mr. Gauntlett, the meeting accepting their enrolment. Fourteen new members were enrolled. There was an attendance of 43. The total membership is now 57.

The meeting closed until the following Wednesday.

Hornsey and District Wireless Society.

Hon. Secretary, H. Davy, 134, Inderwick Road, Hornsey, N.8.

A meeting of the above Society was held on Friday, September 1st, when many members brought up their sets, which were arranged on the table, and a photograph of the whole apparatus together with members was taken. Afterwards an informal demonstration was held by members on their respective sets and a good opportunity was afforded for comparing various methods of valve and crystal circuits, tuners, etc. The construction of each set showed considerable ingenuity, and the owners were heartily congratulated by all present.

Also a further programme was arranged to carry on from that arranged to September 11th, to consist of listening-in, lectures, Morse practice, etc.

It was hoped that the Club set, which was almost completed, would be in use by September 11th.

A hearty vote of thanks was given to Mr. Pugh for his lecture on Tuesday, August 29th, on the theory and practice of crystal sets. The meeting then closed.

Meetings are held every Tuesday and Friday and applications for membership are cordially invited.

Southwark Wireless Telephony Association.

Hon. Secretary, Mr. W. Helps, King's Hall, London Road, S.E.1.

On Sunday, September 3rd, a meeting was held at Headquarters, King's Hall, London Road, S.E.1, when Mr. Winston ably answered questions. An instructive time was spent in this way.

It was announced by the Hon. Secretary that he was still open to receive entries for the "Home-made Crystal Set Competition," which was open to members of the Association, and also to members of kindred associations. The competition is to be held on Sunday, September 17th, and will be judged by Mr. Read. All enquiries should be directed to the Hon. Secretary at the above address.

The objects of this association are: "To assist members in furthering their knowledge of all methods appertaining to receiving of wireless telephony, by mutual interchange of views and lectures from time to time by wireless experts, also to help members by co-operation in buying their sets or spare parts."

Meetings are held every first and third Sunday of the month. Fees are as follows: 1s. to join, and 6d. per month, payable in advance.

The Thanet Radio and Experimental Society.

The above Society is going well, and the membership is increasing weekly.

Meetings are held every Tuesday at 7 p.m., at 119, Northdown Road, Margate, and visitors will be welcomed.

President, Mr. G. W. May, 75a, Trinity Square. Press Secretary, Mr. F. McCardle, 4, Grange Villas, Margate.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"TEC" (Ealing) *asks* (1) *The cause of a continuous note heard in the telephones.* (2) *Why he obtains no results, and if the connections are right.* (3) *If Sullivan's telephones marked "A" are* 8,000 *ohms.* (4) *To what wavelength would a certain tuning coil tune.*

(1) Probably an induction from A.C. lighting or power supply in the vicinity. (2) Your connections are fairly good, and you should get some results. You ought to get broadcasting, although your coil is rather large for the purpose. (3) We believe 6,000 ohms. (4) Maximum about 3,000 metres, minimum difficult to say. Probably inefficient below 600 metres.

"B.P." (Bombay) *asks* (1) *What is the natural wavelength of a certain loose coupler.* (2) *and* (3) *Questions relating to pile-wound inductances.*

(1) Loose couplers do not have natural wavelengths in any useful or predictable sense, but your loose coupler would be suitable for tuning to about 4,000 metres with the larger coil in the aerial circuit. (2) You will find pile winding of wires of these gauges a terribly tedious and unsatisfactory operation, and we should strongly recommend the use of honeycomb coils for the purpose. (3) Neither of the suggested schemes give pile winding at all. For guidance, see article in the issue for October 2nd, 1920, obtainable from the publishers.

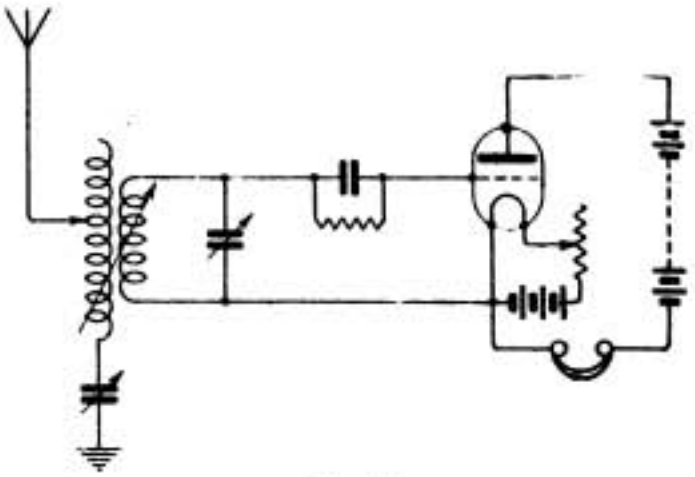


Fig. 1.

"P.T." (Maldon) *asks for a diagram of a certain receiving unit.* (2) *How to calculate the capacity of condensers.*

(1) See diagram (Fig. 1). (2) See reply to **"Radio 3 UC"** in the August 5th issue.

"C.M." (Oldham) *asks* (1) *Which of four tuning systems is the best.* (2) *If a certain coil would receive telephony.* (3) *For advice with regard to his aerial.* (4) *If a microphone button would be suitable for a loud speaker.*

(1) It is almost immaterial which of the last three. The slab coils would be less efficient. (2) Your coils are too big to give satisfaction on short wavelengths, for which you would probably only want about 20 turns with these diameters. (3) Nearness to the roof explains poor signals, also possibly your earth is less efficient. Raise your wires as suggested. (4) The suggested arrangement would not be of any use. Use the H.R. earpiece.

"J.E.M." (Rotherham) *has a single valve panel and* (1) *Wishes to convert it to a four-valve set.* (2) *Whether a three-valve receiver will be suitable for reception of* **FL, 2MT,** *and* **PCGG** *on his aerial*

in an open position. (3) *What values the tuning condensers should have.* (4) *Whether he should make use of reaction.*

(1) See diagram Fig. 2. (2) Yes. (3) For short wave work the aerial tuning condenser need not have a larger value than 0·0005 mfds., but for long wave work a value up to 0·002 mfds. may be found convenient. For tuning direction coil or closed circuit, a suitable value is 0·0005 mfds. (4) The use of reaction is recommended, as shown in the circuit diagram.

"W.T.O." (Cheshire) *encloses a diagram of his single valve receiver and asks if it is O.K.* (2) *What maximum wavelength can he obtain with a certain A.T.I.* (3) *If a certain A.T.I. is suitable for connecting to a five-valve amplifier for receiving broadcasting.*

(1) Yes, but it would be better to connect the two sliding inductances as in the Fig. (*N.B.*—Reaction of type suggested is not now allowed.) (2) 4,000 metres. (3) Yes, fairly efficient for the purpose.

"SUBSCRIBER" (Birmingham) *asks if enamelled or ordinary 7/22 is the most efficient for the aerial, and rubber covered for the earth wire.*

There is little to choose between plain and enamelled for the aerial, although the latter is slightly preferable. Any of the three may be used for the earth wire but rubber covered is best.

"A.G.W." (Camden Town) *asks* (1) *For winding data for certain coils.* (2) *For criticism of a diagram of a three-valve note magnifier.*

(1) Reaction of the type indicated is no longer to be permitted. The A.T.I. might be 6" × 3" of No. 24. The L.F. transformer, core ½" diameter of iron wire, windings 1 oz. and 3 ozs. of No. 44 S.S.C. (2) We have no criticism except that the set is not a three-valve note magnifier.

"NOVICE" (Newhaven) *asks* (1) *If the circuit shown on page 554 of July 29th issue is suitable for reception with honeycomb coils and a single wire 100′ aerial.* (2) *If a tapped H.F. transformer is necessary.*

(1) Yes, but reaction of the type indicated is no longer permitted by the P.M.G. (2) If a considerable range of wavelengths is required a tapped H.F. transformer is very desirable.

"INDUCTANCE" (Salford) *asks for certain information about a set described in "Practical Amateur Wireless Stations."*

Statements of this nature are calculated to deceive. You might possibly get a range of 8,000 metres with a 500 k.W. station at the transmitting end, but 7,000 miles would be unlikely even under these conditions. Your broadcast range might be 100 miles, but for this purpose we should prefer a set of smaller coils than the type you suggest.

"S.M.P." (Wellingborough) *asks* (1) *If it will be better to buy parts of a receiving set in France where he is going for his holiday, or to buy them in England.* (2) *If a receiving licence is necessary in France, and may an English licence be used on the Continent.* (3) *If the condenser should be put across the H.R. telephones alone, or across telephones and H.T. battery.* (4) *If the A.T.C. should be on the earth side of the A.T.I.*

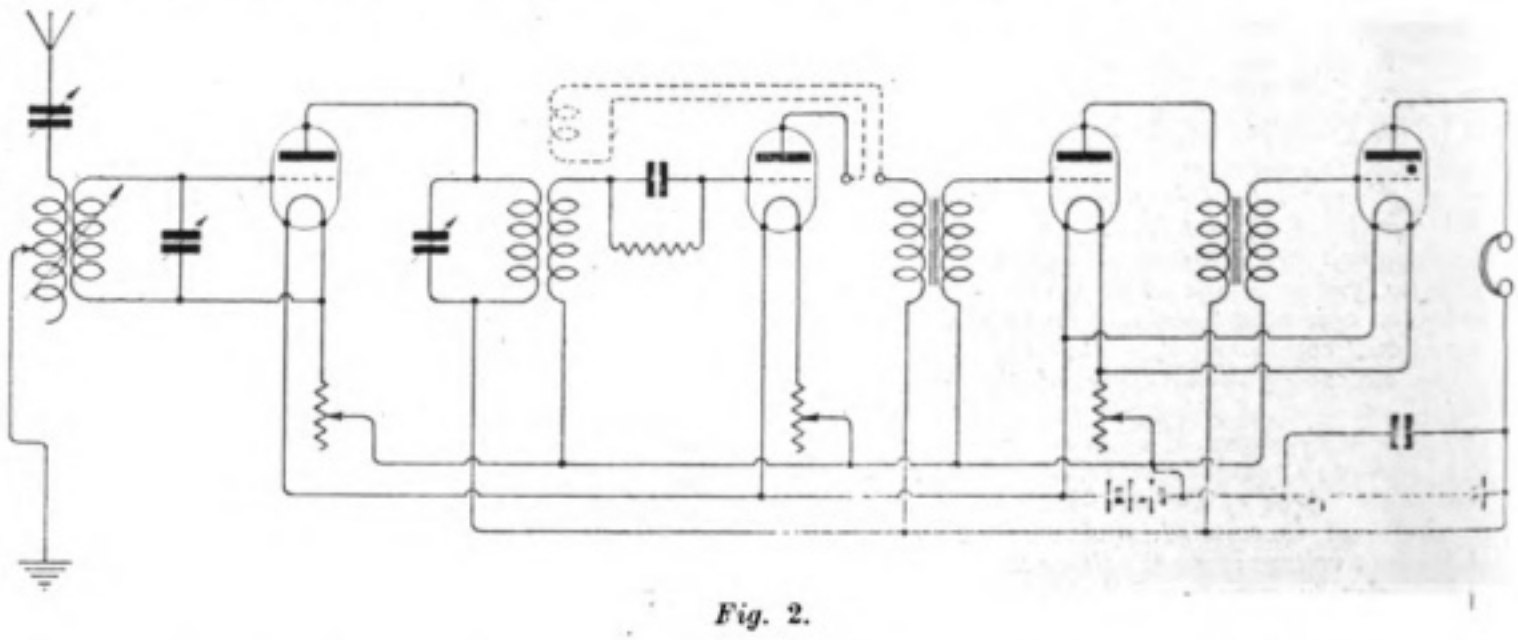


Fig. 2.

(1) It depends on how long you are going to be there. If you purchase in France you will have to pay a heavy duty on returning, and may even find yourself prohibited from bringing the goods into this country. If you are just going for a holiday we should advise you to do without the pleasures of wireless, unless you are prepared to incur considerable expense. (2) Apply to the Department of Posts and Telegraphs. No. (3) Put it across both telephones and battery. (4) In most valve circuits the A.T.C. should preferably be on the aerial side of the A.T.I.

"W.G.P." (Barnes) *asks certain questions regarding the super-regenerative circuit*

(1) The values of the condensers suggested will be satisfactory. (2) The value of inductances for the tuning circuit should be the same as normally used for short wave work. For the oscillating circuits values should be suitable for about 5,000 metres. (3) For the grid battery flashlamp dry cells will be sufficient, the exact voltage required in each particular case being determined by experiment. The value will probably not exceed 12 volts.

"J.S.F." (Herne Hill) *asks* (1) *For circuit diagram of a telephony transmitting set suitable for working on wavelength from 400 to 450m. and using 10 watts.* (2) *Whether the diagram given will eliminate the transmission of carrier wave when no speech*

is taking place. (3) *Whether A.C. supplied at 50 frequency is suitable when stepped up and rectified as a source of H.T. and* (4) *Types of valves suitable for* (*a*) *low power transmission, and* (*b*) *rectification for H.T.*

(1) and (2) The most suitable telephony transmitting circuit is that embodying "choke control" and a suitable circuit is given in Fig. 3, making use of step-up transformer and rectifying valves for providing plate current. The system of quiescent modulation is not always to be recommended, and usually functions by some arrangement of grid potential control. (3) Yes: this can be done, but necessitates the use of high tension condensers of very large capacity for the purpose of smoothing out the ripple. A rectified plate current of about 1,000 to 1,400 volts should be aimed at in designing the transformer. (4) (*a*) T.15 to T.50. (*b*) U1.

(1) An increase in length somewhat increases signal strength, but not so much as a corresponding increase in height, moreover the P.M.G. does not allow more than 100′ length to be used. (2) You might have some difficulty, and will probably need at least four valves, now that variable reaction on to the tuning circuits is not to be permitted. Interference from Carnarvon is not likely to be very serious unless this station should at any time revert to the use of arcs, which is unlikely. (3) "The Construction of Amateur Valve Stations," by Douglas. (Wireless Press, Ltd.).

"A.B." (Stoke-on-Trent) *asks, among various other questions* (1) *The formula to calculate the capacity of an air condenser.* (2) *How to calculate the capacity of a cylindrical coil.* (3) *The wavelength a certain coil and condenser would tune to.* (4) *What happens when a long earth lead is used.*

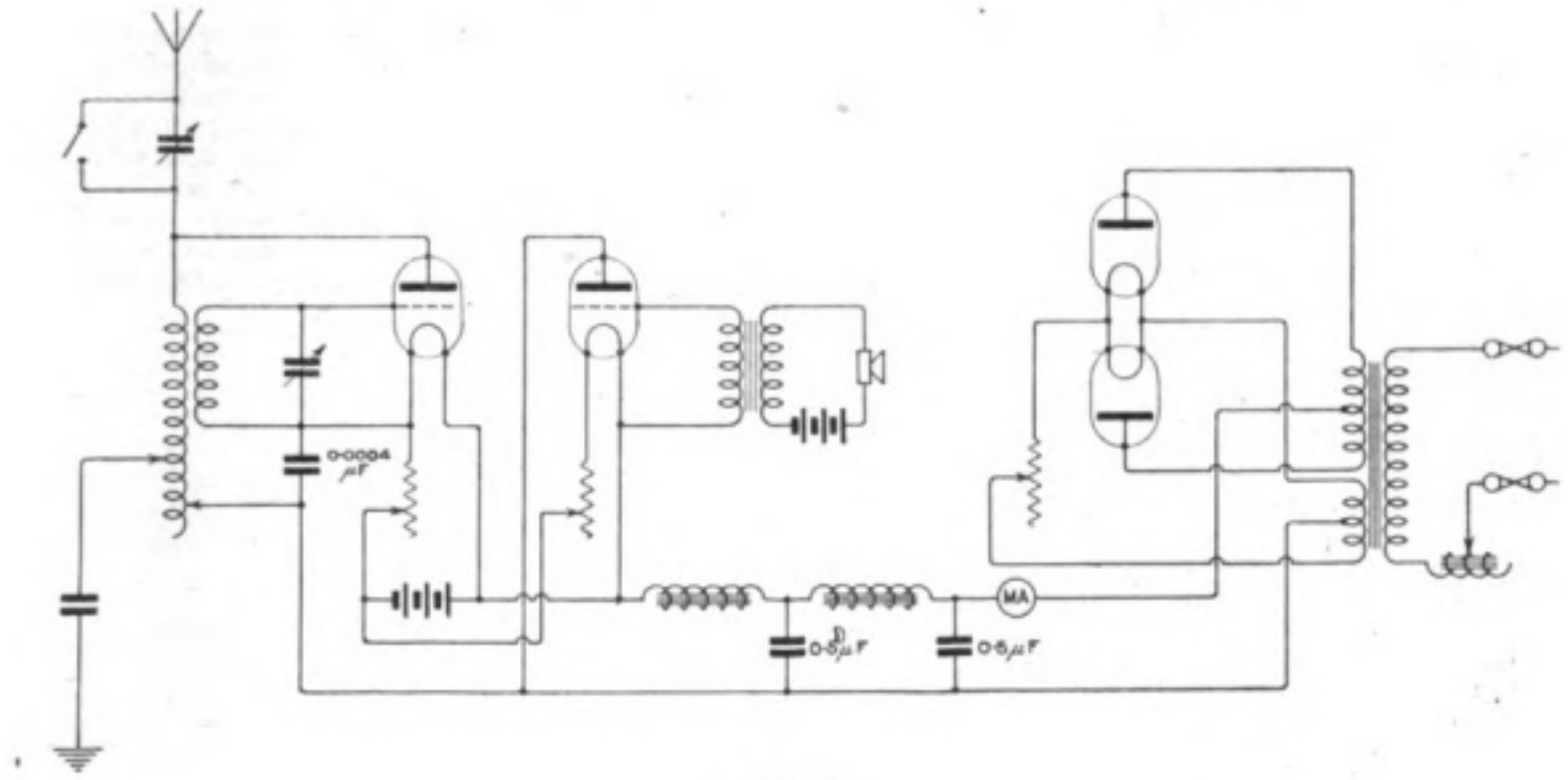


Fig. 3.

"A.M.W." (Hammersmith) *asks for a working description of the Mk. III Tuner.*

We have not space to give a full working description, but the instrument is a short wave tuner working up to about 700 metres. It contains two tuned circuits with tuned stroke stand-bi switch. Tuning is effected by stud switches to inductances and variable condensers. Two crystals, carborundum with a battery and galena without, are fitted, as well as terminals for a detecting valve. The instrument, while of excellent design for its purpose, is unnecessarily elaborate for amateur construction. We should recommend you to purchase one of the Disposal Board instruments, now offered by various dealers, or at any rate to examine one of these instruments before deciding to make one.

"D.S." (Anglesea) *asks* (1) *The effect of increasing the length of an aerial.* (2) *If the three proposed broadcasting stations within* 100 *miles range could be heard among the mountains within* 7 *miles of Carnarvon.* (3) *For a fairly simple book dealing with the construction of a two to four-valve set.*

(1) See reply to **"Radio 3 UC"** in the August 5th issue. (2) Cylindrical coils do not have a capacity in any useful sense. The formula for their inductance has been repeatedly given. (3) About 800 metres. (4) Strength of signals is considerably reduced. From the remaining questions we should recommend you to study Bangay's "Elementary Principles."

"F.A." (Birmingham).—(1) Correct. (2) We should prefer 6 ozs. of No. 32 for the L.R. winding, but ¼ lb. of No. 36 will probably give fair results. (3) Doubtful, or very unlikely now that reaction from the oscillating point is not permitted.

"F.W.P." (Nottingham).—We are unable to answer your questions from the information supplied. If you will forward a diagram of your circuit we shall be pleased to advise you. It is quite possible to add either H.F. or L.F. amplification to the original tuner, or even both.

"J.C.D." (Much Wenlock) *sends a sketch of two panels, and asks* (1) *How to connect them to the batteries and condenser.* (2) *For criticism of his set.*

(1) Connect up as in diagram (Fig. 4). (2) As far as we can judge from the very rough sketches submitted this arrangement should be fairly satisfactory. Also move telephone connections on second panel to the positive side of the H.T. battery terminals.

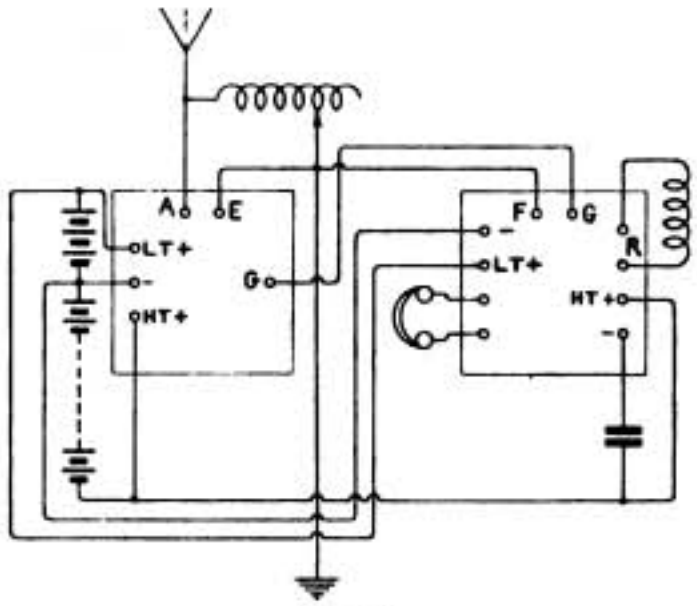


Fig. 4.

"S.H.S." (Liverpool) .—(1) About 0·001 mfd. would be satisfactory, but reaction of this type is not permitted according to the regulations of the P.M.G. (2) Circuit shown is quite satisfactory. A potentiometer to the first grid would be an improvement. (3) We do not recommend "Lokap" wound coils for broadcasting wavelengths, as so few turns are required. With a diameter of 1", about 100 turns would be quite sufficient. You might make coils to the design shown on page 328, June 10th issue. (4) We are unable to give dimensions for suitable reaction coils as the P.M.G. will not allow reaction which is capable of energising the aerial. The amount which could be used without doing this varies so much with conditions—such as the type of aerial, characteristics of the valves, etc.—that it is impossible to predict a safe value.

"H.H." (Wimbledon) *asks* (1) *For the most efficient single valve and crystal circuit for telephony.* (2) *How to adapt a circuit shown for this purpose.* (3) *A question with regard to his aerial.*

(1) and (2) For diagram see Fig. 3, page 537, July 22nd issue. (3) If your house is at the high end of your aerial the addition of a mast on the roof will considerably improve signals. If, however, your house is at the low end the improvement will hardly be worth while.

"V.P.S." (Norbiton) *asks* (1) *For a diagram of a set to fulfil certain requirements.* (2) *If L.R. telephones could be converted into a loud speaker by fitting a horn.* (3) *If he could get* **PCGG, 2 MT, 2 LO** *and Croydon Air Station at Chatham with receiver of question* (1).

(1) The circuit of Fig. 5, page 573, July 29th issue, is a good one, particularly as it uses reaction in a way which is not prohibited by the new restrictions, provided that there is no coupling between the circuits of the second valve and the A.T.I. (2) This may be done if desired but the results will not be very good, as the quality will be somewhat poor and the strength not very great. (3) All these stations should be possible with the exception of PCGG, which is very doubtful. (3) The values suggested will be quite satisfactory for a Vernier condenser.

"R.H.W." (Coventry) *submits a circuit and asks* (1) *For criticism.* (2) *Whether it will receive* 800/5,000 *metres.* (3) *Values for plate resistance.* (4) *Best position and resistance of telephones.*

(1) and (4) Circuit is O.K. except that the A.T.I. is much too small. It should be about 10,000 mhys. instead of 250 and no resistance is needed in the plate of the last valve. The telephones should be introduced in place of this resistance. (2) Yes, with the alteration to the A.T.I. suggested above. (3) About 50,000 ohms.

"A.L.D." (Manchester).—(1) A grid condenser and leak is not necessary, but it may be used if desired (a leak without a condenser is perfectly useless). If employed, it should be connected directly in the lead to the grid in the diagram on page 781. (2) FL probably; **2 MT** very unlikely. (3) This set was never intended for short wave reception and it is impossible to make it efficient on such wavelengths while retaining the large coils suitable for long range reception. See note at head of these columns regarding reaction. The windings given in the article referred to will no longer be permitted.

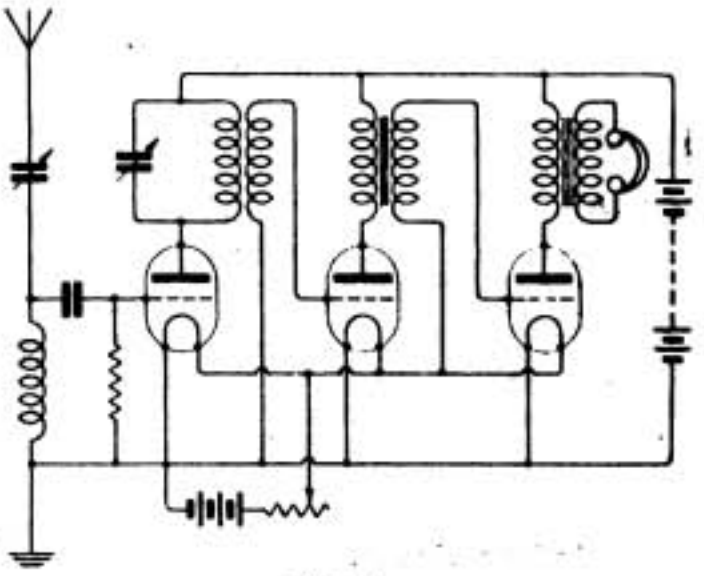


Fig. 5.

"CONCERT" (Woolwich) *asks* (1) *If an amplifier, of which diagram is enclosed, will be suitable as regards lay-out and spacing of instruments.* (2) *Details for wiring up amplifier.* (3) *If the set will be suitable for receiving amateurs and Dutch concerts.* (4) *If a Sullivan L.F. transformer instead of the army type would give better results.*

(1) Yes. (2) The circuit should be wired up as in diagram (Fig. 5). (3) Certainly. (4) Possibly a little better, but not likely to be much different.

"NEGATRON" (Coventry) *asks* (1) *For criticism of a set sketched.* (2) *For the cause of noises in his set.* (3) *How many plates to use in a condenser for tuning H.F. transformers.* (4) *Windings for certain H.F. transformers.*

(1) Circuit sketched appears quite satisfactory, but reaction in the form suggested is capable of

making the aerial oscillate and is therefore not allowed under the present P.O. restrictions. (2) From the information given we cannot state the causes of these noises, which may, however, be due to defective batteries. You should try and find out the cause by test. For instance, if you change the batteries and still get the noises, the cause is not the batteries—and so on with each other possible cause. (3) About 12 fixed plates will be desirable. (4) 300/500 metres—about 50 turns for each winding; 1,000 metres—100 turns; 2,000/3,000 metres—200 turns. These would be probable values, but they should be checked by experiment.

"I.S.D." (Chiswick) *asks re circuit on page* 504 (1) *If basket coils could be used for the oscillation tube.* (2) *Values for the batteries and condenser across grid inductance of oscillator.*

(1) Basket coils could certainly be used. (2) H.T. batteries normal. The grid batteries determine by experiment up to about 10 volts. Condenser about 0·001 mfd. (3) Yes. This circuit may give serious reradiation if incorrectly adjusted and would therefore not be permitted by the P.M.G.

"S.W.R." (London) *asks three questions about a variable grid leak.* (4) *For particulars of the nearest broadcasting station to Rugby.*

(1) (2) and (3) We do not know of any satisfactory leak of this nature on the market. Results could probably be obtained with either a graphite line resistance, with variable contact strips to alter the length of the line in circuit, or a liquid resistance, using some organic liquid of high resistance with movable electrodes. We do not think that the results would justify the trouble involved. (4) Birmingham, using 1½ k.W. The station has not yet started operations, and its exact wavelength is not fixed, although it will lie between 350 and 425 metres.

"G.H." (Goteborg) *asks* (1) *For criticism of a diagram of set.* (2) *For winding for an A.T.I. up to* 4,000 *metres.* (3) *What coils to use for* 15,000 *metres.* (4) *Whether an indoor aerial will give results.*

(1) Set is O.K. except for the 0·004 mfd. condenser between plate and earth on the first valve, which is very undesirable. A leak should also be introduced between grid and filament of the second valve. (2) 10″ × 8″ of No. 24. (3) Use honeycomb coils, the makers of which generally quote wavelength for each coil with a stated condenser. With your aerial you will probably require a size larger for the A.T.I. than is needed for the closed circuit. (4) The indoor aerial will give you some results if it is as high as possible above your set. In any case it should give a spark station 5 miles away.

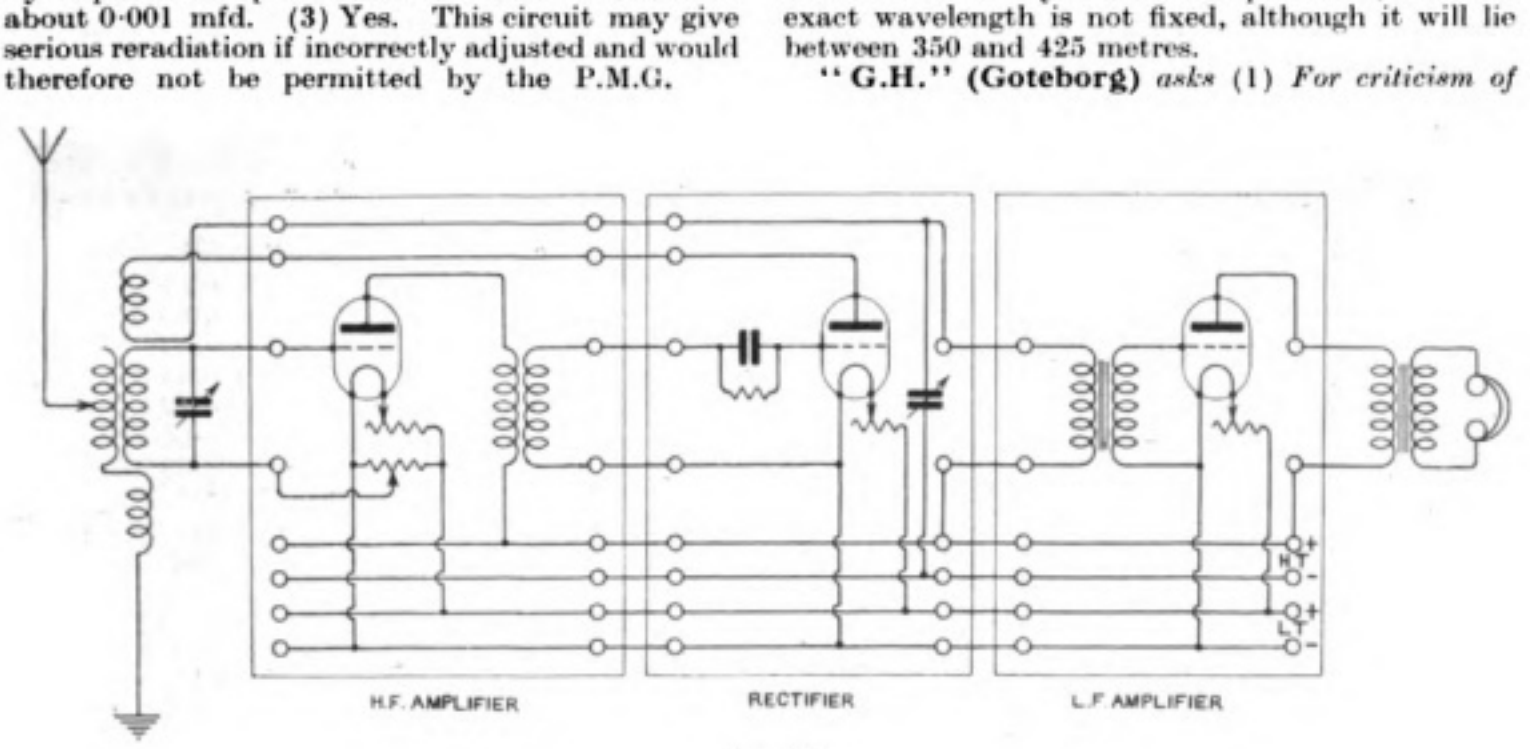


Fig. 6.

"R.A.Y." (Glasgow) *asks questions about a three-valve set.*

(1) See Fig. 1, page 435, issue for July 1st, but note that reaction as shown in this diagram is no longer to be allowed. (2) Three coil holders will be required for a reaction set, but reaction of this sort, capable of energising the aerial, is no longer to be allowed, and a two coil holder will therefore be all that you require. (3) See diagram (Fig. 6).

"R.A.H." (Hull) *asks* (1) *For formula for calculating the capacity of condensers.* (2) *If "Ora" and "R" valves are interchangeable.* (3) *Windings for certain H.F. transformers.* (4) *If enclosing each panel in an iron box is advantageous.*

(1) See reply to **"Radio 3 UC"** in the August 5th issue. (2) The "Ora" valve will work satisfactorily with less plate voltage than the "R" type, otherwise the characteristics are very similar. (3) Use formers 1½″ diameter by 4″ long. For the various ranges the turns for each winding may be as follows, but considerable experimental

"M.T.G." (Manchester) *asks* (1) *For a diagram of a two-valve receiver with L.R. telephones and a transformer and L.F. intervalve transformer, and if possible a loud speaker.* (2) *If the coils X and Y in a diagram on page* 217 *of May* 15*th issue*

bear any relation to each other. (3) *If it will be possible to put* 10 *coils and a ten-way switch in place of the coil Y in the sketch.* (4) *The capacity of the variable condenser C and the fixed condenser C.*1.

(1) If you want to use a loud speaker on near-by stations, we should recommend L.F. amplification. If, however, you want the maximum possible range we should prefer H.F. For a suitable circuit with L.F. amplification, see diagram (Fig. 7). (2) These coils should be coupled together, but there is no definite relationship between their sizes. The size of Y is determined by the wavelength required, X is then made of size large enough to give sufficient reaction with Y. (3) Yes, but not very efficient. (4) C = 0·0005 mfds., and C.1 = 0·0002 mfds.

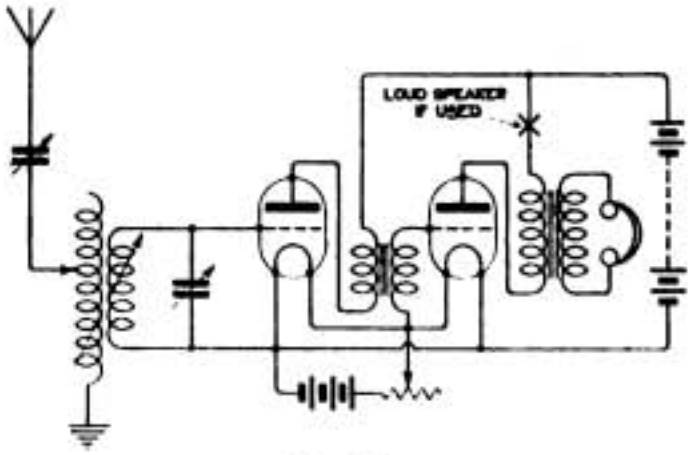


Fig. 7.

"C.W.B." (St. Leonards) *refers to the super-regenerative circuit on page* 305 *and asks* (1) *Maximum capacity of the three variable condensers.* (2) *If one four-volt battery could be used to supply the three-valve filaments.* (3) *Correct sizes for the coils.*

(1) Tuning circuit condenser 0·0005 mfds.; oscillator condensers about 0·002 mfds. (2) Probably, but the circuit might be more difficult to adjust. (3) Coils for tuning circuits should have normal values for short wave reception. L4 and L5 should have values suitable for about 5,000/30,000 metres.

"A.V.S." (Hull) *asks* (1) *For diagram of three-valve set to fulfil certain requirements.* (2) *How many plates* 1½" *diameter would be required to build up a* 0·001 *mfd. condenser, with* 1/16" *between moving and fixed plates.* (3) *If two* 0·005 *mfd. condensers connected in parallel would be equivalent to one* 0·001 *mfd. condenser.*

(1) See diagram on page 435, Fig. 1, July 1st issue, omitting reaction coil there shown, which is no longer allowed by the P.M.G. (2) With plates of this size almost 200 would be required. (3) Yes.

"T.R." (Barnsley) *has a two-valve set which is giving trouble and asks* (1) *For advice.* (2) *If certain alterations to the connections would be satisfactory.* (3) *If a variable condenser in parallel with the plate and grid is an advantage.* (4) *If a* 0·001 *mfd. variable condenser is too large for tuning* 440 *metres telephony.*

(1) and (3) The use of a condenser in the way you suggest is quite enough to explain the persistence of oscillations. It is very difficult to criticise your set in other respects as your diagram shows nothing of the internal connections (2) Suggested method is useless. Condenser and leak, if used, should be introduced between *A* and the grid of the first valve. (4) This is too high a value unless it is used in series with the A.T.I. This is much preferable to a parallel arrangement on such wavelengths.

"D.G.W." (Jersey) *submits a circuit and asks if it is a super-regenerative one.* (2) *Values for certain coils.* (3) *If certain stations could be heard in Jersey with a three-valve set.* (4) *In what issue of "The Wireless World and Radio Review" tables of Nagaokas correction factor K in the formula for calculating the inductance of single layer coils were given.*

(1) The circuit shown bears some family resemblance to Armstrong's super-regenerative circuit, but we are unable to say whether it would function as it stands. L.1, L.2 and V in your circuit should have values suitable for tuning a single circuit receiver to 5,000/6,000 metres. (3) With luck all these stations might be received. (4) As this formula has not been recently given, we repeat it here with the tables asked for:—

$$L \text{ mhys} = \pi^2 d^2 n^2 l \times K.$$

Where d is the diameter of coil in cms. n = number of turns per cm.

l = length in cms., and K the correction factor, which varies according to d/l.

We quote a number of values from which a curve may be drawn, by means of which K may be found for any value of d/l.

d/l.	K.	d/l.	K.
0·1	= 0·96	1·5	= 0·59
0·2	= 0·92	2·0	= 0·53
0·4	= 0·85	2·5	= 0·47
0·6	= 0·79	3·0	= 0·43
0·8	= 0·74	4·0	= 0·37
1·0	= 0·69	5·0	= 0·32
1·25	= 0·64	7·0	= 0·26
		10·0	= 0·20

"F.C.K." (South Norwood).—(1) The first circuit shown is the better of the two, and not at all bad, but it has no advantages of the normal type illustrated, for instance, in Fig. 6, page 437, July 1st issue. (2) If the normal type referred to is used, the A.T.I. for 3,000 metres may be 9" × 6" of No. 22. A somewhat larger coil would be required for this wavelength with the arrangement you suggest.

"J.F." (Harlesden) *sends a diagram of a valve and crystal set and asks* (1) *For criticism.* (2) *What results would be obtained on a rather poor aerial.* (3) *If polished mahogany, or other hard wood could be used for a base-board.* (4) *Dimensions of the coils to tune to* 3,000 *metres.*

(1) O.K., but it would be much better to introduce a 0·005 mfd., variable condenser across B. (2) You should get London broadcasting, amateurs in the London district, ship sets, Croydon, Eiffel Tower, etc. (3) Hard wood may be used as a base, but if so it is preferable to use rubber insulated wire for connecting up through the base-board. (4) Coil A, 9" × 7" of No. 22; coil B, 7" × 5" of No. 24. According to the new Post Office regulations these two coils must not be coupled together.

"NEW READER" (Kirton Lindsey) *asks* (1) *For criticism of an amplifier diagram.* (2) *For sketch of a tuning circuit and detector valve to use with it.* (3) *If we can recommend a more suitable circuit.*

(1) Quite O.K. (2) Suggested type is quite feasible but you would get somewhat better results

from any of the three or four valve circuits, employing H.F. amplification, particulars of which have appeared in these columns recently.

"AMATEUR" (Little Sutton).—(1) Capacity 0·0013 mfds. (2) Gauge is No. 43, and might be used for either L.F. or H.F. transformers. (3) 8" × 6" of No. 22, with a tuning coil. We are unable to specify a suitable reaction coil. See note at the head of these columns. The only telephony you are likely to pick up at present would be local amateurs at irregular hours.

"T.W.O." (Preston) *asks* (1) *If 60 ohm telephones would be satisfactory with a suitable transformer.* (2) *Constructional details for a suitable transformer.* (3) *If the above telephones will be less efficient than 120 ohm telephones.*

(1) Yes. (2) Core ½" × 3" of iron wires. H.R. winding, 3 ozs. of No. 44; L.R. winding, 4 ozs. of No. 32. (3) Probably not so efficient as the 120 ohm telephones.

"G.W.R." (Southwark) *asks type, size and number of Leclanche cells which will be most suitable for a multi-valve amplifier with "Ora" valves.*

We much prefer dry cells owing to the tendency of the small wet Leclanche cells to "creep," giving messy and unsatisfactory working. You will require about 28 cells, and if wet batteries are used they might be about ½ to ¼ pint size.

"X.Y." (London) *has old-fashioned pull-wire bells in his house and asks if it would be possible to use these bell wires for an indoor aerial the house being four-stories high and bells running from top to bottom.*

These might quite conceivably give useful results in London from London broadcasting, but you would not be likely to get much else, and you might get noises and other troubles from bad connections in your wires.

"NOVICE" (Bristol).—(1) It would be better to take your down lead from the point X. (2) You should receive **FL** and the broadcasting stations at Plymouth, Cardiff, Birmingham and probably London, well enough for the purpose you require, but broadcasting stations at greater distances and **PCGG** would hardly give sufficiently good results. (3) You should expect the current change you suggest from many stations, which would be enough for recording purposes. The cost of a suitable relay would be about £15, and an inker about £10 to £25, if suitable for ordinary hand speeds, and up to £100 to £120 for high speed Wheatstone recorders or undulators. (4) Further L.F. amplification with a second rectification after it will be advantageous for recording purposes.

"E.A.A." (West Ham) *asks* (1) *For criticism of a set sketched.* (2) *Wavelength range to be expected.* (3) *If a different make of valve to that at present employed would be an improvement.* (4) *If he will lose signal strength by taking tappings with No. 30 from the coils wound with No. 22.*

(1) The arrangement submitted is quite suitable for a simple set, but the A.T.C. should be used in series with the A.T.I. for short waves. (2) You do not give us enough information to say exactly, but the range is probably from a few hundred metres up to at least 3,000. (3) This will give very little difference. (4) Not seriously, if the tapping leads are short and carefully sweated to the original wire.

"E.C." (Southend) *asks* (1) *What wavelength his set will tune to.* (2) *If the A.T.I. and condenser are O.K.* (3) *How to increase his wavelength to 3,000 metres.* (4) *Who is* **2 MC** *and what is his wavelength.*

(1) As you do not say the size of the condenser plates or their spacing we cannot give the information required, but if this condenser is about 0·0005 mfds. the range is probably up to about 600 metres with series A.T.C., and perhaps 1,500 metres with parallel A.T.C. (2) O.K., if the plates of the condenser are 3" to 4" in diameter, and spacing between fixed and moving plates not more than 1 mm. (3) Add a loading coil—for instance, a honeycomb coil with about 300 turns, in series with the A.T.I. (4) This station is located at Westcliffe-on-Sea. [See note regarding reaction at the head of these columns.]

"R.B.L." (Guildford) *asks* (1) *For criticism of a set.* (2) *How to most easily turn a single valve set into a two-valve set, without the use of an inter-valve transformer.* (3) *If H.F. coupling is best and easiest, what coils he will require.*

(1) Set is of quite efficient type, but will not be allowed under the new restrictions of the P.M.G. See note at the head of these columns regarding reaction. (2) The best way of adding an extra valve is as in Fig. 5, page 573, July 29th issue. (3) This circuit, although it uses H.F. coupling, does not need inter-valve transformers. The easiest way of getting a big range would be by using honeycomb coils of assorted sizes for the coils on the anode side of the first valve.

"J.L." (Paris).—Grid condenser for this set may be about 0·0002 mfds., and telephone blocking condenser may be about 0·001.

"R.J.R." (Westcliff-on-Sea) *has a three-valve receiving set and asks how he can connect up to receive short waves.*

In order to get shorter wavelengths with this set, put the A.T.C. in series with the A.T.I. instead of in parallel with it.

"E.A.A." (Angle).—It is impossible, owing to the new restrictions on the use of reaction in a circuit of this nature, for us to give values. If any reaction is used it must be so little that the set cannot possible oscillate. The safe amount must be determined by experiment, and effective precautions taken to see that it cannot be exceeded. See note on this subject at the head of our columns.

"W.H." (New Barnet) *wishes to make a two-valve set and asks for a suitable circuit.*

In view of the new Post Office restrictions the circuit of Fig. 5, page 513, issue for July 29th, will be about the best that you can do. Care should be taken to see that there is no coupling between the three coils on the anode side of the first valve and the A.T.I.

"R.J.S.C." (Sittingbourne) *encloses diagram a set which will not work satisfactorily and asks of* (1) *If the wiring is O.K.* (2) *How to remedy buzzing noises in the telephones.* (3) *If he can hear Writtle, Paris, London and The Hague with this set.*

(1) Your diagram is not at all clear, but it appears to show the aerial and earth connected to the reaction coil instead of the A.T.I. This would be sufficient to explain poor results obtained. (2) Noise is apparently due to oscillation from the use of too much reaction. A set which can oscillate

in this way is now definitely prohibited by the P.M.G. See note at the head of these columns. (3) Writtle, London and Paris—yes. The Hague very doubtful.

"M.P." (South Africa).—(1) This coil will tune the aerial to about 3,500 ms. (2) We should recommend the use of honeycomb coils for this purpose, but failing this, a coil, 12" × 9", wound with No. 28, would give the desired result if used with a parallel capacity. The closed circuit coil could be 12" × 8" of No. 32. (3) and (4) The best arrangement of apparatus would be as in the diagram (Fig. 8).

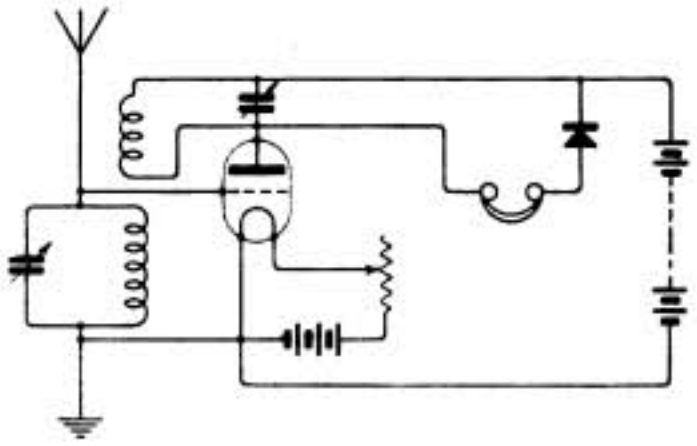


Fig. 8.

"D.H.C." (Wallington) *encloses a diagram of his set and asks* (1) *Why it will not work.* (2) *If there is a simple way of telling whether the valves are defective.* (3) *Gives details of an H.F. transformer and asks the approximate wavelength.*

(1) Circuit shown is quite correct. Failure to work is probably either because your set is not actually wired to the diagram, or some part of your apparatus is defective. See note at the head of these coulmns re reaction sets of this type. (2) The easiest way is to fit them to some tried circuit and see if they give results. The only common faults are grid touching filament, or plate touching grid. These can generally be seen by careful inspection, or in the first plate if the grid lead is shorted a change in filament brightness may occur when the grid is opened or closed. (3) Your circuit does not show a transformer of this type. This transformer would probably be suitable for about 5,000 ohms.

"W.G.M." (Bristol) *describes a set which will only receive in an oscillating condition and asks* (1) *How to stop the howl.* (2) *Maximum and minimum wavelength.* (3) *If wavelength can be increased by adding a loading coil in the aerial circuit.* (4) *How large a loading coil to add for certain specified wavelengths.*

(1) An oscillating set of this type is forbidden under the new Post Office regulations. Howling may be due to grid and plate leads being run too close together. The chief reason for loss of signals when reaction is removed, is the inefficiency of your aerial and also the fact that a 0·001 mfd. parallel condenser is grossly excessive for short wave reception. It is undesirable to use a parallel condenser at all. (2) Minimum approximately 300 metres; maximum about 1,100 metres. (3) Yes. (4) We cannot give the exact amount for each wavelength, but supposing the 0·001 mfd. condenser is removed, a loading coil 6" × 4" of No. 24 should be ample to go to 1,200 metres. The grid and filament of the valve should be tapped across both coils and not only the coil at present in existence.

"M.A.C." (Glossop) *asks* (1) *Where to find a description and circuits of the Marconi four-electrode valve.* (2) *For information on the self-capacity of coils.* (3) *Which is correct, Bangay's assertion on pages* 142-3 *of his book, that the L.F. valve should be worked well up the slope of the curve, or Penrose's that one of the bends should be used.* (4) *Which cartographic system should be used for D.F. calibration.*

(1) See page 198, May 13th issue, and page 230, May 20th issue. (2) Self-capacity is reduced to a minimum when each turn is separated as far as possible from the consecutive turn on the winding, and the winding is so designed that no two turns, which are numerically well separated, are geometrically in proximity. You will observe that these conditions are fairly well fulfilled by solenoid coils, and even better still by basket coils. (3) The valve should be worked well up the characteristic in the middle of the straight portion. In all other positions considerable distortion is introduced. (4) For this purpose gnomonic projection should be used. Neither Mercator's nor the ordinary atlas give true bearings.

"R.B." (Carlisle).—The set sketched should be satisfactory, except that a variable condenser is desirable across the grid circuit of the first valve. Secondly, reaction coil, if used, should be introduced in the plate of the first valve instead of the second. Thirdly, reaction of this type may only be used under the conditions laid out in our note at the head of these columns.

"H.L.H." (S.E. 18) *describes his crystal set and asks* (1) *If the set will work.* (2) *If a telephone condenser is necessary.* (3) *The wavelength of set.* (4) *For any suggested improvements.*

(1) Yes, if correctly connected up. (2) Not essential, but will generally improve results. (3) Maximum about 3,000 metres. (4) A double circuit receiver with a loose coupler would give greater selectivity.

SHARE MARKET REPORT.

Prices as we go to press on September 8th are :—

Marconi Ordinary	£2	8	0
" Preference	2	4	4½
" Inter. Marine	1	9	6
" Canadian		11	3
Radio Corporation of America :—			
Ordinary	1	2	0
Preference		14	0

23rd SEPTEMBER, 1922. THE PRICE 6D. NET.

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AND RADIO REVIEW
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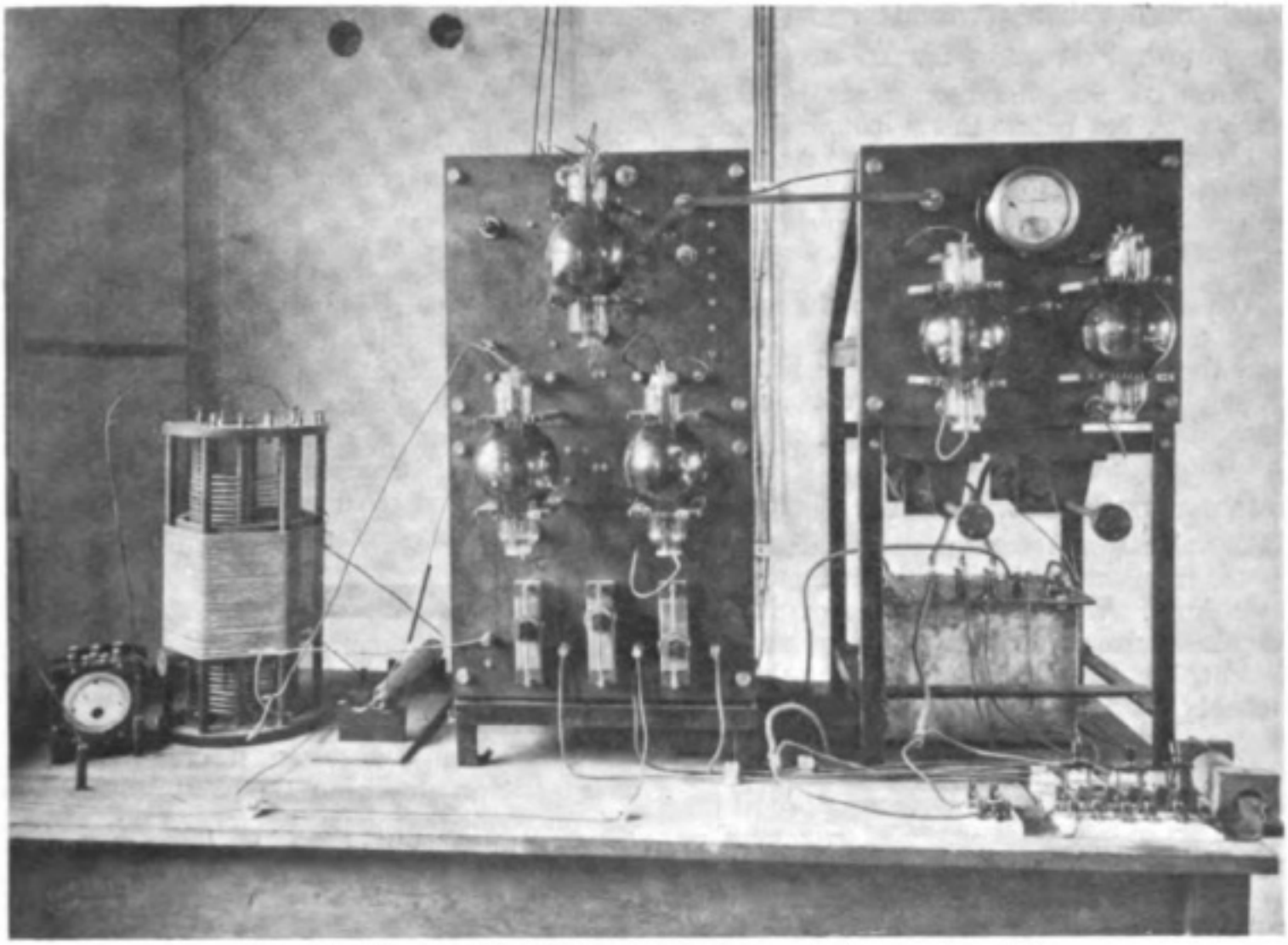
VOL. X. No. 26. SEPTEMBER 23RD, 1922. WEEKLY

2 MT Writtle

A Description of the Transmitting Plant

By CAPTAIN P. P. ECKERSLEY.

AT the outset it should be clearly understood that the transmitter at Writtle does not employ any novel circuits, the results, such as they are, are obtained by attention to detail rather than by resource to high falutin' and theoretically perfect methods. The set is in fact adapted from an old telephone transmitter designed for other purposes. The set was erected and is maintained and run by a staff engaged principally on experimental commercial work, and the station is run out of hours, so that a great deal of time cannot be spared for further research and experiment on this particular transmitter.



The ¼ k W set used for the Tuesday evening's telephony transmissions.

THE AERIAL.

The aerial is of L construction, and consists of four parallel wires equally spaced on a 12-ft. spreader slung between two masts, 100 ft. high, 200 ft. apart. An earth screen is used in place of the ordinary earth, and this provides a low resistance aerial system.

The effective height of the aerial is about 20 metres, and this gives a radiation resistance at 400 metres of

$$\frac{1600\ (20)^2}{(400)^2} = 4 \text{ ohms.}$$

POWER.

The power is ¼ kW, and this gives about 4 amps in the aerial. Assuming a 60 per cent. efficiency, this gives the total resistance of the aerial system as about 9 ohms, or 5 ohms for the aerial and aerial inductance, and 4 ohms for the radiation resistance, giving a radiation efficiency of nearly 50 per cent.; an extremely good figure, thanks to the low resistance aerial and the short wavelength.

METHOD OF PRODUCING OSCILLATIONS.

Direct coupling has been used for the last few weeks, but before this a coupled circuit was employed. It is not thought that the abolition of the coupled circuit has resulted in any deterioration of speech quality.

POWER SUPPLY.—H.T. VOLTAGE.

The H.T. voltage is produced in the standard way, by rectifying the alternating currents from the secondary of a 4,000 volt transformer. Double rectification is employed, and the smoothing is helped by a large condenser and iron core choke.

LIGHTING OF VALVES.

All valves, both control and oscillator, are lighted from accumulators, this giving freedom from hum. We have occasionally received complaints from some amateurs that hum was present, but from their descriptions this was probably not due to the alternator, but possibly to some breathing noises in a temporarily packed microphone. It is practically certain that the use of alternating current for producing the H.T. supply does not give any hum in the carrier wave, provided suitable precautions are taken. It is essential, however, to use D.C. lighting for the valve filaments if silence is to be obtained.

METHOD OF CONTROL.

The well-known method of choke control is used, and practically all the subsidiary control circuits use iron in the circuits. From the point of view of strict theory, distortion should arise from the use of "iron circuits," but in practice it is not thought that this distortion is at all serious, and the simplicity and efficiency of the usual choke control circuit amply compensates for its theoretical disadvantages. Many argue that the necessary blocking condenser connected (as regards the speech circuits) across the choke, must bring in a measure of resonance, and may produce "wolf notes" in musical reproduction, but the heavy damping in the circuit makes the effect very slight. Undoubtedly, however, the unpleasant ringing or hanging-on sounds in musical production by wireless telephony are due to the partial resonance in the control circuits. (This effect, by the way, is often endemic to receivers, hence it is bad to use too much low frequency magnification. Again, phones are always semi-tuned, and produce the ringing quality in speech and music so often heard. Thick diaphragms heavily damped produce best quality, but are very insensitive.)

We have repeatedly proved that the ringing or hanging-on effect gets worse the greater the control; in fact the less the control the better the quality, but unfortunately we cannot please the single valveites at 100 miles if we cut down control too much. The London amateur, however, is better pleased with what is merely a ripple on top of strong C.W.

In the control system at Writtle, every care has been taken to damp out tuned circuits and to prevent any reaction in the amplification chain from the microphone to the main control valves. Spurious low frequency reaction in control circuits is a frequent cause of the "hanging-on" effect and the emission of wolf notes.

THE MICROPHONE.

An ordinary 6-volt Peel Connor has been used since the inception of the concerts. The microphone is probably at the root of most of the music distortion troubles, good as it is. Before touching the control circuits the microphone should be looked to. The microphone as it stands to-day was produced for speech; it was never intended for music. By dint of much research work it has been made to hear, close up to the mouth of the speaker, the sounds being concentrated by a small trumpet, what the human ear, complicated by holes and cavities, hears at a much greater distance. We are now asking

it to hear, still close up to the disturbance, sounds which may differ in frequency in the ratio of 8-1 exactly as the human ear hears them in a large room.

The diaphragm of a microphone has a natural period and tends to give prominence to sounds of that period, hence the awful hoarse grunt that a low piano note gives, the excellence of a violin or soprano, and the poor quality of instrumental harmonised works.

What we really want is an absolutely aperiodic diaphragm which will respond equally to any note within the eight octaves, will be fully sensitive, and will react to sound disturbances much as does the human ear.

So far this ideal can often only be obtained by very insensitive arrangements which require, therefore, electrical amplification, and unless this is very carefully done results in as much distortion as was originally present, due to the more sensitive but less distortionless microphone.

CONCLUSION.

Good quality in wireless telephony is as elusive as good character in human beings, and is as seldom met with. It depends upon such an enormous number of variables that it is marvellous that anything approaching faithful reproduction of music ever results. Sound impinges on a semi-tuned diaphragm casually pressing on small pieces of carbon, the changes of electrical current so produced influence an iron transformer which is greatly non-linear in effect. The secondary of the transformer is only effective in producing current changes in a valve for half its working period, and energy may be absorbed in grid current only for the greater intensities. More iron transformers intervene, some semi-tuned by condensers before another non-linear and half-effective valve once more mars a chain that should be strictly linear. The voltage variations are applied to the high frequency medium and are radiated across miles of attenuating country and finally fall on an aerial tuned to only a few of the frequencies out of the many that are asking for recognition. The high frequency amplification is at least distortionless, but the rectifier necessarily cuts out one half of the disturbance which again is put through perhaps two or three iron transformers and finally manages to waggle semi-tuned diaphragms in the phones. These produce pressures and rarefications of air in the confined space between ebonite earpieces and the flesh of the hearer's ears . . . and sounds are expected in this space, exactly corresponding to those impinging upon the microphone. Truly the human ear is a marvellous piece of apparatus!

In spite of this, exceedingly good quality can be obtained, but this will only result after strict attention has been paid to detail both at the transmitting and receiving ends. I would strongly impress on every amateur that good results are dependent upon his skill nearly as much as upon ours.

If broadcasting has done nothing else as yet, it has opened up a great field for the inventor, and a fascinating hobby for those with scientific leanings. It is hoped in time that research and experiment will bring the art to such a perfection that broadcast concerts will be a real aid towards musical appreciation throughout the country, and it is hoped that this ideal may be brought nearer by the efforts of British amateurs.

The Next Meeting of the Wireless Society of London will be held on Wednesday, September 27th, at the Institution of Electrical Engineers, Victoria Embankment, at 6 p.m.

The Editor will welcome additions to the Directory of amateur transmitting stations for early publication. There are still many holders of transmitting licences who have not supplied particulars.

The Unit System as applied to a Wireless Receiving Installation (*Concluded from p. 782*)

By W. FORBES BOYD.

REFERRING to the diagram Fig. 2, p. 780, it will be seen that most leads, with the exception of the grid leads, are carried across each panel so that the necessary connection can be made to the next panel. It will also be noticed that the plate circuit of the rectifying valve is connected to the reaction coil in the usual manner, except that the plate circuit is broken between the transformer and the positive high tension lead, instead of the more orthodox method of breaking the plate circuit between the plate and the transformer. This is done so that only one extra reaction link tapping has to be brought back through the H.F. amplifying panel to the tuner, since the positive high tension lead is brought to the H.F. amplifying panel in any case. Apart from these features the amplifying section has no special points.

Fig. 8 shows a photographic view of the complete receiver with tuner and four-valve amplifier, and in order to show the flexibility of the system a two-valve amplifier with tuner unit is given in Fig. 9, this combination exactly fitting into the instrument section of a short wave tuner box.

In comparison with Figs. 2 and 8, it will be seen that Fig. 9 omits the H.F. and L.F. amplifying units.

When using the four-valve amplifier with H.F. amplifier unit it is sometimes an advantage to convert it into a three-valve L.F. amplifier, especially for the longer wavelengths beyond the range of present-day telephony. This is very quickly done by connecting the grid link socket in the tuner marked " A," Fig. 2, with the grid link socket of the rectifying valve marked " B," and switching off the filament of the H.F. amplifying unit.

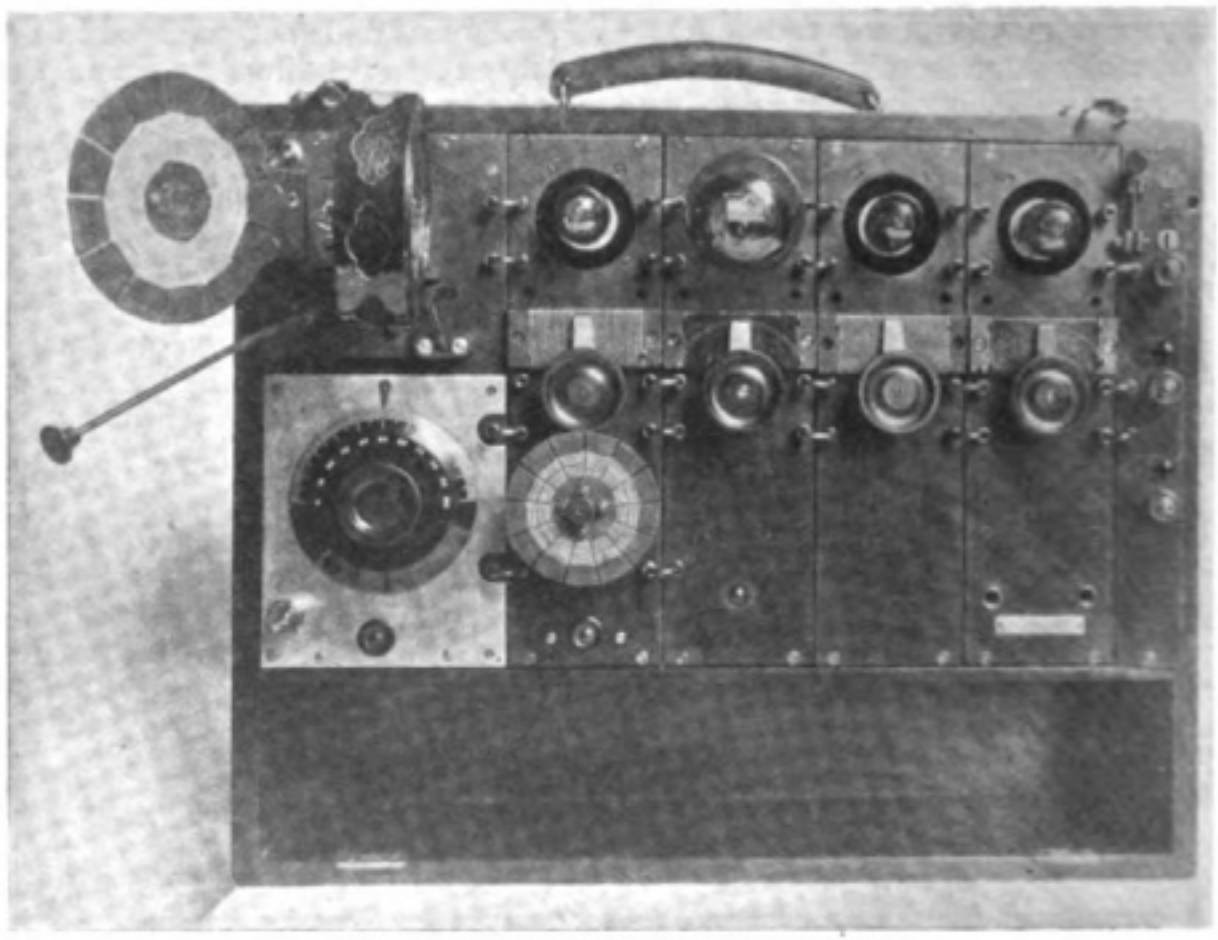


Fig. 8. Tuner with four-valve amplifier.

A very useful accessory to the terminal unit could be added in the form of a flash lamp bulb in series with the positive high tension terminal unit to act as a fuse for the H.T. battery.

The writer invariably uses one on the H.T. battery, and it has many times saved the price of a new battery.

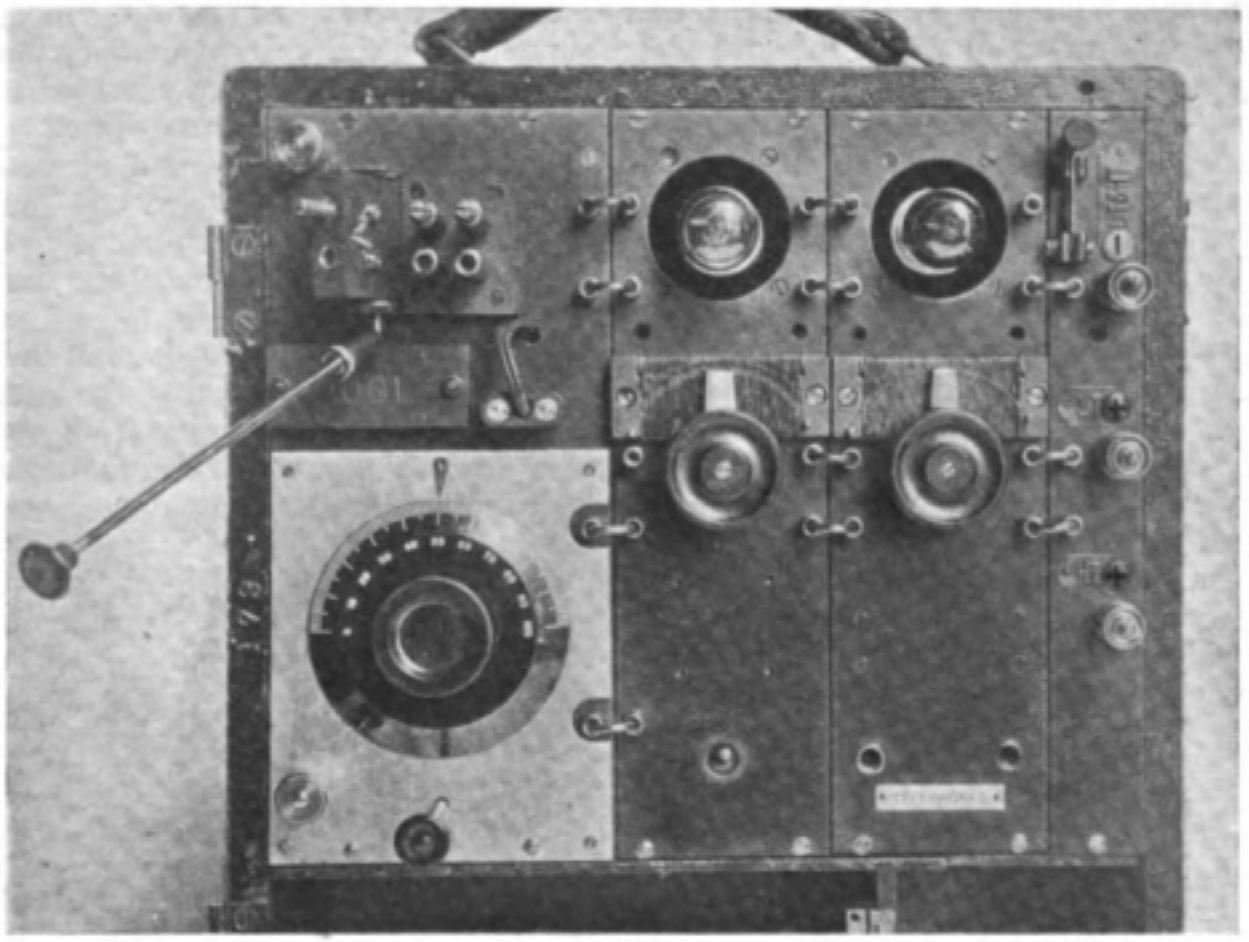
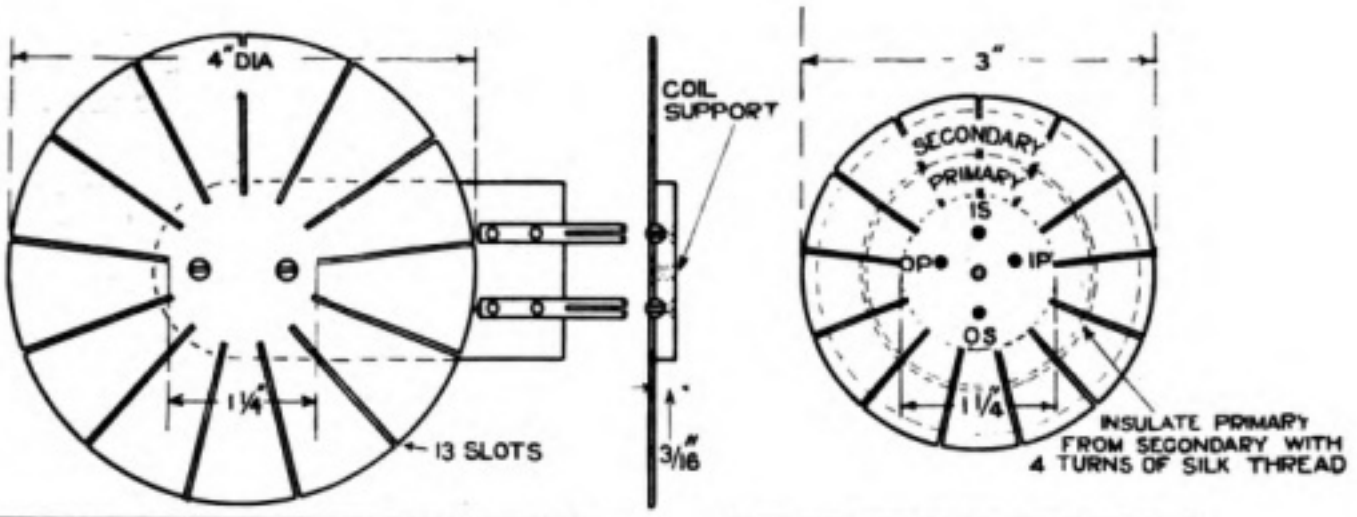


Fig. 9. Tuner, L.F. rectifying, telephone and terminal units. Illustrating the flexibility of the system.



No. of Turns	Size of Wire Double Cotton Covered	Wave length with 100ft Aerial
25	26 SWG	200 - 300 m
35	26 "	280 - 370 "
45	26 "	275 - 450 "
55	28 "	330 - 530 "
65	26 "	390 - 640 "
75	30 "	455 - 740 "
85	30 "	550 - 860 "
100 (Duolateral)	28 "	840 - 1350 "

For Reaction Coils when using H F Amplification use 25 Turns with 35 Turns Aerial Inductance and 35 Turns with all other sizes of Inductance

No. of Turns Primary	No. of Turns Secondary	Wave length with 0.001 fifd	Remarks
35	40	180 - 290	m
50	60	250 - 375	"
75	90	360 - 600	"
100	120	550 - 780	"
150	200	760 - 1100	Separate Pancakes for P & S

In all cases Primary & Secondary wound in same direction with No 42 Single Silk Covered Copper Wire

Fig. 10. Aerial inductances and reaction coil.

For example, a faulty valve was used in the H.F. amplifying panel in which the grid was touching the plate.

On any other panel this result would not be so apparent as the grid leak would provide a high resistance, but on the H.F. amplifying panel the faulty valve constituted a short circuit across the H.T. battery, and a twopenny flash lamp bulb is considerably less expensive than a new H.T. battery.

Fig. 10 gives particulars of the coils for the shorter wavelengths. It will be noticed that the aerial inductance and reaction coils are mounted on a 3/16-in. support, and provided with two pins. The grooves for these pins are made by drilling two supports that are clamped together, and if a pin and socket were provided it would be necessary to increase the thickness of the support.

In order that the two-pin mounting be suitable for the coil holders on the tuner, these top coil holders are provided with loose pins which are withdrawn when using the two-pin coil holder. It will be noticed that there are two pairs of fixed coil supports on the tuner. This arrangement is to allow for the difference in width between the pancake and the duo-lateral coils.

In conclusion, the writer has not the slightest hesitation in recommending the unit system to all wireless enthusiasts, from the novice who scarcely knows where to begin to the eardrum-hardened experimenter to whom the unit system should especially appeal, for not only is it an ideal experimenters' system, but also it is considerably more efficient than the single panel type of apparatus.

Why I Should Join a Wireless Society

By F. HOPE-JONES, M.I.E.E.

(*Chairman of the Wireless Society of London*).

BECAUSE man is a gregarious animal and identity of interest breeds friendship; because the easy and quick way of acquiring the special knowledge you want is to compare notes with others who are engaged upon the same problem.

Such reasons are the obvious ones, but there are others less conspicuous, and as is usually the case it is those below the surface that are the more important.

Your keenness in the new hobby may well lead you to consider who gave you radio-telegraphy. I am not thinking at the moment of the scientists; your text books will teach you what you owe to Clark Maxwell, Hertz, Lodge, Marconi, and Fleming, but do you realise that only six months ago it was technically against the law to transmit or receive wireless telephony in this country? Who fought for that very moderate degree of freedom which you now enjoy or are promised? *Your fellow amateur!* It was he, by joining his local society, who helped to establish the annual conference and enabled us to speak with a voice so unanimous and so authoritative that it had to be listened to. The petition presented to the Postmaster-General in December last was signed by sixty societies affiliated to the Wireless Society of London, and what rapid developments we have seen since then!

Of all the definitions of a gentleman, the one I like best is "he who puts more into life than he takes out." I think all wireless men must be gentlemen, for they are always helping each other and have an eye to the common good.

Apart from ever present technical details of absorbing interest there are many important matters for discussion at this season's meetings. The precise terms of the licences, broadcasting and experimental, are now "in the melting pot," and are of vital concern to us all; the attempt to communicate with the American amateurs on short wave, by way of return for their successful transmission last winter, is a job that can only be done collectively—unless you are a member of a Society you can have no share in it. The forthcoming exhibition will be as full of meat as an egg, and you will need help to assimilate it; and there is much more to be said about broadcasting in all its aspects. So seek out the Secretary of your local society, hear all about these interesting matters, and throw your talents into the common stock in return for the instruction tips, wrinkles, and other valuable help you will receive.

Meteorological Wireless Codes.

By W. G. W. MITCHELL, B.Sc., F.R.A.S., F.R.Met.S.

In the last instalment of this article (pp. 745–749) the coded forecasts for districts were considered. We will now pass on to the form of synoptic reports issued by the Air Ministry.

N.B.—The meaning of the Code letters is explained in the New International Code below. Groups of letters in inverted commas are not in code.

0200 *message*. 0600 *message*. 1400 *message*.

(*a*) I_nI_n BBBDD FwwTT cbWVH ALaNh C_1ddVV

(*b*) "Pilot" I_nI_n $h_1$ddvv $h_1$ddvv etc.

(*c*) "Temp" I_nI_n ddtt BBTTH etc.
(dd = day of month, tt = hour of observation G.M.T.)

(*d*) "Ships" QLLLx_1 llllx_2 BBDDx_3 FvKdx_4 wwGGx_5 TTttx_6 CNWrx_7 y_1 y_2 y_3 y_4 z.
(llll = long. in degrees and tenths; other symbols in New International Code.)

0800 *message*.

(*a*) I_nI_n BBBDD FwwTT cbWVH ALaNh RRmmr C_1ddVV (for Inland stations only). I_nI_n BBBDD FwwTT cbWVH ALaNh RRSV,r C_1ddVV (for coastal stations only).

(*b*) (*c*) and (*d*) Same form as 0200 message.

1900 *message*.

(*a*) I_nI_n BBBDD FwwTT cbWVH ALaNh RRMMr C_1ddVV (for inland stations only) I_nI_n BBBDD FwwTT cbWVH ALaNh RRSV,r C_1ddVV (for coastal stations only).

(*b*), (*c*) and (*d*) as 0200 message.

The reporting stations with their index numbers (I_nI_n) are given in the map, p. 820, where C = coastal station, L = inland station. Stations usually reported are in capital letters.

Aviation Reports.

Messages at 0335, 0435, 0535, 0635

"Meteor" (four-figure group indicating time of observations, *e.g.*, for 0335 message group = 0300).

(*a*) (stations 61, 62, 66) x I_nI_n (Vs) wwVhL NDDFW.
(Ob. at Croydon 5 min. before transmission of message) "CDN" wwVhL.

[*Note.*—x = units digit in sum of figures wwVhL.]

Messages at 0735 (*a*) "Meteor" 0700.
(Stations 61 and 66) I_nI_n (V.) BBBDD FwwTT cbWVH ALaNh C_n ddF_1S.
(Stations 62, 75) x I I_n (V.) wwVhL NDDF C_n ddF_1S.

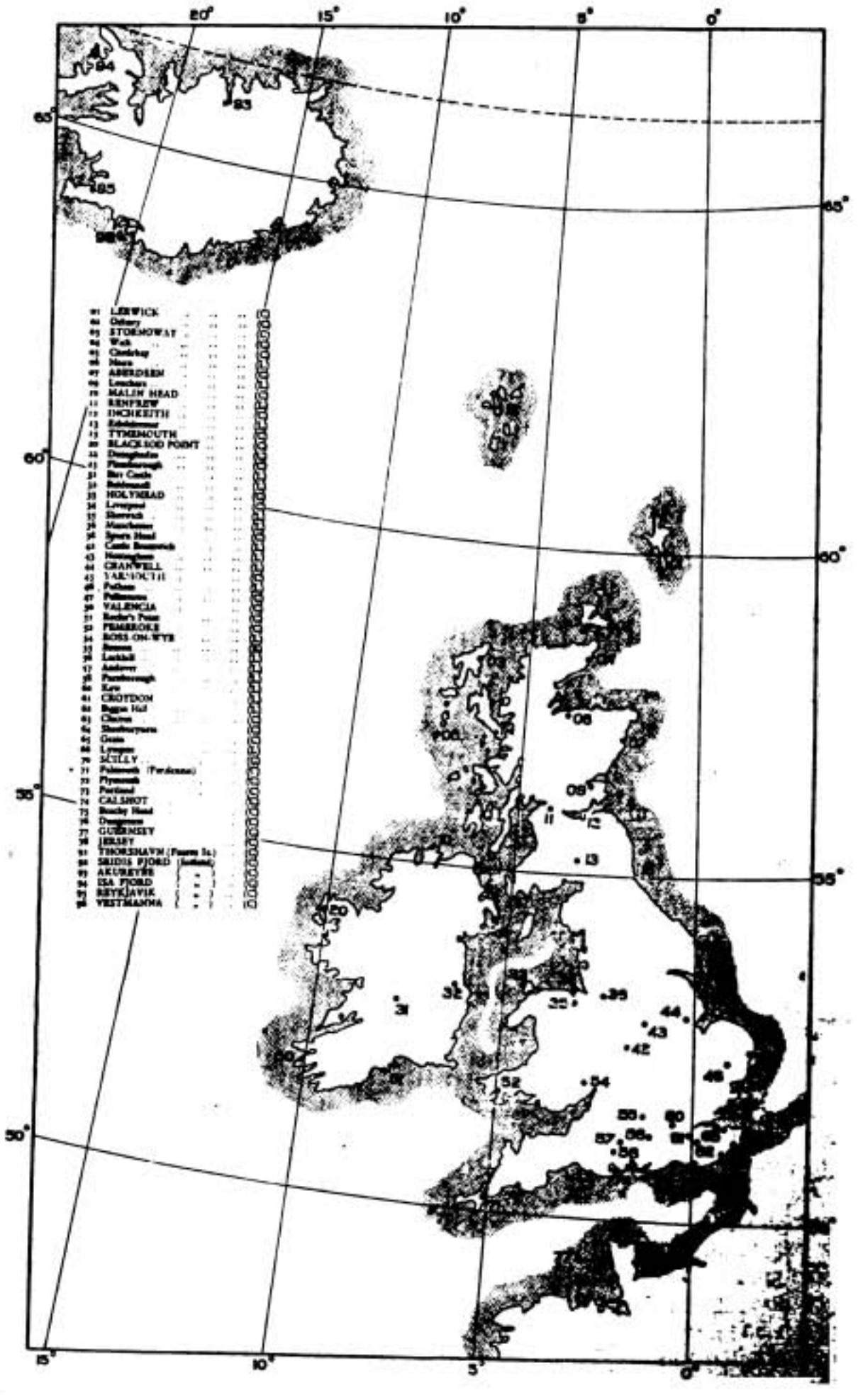
" 1335 (*b*) (Stations 61 *OR* 66) I_nI_n 49tt $h_1$ddvv (tt = hour of pilot balloon ascent).
(Ob. at Croydon 5 min. before transmission of message). "CDN" ww VhL.

Message at 0835 (*a*) "Meteor" 0800 (stations 61, 62, 66) x I_nI_n (Vs) wwVhL NDD FW, followed by reports received too late for inclusion in general synoptic report issued at 0800 and in same code.

(*f*) "Forecast" (in same code as synoptic reports for *districts*). "CDN" wwVhL.

Message at 0935 (*a*) "Meteor" 0900 (stations 61, 62, 66, 75) x I_nI_n (Vs) wwVhL NDDFW (station 76) I_nI_n Vs.

(*b*) Same form as 0735 message (only included if no pilot balloon ascent was available for the 0735 message and one has become available since). "CDN" wwVhL.



Map showing Reporting Stations with their index numbers.

Message at 1035 (*a*) " Meteor " 1000 (stations 61, 62, 66) same form as (*a*) 0735 message.
(Stations 50, 72, 74) I_nI_n BBBDD FwwTT cbWVH ALaNh.
" CDN " wwVh.

Message at 1135 (*a*) " Meteor " 1100 stations 61, 62, 66, 75). x I_nI_n (V_s) wwVhL NDDFW.

(*b*) (Stations 61 *OR* 66) I_nI_n 49tt $h_1$ddvv.

(*f*) " Forecast " [same code as 0835 $(f)_3$ " CDN "wwVh L.

Message at 1235 (*a*) " Meteor " 1200 (stations 61, 62, 66, 75, 76) in same code as 0935 (*a*) message. " CDN " wwVhL.

Message at 1435 (*a*) " Meteor " 1400 (stations 61, 62, 66) in same code as 0835 (*a*) message, followed by reports too late to be included in synoptic message at 1400 and in same code.

(*f*) " Forecast " [same code as 0835 (*f*)] " CDN " wwVhL.

Message at 1535 (*a*) " Meteor " 1500 (stations 61, 62, 66, 75, 76) in same code as 0935 (*a*) message " CDN " wwVhL.

Message at 1635 (*a*) " Meteor " 1600 (stations 61, 62, 66) in same code as 0735 (*a*) message. " CDN " wwVhL.

Note.—The word " Botley " when it occurs in a message is followed by a statement in plain language of the conditions on the North Downs (Botley Hill) as viewed from Biggin Hill, when such a statement adds material information to that contained in the rest of the message.

THE NEW INTERNATIONAL CODE.

A = Form of *predominating cloud* lowest in the scale of cloud forms.

a = Form of *predominating cloud* highest in the scale of cloud forms when more than one type of cloud exists.

BBB = Pressure in millibars and tenths (initial 9 or 10 omitted) or millimetres and tenths (initial 7 omitted).

BB = pressure in *whole* millibars or millimetres (initial 9, 10 or 7 omitted).

b = amount of barometric tendency during the 3 hours preceding the time of observation expressed in half-mbs. or half-mm.

C = form of predominating cloud when only one form is reported (see ship observations).

C_1 = form of cloud observed by nephoscope.

C_a = form of cloud obesrved by nephoscope in aviation reports.

c = characteristic of barometric tendency during the period of 3 hours preceding observation.

DD = direction of wind near the ground on the scale (01-32) in which 08 = east, 16 = south, etc. 00 = calm.

dd = direction of wind in the upper air or of cloud movement on the scale (01-36), *i.e.*, degrees from North divided by 10 to nearest whole number, 00 = calm.

d = direction from which swell comes scal, (0-8) in which 2 = east, 4 = south, etc., 0 = no swell.

F = force of wind on Beaufort Scale.

F_1 = approximate speed of low cloud.

GG = Greenwich time of ob. (01 = 1 a.m.e 12 = noon, etc).

H = relative humidity of the air.

h = height of base of lowest cloud present.

h_1 = height at which upper wind is reported.

I_nI_n = index number of station.

K = characteristic of the swell in the open sea.

L = amount of sky (scale 0-10) covered by cloud form A.

LLL = latitude in degrees and tenths, the tenths being obtained by dividing the number of minutes by 6 and neglecting the remainder.

lll = longitude in degrees and tenths (as for LLL).

MM = maximum temperature in the interval of 11 hours ending at 18h. G.M.T.

mm = minimum temperature in the interval of 13 hours ending at 7h. G.M.T.

N = Total amount of sky covered with cloud.

Q = quarter of the globe in which ship is situated.

RR = rainfall at 7 a.m. for preceding 13 hours. and at 6 p.m. for preceding 11 hours.

R = amount of rainfall for the preceding 24 hours.

r = time of commencement of precipitation.

S = state of the sea and swell (coast stations).

TT = temperature of the air in whole degrees F or C (50 added to negative values).

tt = temperature of the sea (surface water) in whole degrees.

TTT = temperature of the air in degrees and tenths F. or C. (500 added to negative values).

ttt = temperature of the sea in degrees and tenths.

V = visibility or distance at which objects can be seen in daylight or at which lights can be seen at night.

v = visibility at sea from ships at sea.

V_s = visibility towards the sea (from coast stations).

VV = the relative speed of clouds as determined by nephoscope and such that the actual speed of the cloud will be given in km/hour by the equation $VV = \frac{h}{1,000} VV$, if h, the height of the cloud is expressed in metres.

vv = speed of wind in the upper air in km/hour or mi/hour.

W = weather in the interval since the preceding time of report.

ww = the actual weather at the time of ob. with which is combined, whenever possible, the general character of the weather.

x_1 = a check figure obtained by adding the first four figures of the group and taking the units figure in the sum thus obtained.

x_2 x_3 x_4 x_5 y_1 y_2 y_3 y_4 = check figures.

z = key figure, obtained by adding all the x's or all the y's.

The All-British Wireless Exhibition

AS we go to press with this issue we learn that the arrangements for the forthcoming All-British Wireless Exhibition to be held at the Horticultural Hall, Westminster, are in full swing.

The hearty co-operation of all those who are taking part in the Exhibition ensures that the event will be one well calculated to absorb the interest of the public at a time when the popularity of wireless is likely to receive a tremendous impetus.

Those who attend the Exhibition are not likely to come away disappointed with the display of equipment which will be laid out for inspection.

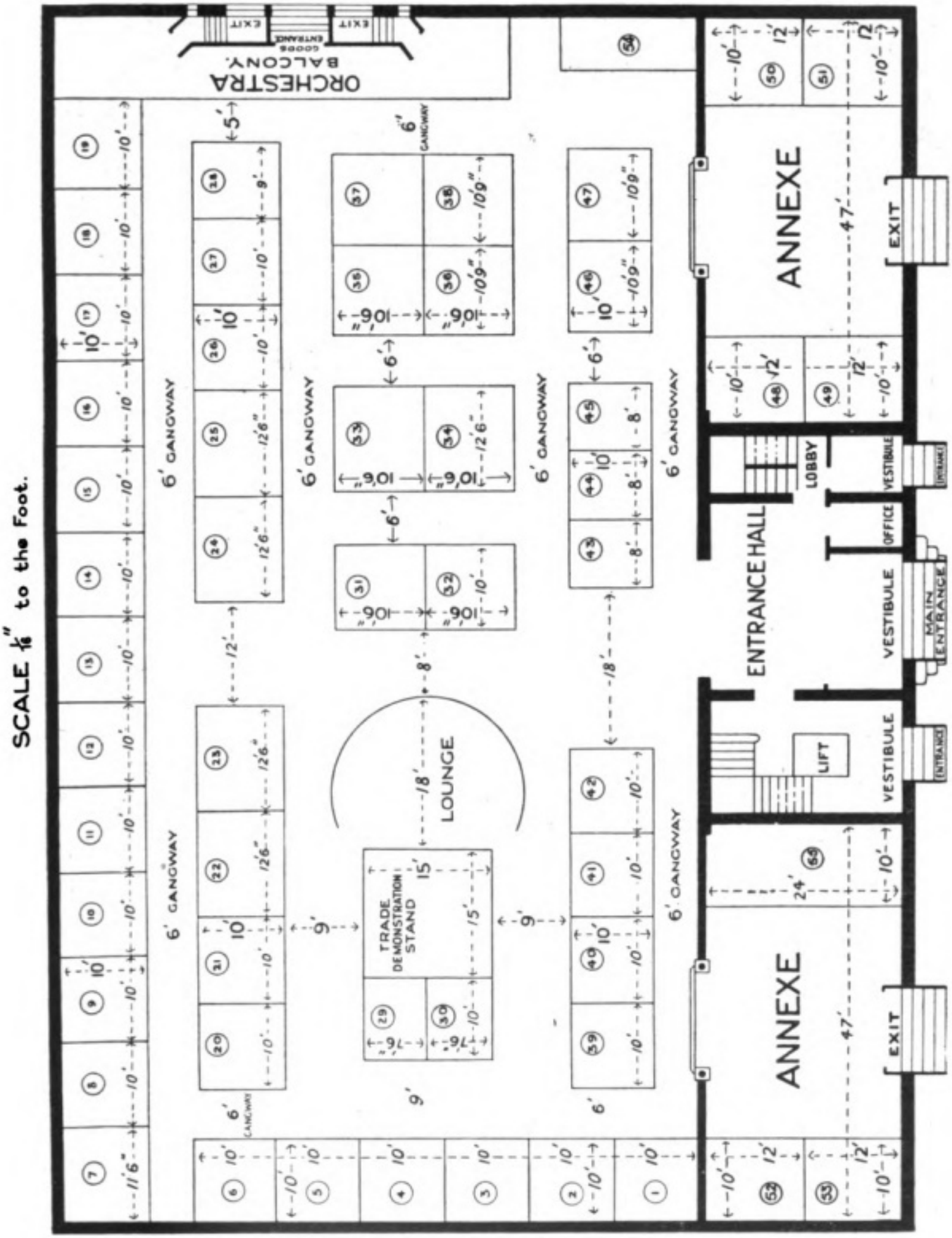
There is little doubt that the exhibitors will confine their attention almost exclusively to the interests and requirements of the experimenter, the amateur and the general public, and therein will be noticed a distinction between this exhibition and those exhibitions not of an "all-wireless" category which have been held in the past where the apparatus shown has been principally of a type designed for handling commercial telegraph traffic.

All the most up-to-date designs of complete sets and parts will be on show, and just as the annual motor exhibition is regarded as the opportunity for the public and prospective purchasers of automobiles to make their choice from all the best that can be displayed, so this Exhibition will fill the same place in affording similar opportunities to those who have interests in wireless.

One cannot help feeling that, to the general public at any rate, a visit to the Horticultural Hall during the week of the Exhibition will be somewhat of a revelation. There must be many who have hardly any acquaintance with wireless beyond perhaps what they have recently read in the daily press, and what they may have gleaned from this source will have served only as an inducement to take a fuller interest in the subject.

For those who already are associated with wireless, the Exhibition will afford an excellent opportunity for initiating friends into the fascinations of the science, and no doubt those who are members of societies especially, will see to it that visitors from their district are accompanied, as far as it is possible to arrange it, by some member who is competent to point out and explain wireless matters so as to add to the enjoyment and profit to be derived from the visit.

No doubt Secretaries of Societies will



Plan of the Horticultural Hall. *For Key see page 824.*

endeavour to arrange for parties to visit the Exhibition with this object in view, and such an arrangement will no doubt result in a large influx of new members to the societies.

As has already been announced, the Wireless Society of London is making special arrangements in connection with the social side of the Exhibition, and will be prepared to welcome members of societies and particularly those of provincial societies for whom the Exhibition may afford an opportunity of meeting London society members which they might not otherwise have.

For those who come to London specially for the event and who may have only one day to spare, it is suggested that where possible some day other than a Saturday might be chosen, since on Saturdays it is likely that the Hall will be very full and some difficulty might be experienced in seeing everything as well as meeting socially some of their London friends.

The Wireless Society of London has obtained the services of a number of lecturers who will conduct special lectures, chiefly of a popular nature, for the benefit of visitors to the Exhibition. Such lectures will be held in a lecture room specially provided for the purpose. The following are the names of those who have already kindly promised to give lectures :—

Admiral of the Fleet, Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., D.Sc., M.I.E.E.
Mr. A. A. Campbell Swinton, F.R.S.
Mr. F. Hope-Jones, M.I.E.E.
Mr. Maurice Child.
Mr. G. P. Mair, A.M.I.C.E.
Mr. G. G. Blake, M.I.E.E., A.Inst.P.
Mr. E. Blake, A.M.I.E.E.
Mr. Philip R. Coursey, B.Sc., A.M.I.E.E.,F.Inst.P.
Mr. W. R. H. Tingey.
Mr. R. C. Clinker, M.I.E.E.
Mr. John Scott-Taggart, M.C., A.Am.I.E.E., F.Inst.P.
Mr. H. Walker, A.M.I.R.E.
Mr. H. R. Rivers-Moore, B.Sc., A.M.I.E.E.

Below is given a list of the names of those firms who are showing at the Exhibition. This list is arranged in alphabetical order, and alongside each name appears the number of the stand allotted. These numbers form the key to the accompanying plan of the Horticultural Hall, whereon all the stands are given their appropriate numbers.

2 Messrs. Anode Wireless & Scientific Instruments, Ltd.
46 Messrs. G. Z. Auckland & Son,
52 Messrs. Automatic Telephone Manfg Co., Ltd.
19 Messrs. J. B. Bower & Co. Ltd.
7 Messrs. British Thomson-Houston Co., Ltd.
42 Messrs. British Wireless Supply Co.
43 Messrs. S. G. Brown, Ltd.
12A Messrs. Burndept, Ltd.
30 Messrs. The Chloride Electrical Storage Co., Ltd.
29 Messrs. A. C. Cossor, Ltd.
18 Messrs. Coomes & Co.
36 Messrs. Dubilier Condenser Co., (1921) Ltd.
55 Messrs. Bertram Day & Co., Ltd.
11 Messrs. The Ever Ready Co., (Gt. Britain) Ltd.
50 Messrs. Econ Manfg. Co., Ltd.
51 Messrs. Economic Electric Ltd.
45 Messrs. C. F. Elwell, Ltd.
10 Messrs. Fellows Magneto Co., Ltd.
47 Messrs. Gambrell Bros., Ltd.
31 Messrs. A. W. Gamage, Ltd.
44 Messrs. Alfred Graham & Co.
26 Messrs. General Radio Co.
5 Messrs. Harwell, Ltd.
17 Messrs. Hart Accumulator Co., Ltd.
12 Messrs. Hambling, Clapp & Co.
35 Messrs. H. P. R. Wireless, Ltd.
9 T. H. Isted, Esq.
4 Messrs. Igranic Electric Co., Ltd.
8 Messrs. "K. B." Radio Equipment Co.
38 Messrs. L. McMichael, Ltd.
41 Messrs. Mullard Radio Valve Co., Ltd.
24 Messrs. Marconi's Wireless Telegraph Co., Ltd.
32 Messrs. The Marconi Scientific Instrument Co., Ltd.
33 Messrs. Metropolitan-Vickers Electrical Co., Ltd.
21 Messrs. Mitchell's Electrical & Wireless, Ltd.
28 Messrs. The M.O. Valve Co., Ltd.
53 Messrs. Pettigrew & Merriman, Ltd.
16 Messrs. The Peto Scott Co.
23 Messrs. Radio Communication Co., Ltd.
37 Messrs. Radio Instruments, Ltd.
22 Messrs. Rogers, Foster & Howell, Ltd.
6 Messrs. Radio Service, Ltd.
27 Messrs. Radio Press, Ltd.
54 Messrs. Stanley Prince & Co.
48 Messrs. Siemens Bros. & Co., Ltd.
49 H. W. Sullivan, Esq.
34 Messrs. Sterling Telephone & Electric Co., Ltd.
25 W. R. H. Tingéy, Esq.
20 Messrs. Telephone Manfg. Co., Ltd.
15 Messrs. Wates Bros.
39 Messrs. Western Electric Co., Ltd.
14 Messrs. Wireless Equipment, Ltd.
1 Messrs. Wireless Supplies Co.
40 Messrs. Wireless Press, Ltd.
3 Messrs. The Zenith Manfg. Co.

It is, of course, not possible at this stage to say anything in detail regarding the apparatus which will be exhibited. No doubt each manufacturer is holding back for the purpose of the Exhibition his most recent productions, and will observe secrecy as to the nature of his exhibits until they are available for inspection on his stand.

In further issues of *The Wireless World and Radio Review* will be described and illustrated some of these attractive features for the purpose of record and for the benefit of those unable to attend the exhibition.

The Radio Direction Finder and its Application to Navigation

SHIP owners, wireless engineers, government departments and others, are giving much attention to the importance of providing wireless direction-finding equipment on board ship by means of which the position of a ship can be quickly and accurately determined. This matter is receiving attention in various countries, especially in the United States. The provision of radio direction-finding equipment on a ship may eliminate serious delays caused by a ship being unable to enter port during a fog because its position, or the bearing of lighthouses, is not known. In case of a wreck, such equipment may be the means of saving many lives.

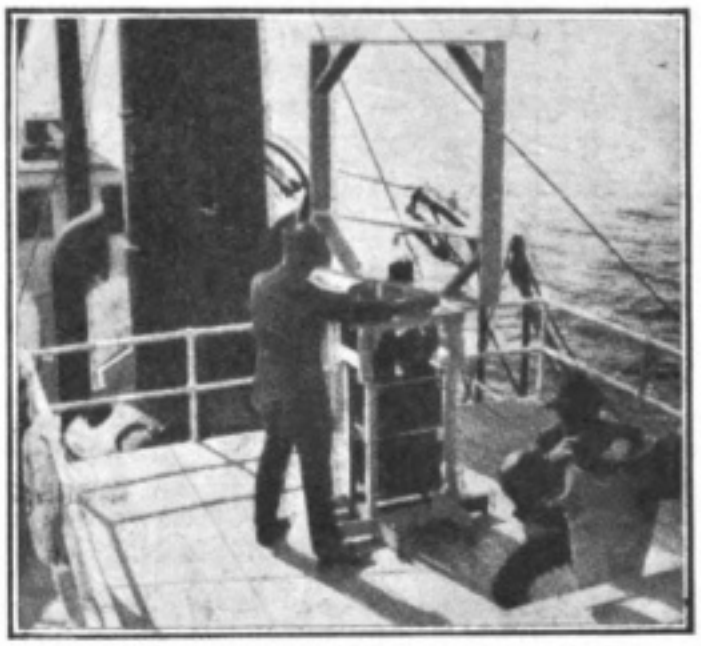
The wireless direction finder is a device for determining in a simple manner the direction of a radio transmitting station with reference to the point at which the direction finder is located. The direction finder has a considerable number of very practical applications, of which one of the most important is its use as an aid to navigation.

Sound and visual signalling devices have been employed for many years as aids to navigation. Lighthouses and lightships, with their characteristic light flashes and sound signals are established and maintained along the coasts and at harbour entrances in order that shipping may be carried on with maximum safety. During fog or thick weather, however, the sound and visual signalling devices often do not give reliable service.

The wireless direction finder is not affected by fog, and has the further advantage that it will operate over much greater distances than sound and visual signalling devices.

The Department of Commerce of the United States has developed a system of wireless direction finding which has proved to be very simple, practical, and dependable. This system has been developed by the Bureau of Standards in co-operation with the Bureau of Lighthouses. The first installations were made in the Third Lighthouse District, with headquarters at Tompkinsville, N.Y. A common type of direction finder which has been used for installation on shipboard, consists of a coil of ten turns of insulated copper wire wound on a wooden frame four feet square, which is mounted so that it may be rotated about a vertical axis. Suitable receiving apparatus is used in connection with the coil, and in recent installations has consisted of a variable air condenser for tuning purposes, a balancing condenser for increasing the accuracy of observed bearings, a six-valve amplifier, having three stages of radio-frequency amplification, a detector, and two stages of audio-frequency amplification, batteries, and suitable telephone receivers.

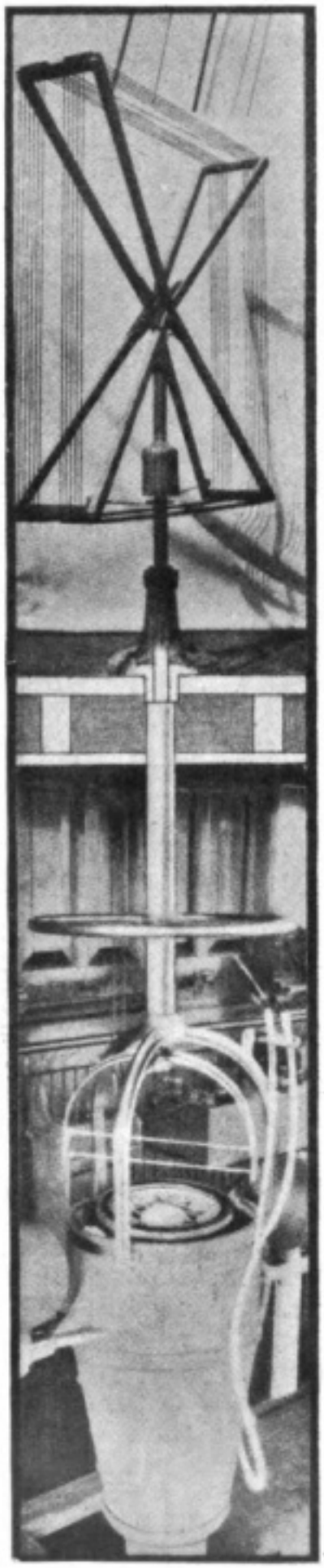
As the coil is revolved about its vertical axis, the intensity of the signal which is being received from the station whose location is to be determined, diminishes until a minimum is reached, which occurs when the plane of



Experimental type of frame on board ship.

the coil comes to a position at right angles to the line of direction to the radio transmitting station. At this point of minimum signal, the bearing is read on a suitable scale, which may be either a fixed scale or the card of a magnetic compass.

In developing this system of direction finding, the Bureau of Standards has made a study of the distortion effects which may result from the presence of adjacent objects, such as the mass of a ship, and methods of eliminating errors which such distortion may cause in observed radio bearings. A particularly careful study has been made of distortion effects on board ship and methods for correcting for these effects by calibration.



Magnetic compass with direction-finder attachment for direct reading of bearings.

Practical methods have been developed for simplifying the operation of the direction finder. The direction finder is essentially a nautical instrument and should be installed on board where it may be used directly by the navigator in taking bearings on wireless stations established on shore or on light vessels. This can be done with the simplified form. Bearings may thus be taken rapidly, at any time, and as often as desired.

This system should be carefully distinguished from the system of determining positions by wireless, in which the ship transmits signals to radio compass stations on shore, which report to the ship its position. This system avoids the delays and errors likely to occur in depending on radio compass stations on shore, since with the latter, even under the most favourable conditions, valuable time may be consumed in making a request for bearings, taking bearings, and getting the information back to the navigator on the ship.

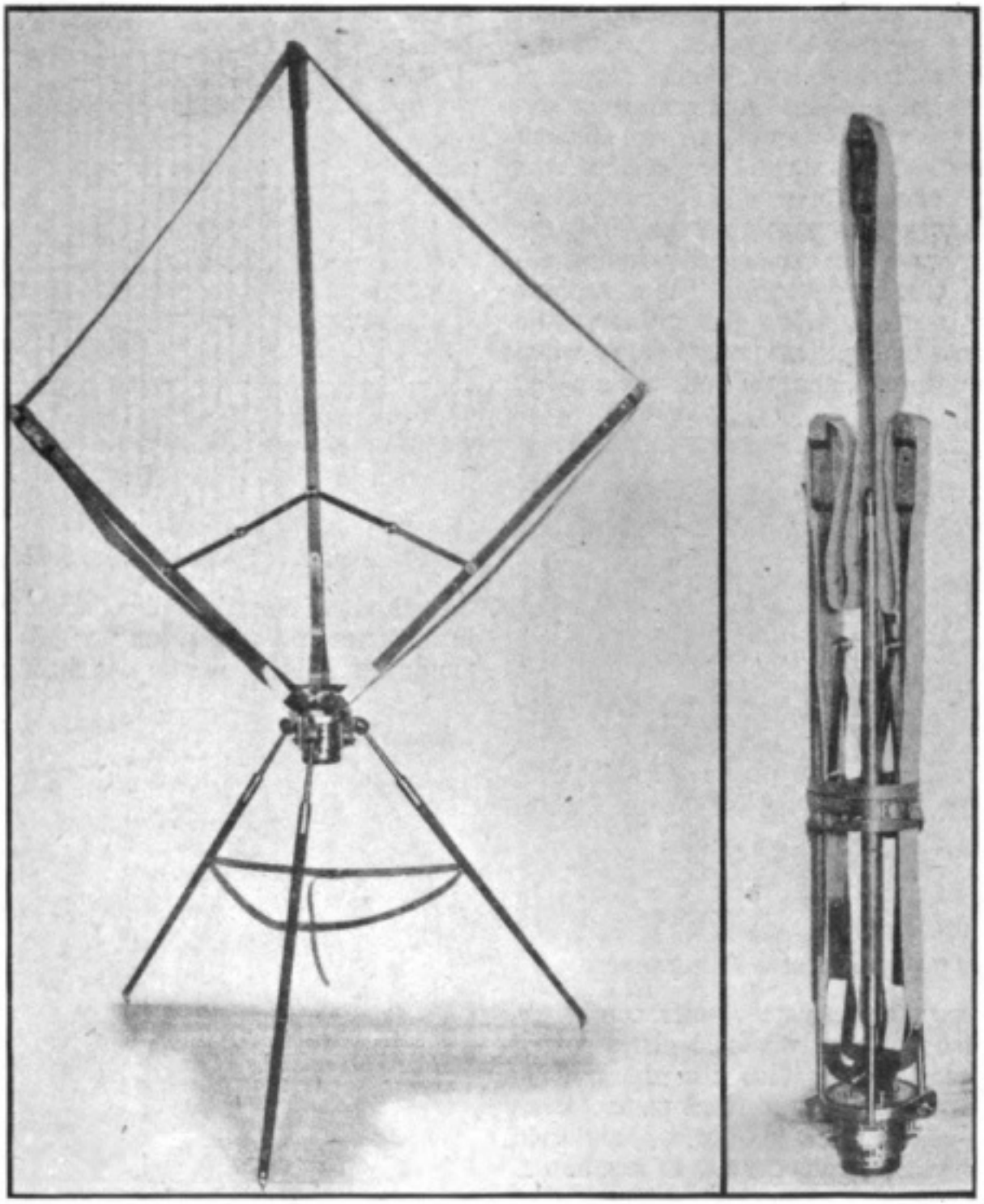
The wireless direction finder as used by the Department of Commerce involves a number of unique features. It is designed to be installed over the ship's binnacle carrying the magnetic compass card, so that the bearings are read directly on the magnetic compass card. An additional scale is attached to the top of the binnacle and marked with the corrections obtained by calibrating the direction finder. By these means the bearings are obtained in a simple and direct manner. The electrical features have been made such that the only operations necessary when taking a bearing are one adjustment in the receiving set, and the rotating of the direction finder coil.

A transmitting station intended primarily for direction finding work is often called a "radio beacon." Radio beacons may be installed at small expense on lighthouses and light-vessels. The transmitting equipment may be designed to operate automatically by simply throwing a switch, so that no additional personnel is necessary. The radio transmitting equipment is set into operation by the lightkeeper, just as the other signalling devices at the light station. The expense of operation of the radio beacon is therefore small.

The Department of Commerce has established three radio beacons at the approaches to New York Harbour, and these are now in regular commission. A radio beacon is being installed on San Francisco Lightvessel No. 70. These beacons have automatic trans-

mitting equipment so that no operator is necessary.

The Bureau of Standards has recently issued a publication describing this system of radio direction finding.* This publication shows numerous photographs of a radio direction finder of the type mentioned above, as installed on the pilot house of a lighthouse tender. Actual courses are shown which were run by means of radio bearings taken by the ship's navigator, on the three beacons at the approaches to New York Harbour. In these tests, positions were determined by cross-bearings on the three radio beacons, and courses were set for one of the lightvessel beacons by taking a radio bearing directly on the beacons. The paper deals briefly with the principles of the operation of the direction finder, but is primarily concerned with practical development which has made possible a device sufficiently simple and accurate for use as an aid to navigation, and with practical applications which have been made.



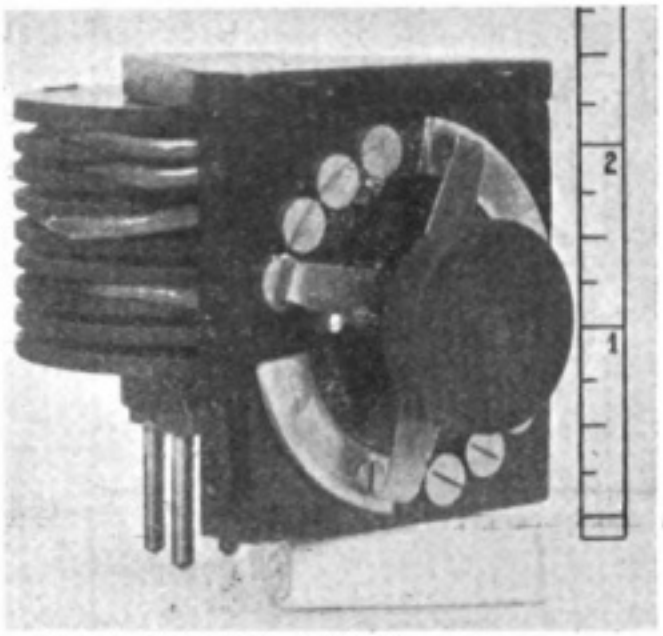
Collapsible type of direction-finding frame aerial for field use.

* A new publication issued by the Bureau of Standards, No. 428.

A Variable H.F. Transformer

By L. W. C. MARTIN.

I DARESAY that in common with myself many amateurs have experienced difficulty in getting efficient reception on short waves such as are now being used. A difficulty arises in the limited wavelength range of H.F. transformers. Since a transformer designed for 350 metres cannot be so efficient on 500 metres, it stands to reason that many H.F. transformers will be necessary to cover, say, 150 to 1,000 metres, since the shorter the wave the closer the tuning required for efficient reception. If a variable condenser is used across the primary, the capacity must be kept extremely low, or when brought into use efficiency falls off very rapidly.



The finished Variable Transformer.

I myself use a three-plate vernier condenser, with one moving and two fixed plates spaced $\frac{1}{8}$ in. apart, $1\frac{1}{4}$ in. radius for the moving plate, $1\frac{1}{2}$ in. radius for the fixed plate. Even this is on the large size, but if only used quarter or half the movement, as maximum, it is satisfactory, and will cover any gaps between various wavelengths.

The H.F. transformer I have designed and will describe here with details of construction covers all wavelengths from 350 to 1,000 metres, and is much better to handle than half a dozen small plug-in transformers, whilst being equally efficient on any wavelength. Slight modifications can be made for covering a different range of wavelengths, shorter or longer.

Referring to Fig. 1, this should be as near as possible to dimensions given, and should be

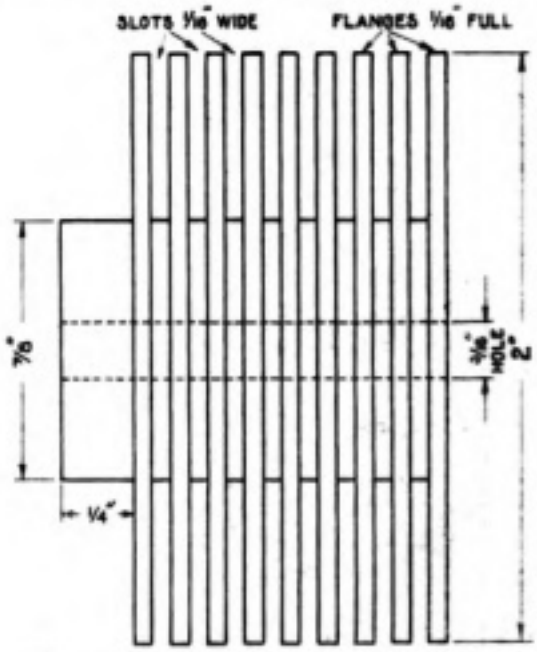


Fig. 1. Turned ebonite bobbin.

turned out of one piece of solid ebonite, 2 ins. in diameter and $3\frac{1}{2}$ ins. long. This will allow ample for holding in the chuck of the lathe.

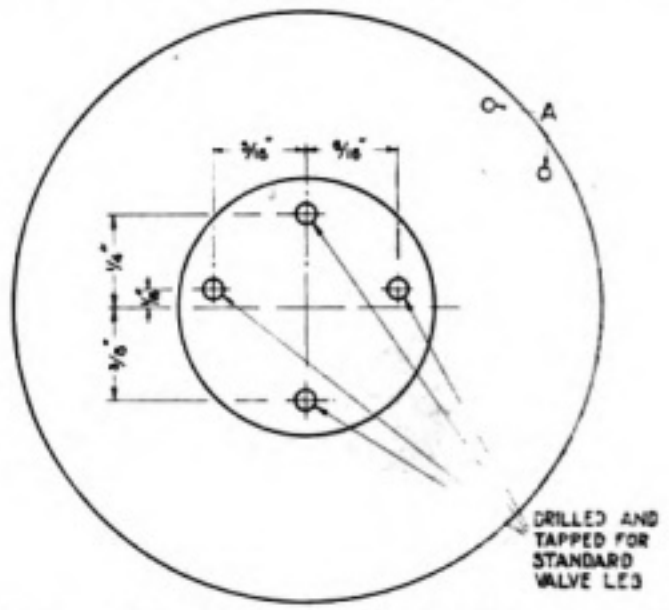


Fig. 2. View showing setting out of connector pins.

Fig. 2 shows the bottom of the former drilled and tapped to take ordinary valve legs, which can be purchased for a few pence, and will fit the standard "R" type valve holder.

Fig. 3 is the front of the switch, made of a piece of ebonite 2 ins. square, $\frac{3}{8}$ in. thick, studs $\frac{1}{2}$ in. long, screwed in, leaving $\frac{1}{8}$ in.

at the back for soldering connection. A small peg screwed in where shown will act as a stop for both ways.

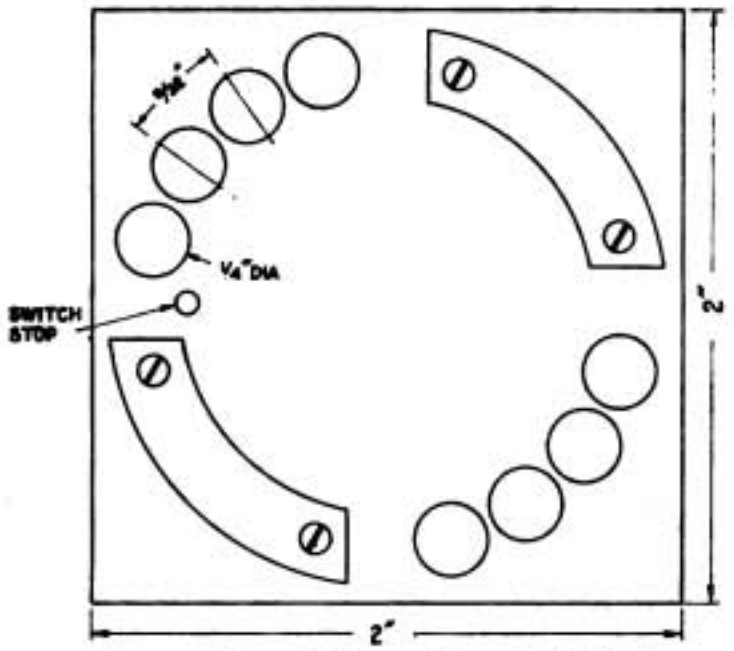


Fig. 3. Front piece with contact studs and plates.

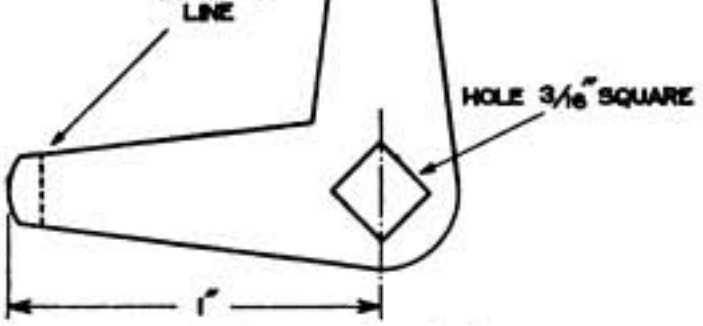


Fig. 5. A switch.

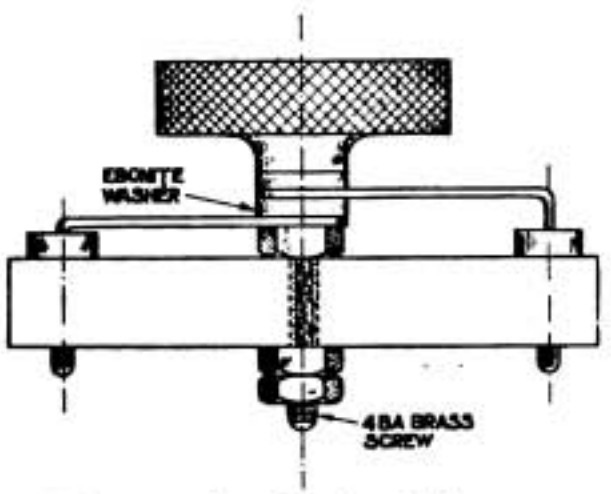


Fig. 7. Assembled switch parts.

Fig. 4 is for the contact plates, and can be turned out of brass or bronze, and cut where shown, having two small holes drilled for fixing, one or both fixing screws projecting at the back of the ebonite for connections.

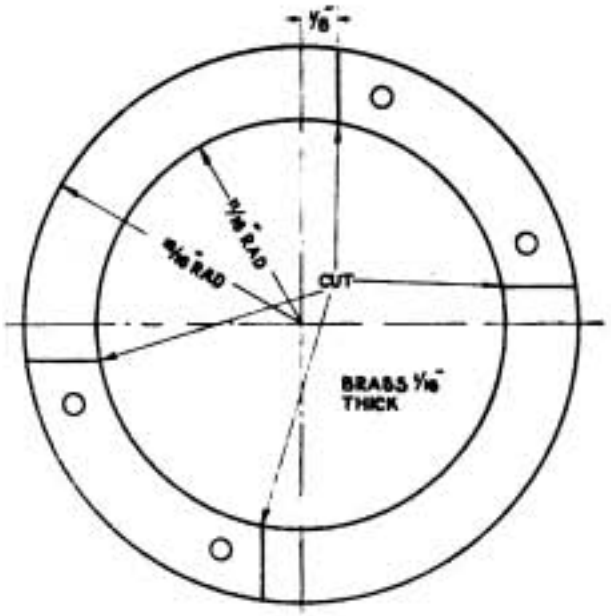


Fig. 4. Method of cutting contact plates.

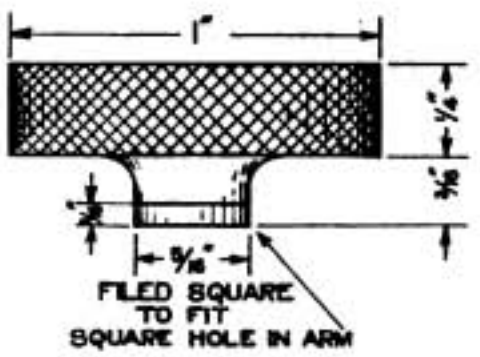


Fig. 6. Ebonite Knob.

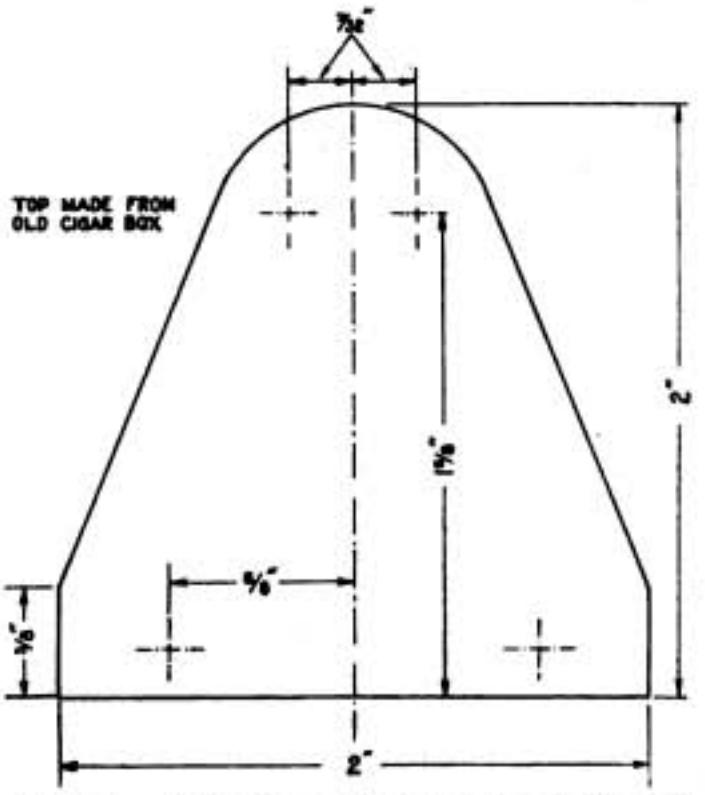


Fig. 8. End piece for attaching bobbin to switch plate.

Fig. 5 shows one switch arm. There must be two of these, the only difference being that one is $\frac{1}{16}$ in. longer, and a 4 B.A. *round hole* in the centre. These can be made of thin springy brass or bronze.

Fig. 6 is the ebonite knob. Great care must be taken in fixing the two arms to see that they do not touch one another. The arm with the square hole should fit on the square part of the knob, and a small ebonite washer $\frac{1}{16}$ in. thick, $\frac{5}{16}$ in. diameter, with a 4 B.A. hole must go between the arms, and be assembled as in Fig. 7.

Fig. 8, I think, will explain itself.

Now wind each slot in the former with 90 turns of 40 S.W.G., S.S.C., copper wire. Care must be taken to wind all slots in the same direction. Every other slot will be primary, secondary, primary, secondary, and so on. If two $\frac{1}{16}$ in. holes are drilled lengthways right through the edge of former, as shown at A, Fig. 2, the wire can be conveniently run from slot to slot, using one row of holes for primary and the other for secondary. Connect the first finish of primary with the second start of primary, and so on until the fourth. Then repeat the same way with the secondary, leaving about 1 in. of wire to spare for tappings, and connect as the diagram Fig. 9.

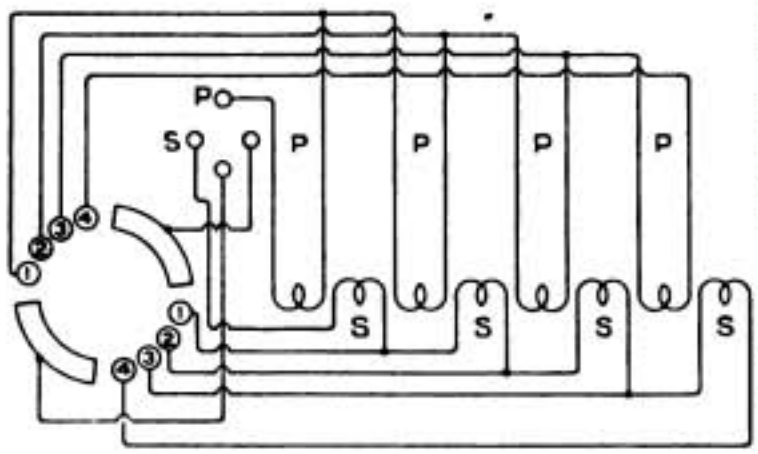


Fig. 9. Connecting up windings.

The first stud covers 350 to 370 metres with half the condenser value; *between* first and second stud 370 to 420 metres. The second stud gives 420 to 600 metres, the third stud 600 to 900 metres, and the fourth stud 900 to 1,100 metres. If this transformer is well made, it is well worth the little trouble involved.

A Cheap Method of Obtaining H.T. for Telephony Transmission

MOST amateurs possessing transmitting licences are generally very much handicapped by the high cost of high voltage direct current, whether obtained by a generator or by dry batteries. The author has been conducting some experiments for obtaining smooth D.C. suitable for telephony from an induction coil and has met with great success, the cheapness of the method being extraordinary.

The way in which it is done is as follows: First obtain an old induction coil and rewind it for a primary voltage of about 6 to 10 volts, with a step up of about 100:1. The author uses an old Army T.V.T. unit, which is very satisfactory and does not require altering. Having obtained your high voltage alternating current the next step is to rectify it, and for this purpose the ordinary "R" valve will be found entirely satisfactory; to get ten watts, two in parallel should be employed. The plates and grids of these valves are connected together and the current passed through them from filament to plate, taking care to see that the pulse of current at break is utilised as it is much larger than that obtained at make. The direct current thus obtained is very uneven and is of no use for telephony unless it is smoothed out by means of condensers; a condenser of sufficient size to stand 600 volts or more is, however, an expensive item, but quite a suitable condenser can be made for about five shillings by purchasing three 2 MF. Mansbridge condensers and connecting them in series. Using this arrangement the author gets 25 milliamperes at 400 volts and the C.W. is perfectly smooth, giving good telephony. This seems to be a satisfactory solution of the problem of obtaining cheap high tension for telephony transmission.

M. C. E.

A Simple Form of High Tension Battery

THE plates of this battery are made of sheet lead about $\frac{1}{32}$ in. thick. They may be cut out by means of shears or a wood chisel, the shape shown in Fig. 1 being the most economical as only the small cross-shaded pieces are waste.

To increase the capacity the surface of the lead is indented or roughened by squeezing it in the vice against a rough file or rasp, one face only of each plate being so treated.

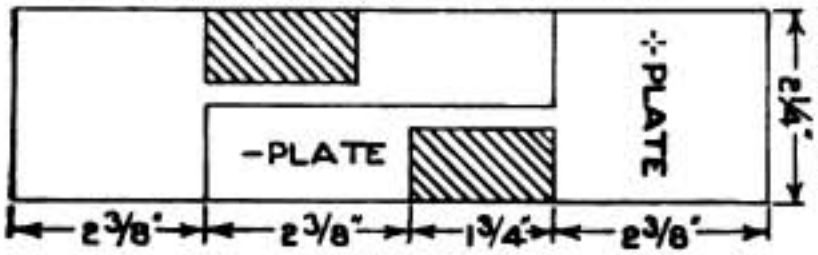


Fig. 1. Dimensions of the plates.

The plates are then formed into cylinders by bending them round rods of suitable size, the roughened surface being inside the larger cylinder and outside the smaller.

The most suitable containing vessels are round glass tubes known as " specimen tubes," about three inches high and one inch diameter, obtainable from dealers in chemical apparatus. A wood tray to contain any required number of these tubes is made, allowing about $\frac{1}{8}$ in. between the tubes for insulation, and drilling a number of holes through the bottom for draining spilt acid. The tray may be supported on four ebonite feet.

The inside of the tray is then painted with anti-sulphuric enamel and a framework of ebonite strips fitted into the bottom to support and insulate the cells. Lateral movement at the top of the cells is prevented and insulation secured by rods of glass or ebonite $\frac{1}{8}$ in. diameter, fitted into grooves in the sides of the tray.

When the tubes are in position a small piece of glass or ebonite rod is placed across the bottom of each cell to allow any sediment to fall clear of the plates. To keep the plates from contact with each other within each individual cell, thin perforated ebonite is used, cut to size with scissors, warmed, and bent round the smaller cylinder.

The plates are then fitted into the cells, beginning at the positive end with a single outer cylinder. The connecting strap of the next pair is then bent so that when the negative cylinder is placed in the centre of the first positive, the attached positive will just fit into the second cell. When all the plates are in position, the strap of the last negative (a small single cylinder) and the first positive are fastened to terminals fixed to an ebonite plate screwed to the side of the tray.

The cells are then filled with dilute sulphuric acid (sp. gr. 1180) to the level of the plates, and oil, known as Price's " Blancol," poured on the top to a depth of $\frac{1}{8}$ in., to prevent spraying and evaporation.

The plates are " formed " by the Planté process of charging in one direction and discharging, then charging in the opposite direction and discharging. After this has been done a number of times the cells will be found capable of maintaining a current of

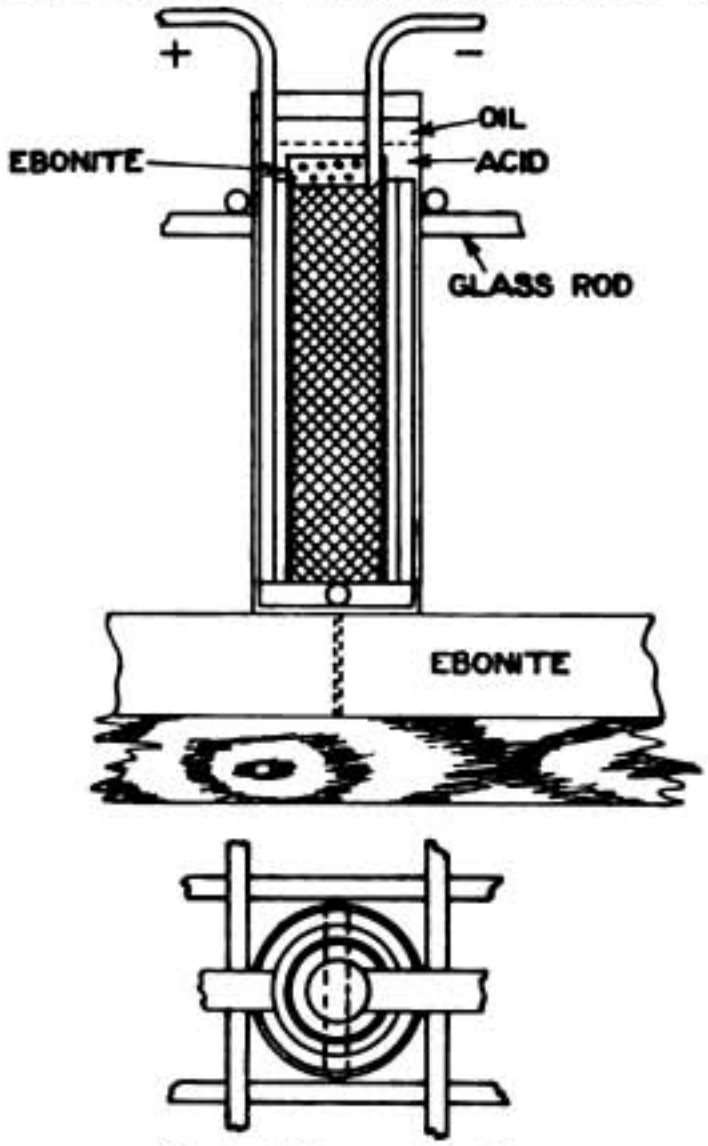


Fig. 2. The complete cell.

ten milliamperes for five hours or a smaller current for a longer time.

The rate of charge is from 20 to 30 milliamperes.

A number of these batteries have been in satisfactory use for some months in the wireless section of the Electrical Engineering Dept. of the City and Guilds Engineering College.

Notes

French Railway Experiments.

A committee of experts in France, who have been conducting research with telegraphy on moving trains on the Paris-Orleans line, report that their efforts have met with success. A small portable apparatus was used, and long distance signals were clearly received while the train was moving at full speed.

It is now hoped that with special aerials affixed to the roof of a coach telephony will also be received.

During their experiments members of the committee set up apparatus at some of the stations on the tour and invited farmers and others to listen-in.

Telephony Reports of Weather Forecasts.

Dr. G. C. Simpson, the director of the Meteorological Office, told the mathematical and physical science section at the British Association meeting that he anticipated that weather forecasts would soon be issued by telephony. A plan of this nature, he said, had already been prepared with details worked out for distributing the "general inference" by wireless telephone as soon as there was an organised scheme for broadcasting in this country. Forecasts would be issued in this way by the Meteorological Office immediately broadcasting was authorised.

British Association Demonstration.

As previously announced, the Meteorological Office and the Air Ministry provided a demonstration during the meeting of the British Association at Hull. It was shown by weather forecasts that anyone possessing a small receiving set can pick up the messages at the hours fixed by the Air Ministry, Eiffel Tower and other stations.

Although the messages received were in code, it was clearly demonstrated that the code was not secret and was decipherable by any amateur, and that the information could be utilised by all who cared to study the method. (See articles appearing in this journal).

Concerts by 2 LO.

Permission has been applied for to broadcast wireless concerts from Marconi House on Friday and Saturday, September 22nd and 23rd at the following times: 5—5.30; 6—6.30; 7—7.30 p.m.

These transmissions are dependent upon permission being received from the Postmaster-General. They will be in aid of the Ex-Services Welfare Society's Carnival at Holland Park Hall.

Dissolution of Partnership.

Mr. J. Griffin and Mr. J. O. Nichol, wireless specialists, trading under the title of the Star Delta Wireless Company, at 333a, Oxford Road, Manchester, have dissolved partnership. Debts will be attended to by Mr. Griffin.

Anglo-American Service.

Telegraph offices and cable company offices in the United States were opened on September 12th to accept messages for wireless transmission to Great Britain by the service conducted by the Radio Corporation of America and Marconi's Wireless Telegraph Co., Ltd.

Cost of French Weather Warning Stations.

Weather forecasts sent out by the National Meteorological Office of France for the benefit of agriculturists are received on sets installed at parish schools or gendarmerie stations at a cost of 200f. (£4). Weather warnings are given locally by sounding a bell.

Stolen Apparatus.

At Penge Police Court, William Thomas Hinton and James Watts were each sentenced to two months' imprisonment with hard labour for being concerned together in stealing from a railway truck at the goods depot at Penge Railway Station a wireless receiving set valued at £4 10s.

Coming Exhibition at Manchester.

Space is now being booked for a Wireless Exhibition to be held at the City Exhibition Hall, Manchester, in the last week of April.

The Fire resulting from the recent attack on **MFT.**

Clifden.

The accompanying photograph is a snapshot taken by Mr. A. J. May at the wireless station at Clifden, Ireland, and illustrates the burning of a part of the station during recent fighting in that district. The damage done to the station was referred to in our issue of August 5th, page 594,

Broadcasting Progress.

On Tuesday, September 12th, a meeting took place in London between the Committee of the proposed Broadcasting Company and certain officials of the General Post Office. As a result of this meeting it is understood that an official statement on the subject of broadcasting may be expected from the Postmaster-General very shortly.

Experimental Station Design: A Correction.

In Fig. 6(*b*), p. 794, the positive and negative connections of the H.T. battery have been shown reversed. The H.T. positive should, of course, go to the plates of the valves.

Edinburgh Society's New Station.

Edinburgh and District Radio Society's new transmitting station has the call sign **2TF** and not **2FT** as previously stated.

Elementary School Set at Southampton.

At the celebration of the coming of age of the Winnington Road School, Southampton, the formal inauguration of a wireless receiving apparatus took place.

Lost Postal Packets.

The Secretary of the Wireless Press, Ltd., having been advised that the mail intended for his company has been tampered with, he would be glad if any of our readers who have sent communications to the Company and who have not received replies, would forward, addressed to him, full particulars of such communications.

La Fayette.

At the new station to be opened at La Fayette, Bordeaux, the Société Française Radio-Electrique is to carry out the work of equipment. The type of apparatus will be the same as for Sainte Assise.

The West London Wireless and Experimental Association.

Mr. Horace W. Cotton, Hon. Sec., 19, Bushey Road, Harlington, Middlesex, has issued a special notice as follows:—On and after Friday evening September 22nd, 1922, and every subsequent Friday, the meetings of this Association will be held at its new headquarters at Stamford Brook Lodge, Ravenscourt Park, W.6 (close to Stamford Brook Station, District Railway), from 7 to 10 p.m.

Re-charging of Batteries.

In order to meet the requirements of suburban and other users of "Hart" portable batteries in London, the Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, intend inaugurating a motor service for re-charging. For a few shillings monthly, we are told, they would send regularly to various districts in and around London, and collect batteries, and promptly re-deliver them in a fully charged condition, ready for use. The scheme will mature if sufficient users take advantage of it. When communicating with the Hart Accumulator Company the voltage and capacity of the battery in question and the approximate number of times per annum the battery would be required to be recharged should be mentioned, and the letter marked "For Wireless Department."

Calendar of Current Events

Friday, September 22nd.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Construction of Society's Apparatus," by Mr. S. Burman.

WAKEFIELD AND DISTRICT WIRELESS SOCIETY.

Lecture by Mr. H. E. H. Burbury.

LEEDS AND DISTRICT AMATEUR WIRELESS.

At 8 p.m. Second Annual General Meeting.

Sunday, September 24th.

Daily Mail Concert from the Hague **PCGG** 8 to 9 p.m. B.S.T., on 1,085 metres.

Monday, September 25th.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

Sale and exchange of apparatus at 55, Fonnereau Road, Ipswich.

ILKLEY AND DISTRICT RADIO SOCIETY.

At 8 p.m., at Regent Café. Morse practice.

Tuesday, September 26th.

Transmission of Telephony at 8 p.m. on 400 metres by **2MT** Writtle.

Wednesday, September 27th.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At 111, Station Road, Redhill. Lecture on "Phones and Loud Speakers," by Mr. White.

PORTSMOUTH AND DISTRICT WIRELESS ASSOCIATION.

A special lecture by Mr. Gall.

Thursday, September 28th.

Daily Mail Concert from the Hague **PCGG**, 8 to 9 p.m. B.S.T., on 1,085 metres.

RADIO EXPERIMENTAL ASSOCIATION. NOTTINGHAM AND DISTRICT.

Meeting at Room 74, Mechanics' Institute. Discussion on Mr. Ford's lecture on "Radio Measurements." Subscriptions due.

Friday, September 29th.

WIRELESS SOCIETY OF HIGHGATE.

At Highgate Literary and Scientific Institute, South Grove, Highgate, N.6. Annual General Meeting, Election of Officers, Annual Report, etc.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Oscillatory Circuits," by Mr. A. G. Warren, M.Sc.

Sunday, October 1st.

Daily Mail concert as above.

Monday, October 2nd.

ILKLEY AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. at Regent Café. Morse practice.

Tuesday, October 3rd.

Telephony by **2MT** Writtle, as above.

GREENWICH WIRELESS SOCIETY.

At 7.45 p.m. At Rangers House, Blackheath. Ordinary Meeting.

Wednesday, October 4th.

PORTSMOUTH AND DISTRICT WIRELESS ASSOCIATION.

Lecture on "Portable Receivers," by Mr. Donkin.

Thursday, October 5th.

Daily Mail concert as above.

Wireless Club Reports

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

West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

A meeting was held on August 31st. Buzzer practice was attended by a good number. Owing to several members still being on their annual holidays nothing exceptional was arranged for. "Listening in" on club's apparatus and an informal chat took place; many questions as to the restriction in connection with the use of reaction circuits were asked, and a question in form of a resolution was sent to the Wireless Society of London in connection therewith. A good attendance was made.

On September 7th another meeting was held. The Morse practice class was well attended. Mr. J. F. Bruce related his experiences in connection with the Armstrong circuit and loop aerial, and much information was given to the members present in connection therewith.

Members are asked to turn up strongly in future and to watch for forthcoming events. It is hoped to have many lecturers from the Wireless Society of London down during the winter session. The Secretary will have much pleasure in replying to any inquirers as to membership, etc.

Club rooms, Belmont Road, Chiswick, W.4.

The Wallasey Wireless and Experimental Society.*

Hon. Secretary, Mr. C. D. M. Hamilton, 24, Vaughan Road, Wallasey.

On Thursday, August 10th, Mr. Smith kindly read the Society a paper entitled "Useful Wireless Data."

The paper was most instructive and entertaining. A hearty vote of thanks to Mr. Smith was passed on the termination of his lecture.

On Saturday, the 19th, experiments were conducted at Irby Hill, with a two-valve receiver. Excellent results were obtained.

The Society's thanks are due to Mrs. Dodd, who kindly lent the field in which the experiments were made.

Members are requested to note that owing to the Hague concerts, the meeting night has been altered to Wednesday, starting at 7.30 p.m.

Smethwick Wireless Society.*

Hon. Secretary, Mr. Ralph H. Parker, F.G.S., Radio House, Wilson Road, Smethwick, Staffs.

A meeting was held on Friday, August 11th, Mr. J. Stoney, B.Sc., A.M.I.M.E., in the chair. After the usual buzzer practice the meeting was left open for discussion; it was also arranged that some of the senior members should give short and concise lectures bearing on the elementary principles of wireless for the benefit of a large number of new members.

Mr. C. Grew gave a short discussion on aerials on Friday, August 18th, which was very much appreciated.

A lecture entitled "That Little More Per Cent. Efficiency" was given on September 2nd, by Mr. McKerle. After a vote of thanks had been passed, Mr. Headley, of the Birmingham Club, gave some of his experiences of transmission and reception at Baggeridge Colliery at particular distances underground. A hearty vote of thanks was accorded to Mr. Headley who reciprocated.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

A general meeting was held at the Leeds University on Friday, September 8th. Mr. A. M. Bage (Vice-President) taking the chair at 8.0 p.m. The Chairman called upon Mr. H. Mortimer, of the P.O. Telephones (Leeds) to deliver a paper on "Automatic Telephony." Mr. Mortimer successfully conveyed to the meeting the principle upon which the complicated mechanism installed at the Leeds Exchange functioned. The lecturer briefly outlined the historical facts relating to his subject, and paid special attention to the work of Keith. The principles upon which the old hand-operated exchange worked were considered, in order that one could appreciate fully the great advantages attached to automatic operation. With the aid of lantern slides and the apparatus on view, the methods of automatic operation were explained and made clear to the meeting. The circuits were traced from a subscriber to the exchange by the open and underground wires. It is intended to substitute underground wires or cables for all overhead or open wires. The circuit in the exchange is completed by various apparatus, including the line switch, junctions, the selector switch, etc., and on to the called subscriber by underground and open wires. Most of the switches used seemed extremely delicate devices, being a combination of electrical and mechanical operations. The method of working public telephones was considered, and the means of rectifying faults treated. The lecture concluded with numerous lantern slides showing views of the Leeds Exchange.

The Chairman then opened a discussion, which undoubtedly resulted in the membership acquiring a much greater respect for the P.O. telephone than had hitherto been the case. Numerous practical and theoretical questions were ably dealt with by the lecturer. At the close of the discussion, a hearty vote of thanks was accorded to Mr. Mortimer, for his kindness and for the trouble he had been to in arranging so instructive and fascinating a paper.

The meeting then adjourned.

The second annual general meeting (for members only) will be held on Friday, September 22nd, at

8.0 p.m. Meetings next session will probably be held weekly, formal (general) and informal (instructional) meetings being held alternately. The Hon. Secretary is drawing up a syllabus of lectures, demonstrations, etc., for the approaching session, 1922-23, and will be pleased to hear from members of local societies, who would lecture before this Society. Intending members should apply to the Hon. Secretary.

The East London Radio Society.*

Hon. Secretary, Mr. L. E. Lubbock, King George's Hall, East India Dock Road, Poplar.

At a meeting held on Tuesday, September 5th, at the Lecture Hall, Woodstock Road, E.14, the matter of changing the Society's meeting night was discussed at length.

This Society is a large one. It is becoming larger every week and all the members are keen to attend regularly. So much so that it was difficult to find any one night to satisfy everyone. After a considerable amount of discussion it was unanimously decided that it would be absolutely necessary, in view of the increasing membership, to have the Society's accommodation and apparatus at the disposal of the members for at least two evenings every week; these to be Tuesday and Friday.

The first Tuesday in every month being Committee night, the Management Committee then adjourned to their own room, leaving the rest of the members, with the Society's four-valve set, listening in.

The Management Committee arranged the programme for the next month, reserving Tuesdays for lectures and debate, and Fridays for experimental work.

The new arrangement of meeting nights promises well, for on Friday, September 8th, even more members attended than on the previous Tuesday.

The meeting was opened with the usual buzzer practice, after which the Society's sets were put into operation and the members spent the rest of the evening in open discussion. A very pleasant evening ended at 10.15 p.m. with a hearty vote of thanks to the Chairman.

Wakefield and District Wireless Society.*

Hon. Secretary, Mr. Ed. Swale, 11, Thornes Road, Wakefield.

A meeting of the above was held in the Physics Laboratory of the Grammar School, at 8.0 p.m. on Friday, September 8th, Mr. Wrigley in the chair. The minutes were read, after which Mr. G. E. Welch was called upon to deliver his lecture on "Simple Facts and Experiments in Electricity."

For upwards of an hour Mr. Welch described the composition of batteries of various kinds, building of an ammeter, voltmeter, measurement of voltage and resistance, electro-magnetism, etc., together with apparatus and blackboard illustrations.

The Chairman moved a vote of thanks for his kindness in making the meeting such a success. Mr. Haig seconded, and the vote was passed very heartily.

The members are looking forward to Mr. H. E. H. Burbury's lecture on the 22nd, probably at the Y.M.C.A., Grove Road, to which intending members are cordially invited.

Wireless and Experimental Association.*

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

At the meeting of the Association at the Central Hall, Peckham, on Wednesday, September 6th, Mr. Voigt, fresh from his holidays, detailed the various experiments which he had carried out with the Postmaster-General's permission on a portable receiving set at the hotel where he stayed.

From above the roof to the metal pipes below the cellar floor and every inch in between he carried out his researches, and even did not cease experimenting in the railway carriage which conveyed him home, and, as one might expect, some of the results he got were worthy of note.

His fellow members shared his successes with him on Wednesday, his failures they sympathised with, and few did not add to their sum of wireless knowledge as the result.

The Association went into committee to consider what should be done to meet the vague threats on their liberties, and the Secretary was instructed to write to the Postmaster-General to seek light upon their present and future position. A letter was written and sent to the Secretary, Wireless Section, G.P.O., on the subject of prohibition of the use of amateur constructed receiving apparatus. The letter offered the suggestion that all members of a properly organised and affiliated Wireless Society may be decent *bona-fide* experimenters, and stated that the Association's committee would do all in its power to assist in "keeping order in the ether."

Ilkley and District Wireless Society.

Hon. Secretary, Mr. E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

The Fourth General Meeting of the Society was held at the premises of Mr. Francis Law, Tower Buildings, Ilkley, on September 11th. The chair was taken by the President, Dr. J. B. Whitfield. Following the reading of the minutes of the previous meeting a resolution was passed, deciding on the construction of a receiving set for the society. A committee was appointed to draw up a scheme and prepare estimates to be brought before the next general meeting.

The Chairman then called on Mr. Law to give his lecture on "The Theory, Use and Maintainance of Accumulators." The lecturer commenced by showing the difference between primary and secondary cells and demonstrated the principle of the accumulator in its simplest form by means of "Planté's Electrolysis experiment." The development of this was then traced up to the storage cell as used in practice at the present day. The different makes of cell were explained in turn, the construction of the plates being dealt with in detail. Mr. Law then proceeded to give some very useful hints on the care of cells. The allowable rates for charge and discharge were dealt with, with particular regard to the needs of the wireless amateur using one or more valves. Instructions for charging cells at home, where necessary supply of current is available were given, and the causes of sulphating and buckling were explained, together with the appropriate remedies where such are possible.

At the close of the lecture a hearty vote of thanks was accorded to Mr. Law, and an interesting discussion followed.

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Belvedere and District Radio and Scientific Society.

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

A successful meeting of the above society was held on Friday, September 8th, at the Erith Technical Institute, for the purpose of enrolling members, a preliminary meeting having been held in July. The President (F. J. Watson, Esq.) was in the chair.

The programme of weekly meetings for the month of September was arranged. Lectures were to be given by Mr. A. G. Warren, M.Sc., M.I.E.E., F. Inst. P., on "Scope of Wireless" and "Oscillatory Circuits." Mr. S. Burman will commence a series of lectures on "The Construction of the Society's Apparatus."

The Secretary was instructed to apply for affiliation to the Wireless Society of London.

There were 47 members enrolled and it is hoped that this number in the near future will be considerably increased.

The Secretary will be pleased to give full information to amateurs living in Erith, Belvedere and district.

Fulham and Chelsea Amateur Radio and Social Society.

Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W.6.

A general meeting of the above Society was held at their temporary headquarters at the Social Centre, Townmead Road, Fulham, attendance for the evening being 45 and new members enrolled numbered 8.

The crystal set was fully discussed by the members, and numerous question papers were handed in. The majority being dealt with by the Secretary.

Ladies are specially invited to join the above Society. Full particulars may be obtained from the Secretary.

The Fulham and Putney Radio Society.

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

The above Society started the autumn season with a meeting at their new headquarters on Friday, September 8th. The new headquarters is a large studio centrally situated, and has a large aerial fitted, and has been kindly lent by Mr. E. Vernon Barker, M.P.P.A.

As a prologue to the meeting Mr. Barker switched on his set and the members heard the result of the air race through a Brown loud speaker.

A considerable amount of business was done at the meeting, a new committee was formed to deal with the rules, etc. By a vote of the members it was found that Friday evening was a more suitable night for the meetings, and so the future meetings will be held on that night. A large number of new members were enrolled with promises of more to follow. It was decided that the first Friday in each month should be set apart for lectures and it is hoped to start with a well-known lecturer on the October meeting, the between meetings to be devoted to Morse buzzer practice and minor demonstrations and discussions.

At the conclusion of the business Mr. E. Vernon Barker, who is a member of this and the Willesden Society, explained his apparatus to the members, and with five valves and the Brown loud speaker obtained music and singing that was rendered particularly clear and free from the usual disturbances. Mr. Barker was congratulated upon the completeness and arrangement of his apparatus and it was nearly 11 p.m. before the meeting closed.

All amateurs in the district are cordially invited to join the Society, and are assured of a continuance of instructive and entertaining meetings.

The Society has been formed purely as a Wireless Society devoted to the assistance of the amateur and novice in the science of wireless telegraphy and telephony.

Southampton and District Wireless Society.

Hon. Secretary, Mr. T. H. Cutler, 24, Floating Bridge Road.

The weekly meeting of the above Society was held on Wednesday, September 6th, at Kingsland Assembly Rooms. A fair attendance was recorded. Dr. MacDougall brought his three-valve receiver to the meeting and gave an interesting demonstration, which was thoroughly enjoyed by all present. Mr. Goodall, of Southampton, also gave from his experimental station for the benefit of the Society, a transmision of speech and music. At the conclusion of the meeting a hearty vote of thanks was accorded to Dr. MacDougall and Mr. Goodall. The Society are now organising demonstrations fortnightly, and lectures by well-known people, and a pleasant time should be in store for the coming winter. All particulars, etc., can be obtained from the Hon. Secretary.

Portsmouth and District Wireless Association.

Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

On Wednesday, September 6th, the usual monthly meeting was held at the Pile Memorial Rooms, Fratton Road. A large number were present and four new members were elected. In view of an anticipated large increase in membership, a Vice-President was also proposed, Mr. Stevenson being unanimously elected to fill the post.

In future it has been decided to hold two business meetings each month, the first and third Wednesdays suiting the majority of the members.

A visit was recently made to the local electric light and power station. This visit was arranged by Mr. Lawrence, a station engineer, and a most enjoyable afternoon was spent by all those present.

Forthcoming lectures include the following:—September 27th, a special lecture by Mr. Gall. October 4th, "Portable Receivers," by Mr. Donkin. October 11th, "Charging Accumulators by the Noden Valve off A.C. Mains," by Mr. R. Cole.

Barnes, Mortlake and Richmond District Wireless Society.

Hon. Secretary, Mr. Eric A. Rogers, 122, Wood Street, E.C.2.

The first meeting of the above was arranged to be held at Inglenook, Sheen Gate Gardens, East Sheen, on Wednesday, September 20th, by kind invitation of Mr. and Mrs. Davy.

Mr. Blake has kindly accepted the office of President of the above. The Society's future and its rules were discussed.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/,13 Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requiremenent, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"E.P." (Bexley Heath).—(1 and 2) See various answers which have appeared in the last few issues to queries on this point. (3) 45 plates for 0·0005 mfds. Numbers for other capacities in proportion.

"F.M." (Sydenham) *asks re the Armstrong super-regenerative circuit. (1) If crystal rectification is possible instead of one of the valves in this circuit. (2) What are the merits of potentiometer grid control. (3) If it is possible to determine the hardness of a valve by judging the type of discharge with a spark coil put across the plate and filament.*

(1) Not possible, as is evident from the whole principle of the circuit. (2) Potentiometer control enables the adjustment of the working point to the best part of the valve characteristic more accurately than can be done by a fixed connection. (3) A hard valve in anything like condition is too hard to give results in this way—moreover, if obtained, the results would be seriously detrimental to the valve.

"INKY" (Newbury).—The amplifier may be as in Fig. 1, to be introduced instead of the telephones of your set, but why specify separate batteries which are wasteful and in no way improve results.

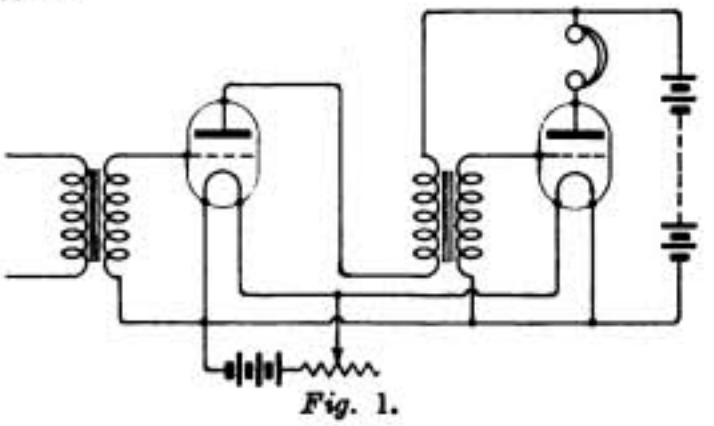

Fig. 1.

"W.E.R." (Histon) *gives a diagram of a circuit which he wishes to adapt for short wavelengths and asks (1) For various windings and suitable capacities. (2) If using 4,000 or 8,000 ohm telephones in place of 2,000 ohm. would appreciably increase signal strength.*

(1) For remarks on circuits of this type see note at the head of these columns. Parallel A.T.C. is worse than useless at short waves. L.1 might have 120 turns with a mean diameter of 2″. L.2, 100 turns with a similar diameter. L.3 is best omitted. Suitable condenser values have been given repeatedly. (2) You might expect 15% to 25% improvement.

"M.N." (Prague) *asks (1) The meaning of the abbreviation "O.K." (2) Actual sizes of certain gauges of wire. (3) Which of two possible sizes of wire to use in place of the one suggested. (4) What is the shortest wavelength on which a capacity resistance receiver is efficient.*

(1) A phonetic abbreviation for "all correct." (2) See below. No. 10 = 3·25 mm., 12 = 2·64 mm., 14 = 2·03 mm. 16 = 1·63 mm., 18 = 1·22 mm., 24 = 0·56 mm., 32 = 0·27 mm., 34 = 0·23 mm., 38 = 0·15 mm., 42 = 0·10 mm., 44 = 0·081mm., 46 = 0·061 mm., 47 = 0·051 mm. (3) We should prefer the thicker wire unless it is absolutely necessary to get the full range in which case the thinner wire should be used. (4) About 1,000 metres, but there is no definite or sharp limit.

"JUMPER" (Woking) *asks* (1) *If a reactance condenser could be used instead of a reactance coil in the H.F. amplifier and detector circuit described in the issue of July 22nd, and if so, the capacity.* (2) *If telephone lines running at right angles about 10 ft. below his aerial affect its working.*

(1) Yes, except for the limitations imposed by the P.M.G. on both these types of reaction. We are afraid we cannot state a "safe" value for the capacity required without experiment. (2) Probably not.

"G.W.D." (Durham) *asks for a diagram for a three-valve receiver.* (2) *Size of former and wire for reaction coil for use with this set.*

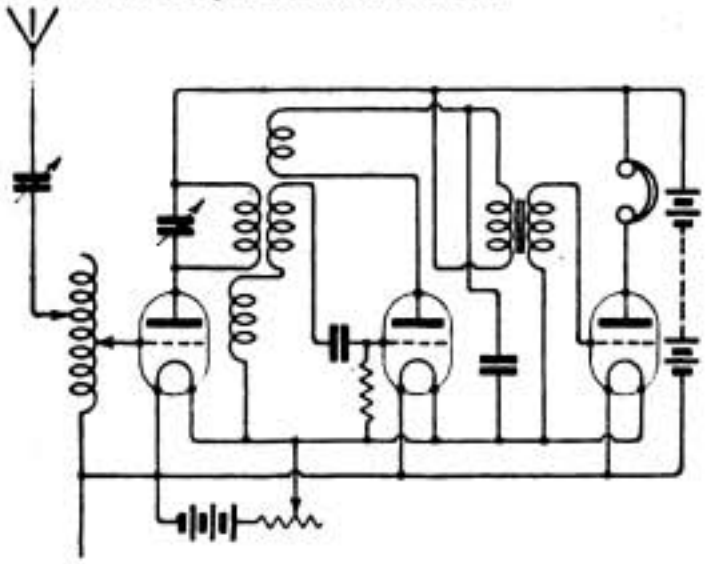

Fig. 2.

(1) See diagram (Fig. 2). (2) See note at the head of these columns on the subject of reaction, but with circuit given 4" × 3" of No. 26 should be all right provided that there is no coupling between the A.T.I. and the remaining coils.

"W.R.G." (Tiverton) *has a certain make of telephone transformer and asks how same is connected up, and why there are only three connections.*

From the information you give there appears to be a H.R. winding across P and $P'-$, and a L.R. winding across the telephone terminals. Cross-connecting one side of each winding in the manner shown in fairly common practice—connections for each circuit should, of course, be made to the black lead. We cannot say whether a condenser is incorporated—probably not.

"W.R.S." (Burgess Hill).—(1) *A.*—0·005 mfds. *B.*—0·002 mfds. *C.*—0·002 mfds. *D.*—0·001 mfds. (2) Yes. (3) 2 megohms. (4) No. For comments on reaction sets of this type, see note at the head of columns.

"LUCK" (Grimsby) *asks* (1) *The resistance of a single telephone receiver wound full of wire of which he encloses sample.* (2) *Where to obtain diaphragms of any size or thickness.*

(1) We are quite unable to say from the information furnished, but it is probably fairly high—say, 1,000/2,000 ohms. (2) You will find it very difficult to obtain diaphragms of *any* size or thickness, but you should be able to get common sizes from dealers in accessories, or from telephone makers, who might possibly agree to cut you special sizes.

"GRID MODULATION" (Liverpool) *asks* (1) *With regard to a modulated grid circuit if it is necessary for both grid and plate circuit to be tuned.* (2) *With reference to a microphone transformer, page 132, in May 28th issue, if this transformer would be more efficient if enamelled wire were used for the secondary.* (3) *With reference to Fig. 6, page 131, May 28th issue, what is the value of the by-pass condenser C.*

(1) In a grid modulated oscillator it is not in general necessary to tune the grid circuit as well as the plate, although in some cases it is desirable to do so. The best value of the grid coil for each case should be determined by experiment. (2) There is very little difference in efficiency, but enamelled wire needs rather more careful handling. About 3 ozs. should be sufficient. (3) About 0·001 mfds.

"....." (Kingston-on-Thames) *asks* (1) *Reason for a sudden falling off and then increase in signal strength when receiving Leafield with a 6-volt accumulator which had run down.* (2) *If atmospherics would be of equal strength at two receiving stations with aerials of different heights.*

(1) It is not possible to give an absolute reason without careful experiment, but it is probably due to the drop in filament voltage lowering the position of the upper bend of the charactoristic and bringing it back to the point of grid potential on which the valve was operating. (2) We cannot give a hard and fast rule, but in general the atmospherics should be somewhat less troublesome with the lower aerial.

"C.G." (London) *sends some information about a tuner and asks* (1) *Wavelength it is suitable for.* (2) *If it can be used for crystal and valve.* (3) *If it is used in conjunction with the Armstrong super-regenerative circuit, whether music will be audible all over a room without a loud speaker.*

(1) The information supplied is insufficient for us to identify the instrument or to state range, but from particulars given it would appear quite unsuitable in its present form for a two-circuit tuner. You might rewind secondary with about 250 turns, using pile winding. The instrument should then be suitable for about 2,000 metres. (2) In its present form it might be used for A.T.I. and reaction, but this arrangement is not to be allowed in future owing to the possibility of re-radiation. (3) This depends very much on the rest of the apparatus employed, but probably not.

"J.C.B." (Cricklewood).—(1) and (3) You do not give us enough information to help you much. The components appear O.K., but as you give no diagram we cannot say whether your circuit is efficient. Try removing the reaction coil, which will not in future be allowed. (2) Yes. Put the H.R. telephones in series with the H.R. winding of the telephone transformer, which should be used with the L.R. telephones.

"A.C.McA." (Birmingham) *asks* (1) *How many honeycomb coils, with how many turns, should be used to tune to 10,000 metres with a 0·0015 condenser, the former being 2" × ½".* (2) *If it would injure the coils to soak them in shellac varnish.*

(1) Assuming 2" to be the diameter of the former, about six coils, with numbers of turns ranging from 25/400, should be provided. (2) The coils may be

dipped in thin shellac varnish if carefully dried afterwards, but they must not be left damp, or covered with an unnecessarily large amount of shellac.

"C.J." (Leeds) *asks the following questions about the Armstrong super-regenerative circuit.* (1) *Voltage of the various batteries.* (2) *If one battery can be used for the three filaments.* (3) *Data for the oscillation circuits.* (4) *Number of turns for a set of coils to cover all purposes on tuner and receiver. N.B.—As this circuit may radiate seriously when out of adjustment, it is almost certain to be prohibited by the P.M.G.*

(1) Grid batteries may be dry cells, up to 12 volts. Plate and filament volts should have normal values for the type of valve used. (2) Yes. (3) Values suitable for about 5,000 metres, say 0·002 mfds. and 3,000 mhys. A two-coil holder might be used. (4) The tuner is only suitable for short waves. The tuner coils might be 80 turns, and the oscillator coils 300.

"H.O.W." (Thames Ditton).—See diagram (Fig. 3) for the set required. The telephones should be H.R., and any recognised brand of hard valve may be used.

"S.F.H." (Barnes) *asks* (1) *Whether a separate heterodyne could be used with various types of crystal and valve sets.* (2) *For a diagram of a set to fulfil certain requirements.* (3) *Thickness of copper foil and what size* 10 *m/m mica must be to make a fixed condenser of* 0·002 *mfds.* (4) *Price of Berne List.*

(1) A separate heterodyne might be used with any type of receiver. (2) Your statements are very vague. We presume you require a range of 300 metres upwards, instead of downwards as suggested. Type of circuit to employ will depend on range required, *i.e.*, for broadcasting, a crystal set will do up to 20 miles, one valve 35 miles, two valves 50/60 miles, and so on. Circuits of each type have been repeatedly given. (3) 8 square cms. of overlap for the foils will be required. The thickness of the copper foil is immaterial. (4) About 20s. Amendments are published monthly.

"C.L." (Malvern) *asks* (1) *The best valve for L.F. amplification.* (2) *How much resistance to use to vary the plate voltage of a non-tapped H.T. battery.* (3) *If the L.F. transformer of a L.F. amplifier should be surrounded by an earth plate.* (4) *If it would affect reception if the reaction and A.T.I. leads were carried by four-wire flex, and also if the L.F. transformer leads were carried in the same way.*

(1) Special valves for this purpose, with very excellent performance, are being got out by the leading manufacturers, of whom you should make enquiries. We are obviously unable to single out any one valve in particular for favourable comment. (2) It depends on the type of valve and circuit. For a single valve circuit with a normal receiving valve, 1,000/2,000 ohms per volt would be needed. (3) Not usually necessary, but its use can do no harm. It should be of iron. (4) Yes. You would probably get serious howling trouble, particularly in the H.F. case.

"C.W.E." (Streatham) *submits a two-valve circuit and asks* (1) *For windings for* 3,000 *metres.* (2) *If the reaction coil and A.T.I. are inductively coupled in any way.*

(1) A.T.I. might be 9" × 6" of No. 22. As you have no other method of tuning, provision of taps would not be sufficient. A slider would be necessary. Reaction of the type suggested is to be prohibited in future by the P.M.G. Your set should therefore be much more efficient if arranged as in Fig. 5, page 573, July 28th issue. (2) In your circuit the A.T.I. and reaction coil should certainly be inductively coupled together, but see note above.

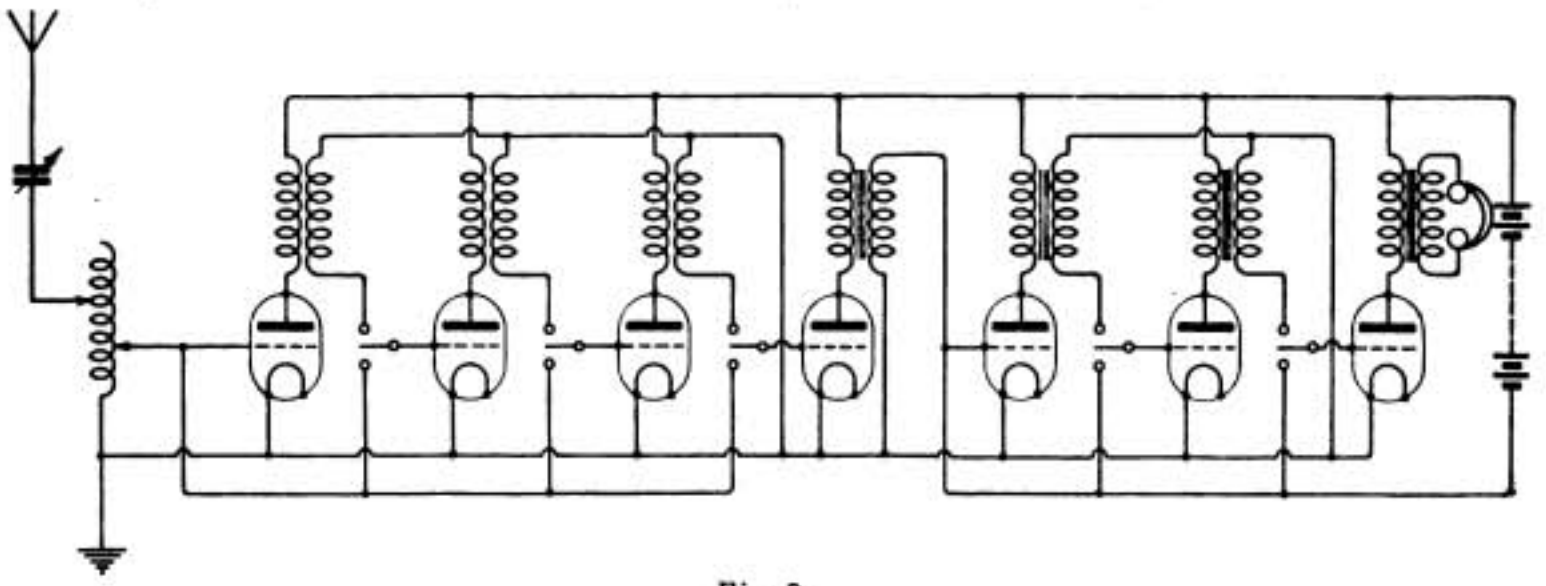

Fig. 3.

"J.B." (Gt. Yarmouth).—(1) The sets submitted only differ in minor points, and there should be very little difference in their respective performances. (2) You might get various British broadcasting stations on a three-valve set if your aerial were increased in height and length, but seeing that the use of reaction is to be so much restricted, the results obtained are not likely to be very good. (3) A 6′ length of ¼″ diameter brass tubing would make a fairly good earth if buried vertically in damp soil. (4) Additional L.F. amplification would be necessary for the use of a loud speaker.

"VERY INNOCENT" (London).—(1) The maximum wavelength with your aerial would probably be about 2,000 metres. Minimum 350 metres. This wavelength could be somewhat increased by adding a coil in series with the aerial.

"W.B." (Bradford) *sends diagram of a set and asks* (1) *For comments.* (2) *What arrangement of valves to use with it.* (3) *The reason for a particular tuning effect.* (4) *How to get* 200 *metres wavelength with basket coils.*

(1) The diagram sent is rather staggering. Your aerial is shown connected directly to earth, with the A.T.I. introduced somewhere in the grid lead. One side of your reaction coil is connected to the grid of the first valve, and the other side to nothing, and the remainder of your anode connections are wrong. We should advise you to consult carefully the many three-valve diagrams which have been given recently. (2) Probably best to use the "Ora" for the first valve, followed by the two "R" valves. (3) This is probably due to the set starting to oscillate, and the signals are improved gradually up to this point, and are then completely lost. For 200 metres the A.T.I. might have 50 turns with a mean diameter of 2½", with a series aerial condenser.

"S.G.O." (Birmingham) *asks* (1) *The probable wavelength of the proposed English broadcasting stations.* (2) *For a diagram of a set to fulfil certain requirements.* (3) *Maximum length of aerial allowed by the P.M.G.*

(1) Various values between 350 and 425 metres. (2) See diagram (Fig. 4). The loud speaker and various numbers of telephones may be introduced as desired in a position in which a pair of telephones is shown. (3) 100 ft.

"J.McV." (Belfast) *asks* (1) *For a diagram of a set suitable for the reception of* **PCGG** *and English concerts in Belfast.* (2) *If we advise replacing resistance capacity amplification with transformer coupling for short wave work, and also putting the A.T.C. in series.* (3) *If we recommend the new Armstrong circuit for use in his position.* (4) *Whether a certain aerial would be O.K.*

(1) See diagram given to **"S.G.O." (Birmingham)** above. (2) Yes, in both instances. (3) The set is capable of good results, but needs very careful and skilful attention. (4) Fairly good, but more than 20′ of height is desirable.

"W.E.R." (Holloway).—(1) The tuner suggested would be quite satisfactory. (2) The above circuit is quite suitable for all wavelengths with interchangeable coils, the variable condensers used having capacities of about 0·005 mfds. for short wavelengths, and somewhat higher values for long waves. (3) There is no danger of burning out telephones on a five-valve amplifier unless excessive plate voltages are used. The average plate current passing through the last valve of a multi-valve amplifier is very little different from that passing through the first valve, and is generally of the order of a milliamp. (4) Either a change-over switch or the jacks may be used.

"R.Y.H." (Monkokehampton).—The probable reason for your oscillation trouble is running your grid and plate leads too closely together. You may be able to stop it by applying a little positive potential to the grid of the first valve; also, the H.T. lead from the first anode should go to the positive of the H.T. battery and not the position shown. (2) It is quite possible that you may have difficulty in getting **2MT** at such a distance, unless your set is in the best possible adjustment, particularly as you are using a comparatively large A.T.C. (3) From the information given we cannot say what is the matter with your telephones, which have apparently developed some fault. We should advise returning them to the makers for overhaul. (4) This circuit is O.K. except for points commented on with your previous circuit.

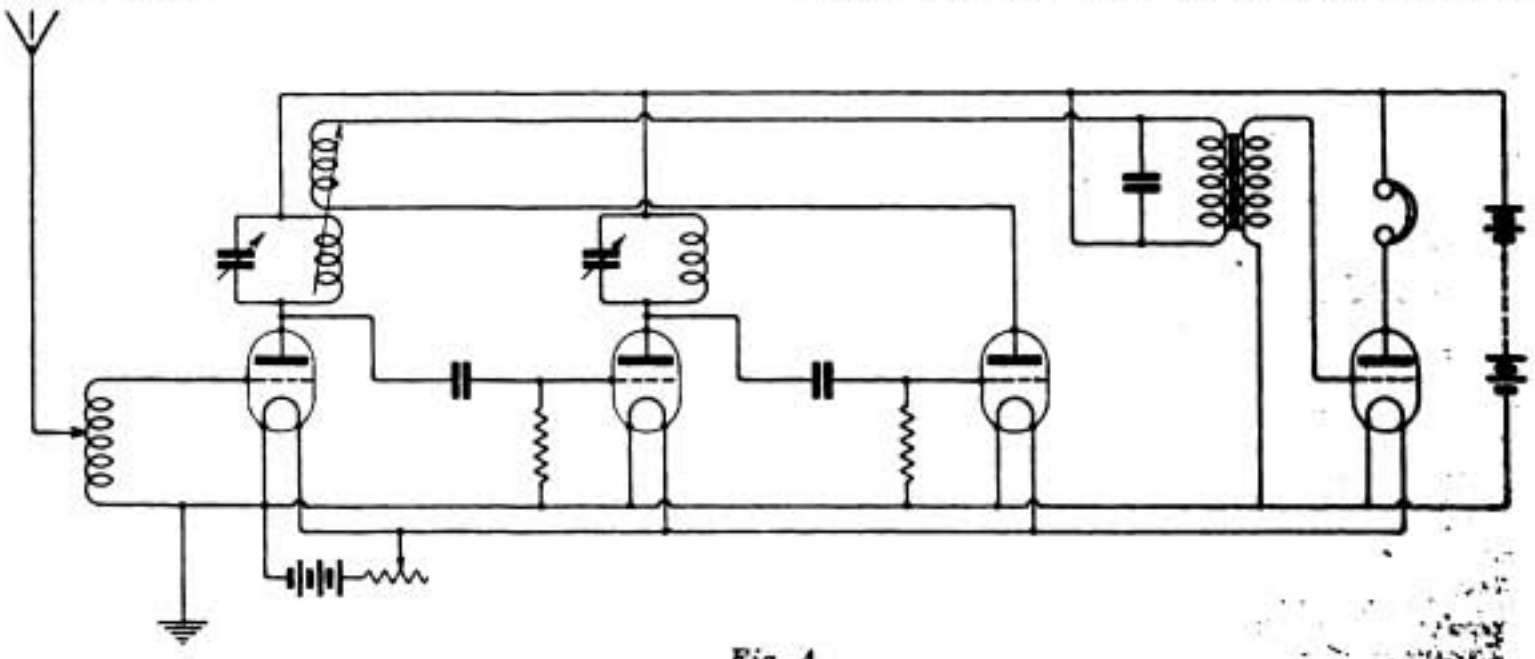

Fig. 4.

"A.N.H." (Edinburgh) *gets poor results with an aerial which is led in down a chimney, and asks for comments.*

The running of a lead close to brickwork is never satisfactory, and is probably worse than usual when the brickwork is covered with soot. You do not say whether the chimney is used for its normal purpose. If so, the bad results are probably due to a deposit of soot on the glass insulating tube. You do not describe the insulation at the bottom of the tube, which is also possibly affected. Possibly, also, your earth is not as good as it might be.

"AMATEUR" (New Barnet).—(1) The wavelength range would depend on the circuit used as well as the wire with which the A.T.I. is used. Best results would be obtained with condenser in series and the A.T.I. wound with No. 24. Maximum wavelength would then be about 1,000 metres with a normal aerial. (2) For receiving up to 9,000 metres, basket or honeycomb coils are more convenient in size than solenoids, and their performance is satisfactory electrically. (3) The cable submitted might be used for aerial and earth connections, but is too stiff for other purposes.

"C.M.M." (Stockwell) *asks* (1) *The gauges of three samples of wire.* (2) *Which is the most suitable for winding H.F. transformers.* (3) *Whether beechwood, boiled in paraffin wax, would be an efficient material for a H.F. transformer and, if not, for a good ebonite substitute.* (4) *How many transformers of the type indicated would be required to cover a range of* 150/2,000 *metres when used with a variable condenser.*

(1) A = No. 26. B = No. 34. C = No. 41. (2) No. 41. (3) Not very good. Millboard tubes, dipped in shellac and carefully dried, would be better. (4) Three would be sufficient, or four to allow a good overlap.

"....." (Southport).—(1) Better results are probably obtained because the coils have a less distributed capacity. Signals are generally somewhat stronger on a single circuit than they are with a double circuit. The latter is used because the extra selectivity which is given eliminates much trouble from interference. (2) There is no simple formula. If the coils are not coupled together, their number would be approximate as the square of the wavelength, but owing to the fact that the coils are generally very closely coupled, much less than this is actually needed. (3) The method suggested may quite well be used. (4) See various replies since the issue referred to.

"T.S." (Sydenham) *asks for a loose coupler to tune up to* 3,500 *metres.*

Primary might be 9" × 7" of No. 22, preferably with a slider. Secondary may be 7" × 5" of No. 26, with taps at ½", 1", 1½", 2", 4" and 5½". Closed circuit condenser may be 0 0005 mfds. at maximum.

"J.P." (Spain) *asks* (1) *If it is possible to receive* FL *telephony at* 800 *kilometres on a frame with a six-valve set, having* 3 *H.F. and* 3 *L.F.* (2) *If so, the size of the frame.*

(1) We should not expect very good results at this distance, but by careful use of reaction you would probably obtain some results. (2) The frame might be 1·5 metres in diameter, and have 25 turns spaced 0·5 cms. apart.

"W.P.G." (Gloucester) *sends a description of a set and asks* (1) *If a crystal would improve results.* (2) *If the reactance coil should be of finer wire than the A.T.I.* (3) *For windings for the H.F. transformer.* (4) *If results would be as good if the reaction coil is wound with No.* 24 *wire and the same number of turns as at present.*

(1) It should improve results if connected as in the reply to **"D.C.M." (Dublin)**, July 22nd issue. (2) Not necessarily, but it may be, and it is often convenient to make it so. (3) Try 50 turns of No. 40 for each winding on a former 1½" diameter with shellaced paper between the windings. (4) No, because the coupling between the coil would be less. *N.B.*—See recent remarks on reaction of this type.

"M N." (Prague).—(1) The multi-wire aerial will be the better, but little advantage would be gained by the use of more than two wires. (2) The circuit of your Fig. 3 will be quite O.K. Values should be as follows:—A.T.C., 0·0015 mfds. Closed circuit condenser, 0·001 mfds. Coils—an assortment of honeycomb type, in sizes up to about 1,000 turns with a mean diameter of 2" (3) Scheme 2 would be very inefficient. Either 3 or 4 might be used—preferably 3.

"CONSTANT READER" (.....) *asks* (1) *For a two-valve set to conform to certain requirements.* (2) *Capacities of the condensers.* (3) *Best kind of valve to use.*

(1) and (2) See diagram (Fig. 5). (3) Any standard hard valve by a reputable maker would give good results.

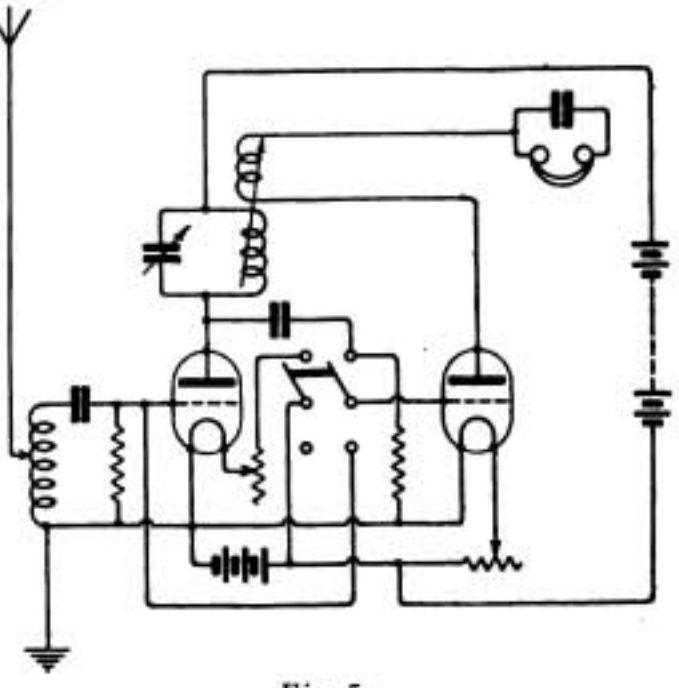

Fig. 5.

"R.B." (Carlisle) *asks for criticism of a set, and what he may expect to receive on it.*

The set is all right except (1) For short waves A.T.C. should be in series with the A.T.I. (2) The loose coupler should be tuned by a variable coil. (3) The reactance coils should be connected in the anode circuit of the first valve and not in that of the L.F. amplifying valve. (4) Reaction of this type is no longer to be permitted. You might possibly receive broadcasting from Manchester, Newcastle and Glasgow if these points are attended to, and you will also get stations such as Cullercoats and the larger Continental stations, and possibly ships.

"A.E." (Bournemouth) *asks for advice with a four-valve set which howls and gives no other results.*

The diagram submitted is quite correct and should give no trouble. Howling is probably due to coupling between the L.F. transformers. This might be cured by altering their position, or by screening them in iron boxes. It may also be due to the grid and plate leads of the H.F. valve being run too close together, remedy for which is obvious.

"NOYZ" (Tiverton).—The circuit shown is quite correct, and the winding up is also as it should be except that all the L.T. battery leads may be run to a common battery. Your arrangements are distinctly ingenious.

"D.D.W." (Ebbw Vale) *asks* (1) *For criticism of an amplifier.* (2) *For a circuit to use with it.* (3) *If the telephone terminals are shown in the right place.* (4) *If circuit will operate with valves taking* 20/30 *volts on the plate.*

(1) Circuit is quite correct except for reaction, which will probably have to be omitted, but if used should be connected as in various recent diagrams. (2) Any simple two-circuit tuner might be used as, for instance, Fig. 1, page 670, August 19th issue, with the addition of a switch for paralleling the A.T.C. and A.T.I. for long wavelengths. For wavelengths up to 20,000 metres both the A.T.C. and the closed circuit condenser might be 0 003 mfds. (3) Yes. (4) Yes, but if so about a 45-volt battery should be used to allow for the drop through the anode resistance.

"X.Y.Z." (Seaham Harbour) *asks* (1) *For a circuit to fulfil certain requirements.* (2) *Values of condensers and resistance to use.*

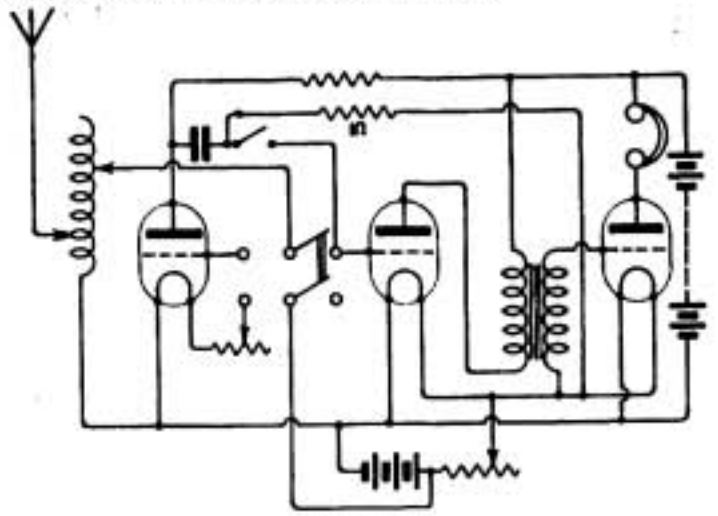

Fig. 6.

(1) See diagram (Fig. 6). (2) The anode resistance may be 50,000 ohms ; grid leak 1 megohm and coupling condenser 0·002.

"J.P.N." (Frieborg) *refers to the article by G. P. Kendall in the issue of June 3rd, and asks under what condition it is possible to use reaction coil for amplification, and not for heterodyne.* (2) *If a frame aerial can usefully be connected to an outdoor aerial.* (3) *Since a certain amount of rectification occurs at each stage of resistance capacity amplifier, if the intervalve condensers should be increased in capacity to pass on the L.F. pulses arising.* (4) *Refers to the article on page* 18, *April* 1*st issue, and asks whether the intervalve capacity of* 0·003 *mfds. there quoted is not too great.*

(1) Conditions on the use of reaction are given in the article referred to. For amplification without heterodyne effect reaction coupling must not be great enough to cause the set to oscillate. This can be assured either by using a very small reaction coil or by preventing too close coupling between it and the tuning coils. (2) Not as a rule, but special directional effects may be obtained by the use of frames in conjunction with external aerials. (3) No, this is undesirable as it introduces less efficiency in the amplification of the H.F. component. (4) In our experience this is excessive except for very long wavelengths.

"F.W.G." (Finchley) *sends a sketch of his set and asks* (1) *If the coils are all connected, though only one is inserted for a time, would it result in "dead-end" losses* (2) *What type of reaction would be best with the set.*

(1) Yes, probably of a fairly serious nature, even without the tapping scheme suggested, which is quite hopeless as it permanently connects the coils in a large number of ways. Whenever you switch for a particular connection of a particular coil you will find that you have a variety of sections of other coils in circuit at the same time. (2) Reaction could not be employed without the use of entirely separate coils for the purpose, and see recent notes on the subject. The best method of getting a range of this magnitude is by a set of interchangeable slab coils, not connected in any way.

"RADIO" (Bournemouth) *refers to the article on an experimental station in the issue of June* 10*th, and asks* (1) *If the slab coils could be used as loading coils.* (2) *If No.* 28 *wire would do.* (3) *If the slab coils could be used with a switch and studs.* (4) *If an aerial* 36′ *high and* 48′ *long is good enough.*

(1) It depends on the wavelength required, about which you say nothing. Some indications are given in the article referred to. (2) Enamelled covered wire is not recommended for this type of coil owing to the risk of the insulation being damaged in winding. (3) Certainly. (4) Quite good.

"SOLWAY" (Whitehaven) *sends a sketch of a loose coupler and asks* (1) *For criticism and the maximum wavelength obtainable.* (2) *If a five-valve receiver, with aerial as sketched, will receive* **2 MT, PCGG** *and* **FL.** (3) *If an alternative arrangement of aerial will give better results.* (4) *If any set on the market will receive these stations at Whitehaven.*

(1) A 0·001 mfd. condenser across the A.T.I. is hopeless. None should be used on short waves, and only about 0·001 mfd. on long. Your coupler would be efficient up to about 2,000 metres. (2) **FL** probably, remaining stations very doubtful. (3) This aerial will give you a much better chance. We are doubtful whether this will give good results with the restricted reaction to be allowed in future. (4) We know of no set on which we should care to guarantee the desired results.

"AMATEUR" (Stoke-on-Trent) *sends a sketch of his set and asks* (1) *For criticism.* (2) *How to add a third and fourth valve.* (3) *If a certain arrangement of his apparatus will give capacity interference, and if this can be obviated by screening.* (4) *What are the advantages and disadvantages of* (*a*) *plug-in type H.F. transformers or selective switch type ;* (*b*) *A.T.I. basket coil or slider type.*

(1) The circuit is O.K. except that the condenser marked 0·004 mfd. should be replaced by a leak of about 1 megohm. (2) See Fig. 1, page 303, issue for June 3rd. A three-valve set can be built up on exactly similar lines. (3) You may get some capacity troubles. We should advise you to get over them as far as possible by the attention to the exact position of parts and leads rather than by the

use of screens, which, however, may be some help. (4) (*a*) Performance as a rule is somewhat better for plug-in type. There are no dead-end effects. (*b*) The slider type gives almost continuous adjustment, and is preferable except from the point of view of saving of space.

"B.B.H." (Eastbourne) *encloses a diagram of his set and asks* (1) *If he can receive C.W., spark and telephony on it.* (2) *How much and what kind of wire should be used to wind the variometer formers to receive wavelengths of* 300/3,000 *metres.* (3) *Winding details for primary and secondary coils.* (4) *For a diagram of a circuit for two-step amplifier to be added to his set.*

(1) No, we do not like this arrangement at all. The nearest satisfactory approach to it is the American short-wave tuner of June 3rd issue of which it appears to be a poor copy. The grid leak should go from the grid to the filament, not as shown. (2) and (3) This type of construction is unsuitable for such a range of wavelengths, and we cannot give the desired figures. (4) See diagram (Fig. 7) for a possible variation of this type.

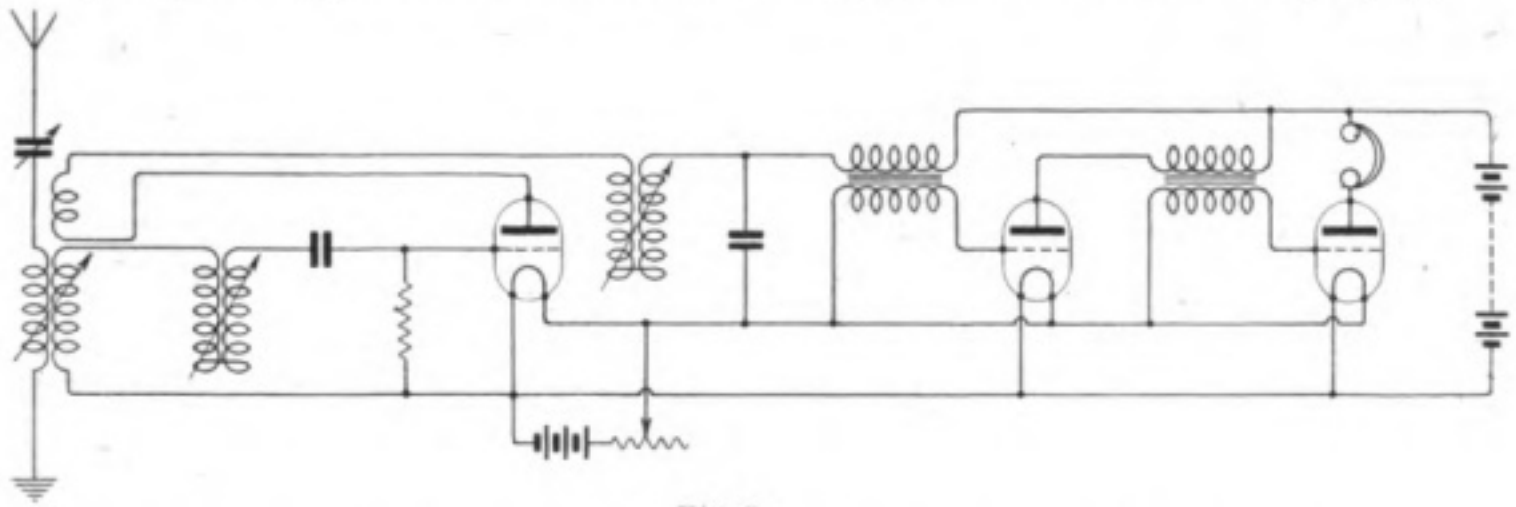

Fig. 7.

"IN DOUBT" (Staines).—Yes, for a short wave range set.

"E.T." (Newport).—(1) The reasons for the poorness of the demonstrations are various. It is possible to obtain perfect articulation by wireless with quite clear signals. In order to get this, the following conditions are essential. (*a*) The proper gear. (*b*) In the hands of someone thoroughly conversant with its use. (*c*) Reception from a distance well within the range of the transmitting station. We suggest that the poorness of the results you heard were due to the failure of (*c*), and faulty adjustment of the gear by the operator. For really good results, musically speaking, we do not recommend the reception of broadcasting stations at more than 100 miles. (2) **PCGG** very doubtful, **2 MT** probably. Paris and Berlin possibly, as these stations use larger power. (3) It is impossible for us to recommend any one of the many advertised sets, but you should use several valves.

"C.J.W." (Coventry) *describes his set and asks the maximum and minimum wavelength to which he can tune.*

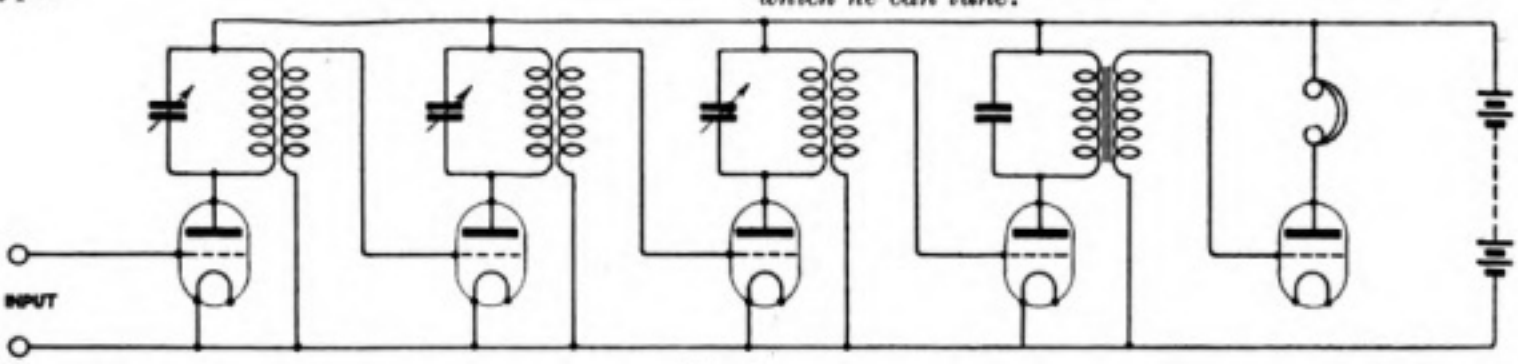

Fig. 8.

"RAGS" (Watford) *asks for a diagram of a simple type of five-valve amplifier.*

See diagram (Fig. 8), in which we have omitted reaction as this will probably not be allowed for broadcast wavelengths.

"GEORGIUS" (Crewe) *asks three questions about his set.*

(1) Arrange as in the circuit given to **"G.B." (Fulham).** (2) Capacity of condenser 0·0006 mfds. Probably the insulation of the glass condenser is in some way defective. (3) Very little, if at all.

Without taps on the secondary your minimum will probably be over 1,000 metres, and maximum 5,000 metres.

"W.P." (Plumstead) *asks* (1) *Whether constructional details of a two-valve receiving set, not transformer coupled, have been given in past issues.* (2) *If not published, where such details can be obtained.*

(1) Constructional details of such a set have not been given in a recent issue, but you will find a great deal of information in Alan L. M. Douglas's book, "The Construction of Amateur Valve Stations." A suitable circuit is given on page 12.

"**H.A.C.**" **(Rotherham)** *encloses a diagram of his set and asks* (1) *For any suggested improvements.* (2) *If the grid circuit should pass through the filament rheostat, or if it may be as shown in diagram.* (3) *If a* 1/5 *Sullivan transformer will be O.K. for this set.* (4) *If a grid potentiometer would improve the set.*

(1) No, the set is quite O.K. We cannot suggest any considerable improvements, although filament switches to cut out the valves not required would be an advantage. (2) The suggested scheme is all right, but will give you a somewhat smaller range of potential. (3) Yes. (4) No, a potentiometer is unnecessary with grid condenser and leak.

"**E.S.**" **(Highbury)** *asks* (1) *If he can use* 152 *ohms telephones with a transformer on a crystal set: also particulars of windings for this transformer, using No.* 25 *and* 36 *S.W.G. enamelled wire.* (2) *For the best type of valve and connections for note magnifier with a crytsal set.*

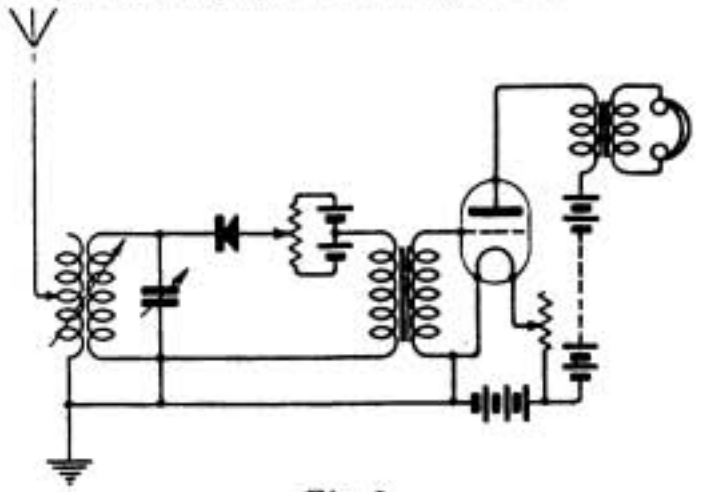

Fig. 9.

(1) The wires suggested are quite unsuitable for an efficient transformer of this type, but if used you might try a core of 1" diameter by 6" long, with 9 ozs. of No. 25 and 7 ozs. of No. 36 for the windings. (2) Any hard receiving valve will do. Connections may be as in the diagram (Fig. 9).

"**NEGATRON**" **(Coventry)** *asks* (1) *Why a certain receiver will not work.* (2) *For more suitable values or windings for his set.* (3) *If* **PCGG** *should be strong enough to allow of the use of a loud speaker.* (4) *If results on this set would be as good as on a seven-valve receiver.*

(1) We can only suggest unsuitable values for the components, particularly inductances 2 and 3, and the grid battery 6. The circuit is admittedly tricky in operation. (2) Two and three should be suitable for about 5,000 metres, and grid batteries anything up to 10 volts. (3) Doubtful. The Circuit is intended particularly for shorter wavelengths. (4) This claim is rather far-fetched. The same may be said in a similar sense of any reaction circuit, but in practice a limit is imposed by the inherent stability of the valve. We should be extremely surprised if you got as good results as with a seven-valve set, except very occasionally when you happen to "fluke" a particularly lucky adjustment.

"**S.J.**" **(Stockholm).**—(1) The approximate wavelength of your set will be 3,500 metres. We regret that we have no information about this receiver, additional to that given in the article referred to.

"**G.B.**" **(Fulham)** *sends a description of his set and asks* (1) *For a diagram of connections.* (2) *If it will receive Broadcasting and* **2 MT.** (3) *How his wavelength could be increased.* (4) *If the apparatus described would be of any use in the assembling of a three-valve set.*

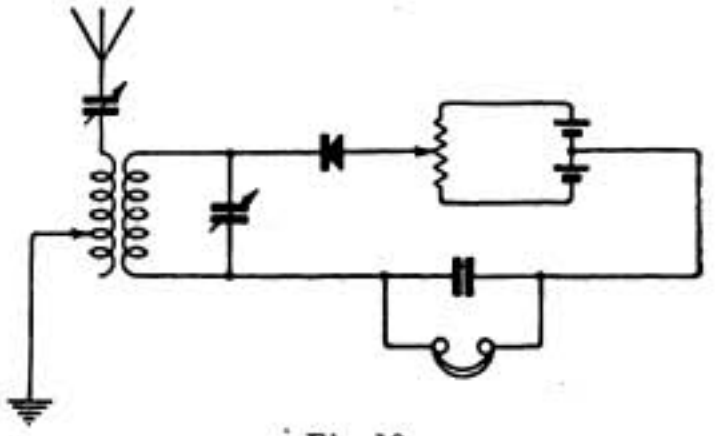

Fig. 10.

(1) See diagram (Fig. 10). (2) Quite satisfactory for London Broadcasting. If your aerial is a very good one, you may get Writtle very weakly. (3) By increasing the size of both coils. (4) Yes, all the parts except the crystal could be used for this purpose.

"**E.G.V.**" **(Woking)** *asks how to add a second valve to a circuit shown, using* 2 *H.T. and* 2 *L.T. batteries.*

The circuit shown is of a very inefficient type, and could only give good results with a variable tuning condenser across the anode coil. The use of separate H.T. and L.T. batteries on a two-valve set is unnecessary, and would serve practically no useful purpose. A suitable set for your purpose has been given to "**H.E.P.**" **(North Greenwich).** You can, of course, use separate batteries with each valve of this set if you prefer it.

"**M.F.**" **(Folkestone)** *asks re American short wave tuner described in June 8th issue* (1) *Suitable values for the condensers.* (2) *Whether fixed or variable.* (3) *If a crystal could be used in place of the valve.*

(1) 0·0002 mfd. for the grid condenser and 0·001 mfd. for the plate. (2) Condensers may be fixed but some slight advantage might be obtained by making the grid condenser variable. (3) No.

SHARE MARKET REPORT.

Prices as we go to press on September 15th, are :—

Marconi Ordinary	£2	7	7½
,, Preference	2	3	3
,, Inter. Marine.. ..	1	8	3
,, Canadian		10	6
Radio Corporation of America :—			
Ordinary	1	1	6
Preference		14	0

h SEPTEMBER, 1922. THE PRICE 6D. NET.

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On Heterodynes

THE CONSTRUCTION OF A HETERODYNE WAVEMETER.

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

IN the earlier articles in this series, which were published in these columns a few months ago, details were given for the construction of several forms of heterodyne oscillator. In all of these, separate plug-in coils were used in order to obtain the necessary wavelength range for the instrument. While this is a very convenient method to employ for the ordinary purposes of a heterodyne, the wavelength calibration of the instrument does not remain constant, since any small change in the relative positions of the tuning and reaction coils will alter the oscillation wavelength independently of any change in the setting of the variable condenser. Further, unless the coils themselves are very rigid, slight distortions of the coil windings may occur from time to time, which will cause changes in their constants and therefore also changes in the calibration of the instrument.

These difficulties can only be overcome effectively by building the coils into the instrument, and fastening them securely so that no changes can take place. When this is done the simple heterodyne becomes a heterodyne wavemeter which can be employed not only for the accurate measurement of wavelengths but also for numerous other radio measurements and tests as well.

While there are many ways in which such an instrument can be constructed, it is not necessary for many purposes to build it with all the care or refinements necessary for a standard laboratory wavemeter. Hence the design of the instrument described below aims at providing a simple apparatus which will meet most ordinary requirements without entailing an excessive cost in its construction.

The general outline of the arrangement used follows that employed in the first type of heterodyne described in this series of articles, in that an ordinary type of inductively coupled oscillation circuit is employed, using separate reaction and tuning coils (Fig. 1).

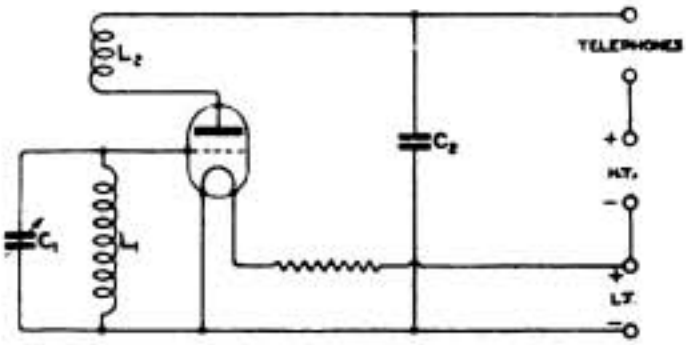


Fig. 1. Inductively coupled oscillation circuit.

The effective wavelength range is from rather under 150 metres up to approximately 30,000 metres, so that it covers most ordinary wavelengths encountered in radio working, and also overlaps the range of the short wave heterodyne, which has been described in these columns. It has also been found possible to enclose the apparatus in a box of the same outside dimensions as those of the above-mentioned short-wave heretodyne, so as to be uniform in style with that instrument.

The box is constructed of any convenient hard wood, $\frac{1}{4}$ in. thick, with outside dimensions of $9\frac{3}{4}$ ins. by 6 ins. by $4\frac{1}{2}$ ins. high, so that when the top panel of $\frac{1}{4}$ in. ebonite is fitted in position the instrument will be $4\frac{3}{4}$ ins. high over all.

The top panel should be cut out from ebonite $\frac{1}{4}$ in. thick, to the dimensions of $9\frac{3}{4}$ ins. by 6 ins., and needs to have holes drilled in it in the positions shown in Fig. 2.

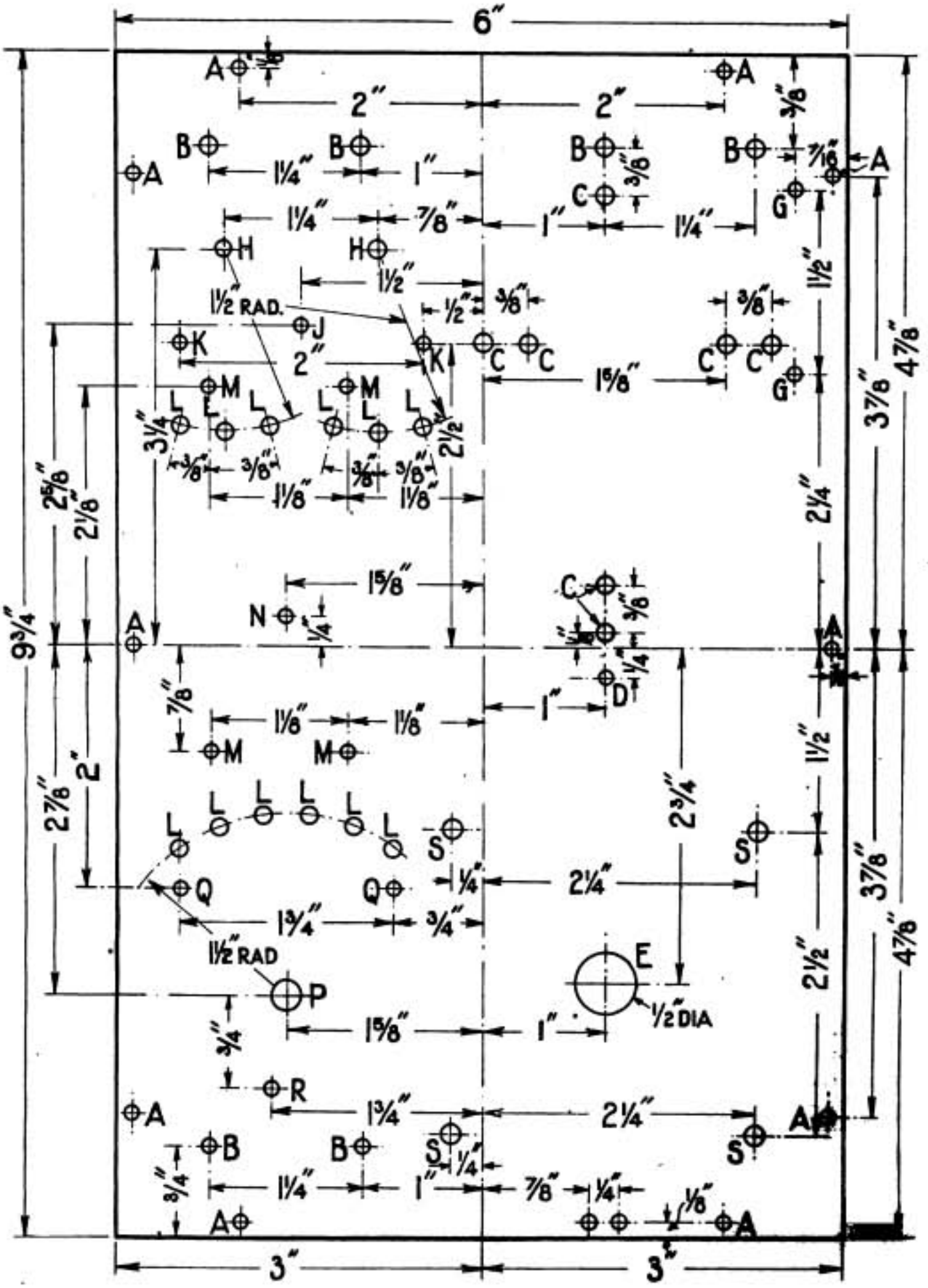


Fig. 2. Drilling diagram (back view of panel).

This drawing is arranged so that the positions are ready for marking out directly on the *back* or underside of the ebonite panel.

The sizes and uses of the various holes lettered from A to S in Fig. 2 are set out below, as it is not easy to label the individual holes on the drilling diagram itself without unduly complicating the drawing.

A = Holes $\frac{1}{8}$ in. diameter, countersunk on surface for screws holding ebonite panel to box sides.
B = Holes for terminals, tapped 4 B.A.
C = Holes for screws for fixing valve holder contacts, tapped 6 B.A.
D = Hole, 4 B.A. clear, countersunk on front surface for screw fixing pillar holding short-wave coils.
E = Hole $\frac{1}{2}$ in. diameter for spindle and bushing of condenser.
F = Holes tapped 8 B.A. for condenser scale pointer.
G = 4 B.A. clearing holes, countersunk on surface for screws to hold ebonite frame for long-wave coils.
H = 1 B.A. clearing holes for switch spindles.
J = 6 B.A. hole for screw to hold brass bracket of long-wave coils.
K = Two 4 B.A. holes for stop pins of switch.
L = 4 B.A. holes for switch studs, at $\frac{3}{8}$ in. centres.
M = Holes for bracket carrying condensers 6 B.A. clear, countersunk on surface.
N = Centre of miniature tumbler switch for filament circuit.
P = $\frac{1}{4}$ in. diamater hole for switch spindle (0 B.A.).
Q = 4 B.A. holes for stop pins for switch.
R = 5 B.A. hole for stud to support end of 0·01 μF condenser.
S = Four blank holes drilled and tapped 4 B.A. to a depth of 3/16 in. into the ebonite. These are used for fixing the variable condenser in position, and would be required in other positions for some patterns of condenser.

When all the holes have been drilled and tapped to the proper sizes, the edges and front of the ebonite panel should be cleaned up, and polished or dull finished as preferred.

The front surface can then be engraved, if desired, with the appropriate lettering, as indicated in the plan of the instrument in Fig. 3.

For convenience in tuning, the inductances fitted into a wavemeter of this type should be subdivided into several coils. It has been found possible to limit the number of tuning coils to three in this instrument, and the number of reaction coils to two. For the longer wavelengths three duolaterally wound coils are used, two for tuning and one for reaction, while for the shorter waves two single layer solenoidal coils give good results.

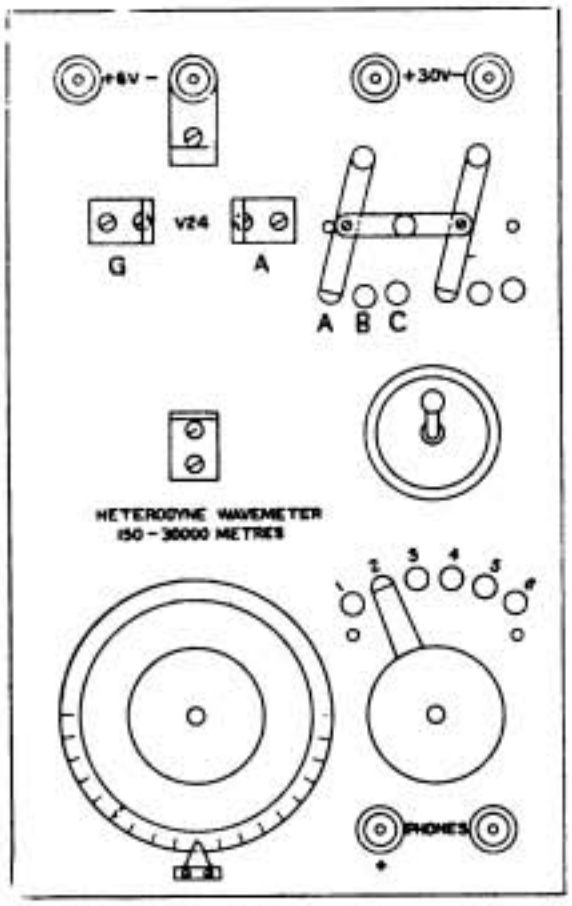


Fig. 3. Plan of the instrument, showing engraving.

The materials necessary for constructing this instrument are set out in the list below, from which it will be noted that it is proposed to utilise ready-made duolateral coils and variable and fixed condensers, since this method is usually the more satisfactory. The construction of the variable condenser and the duolateral coils, while quite easy, is a tedious process without the proper facilities, while the prices for which they can be purchased are not prohibitive.

MATERIALS USED IN CONSTRUCTION OF A WAVEMETER OF THIS TYPE.

No.	DESCRIPTION.
1	600-turn duolateral coil (inductance approximately = 24,000 microhenries).
1	150-turn duolateral coil (inductance approximately = 1,380 microhenries).

1 100-turn duolateral coil (inductance approximately = 620 microhenries).

1 Variable air condenser of maximum capacity = 0·0015 microfarad, with standard knob and indicating dial.

10 6 B.A. by 7/16 in. cheese-head brass screws.

14 6 B.A. by ⅜ in. countersunk-head brass screws.

10 6 B.A. by 5/16 in. round-head brass screws.

3 6 B.A. hexagon nuts.

6 4 B.A. by ⅜ in. countersunk-head brass screws.

4 4 B.A. by ¼ in. cheese-head brass screws.

6 4 B.A. terminals, with nuts and washers.

2 1 B.A. by 1¼ in. cheese-head brass screws.

4 1 B.A. hexagon nuts.

4 0 B.A. hexagon nuts.

6 0 B.A. brass washers.

3 0 B.A. spring washers.

1 0 B.A. stud 1⅛ in. long.

5 Fixed condensers of capacities of 0·0013, 0·0026, 0·0040, 0·0053, and 0·0065 microfarad. (Dubilier type 600A condensers are suitable.)

1 Fixed condenser 0·01 microfarad capacity (Dubilier type 577 condenser of this valve is suitable).

1 Miniature tumbler switch.

12 4 B.A. by ¼ in. by ¼ in. switch studs.

1 1½ in. diameter ebonite knob for switch.

3 8 B.A. by 3/16 in. round-head brass screws.

Phosphor bronze strip for switches and valve holder—thickness approximately 0·015 in.

1 Piece 6 ins. by ½ in. by 3/32 in. brass strip for valveholder and coil bracket.

10 ⅜ in. by No. 3 wood screws—brass counter-sunk heads.

4 4 B.A. switch stops.

1 V24 valve.

From the above, as well as from Fig. 3, it will be noted that a V24 valve is used in this instrument, as the low capacity of these valves renders them particularly suitable for use on the shorter wavelengths.

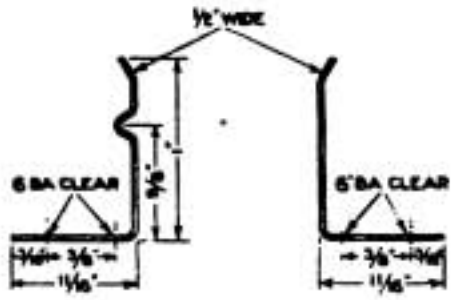


Fig. 5. Dimensions of the contacts for the V24 Valve Holder.

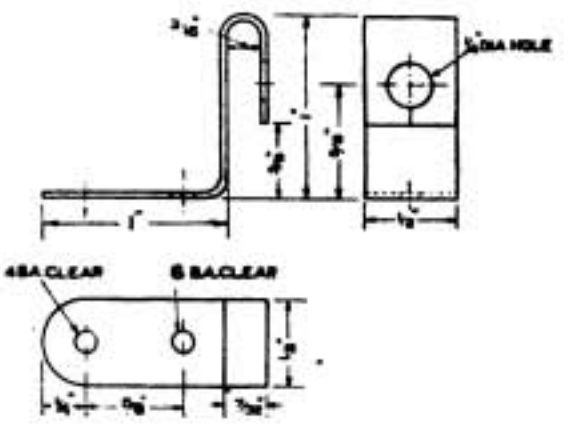


Fig. 6. Dimensions of the contacts for the V24 Valve Holder.

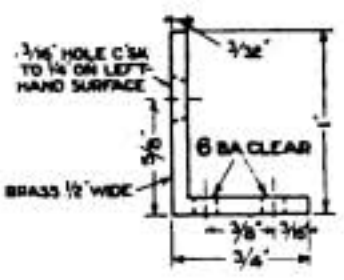


Fig. 4. The rigid contact for V24 Valve Holder.

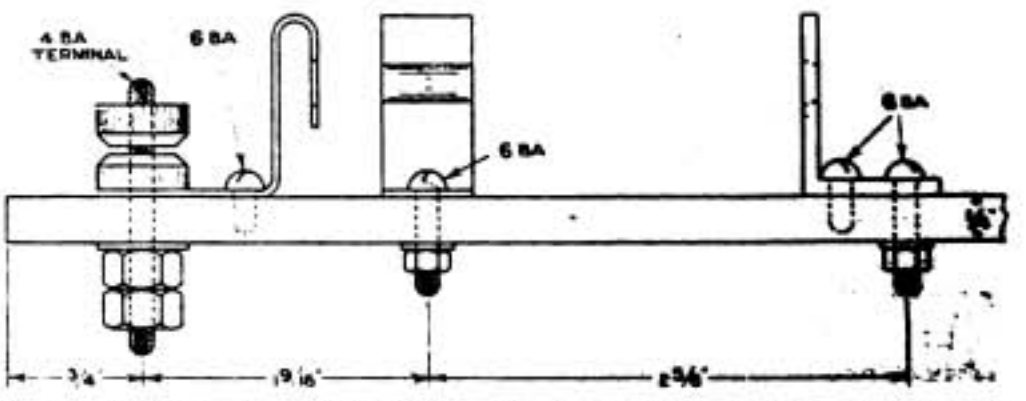


Fig. 7. Showing how to arrange the V24 Valve Holder contacts, one of which is held under the 4 B.A. terminal with a 6 B.A. screw for fixing.

The parts of the valve holder may next be prepared. Valves of the V24 type require four contacts, three at least of which need to be of springy material in order to retain good contact with the valve caps. The fourth is

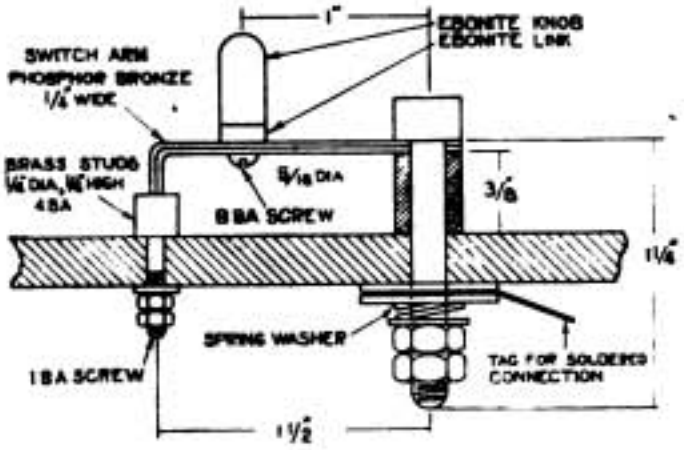


Fig. 8. Arrangement of double-pole range switch.

dreferably a rigid contact. The last may be bent up of 3/32 in. brass strip, ½ in. wide to the dimensions shown in Fig. 4, while the springy contacts are made of phosphor bronze about 0·015 in. thick. The dimensions of these contacts are given in Figs. 5 and 6.

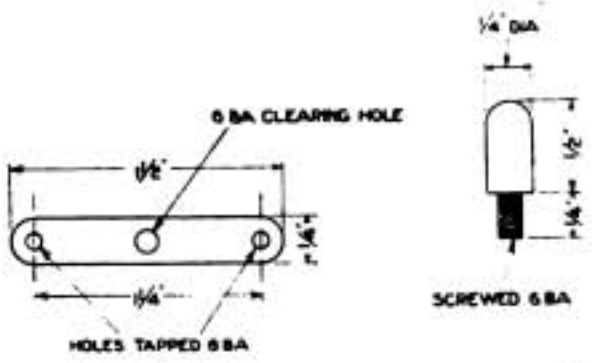


Fig. 9. Details of link and knob for double-pole range switch (ebonite).

One of the springy bronze contacts can be fixed in position under the 6 V — terminal, as indicated in Figs. 3 and 7, the latter giving

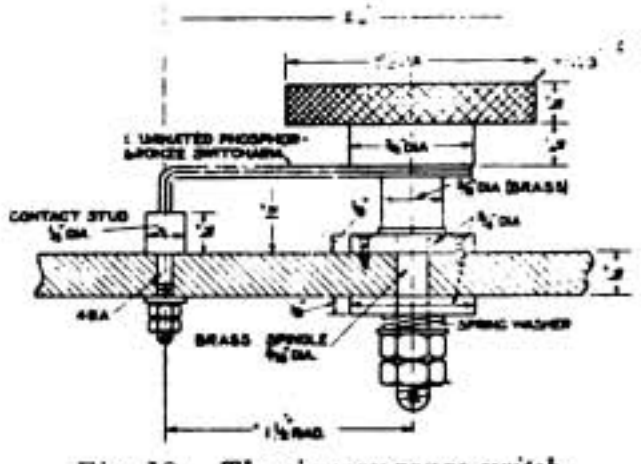


Fig. 10. The six-way range switch.

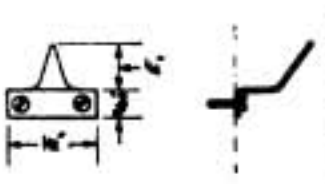


Fig. 11. Dimensions of pointer.

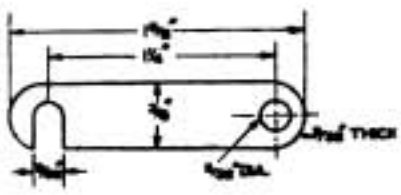


Fig. 12. Dimensions of link.

also the general arrangement and relative positions of the other contacts.

The double-pole range switch may next be prepared. The general arrangement of each arm is shown in Fig. 8. Each switch arm is built up of 5 phosphor-bronze strips ¼ in. in width, three of these being bent round to press on the switch contact studs, and the two intermeditate ones being cut short so as to space the contact laminations apart and give a better contact. The five strips should be rivetted together into a coherent whole at a distance of about ⅜ in. from the centre of the spindle. The spindle or pivot for this switch is a 1 B.A. cheese-head brass screw, 1¼ ins. long, which after passing through the switch arm, is supported by a brass sleeve 5/16 in. diameter by ⅜ in. long, having a 1 B.A. clearing hole drilled through it. After passing through hole H (Fig. 2) in the ebonite panel, washers, a spring washer, and nuts are fitted to this screw on the underside of the panel.

The two switch arms, pivotted through holes HH (Fig. 2), should be linked together by an ebonite link, the dimensions of which are given in Fig. 9. This link is pivotted to the switch arms by two No. 8 B.A. round-head brass screws. In the centre of this link a small ebonite knob is fitted. This may be made of the size given in Fig. 9.

The studs for this and the other (six-way) range switch should be ¼ in. diameter by ¼ in. high, with 4 B.A. screwed shanks.

The six-way range switch may also be built up with five phosphor bronze strips or laminations, to the dimensions shown in Fig. 10. The 1½ in. diameter ebonite knob is screwed to the switch arm. A piece of No. 0 B.A. studding may be used for the spindle of this switch, and may be screwed into the underside of the ebonite knob.

For switching the filament of the valve on or off, a miniature tumbler switch may be used. No holes for this are shown on the

drilling diagram, Fig. 2, since these switches vary somewhat in style and dimensions. The position of the centre of the switch is, however, shown on that diagram.

In the filament circuit of the valve a fixed resistance of 1 to 1¼ ohms should be fitted so that a six-volt accumulator may be used as the

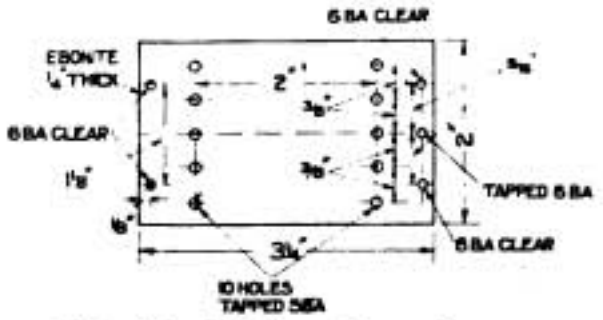


Fig. 13. Platform for condensers.

supply, giving about 5 volts on the valve terminals. A straight piece of No. 36 Ferry resistance wire slipped into a piece of sistoflex insulating sleeving may conveniently be used for this purpose, and may be used as one of the connecting wires in the circuit. A length of from 4 ins. to 5 ins. is about correct.

The variable air condenser should have a maximum capacity of approximately 0·0015 microfarad. This part is best procured ready made but can of course be built up if desired. In order that it may go conveniently into the available space its fixed plates should not exceed about 2¾ ins. or 2 13/16 ins. diameter. For a condenser of this size about 30 fixed and 29 movable plates usually gives about the correct capacity value. The overall depth of the condenser under the panel should not exceed 4¼ ins in order that it may go inside the box.

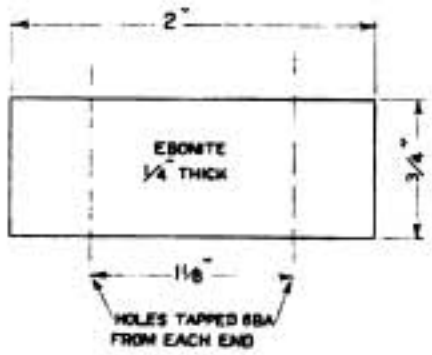


Fig. 14. Support for condenser platform.

The usual type of indicating dial fitted to these condensers requires a pointer fixed on the ebonite top of the instrument. Dimensions for such a pointer are given in Fig. 11. It should be fixed with two No. 8 B.A. round-head brass screws to the two holes marked FF in Fig. 2.

At the front of the instrument two terminals —marked "Phones" in Fig. 3—are fitted. These should be provided with a short-circuiting link so that the circuit may be closed if it is not desired to use telephones with the instrument. The dimensions of the link are given in Fig. 12.

The next consideration is the fixing of the additional condensers which are paralleled with the variable condenser by the six-way range switch in order to increase the capacity range of the set. In the instrument here described Dubilier Type 600 A condensers were used, since these take up very little mounting space, besides being of high insulation resistance and having great constancy of capacity. As there is insufficient space on the ebonite panel itself to mount these near the range switch, they must be screwed together on to an ebonite platform of the size given in Fig. 13. This should be

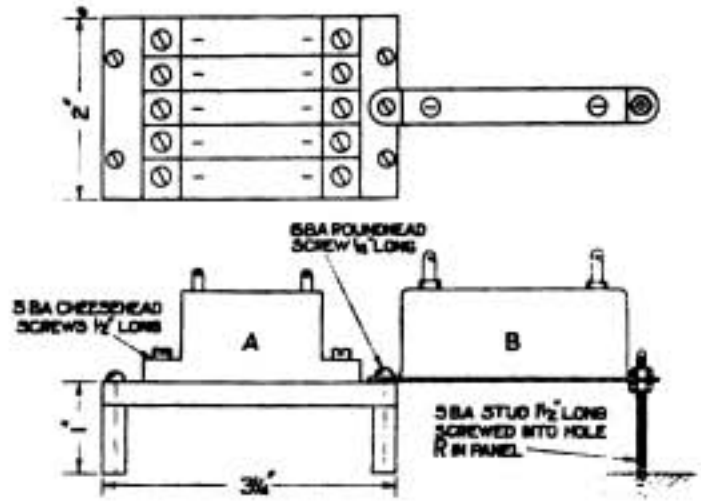


Fig. 15. Arrangement of the condensers when mounted on their platform.

supported from the panel by two strips of ebonite of the size shown in Fig. 14, these being secured to the instrument panel by 6 B.A. countersunk-head brass screws through the holes marked M M M M in Fig. 2. This platform also serves to support one end of another condenser (of capacity=0·01 microfarad) which is shunted across the telephones and H.T. battery. The condenser used here was of the Dubilier Type 577 pattern. Its other end was supported by a No. 5 B.A. brass stud screwed into the instrument panel (hole R, Fig. 2) the metal case of the condenser being clamped to this stud by two 5 B.A. nuts.

The general appearance of these condensers when mounted up on their platform is shown in Fig. 15.

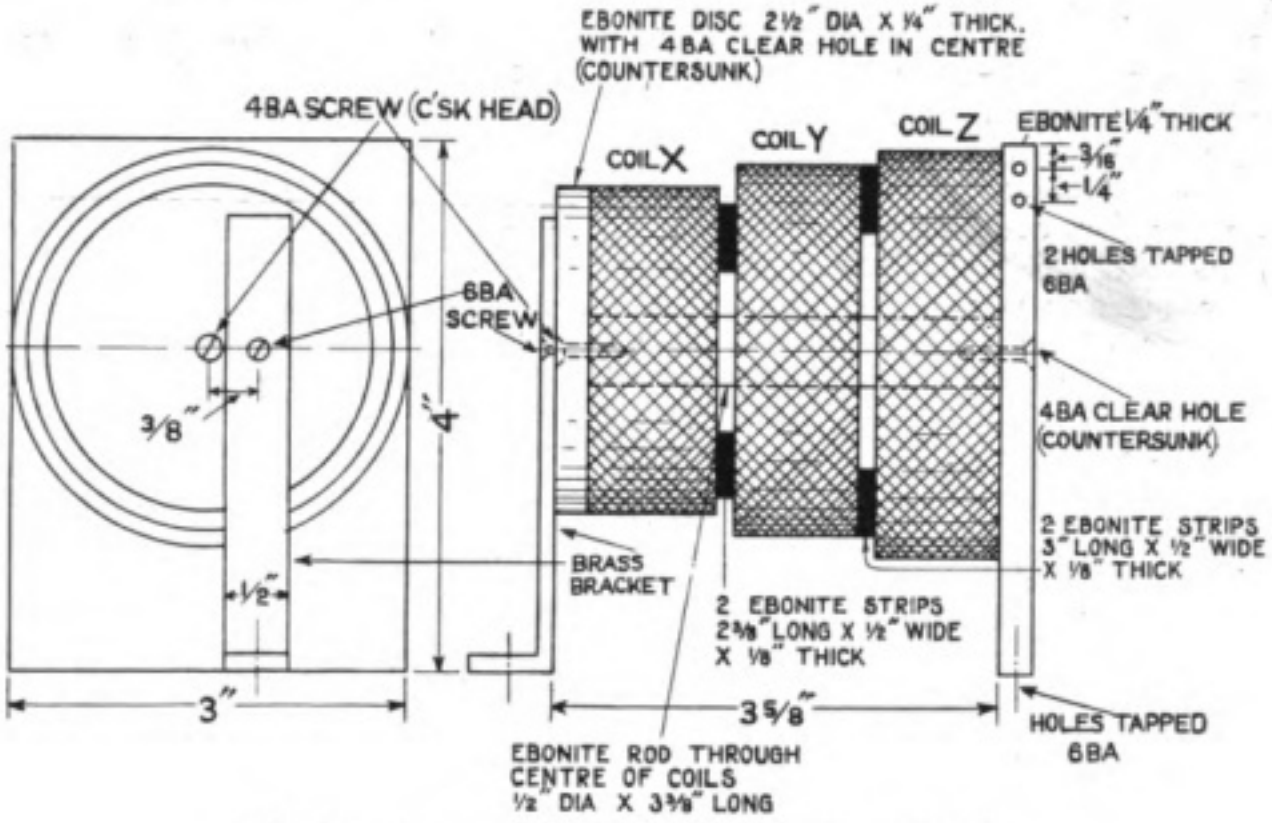


Fig. 16. *Arrangement of mounting for long-wave coils.*

The remaining points to be considered are the mounting of the tuning and reaction coils, and the wiring up of the set.

For the longer wavelength ranges the three duolateral coils are used. These are clamped between two pieces of ebonite as shown in Fig. 16. One of these is attached to the

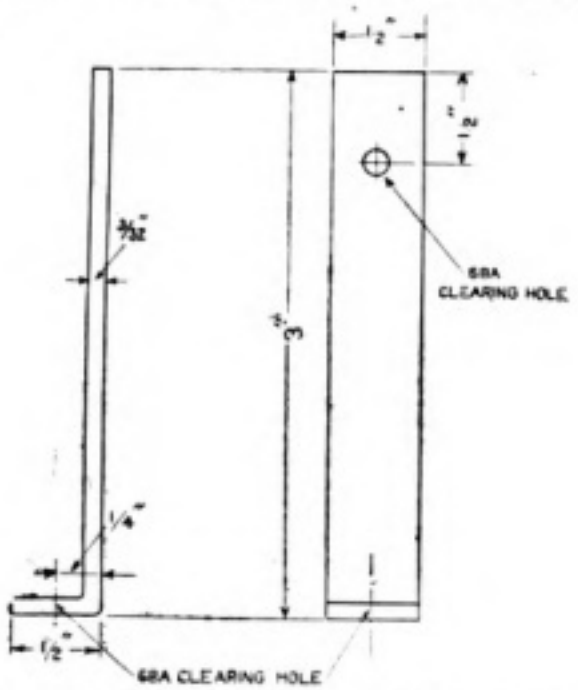


Fig. 17. *Brass bracket for supporting long-wave coils.*

instrument panel by two 6 B.A. countersunk-head brass screws through the holes marked GG in Fig. 2. The second piece of ebonite is in the form of a disc 2½ ins. in diameter. This is supported from the instrument panel by means of a brass bracket bent up from strip ½ in. wide by 3/32 in. thick to the dimensions given in Fig. 17. This bracket is secured to the ebonite disc at the ends of the coils by means of a single No. 6 B.A. countersunk-head brass screw as shown by the sketch on the left-hand side of Fig. 16. The lower part of the bracket is screwed to the instrument panel by a No. 6 B.A. brass screw into the hole marked J in Fig. 2. The coils marked X, Y and Z in Fig. 16 are separated from each other by ebonite strips ½ in. wide by ⅛ in. thick, two strips being placed between

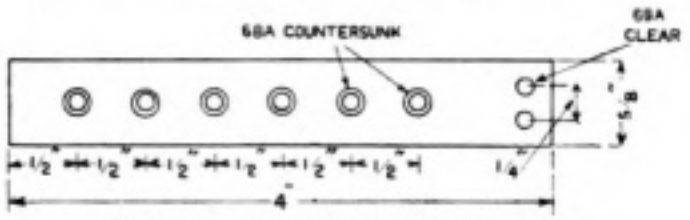


Fig. 18. *Terminal strip for coils.*

adjacent coils. In Fig. 16, coil X is the one having 100 turns, coil Y the one of 150 turns, and coil Z the one of 600 turns. The two pieces of ebonite at the ends of these coils are clamped together by two No. 4 B. A. countersunk head brass screws into an ebonite rod ½ in. diameter by 3⅜ ins. long, which passes up the centre of the coils.

It will be noted that near the top of the right-hand piece of ebonite in Fig. 16, two holes are shown tapped 6 B.A. These are to support a

strip of ebonite, carrying terminals to which the ends of the fine wire winding of the coils can be connected. The dimensions of the strip are given in Fig. 18. It has six holes in it through which are screwed six No. 6 B.A. countersunk-head brass screws, $\frac{3}{8}$ in. in length, these screws being provided with nuts and washers under which wires may be gripped. This row of screws and nuts provides a connecting means for the short-wave coils as well as for the duolaterally wound long wave coils.

The short-wave tuning coil consists of 25 turns of No. 20 S.W.G. double cotton covered bell wire, wound with adjacent turns touching on an insulating former $2\frac{1}{4}$ ins. in diameter by $2\frac{1}{4}$ ins. long, the ends of the wire being secured in place by passing through holes in the former. A stout paxolin tube forms a convenient support for this winding.

The short-wave reaction coil consists of 80 turns of No. 28 S.W.G. double silk covered copper wire, wound with adjacent turns touching, on an insulating former $1\frac{3}{4}$ ins. diameter by $2\frac{1}{4}$ ins. long, the winding being arranged to occupy the centre of the length of this tube. A paxolin tube may again be used for this purpose. These two coils when completed are arranged concentrically, and clamped between two ebonite discs $2\frac{1}{4}$ ins. diameter by $\frac{1}{4}$ in. thick, as shown in Fig. 19, the two

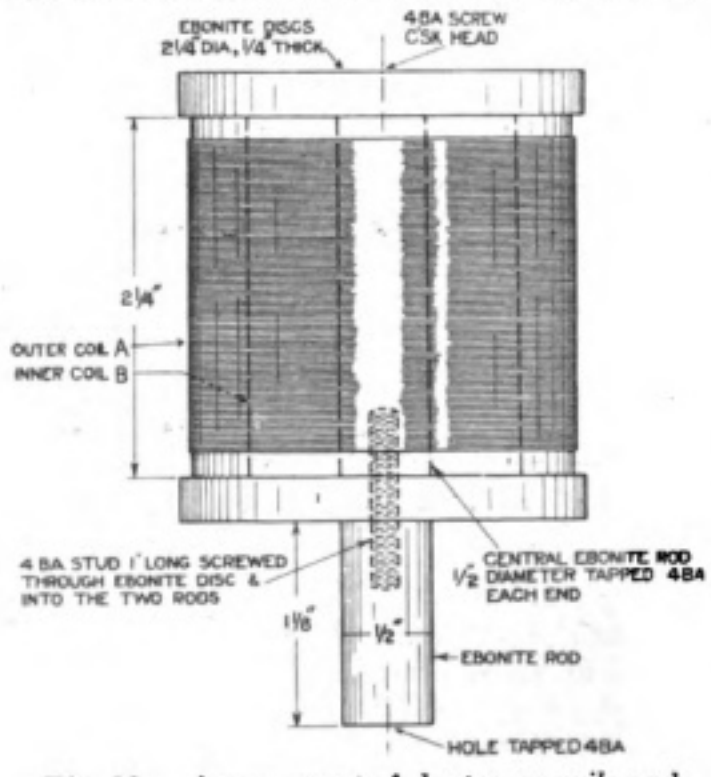


Fig. 19. Arrangement of short wave coils and supports.

discs being held together by an ebonite rod $\frac{1}{2}$ in. in diameter, passing up the centre of the coils and screwed to the discs at each end. Before finally clamping up these coils the space inside the smaller coil and between the two coils should be filled up solid with paraffin wax so as to maintain the coils rigidly in the same relative positions.

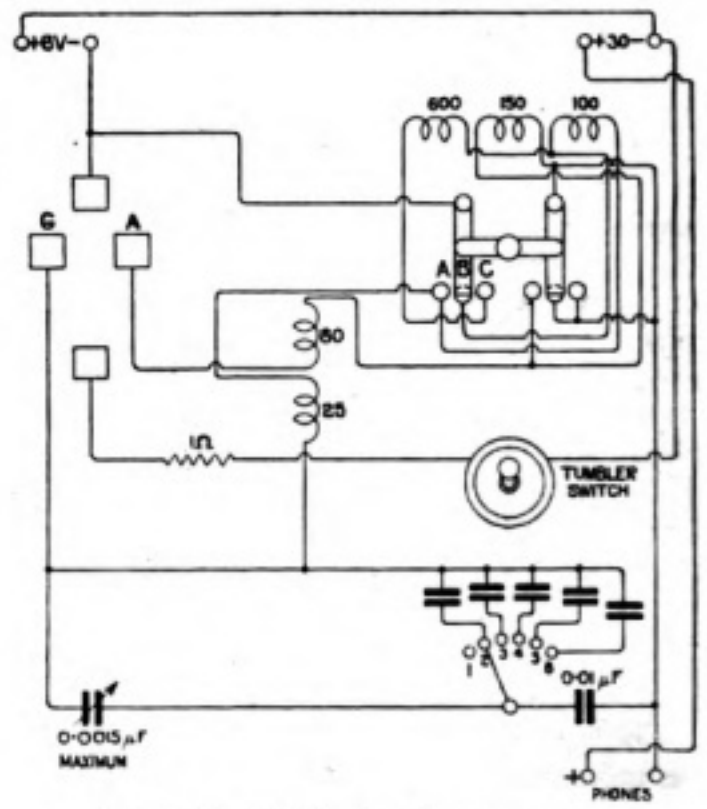


Fig. 20. Wiring for the wavemeter.

When completed this pair of coils is mounted with its common axis vertical by means of an ebonite rod $\frac{1}{2}$ in. diameter by $1\frac{1}{8}$ in. long, screwed to the lower ebonite disc by means of a No. 4 B.A. brass stud 1 in. long, which also serves to secure the lower disc to the ebonite rod passing between the two discs as sketched in Fig. 19. This lower ebonite rod carrying the coils is fastened to the instrument panel by means of a 4 B.A. brass screw through the hole marked D in Fig. 2. When in this position the centre of the length of these coils should be level with the axis of the long wave coils, which are mounted across the width of the box, so that the axes of the two sets of coils, being at right angles to one another, the mutual coupling between them is a minimum. If this precaution is not taken, the proximity of the long wave coils may prevent the production of oscillation on the shorter wavelength ranges. As a further aid to eliminating such disturbing action, it is desirable to short circuit any of the coils that are not in use. This can be done automatically by the double pole range switch, in the manner shown by the connection scheme of Fig. 20. This figure gives the wiring diagram for the

whole set, and it is desirable to arrange the connecting wires as nearly as possible in the manner sketched in this diagram, taking particular care to space the wires apart as far as possible and in particular to keep the path through which the unused portions of the windings are short-circuited as short as possible.

The five fixed condensers, of which the values have been given above, are connected up to contacts 2, 3, 4, 5, 6 of the six-way range switch, the condenser of lowest capacity (viz., 0·0013 microfarad) being joined to contact 2, and the largest condenser of 0·0065 microfarad capacity being joined to contact 6 of the range switch.

All wiring should be carried out in No. 18 S.W.G. tinned copper wire as this is sufficiently stiff to remain fairly rigid. Sistoflex insulating sleeving should be used where necessary, and it is desirable to solder all joints and connections in an instrument of this type.

When the wiring has been completed the instrument should be tested for the production of oscillations throughout the entire tuning range. A simple way of effecting this test is to repeatedly touch the grid terminal of the valve with a moistened finger, when, if the valve is oscillating, a sharp click will be heard in the telephone receivers both on touching and removing the finger from the grid terminal. If oscillations are not produced on one of the ranges, the connections to the appropriate coil should be reversed, while in wiring up it is advantageous to bear in mind that when looking at the coils so that the windings run in the same direction, the connections to the grid and anode of the valve should go to opposite ends of the tuning and reaction coils respectively.

The All-British Wireless Exhibition.

NOTES ON SOME OF THE APPARATUS SHOWN.

THE present issue of this journal bears the date of September 30th. This is the date of the opening of the All-British Wireless Exhibition at the Horticultural Hall, Westminster.

As has already been announced in these columns, the Exhibition will remain open from September 30th to October 7th, inclusive. Everything wireless which the British manufacturer has produced will be represented at this Exhibition and whilst it will be the endeavour of this Journal to refer to the majority of the principal exhibits space will not of course allow for a detailed description of all of the very numerous pieces of apparatus, though most of them no doubt merit individual notice and description.

In the following pages reference is made to the apparatus to be seen on a number of the stands and in a later issue those products not referred to in the following descriptions will be dealt with in so far as space permits.

It is of course not possible, prior to the Exhibition, to obtain information concerning all the new types of apparatus which the Exhibition will disclose, as details concerning many of these will not be available until the opening of the Exhibition.

Arrangements have been made by the organisers of the Exhibition for wireless telephony transmissions to be conducted specially for the Exhibition, when, at the Horticultural Hall these transmissions will be received and made audible in the Hall. A special musical programme has been arranged. Half-hour telephony transmissions on 360 metres will take place daily at 11, 3, 6 and 8 o'clock.

No doubt the Exhibition will do much to add to the popularity of wireless by introducing the public to the possibilities which Broadcasting is about to open up. At the same time engineers and research students will find in the Exhibition an endless source of interest. A description of some of the exhibits follows :—

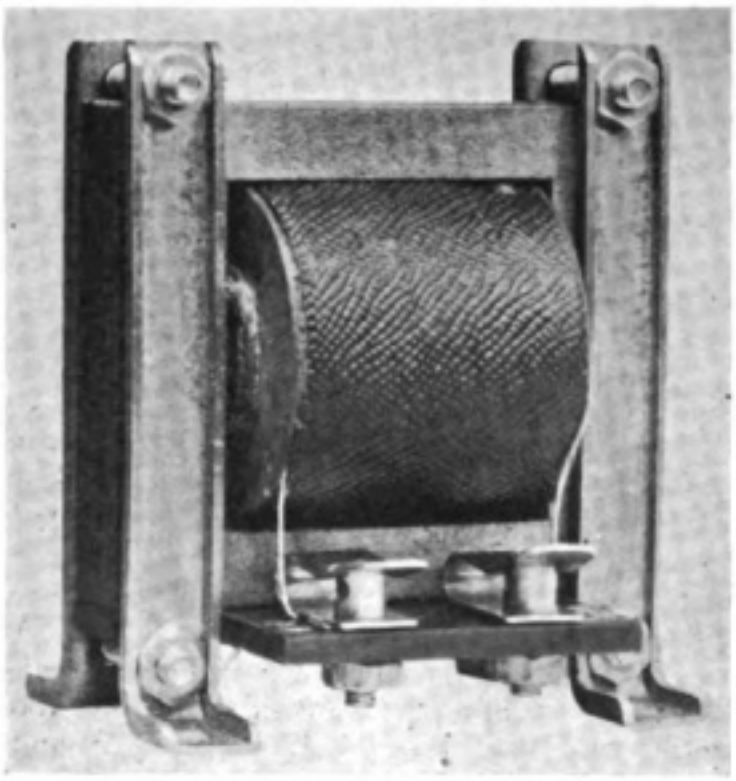
The Zenith Manufacturing Co. (Stand No. 3).

At this stand a complete range of regulating resistances is shown suitable for the adjustment of current and voltage in all wireless and similar circuits. These resistances incorporate many improvements.

A potentiometer resistance is shown arranged to permit the measurement of the voltage amplification factor of any given valve in accordance with the methods described by Mr. P. R. Coursey in *The Wireless World and*

Radio Review of February 4th. As this potentiometer resistance is a very moderate priced article it should be of particular interest to experimental workers.

New "Zenite" resistance units are also shown. This particular unit comprises a fire-resisting tube on which is applied a suitable winding of resistance wire ultimately embedded at high temperature in a vitreous enamel. As these resistances are then impervious to moisture or oxidisation, the value remains constant, and they are specially useful for various wireless circuits, especially as grid leaks for large transmitting valves.



"Igranic" Intervalve Transformer.

Other exhibits include high tension transformers, choke coils and smoothing condensers such as are used for obtaining high tension rectified current for feeding the plate circuit of moderate power transmitting sets. These transformers, choking coils and condensers are made in a very large variety of ways to fulfil all requirements, and to minimise the humming noise so frequently associated with experimental telephony transmission.

Where continuous current is available, accumulator charging is a simple matter, and many types of regulating resistances are shown suitable for adjusting the charging current for the various types of accumulators in common use, but when an experimenter resides in a neighbourhood supplied only with alternating current power, the problem is a more difficult one, as in that case some form of rectifier or converter is essential. A variety of rectifiers which will overcome all such technical difficulties are shown.

Amongst accessories exhibited may be mentioned grid leaks and condensers of all kinds.

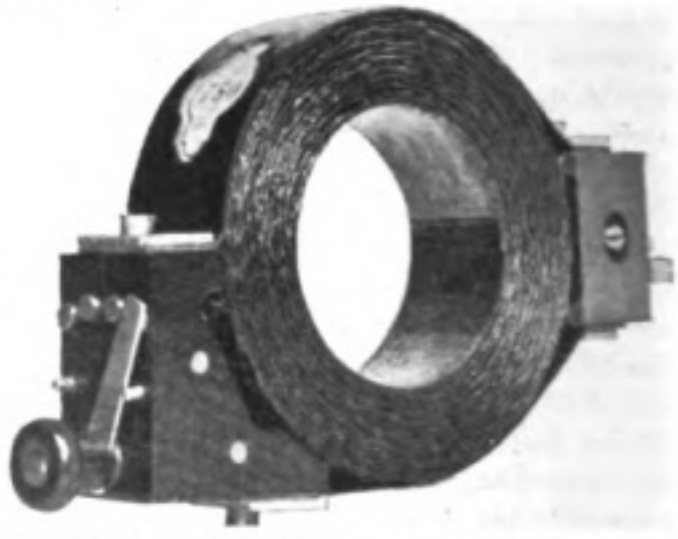
Igranic Electric Co., Ltd. (Stand No. 4).

The salient feature of the exhibit of this firm is the manufacture of coils for wireless work. With a view to demonstrating the advantages of the honeycomb type of inductance coil an enlarged model of a coil is exhibited to clearly illustrate the duolateral formation.

The majority of radio enthusiasts know that this formation, by attaining the maximum spacing between the various turns of wire, reduces the self-capacity of the coil in comparison with that of concentrically wound coils, and makes sharper tuning possible with consequent increase in signal strength.

Slab inductance coils, wound by the self-forming cross-wind method, are also exhibited, as well as transformer coils, which embody two methods of winding, viz., the "paper interlay" and the "cotton interweave."

Three coil winding machines are actually at work on the stand. One of these is employed in making honeycomb coils, the second in winding transformer coils with paper interlay between successive layers, and the third in making transformer coils by the cotton interweave method.



"Igranic" Tapped honeycomb coil with 4-contact switch.

The ingenious means by which the paper is interlaid between the layers as the winding proceeds, and exceptionally durable character of the transformer coils made by the cotton interweave method, is specially attractive.

Turning from coils, the exhibit is interesting also because of the display of various types of

coil-holders for tuners. The "Micro-Adjusta" coil-holder is designed for exceptionally fine tuning, where adjustment of coupled coils needs to be carried out very accurately, as in telephony. The "Triplug" coil-holder, is suitable for table use or for panel mounting.

The neat design and exceptional finish of these accessories will commend them to users.

A patented method of mounting both honeycomb and slab inductance coils is on view. In this method, which is called the "Gimbal" mounting, the coil is provided with pivots at right angles to its axis, so that when tuning the coil can be rotated about its own pivot as well as moved radially, thus affording what might be described as a vernier adjustment. A conspicuous advantage of this method of mounting is that two coils connected in series can be used as a variometer. A very interesting and new design of honeycomb-wound variometer is on view as well as one or two types of intervalve transformers.

Harwell, Ltd. (Stand No. 5).

A new Replaceable Dry Battery for wireless receiving sets is exhibited here. It is made by Semaphore, Ltd., for whom this firm acts as sales managers.

Each cell is stated to have about five times the life of the standard battery and they are made up in units of two cells, *i.e.*, three volts nominally. Each two-cell unit is connected together with a special brass coupling (with holes for tapping at any voltage) so that no soldering is required. Either six or twelve units are fitted in a box and any quantity of such boxes can be put together where more than 36 volts are required.

Any two-cell unit can be replaced at a very low cost if one gives out, thus avoiding any necessity of scrapping the whole battery.

The ordinary high voltage Semaphore Batteries are also being shown, but it is claimed that the new cell is distinctly novel and a decided improvement.

A brass coupling for connecting ordinary flash lamp batteries is also on view. Messrs. Harwell also control the sales of the Solidite Manufacturing Company, Ltd., who make moulded valve-holders of all types, knobs, sliders and various articles made out of Solidite Insulating Material.

Voltmeters and ammeters for wireless work are displayed and also an instrument termed a "radio-gramophone," which is a combined valve receiving set and gramophone, contained in a neat cabinet.

T. H. Isted (Stand No. 9).

The above firm show an instrument described as the Broadcast Receiver "De Luxe."

It is designed to stand on a table, in a vertical position, so that it may be moved to any part of a room into which the aerial is led.

It has five valves, one being the detector and the remaining four being L.F. amplifiers.

A filament resistance is fitted to each valve, which serves also to cut out valves that are not required. Any number can be used, from two valves up to five, by means of switches at the bottom of the panel.

A change-over switch is provided for telephones or loud speaker.

A distinctive feature is the utilisation of the off position of a filament switch to connect the aerial to earth.

The aerial and earth lead-in terminal are in a small ebonite panel on the right of the cabinet. The H.T. and L.T. batteries are accommodated inside and are easily accessible by means of a small door at the foot of the cabinet.

Everything being included in the cabinet, it forms a complete receiving station in itself. So simple is the operation, that once the station has been calibrated to its broadcast station and others that are within its receiving area, and a note made of their positions on the condenser, it only needs two actions of switching to receive the broadcasting.

Hart Accumulator Company, Ltd. (Stand No. 17).

The following "Hart" exhibits are shown :—

High Tension Batteries.

1. "Hart" 50-volt "PL" type batteries, in specially insulated ebonite boxes of good design, contained in waxed wood cases with outside terminals and regulating switch (if required). Capacity 1·2 ampere hours.

2. Special 24-volt "DPL" 3-plate batteries, fitted in specially insulated glass boxes of latest design. This battery is entirely new, and has no equal for the high tension circuit of the wireless system. Capacity 2·5 ampere hours.

3. 24-volt "PL.3" type battery, fitted in specially insulated glass boxes, exactly as above, but 1·2 ampere hours capacity.

4. 2-volt "DPL.3" cell, in sealed glass box.

5. 2-volt "PL.3" cell, in sealed glass box. Items 4 and 5 are 2-volt cells as used in the above 24-volt sets.

6. Set of 17 cells (32 volts) for ship wireless installations, as supplied for transmission work.

Low Tension Batteries.

7. Portable batteries in celluloid boxes of various voltages and capacities.

8. Portable batteries in sealed glass boxes of various voltages and capacities with wood crates and carrying handles. This is a type now greatly in demand.

9. "MEU" type "splash-protected" accumulators. These are specially used for portable wireless outfits, voltage 2, 4 or 6. Capacities 10-100 ampere hours.

10. 6-volt portable accumulators in sealed glass boxes fitted in wood crate with leather strap handle. This size is of larger capacity than usual, and is introduced to meet the growing demand for larger capacity cells for multi-valve circuits. Capacity 67 ampere hours.

General Types.

11. 6 and 12-volt "Hart" motor starter and lighting batteries as used for replacement on all makes of cars. Capacities 45-123 ampere hours.

12. 2-volt "AP.7" cells in ebonite boxes as largely used by the Admiralty. Capacity 11 ampere hours.

13. Portable hand lamps in case fitted with tumbler switch and 4-volt accumulator. Capacity 45 hours light on one charge.

14. 2-volt inspection lamp outfits, fitted with accumulator. In demand for meter reading work, inspectors, railway officials, electricity and gas undertakings, etc.

15. "PL.3" type cells in celluloid boxes. These represent the exact size to replace dry cells in the usual standard type of flash lamp case. They are a great saving in cost, and are easily recharged.

All capacities mentioned represent actual output based on continuous rating.

J. A. Coomes & Co., Ltd. (Stand No. 18).

A broadcasting receiving set of new design, styled the "Ionophone" is exhibited on this stand.

In the design of this receiver the variable condenser has been eliminated and tuning is done entirely by means of fixed condensers and variometers, the latter of their own design.

The variometer gives sharp tuning over a range from 200-3,000 metres wavelength, so that the Hague concerts and Eiffel Tower meteorological reports and time signals can be obtained as well as all the ordinary broadcasting wavelengths.

The set is so arranged, in view of the regulations of the P.M.G., that self-oscillation is impossible.

The receiver consists of two radio-frequency amplifying valves with a radio frequency intervalve transformer of the firm's own design, a rectifying valve, telephone transformer, and low resistance telephones.

Where extra amplification is required, a two-valve audio-frequency amplifier is supplied for attachment to the set.

In addition there are exhibited intervalve transformers, telephone transformers and variometers.

Cabinet "Aristophone" in Jacobean style.

C. F. Elwell, Ltd. (Stand No. 23).

Cabinet "Aristophones," for drawing-room use, having specially designed cabinets, which are accurate period reproductions and contain the whole of the wireless apparatus, including batteries and "loud-speakers" form a special feature of this exhibit.

The loud speaker has novel features, being hand moulded of a wood fibre compound to proportions which have been scientific-

ally ascertained for the greatest purity of tone, resulting in a shape resembling that of the human ear. The wireless receiver is unusually simple, and it is apparent that great care has been taken to design an instrument with very few adjustments.

One particularly interesting exhibit is a lacquer-work china cupboard and bureau of 1722, into which wireless apparatus characteristic of 1922 has been built.

"Aristophone" cabinets are shown in Cromwellian, Sheraton, Lacquer, and Adams styles.

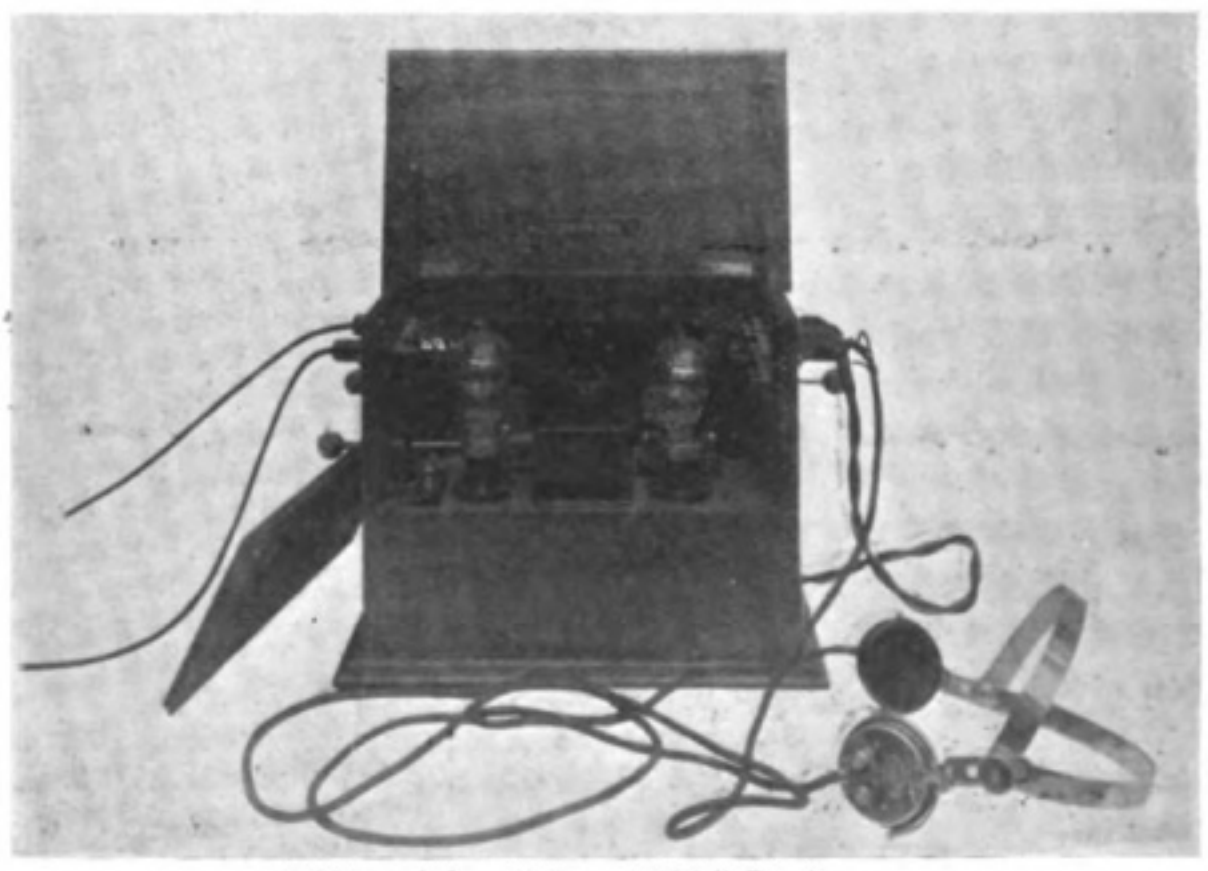
An Elwell accessory. A "bull-dog" grip terminal.

Various types of special "Polar" receivers and amplifiers for long range reception and various wavelengths are also shown.

Marconi's Wireless Telegraph Company, Ltd. (Stand No. 24).

The exhibit includes several pieces of historical apparatus showing the advance which has been made in wireless science during the past 25 years, and also a number of the latest wireless instruments. The latest pattern Wireless Direction Finder, as installed at the London Air Port for the Air Ministry, and as used by the British Post Office, and in numerous foreign aerodromes is shown. This is known as Type 12a and is designed for use on land in connection with the navigation of ships and aircraft. It provides a means for accurately determining the plane of received signals and the absolute direction of reception. The sensitiveness of this instrument is such that it may be used for ordinary reception with satisfactory results, and in this connection its directional properties are of very considerable value in the presence of "jamming." Change from directional reception to uniform all-round reception can be brought about instantaneously by the operation of a single switch, and the circuits are equally suitable for the reception of spark, tonic train, telephony or continuous wave signals. The wave range lies between 300 and 4,500 metres.

In conjunction with this instrument there is also shown the Aircraft Wireless Telephone Transmitter and Receiver, Type A.D.2, such as is fitted to British commercial aeroplanes flying between London and the Continent, and to machines in all parts of the world. This set is primarily designed for wireless communication—telegraphic or telephonic—between aircraft and ground stations or to other aircraft. Its chief characteristic is that it combines in one box both transmitter and receiver, connected per-



"Marconiphone" Type "V.2" Receiver.

manently by cables to a small unit which carries all the handles necessary for controlling the set. This small unit, called the " Remote Control," can be mounted conveniently to the hand of the user, while the set proper can be stowed permanently away in the most convenient position. The principle of remote control enables a pilot, while flying, to have all the necessary adjustments for both sending and receiving either telegraphy or telephony in a very compact space. A small wind-driven generator supplies all power for transmission.

The Marconi Direction Finder.

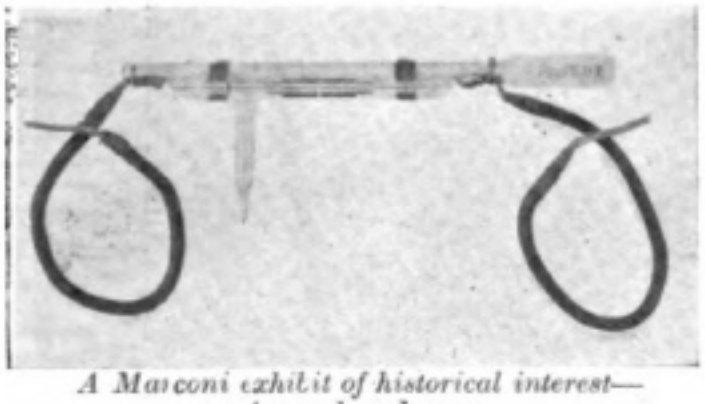
A " Marconiphone " Crystal Set.

There are several types of " Marconiphones " on view. These are special instruments designed by the Marconi Company for the reception of broadcast telephony in the home. The popular models will include the two-valve receiver known as Type V.2 and two Crystal receivers known as the Crystal " A " and the Crystal Junior.

The V.2 model has been constructed to meet the new Post Office requirements, which specify that the receiver must not be capable of radiation. Reaction is not employed, but a throw-back circuit is utilised by means of which additional low frequency magnification is obtained. The " grid condenser " method of rectification is employed, and a novel method of tuning is used in which the inductance of a fixed coil is varied by means of a copper spade. Inductance units are interchangeable. The set has been so designed that either " R " or " Dull Emitter " valves can be fitted, the latter permitting of the operation of the set from dry cells instead of accumulators. This receiver has a guaranteed

range of 50 miles from a broadcasting centre, on the broadcasting wavelengths.

The Marconi Crystal "A" is an attractive



A Marconi exhibit of historical interest—An early coherer.

crystal model fitted with two types of crystals, galena and carborundum. It employs the same system of tuning as the "V.2," and there is an automatic adjustment for the carborundum crystal. There is provision for wo pairs of telephones.

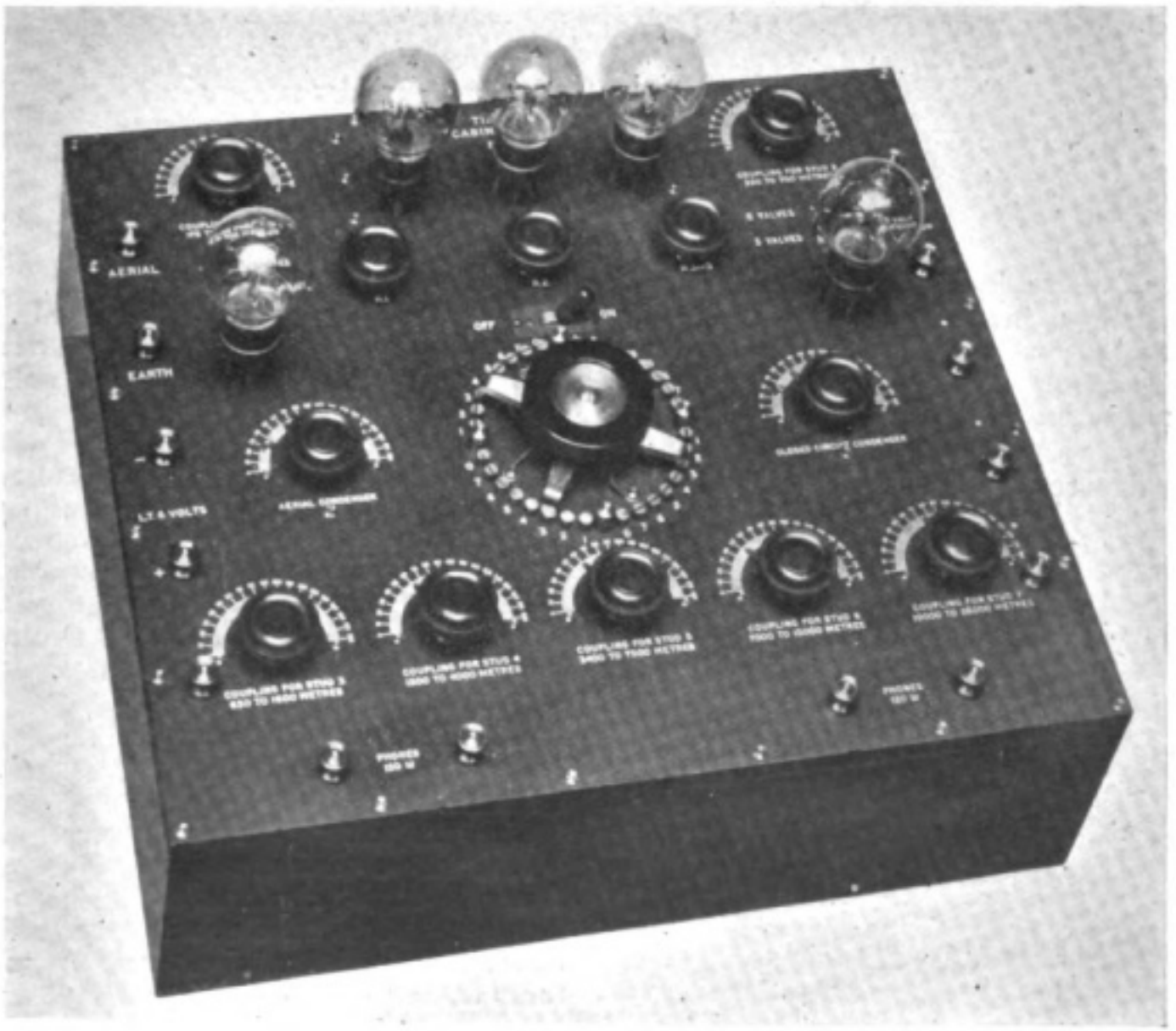
The Marconi Crystal Junior has two interchangeable crystals, galena and carborundum, with automatic adjustment for the latter. It has a single circuit tuning system, employing the "spade" method, and the range is from 10 to 12 miles. There is provision for one single earpiece headphone.

W. Robert H. Tingey (Stand No. 25).

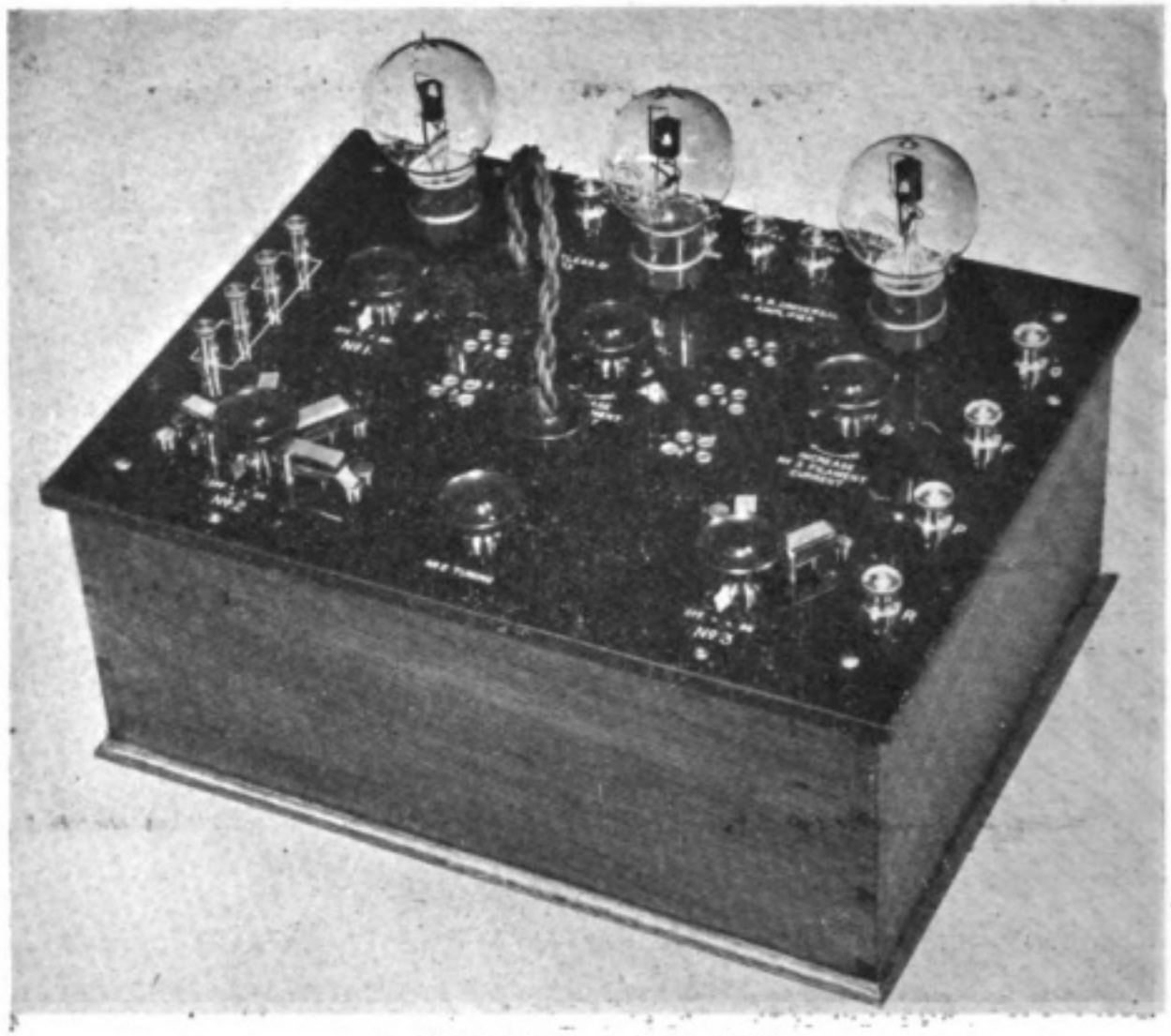
The special feature of the exhibits on this stand is undoubtedly the receiver, which covers the complete wavelength range with equal efficiency on all wavelengths and is possibly one of the first instruments put on the market designed to accomplish this.

H.P.R. Wireless, Ltd. (Stand No. 35).

Up to the present the wireless recruit has always been faced with two big difficulties —how to tune his instrument quickly and



A Tingey Universal Receiver.



An H.P.R. Tuner and Amplifier.

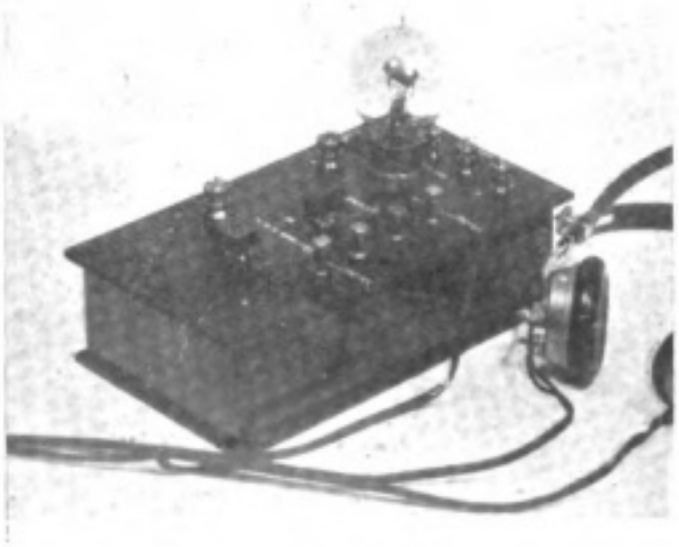
accurately to the known wavelength of the stations he wants to pick up, and how to recognise from the signals he is receiving on his instrument the station which is transmitting them.

By the use of the H.P.R. Patent Automatic Wavelength Indicator, invented by Mr. H Powell Rees, all these difficulties are cleared away. "Tuning-in" becomes as simple as turning on a gramophone.

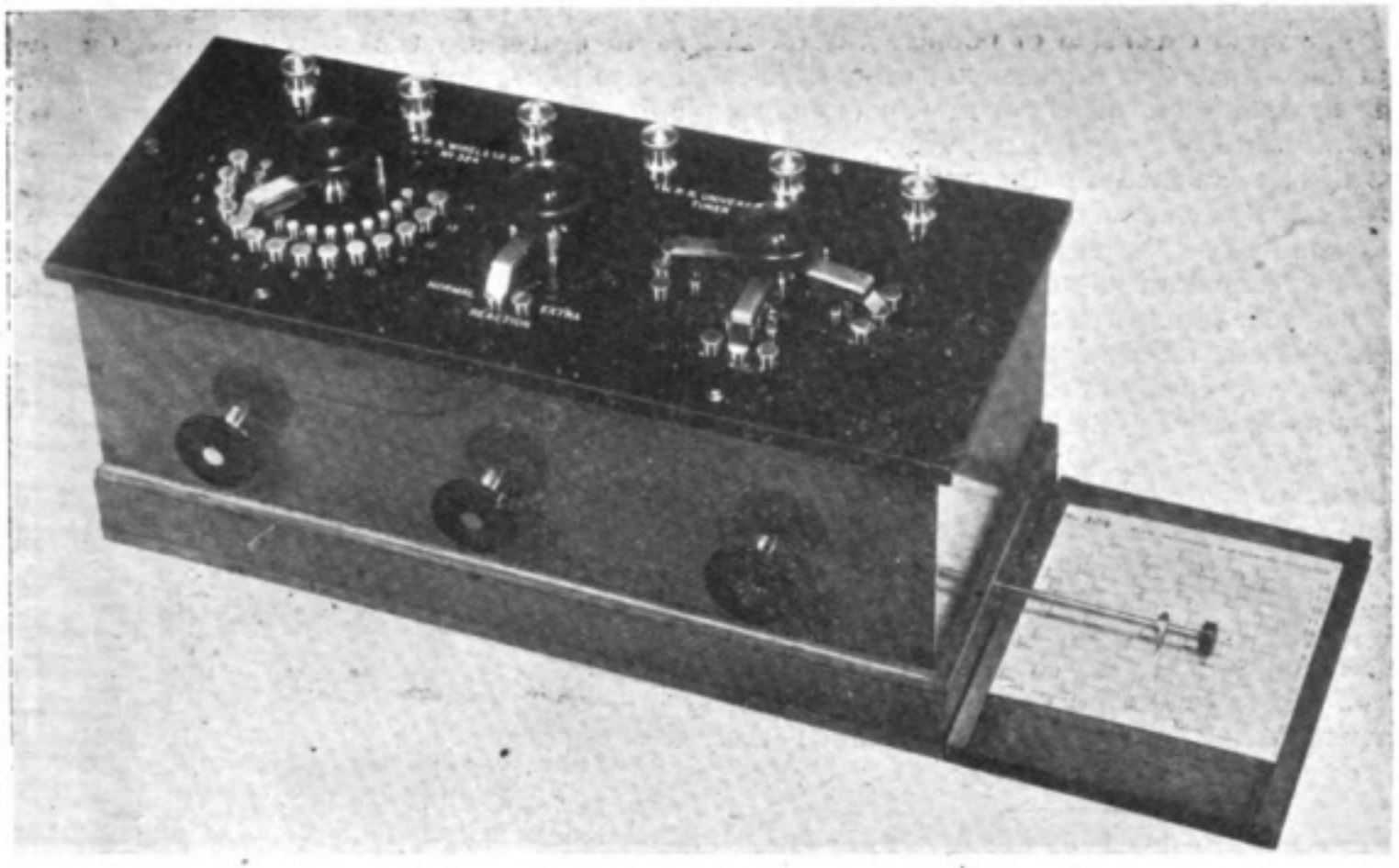
Each H.P.R. Universal Tuner includes a specially calibrated wavelength indicator. By setting the pointer to the figure of the wavelength, the required station is immediately picked up. If unknown signals are coming through, it may usually be ascertained in an instant which station is sending. The operation is as certain as switching on an electric light.

The Automatic Wavelength Indicator may be described as an "indispensable guide to the ether."

The "Simplex" Wireless Phone which fulfils the conditions of the Postmaster-General for "broadcast receiving," is thoroughly efficient and no wireless knowledge is required for its manipulation. Gives the concerts, etc., at their best by turning a handle. Magnifying apparatus may be added if desired.



The "Simplex" Wireless Phone.

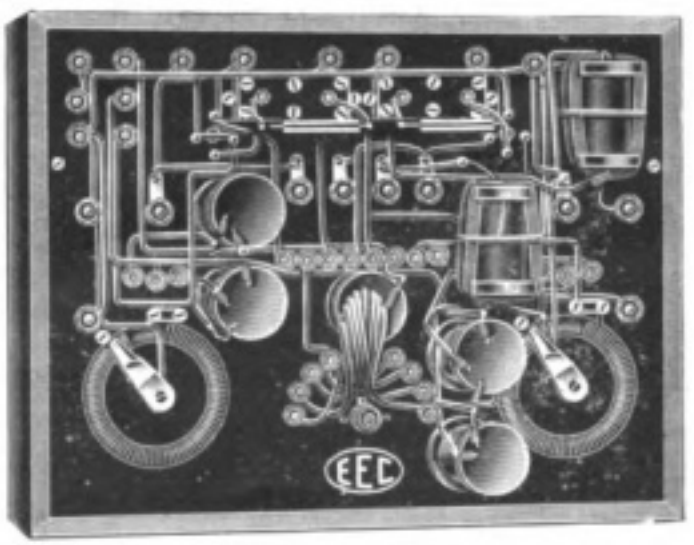


The Universal Tuner with wavelength indicator.

Economic Electric Co., Ltd. (Stand No. 51).

An instrument designed for recording wireless signals is of special interest. It employs the principle of two valves balanced in opposite links of a wheatstone bridge which is a particularly efficient method for causing feeble oscillations to operate a relay.

Another instrument, termed an "Oscillator," is a device for adding in a receiving circuit to permit of the reception of continuous wave signals over a wavelength range of 3,500/25,000 metres.



A Valve Bridge used for Recording Wireless Signals.

The Dubilier Condenser Co. (1921), Ltd. (Stand No. 36.)

The rapid expansion of popular interest in all radio matters is emphasised by the exhibits to be found on the stand of The Dubilier Condenser Co. (1921), Ltd., which show the principles adopted in the well-known condensers manufactured by this firm for use on the larger wireless installations applied to the requirements of radio receivers.

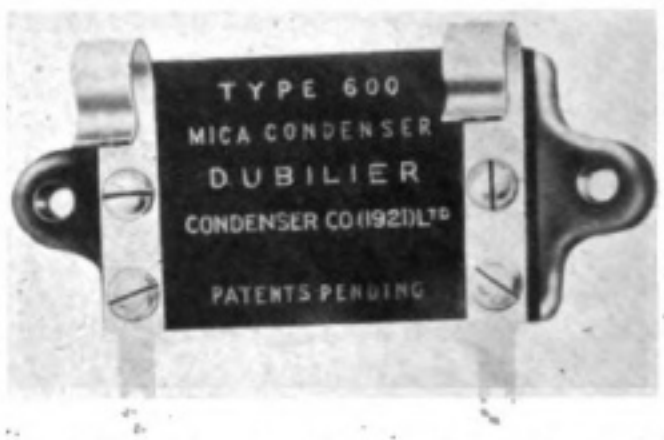
For use with wireless receiving apparatus four patterns of fixed condensers are shown, known respectively as the Type 600, with and without grid leak attachment, the Type 600A and the Type 577 condensers. These condensers are all constructed with carefully selected mica dielectric and are built up on the same principles as those adopted for the larger power condensers.

The Type 600 condensers are made in two patterns, one carrying clips into which a grid leak resistance can be pushed, and the other having tag connections only, to which the external leads can be soldered. These condensers are enclosed in a moulded insulated case and have very high insulation resistance and the absolute minimum of losses.

The "Ducon" attachment for enabling the electric lighting wires to be used for radio receiving with perfect safety.

The Type 600A condenser is of very similar type, but is designed for mounting on edge, so as to economise the space required on the instrument panel. It is not provided with clips for a grid leak, but merely with metal tags to which connections can be soldered. These three patterns of condensers are supplied in any value desired up to 0·005 microfarad.

The Type 577 Universal Condenser is also constructed with a mica dielectric and is enclosed in a metal case. It is suitable for use in wireless receiving and in low power wireless transmitting circuits, for the parts of telephone repeaters and many similar purposes. Extreme constancy of capacity is the main feature of this condenser, while the metal case which can be earthed also forms an efficient electrostatic screen. This type is available in any capacity up to 0·01 microfarad.



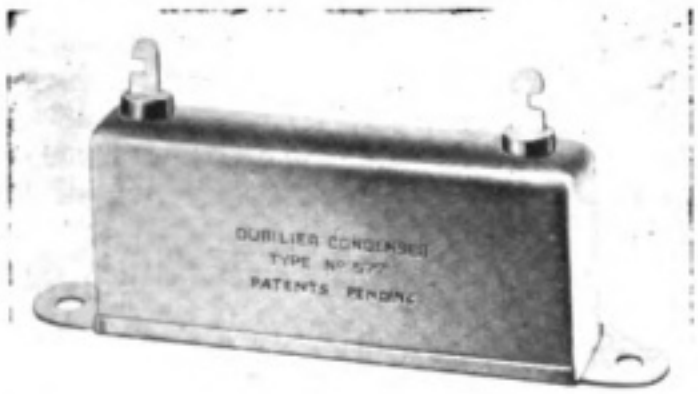
Condenser for use in receiving circuits fitted with clips to carry leak resistance.

For the more elaborate types of receiving apparatus such as are used by amateur experimenters and in the better class of broadcast receiving apparatus, special patterns of variable air condensers were exhibited by this firm, Variable air condensers ("Varicons") of the moving vane type are shown in three patterns,

Designed specially for panel mounting, measuring only 2⅛" × ⅜"

suitable respectively for panel mounting, for ordinary experimental purposes, and as a laboratory condenser, the difference being in the type of case fitted to the condenser.

A novel pattern of variable air condenser (known as the " Sphericon ") is also shown, in which the electrodes are in the form of hemispherical shells, fixed and movable shells being interleaved with one another somewhat similar to the arrangement of the moving vane



A Universal Condenser for use in receivers and low power transmitters.

condenser. This arrangement secures great mechanical rigidity and ensures constancy of calibration.

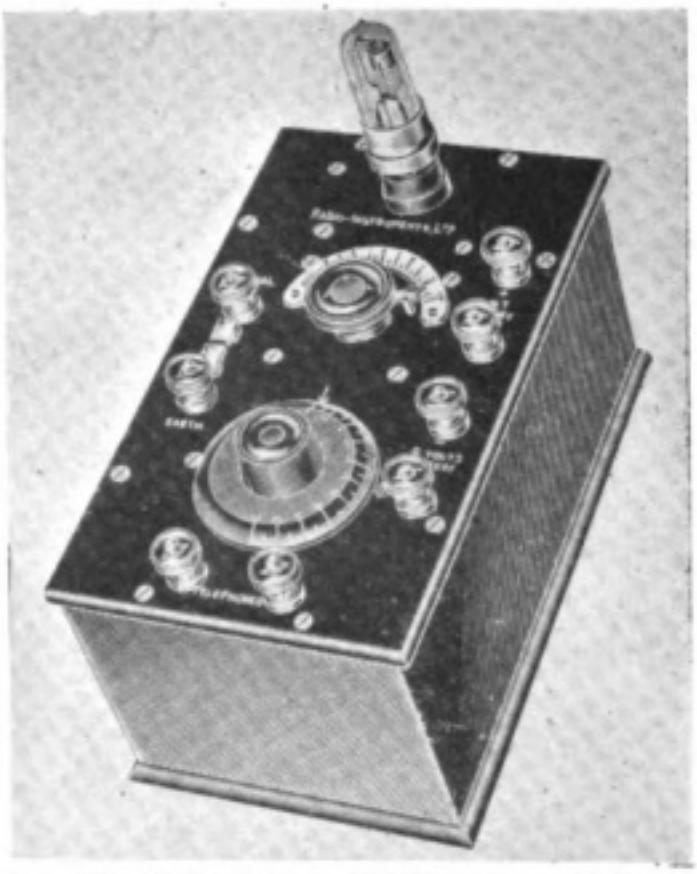
For the simpler types of broadcast receiver, such for example as the crystal receivers, where great mechanical rigidity and extreme constancy of calibration is not required, a very compact form of condenser has been devised.

Self-contained 4-valve amplified receiver for broadcast reception, by Radio Instruments, Ltd.

This variable condenser has a mica dielectric which enables comparatively large capacities to be contained in a very small space.

An apparatus of special interest which is also exhibited, is a device for enabling the ordinary house electric lighting wires to be used as radio receiving aerials. In the ordinary way it is not possible to utilise the house wiring as a receiving aerial without first switching off the current at the main switch where it enters the building, as otherwise a short circuit would result and the receiver would be damaged. The use of the " Ducon " attachment obviates this. It is tested to withstand 2,000 volts so that perfect safety is assured with no possible risk of shocks when handling the apparatus with the current switched on. The attachment is designed for inserting directly into an electric lamp-holder and is provided with terminals for attaching a wire to the aerial terminal of the receiving apparatus.

Various other patterns of standard laboratory condensers and condenser units suitable for



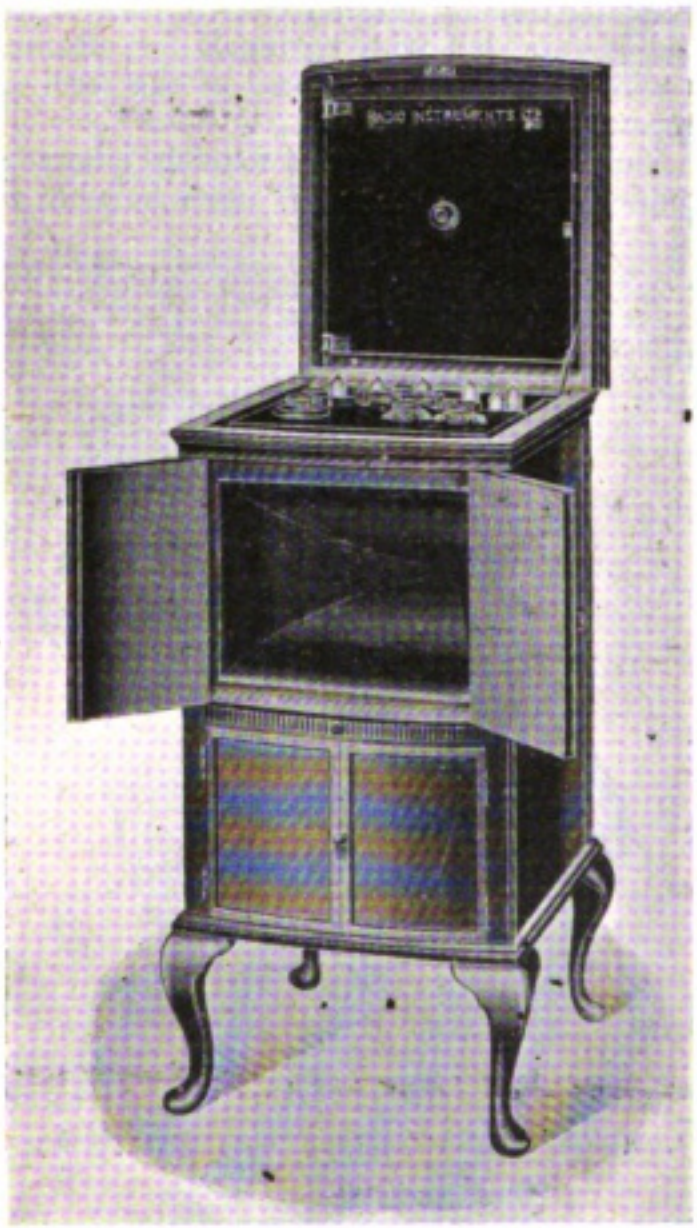
Complete single valve amplifying receiver for broadcasting on Stand **37.**

both spark and C.W. wireless transmitters are also exhibited, the latter including a standardised condenser unit enclosed in an aluminium case, which can be employed for many patterns of transmitting equipment. This unit is fitted with a special type of mica terminal and can be used on circuits of which the voltage does not exceed about 10,000.

The patented construction adopted in the manufacture of this condenser ensures constancy of capacity and very low losses, even when carrying considerable high frequency currents.

Radio Instruments, Ltd. (Stand No. 37).

Residents in flats, hotels and places where the erection of a wireless aerial is out of the question, will be interested to learn that a complete wireless receiving set enclosed in a cabinet without any external wires or connections of any kind has now been designed by the above firm, and is exhibited at their stand. The receiver illustrated here comprises a 7-valve set with a frame aerial



Frame Aerial Cabinet Receiver.

fitted to the lid of a cabinet of period or other design in which is included a powerful loud speaker, and the necessary high and low tension batteries, the latter being accommodated in a cupboard in a lower part of the cabinet. To receive broadcast telephony, it is only necessary to open the lid of the instrument and to manipulate three knobs which control the tuning circuits, when music can be heard in a large room by a number of people. Doors are fitted to the loud speaker which can be opened or closed thereby reducing or increasing the sound as required.

Three specially designed high frequency intervalve transformers, fitted with tapping points on the windings and controlled by a coupled switch for simultaneous operation, are connected with the first three valves; the fourth valve acting as a detector, the last three valves being coupled through audio-frequency transformers, which are free from distortion so that the resultant magnified signal or speech is loud and clear. The frame or aerial coil fitted in the lid is hinged so that it can swing through an angle of 90 degs. for obtaining the maximum volume of sound according to the direction of the transmitting station.

The manufacturers inform us that a series of tests were recently carried out with the instruments fitted in a motor car while broadcasting was in operation, and the results

H.F. Transformer 150/30,000 metres, with 12 tappings.

observed with varying distances from transmitting stations. At 20 miles distance the music was quite clear, but much weaker than 10 miles distance, at which latter distance the music could be heard quite comfortably in the car. In London the volume of sound was sufficient to be heard outside the car.

The erection of an external aerial has undoubtedly prevented many people interested in wireless from installing a set. This objection has now been entirely overcome by this cabinet set.

Other apparatus exhibited by this firm includes 1, 2, 3, 4 and 7-valve sets complete with tuners and self-contained in one case, and crystal receivers of variometer type.

High frequency amplifying units, condensers, a loud speaker, and telephones of a new type are included amongst the accessories shown.

Experimental Station Design

(*Continued from p. 795, September 16th, 1922*).

These articles, which appear in alternate issues, are intended not only to be a complete guide to those new to wireless, but to give explicit details on the construction of all the components of the Experimental Station. Actual designs will of necessity in some instances be somewhat crude, in order that they can be made up without elaborate workshop equipment. Practical working instructions are given where necessary for the help of those unacquainted with the more simple processes of instrument making. Of course, where good workshop facilities exist, the designs may be readily modified.

Economy is made an essential feature, bearing in mind always that where low-priced component parts can be obtained their use has been embodied in the designs. For those who do not desire to make their own apparatus, the descriptions will assist them in selecting the equipment for their stations.

The information contained in the first few articles under this heading is to help those new to wireless and whose first aim is to build a simple set capable of receiving broadcasted telephony, and consequently may cover ground already familiar to many readers. The succeeding instalments, however, advance by easy stages, and in the course of the series the construction of an elaborate station will be evolved.

XIII.—SINGLE VALVE H.F. REACTING AMPLIFIER.

AN AMPLIFIER ARRANGED TO ELIMINATE INTERFERENCE BY RADIATION.

FOR a good range, or for reception from low power stations, it is necessary to employ at least one stage of high frequency amplification. The unit to be described is intended for adding to a detecting valve set, which may already be arranged with a reaction coil coupled to the aerial circuit and followed by one or more note magnifiers.

A view of the top of the instrument is shown in Fig. 1, in which all essential dimensions are given. The panel is sawn from a sheet of $\frac{5}{16}$-in. ebonite and all edges filed true and square to one another and exactly square to the front face. They are finished by carefully sliding the panel edgewise along a piece of fine emery cloth, nailed down

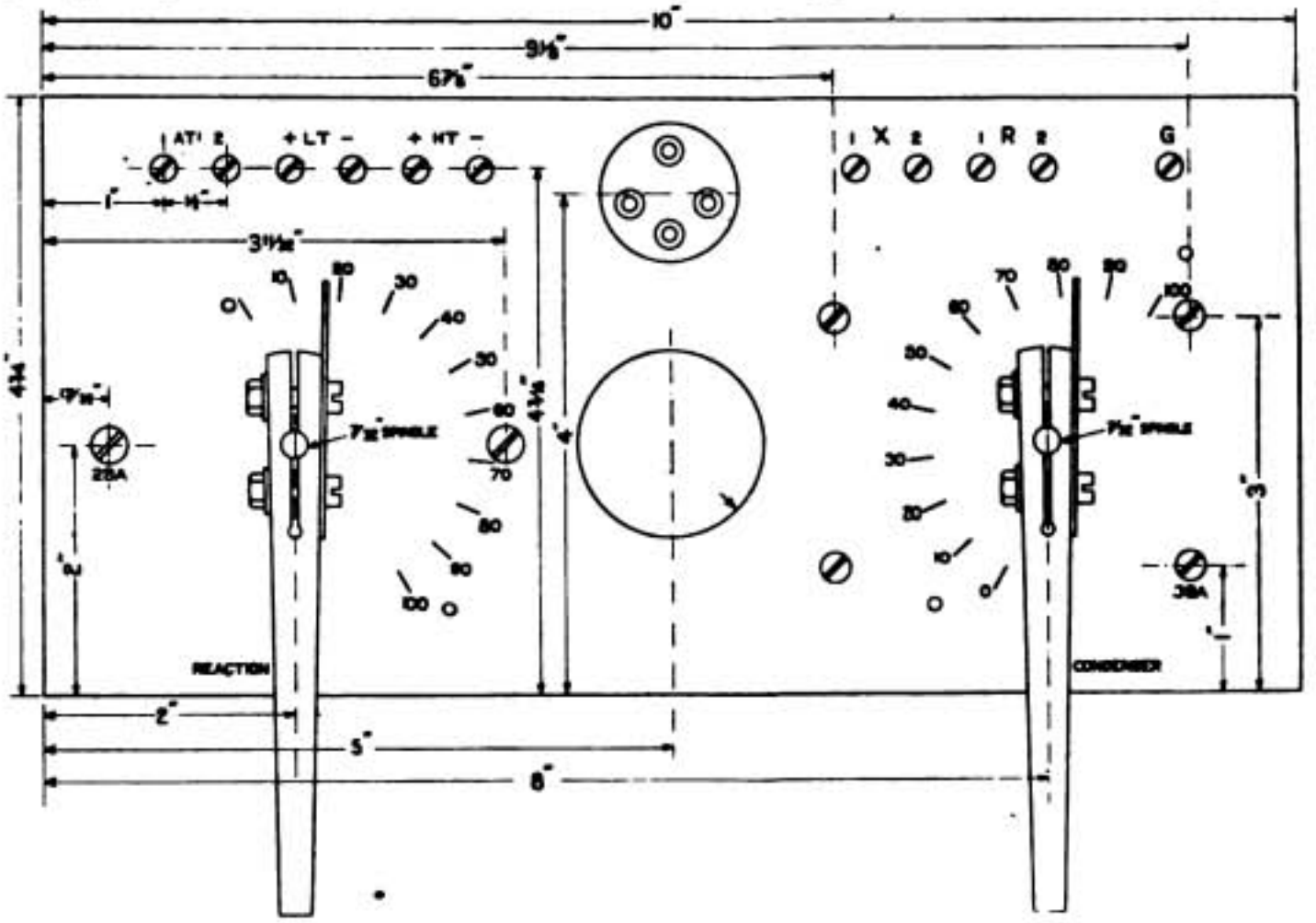


Fig. 1. Lay out of panel of H.F. Amplifier. The lever on the left will be replaced by a knob, if a sliding instead of revolving inductance is fitted to provide tighter reaction coupling. Half full size.

to the bench, keeping the panel at exact right angles to the face of the bench and exerting even pressure along the edge.

Before drilling the panel the reader must bring together any pieces of apparatus already made up which he proposes to incorporate in the set. He will require a variometer, loose coupler, or any arrangement of two formers that will provide a variable coupling, an air dielectric variable condenser having a maximum value of about 0·0004 microfarads, a variable filament resistance, a valve holder and terminals, wire, "sistoflex" insulating sleeving and miscellaneous screws.

Holes for attaching the filament resistance and valve holder can be made equidistant from the ends.

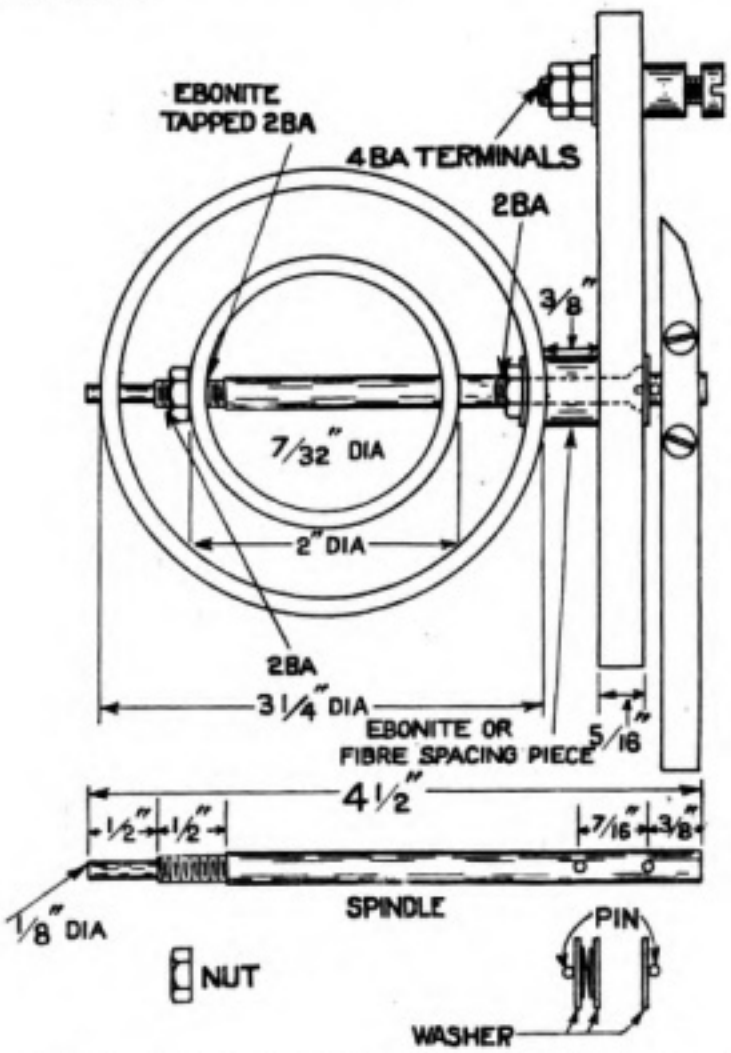


Fig. 2. Constructional details of revolving type variable coupling. End view.

The condenser shown in the figure is one the construction of which has been given in a former article.* It is attached by means of four 3BA screws and may consist of about one-third the number of plates shown in the illustration explaining its construction, provided the thickness of the plates and spacing washers are the same as those given. The

* Page 581, August 5th, 1922.

capacity in microfarads for any condenser of other dimensions, can be found by multiplying the area of one side of one of the moving

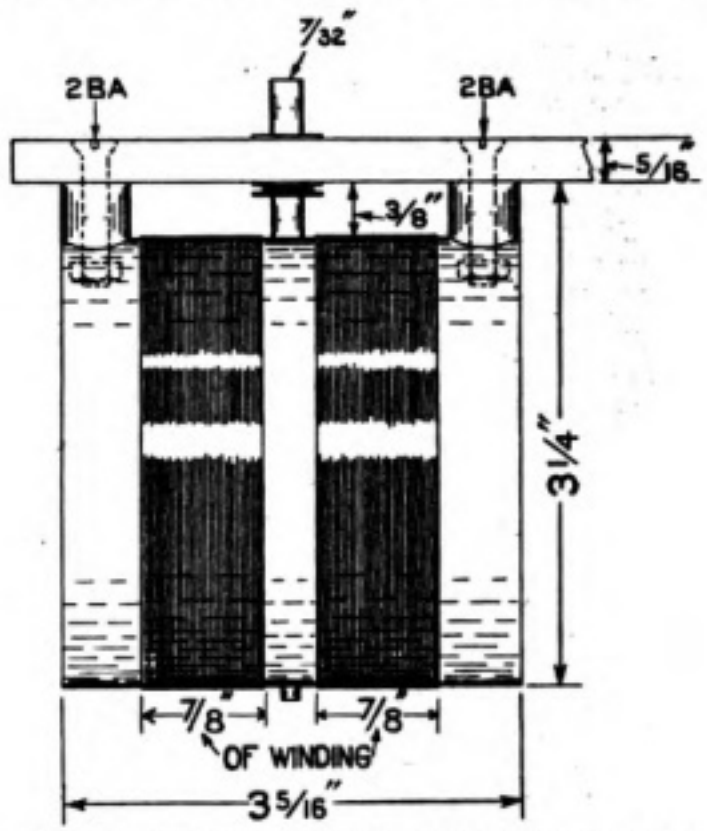


Fig. 3. Side view, showing arrangement of the inductance which is in the plate circuit of the H.F. valve.

plates (less the ineffective portion in the centre which is not overlapped by a fixed plate when in use) expressed in square centimetres by 1,768 times the number of moving plates and dividing this figure by the distance between the plates (that is, the thickness of the spacing washers less the thickness of the moving plates, and dividing the remainder by two), expressed in

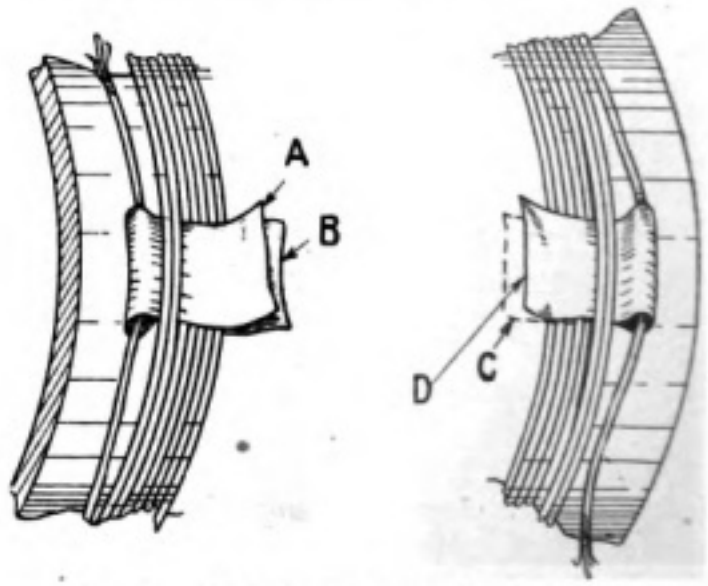


Fig. 4. Method of terminating inductance windings.

millimetres. The result obtained is divided by 1,000,000,000.

The variable reaction coupling is arranged at the other end of the panel, the controlling handle of which balances out in appearance that of the condenser. One form of construction is shown in Figs. 2 and 3. A piece of $3\frac{1}{4}$-in. external diameter ebonite tube is obtained with a wall thickness of from $\frac{1}{8}$ in. to $\frac{5}{32}$ in. and is carefully sawn to length, taking great care by sawing to pencil lines that the ends are true, and avoiding fracture while cutting. The ends are finished by rubbing on the piece of emery cloth which is nailed down to the bench. This tube is attached to the panel by means of two 2 BA brass screws with countersunk heads and $1\frac{1}{4}$ ins. in length. Ebonite spacing pieces fit over the screws to hold the coil away from the panel. These pieces have an external diameter of $\frac{1}{2}$ in., a hole diameter of $\frac{3}{16}$ in. to $\frac{1}{4}$ in., and are $\frac{3}{8}$ in. in length. One end of each piece is filed away to a hollow shape to fit the cylinder. The reader is again warned that great care is necessary in working big diameter ebonite tube owing to its liability to snap. The drill used for making the holes for the 2 BA screws and spindle must be put through slowly and without excessive pressure. The hole for the larger end of the spindle gives clearance, the actual bearing for this end being the panel.

The inner cylinder is cut from a piece of 2-in. tube and is 2 ins. in length. Holes are made in opposite sides at the exact centre point, one to exactly fit the $\frac{7}{32}$-in. spindle and the other a $\frac{13}{64}$-in. hole suitable for tapping to 2 BA. The spindle, also shown in Fig. 2, is made from a piece of $\frac{7}{32}$-in. brass rod. If $\frac{7}{32}$-in. is not easily available, $\frac{1}{4}$-in. rod may be used. One end is reduced in size, as shown in the diagram, for tapping to 2 BA and for providing a bearing. If a lathe is not available the diameter can be reduced by filing, as described in the earlier article on condenser construction.

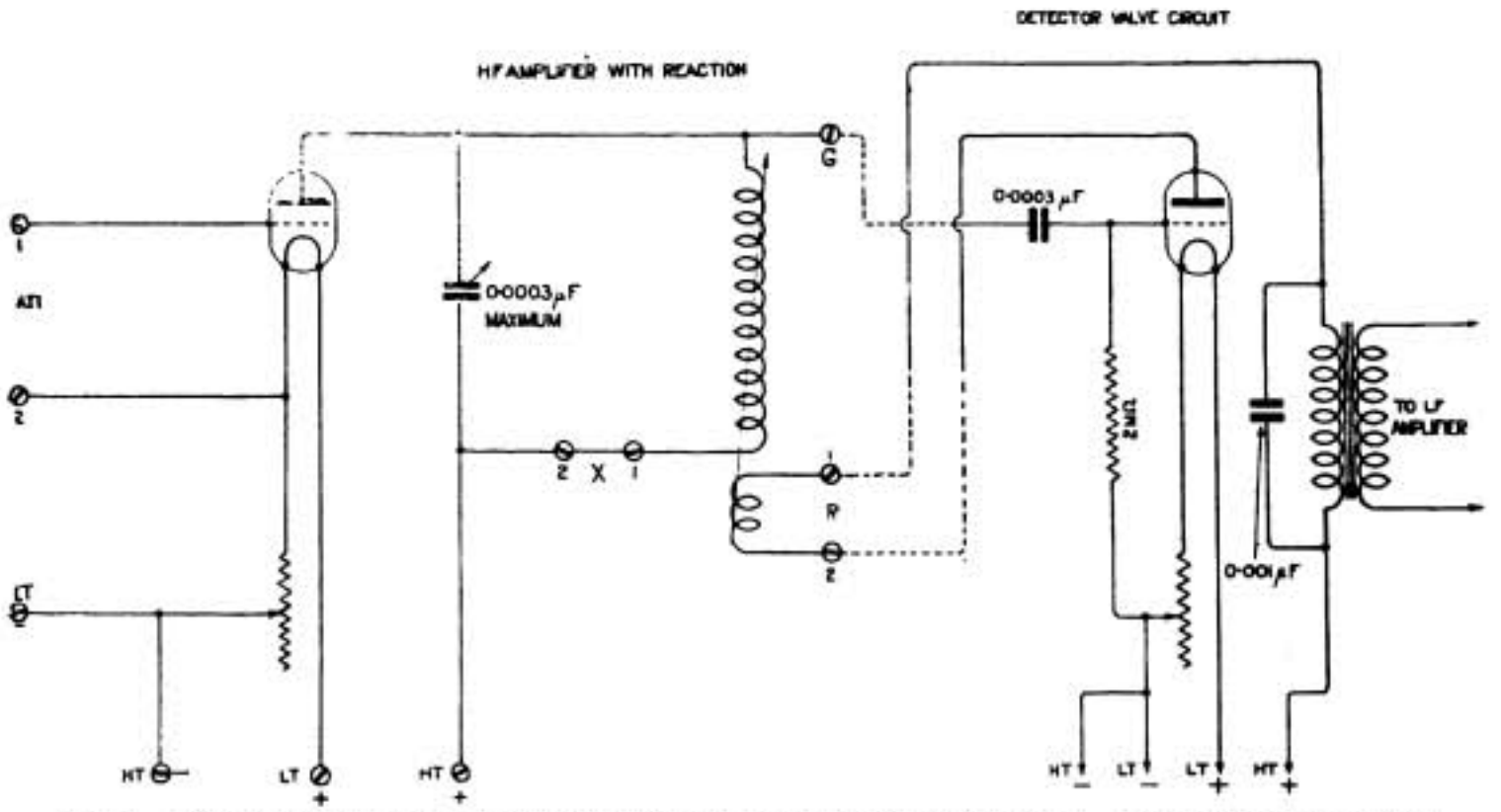


Fig. 5. Circuit diagram of reacting amplifier connected to the detector valve. The terminals marking "A.T.I." on the left are for connection to the secondary inductance or former reaction coil, coupled to the aerial circuit.

Two small holes are drilled through the spindle to carry pins made from about 18 gauge hard brass wire. The exact spacing of these holes must be determined, as the dimension given in the diagram only applies when a particular size of split washer is used.

In fitting up the formers the smaller one is adjusted to a central position and held by means of a lock nut. It is essential in making this component that the holes in the formers which carry the spindle are exactly opposite to one another. An easy way of ensuring this is to mark the positions for the holes by standing the cylinders on squared paper so that one of the lines becomes a diameter and extending this line vertically up the opposite faces.

The larger former is wound with two

sections, each $\frac{7}{8}$ in. in width, of No. 20 D.C.C. wire. The few turns required are, of course, put on by hand, even though the reader may possess a lathe, as the wire is rather stiff. The method of fixing the ends of the wire is shown in Fig. 4. Three pieces of strong silk ribbon, $\frac{3}{4}$ in. in width, are laid on the former at equal distances around it. One turn of wire is then passed round over the three pieces and they are then bent back as shown in "A." Two more turns of wire, quickly and roughly put on, will hold the ribbons in place sufficient to secure the first turn. By pulling on the end "A" the first turn can be brought down in contact with the second turn and the three turns pushed up into position. Tension must of course be kept on the wire the whole time and the beginning end can be bent back to prevent it slipping through the loop in the ribbon. The end "B" is buried under subsequent turns. When the winding has progressed to within about $\frac{1}{2}$ in. of the required distance to which the coil is to be wound, three more ribbons are laid on the former so as to secure the ends "C." The full number of turns are then put on and the wire cut to length. Three or four turns are then unwound, taking care not to allow the whole winding to run slack. All except one turn are then wound on again, this time over the ribbon and securing down the ends "D." The last turn is tucked through the loops and by pulling on the ends "D" is brought down into position.

The smaller coil is wound with No. 26 D.C.C. in two sections, each $\frac{3}{4}$ in. The end turns are secured in the manner just described. Flexible wires are soldered to the ends and must be given two or three turns round the spindle and passed on for connecting in the circuit, either through one end of the large former or through two holes made between the two sections of the outside winding, and on either side of the spindle.

If preferred, coupled coils may be built up to the design given for a high-frequency intervalve transformer with coupled reaction. Only one winding will be required on the outside former, which should consist of 44 turns of No. 24 D.S.C. wire, occupying $1\frac{1}{8}$ in. The inside former should be wound full with No. 34 enamelled or S.S.C. wire.

This arrangement is most convenient to operate and does not burst into oscillation with small changes of adjustment. At a position of medium coupling a very high

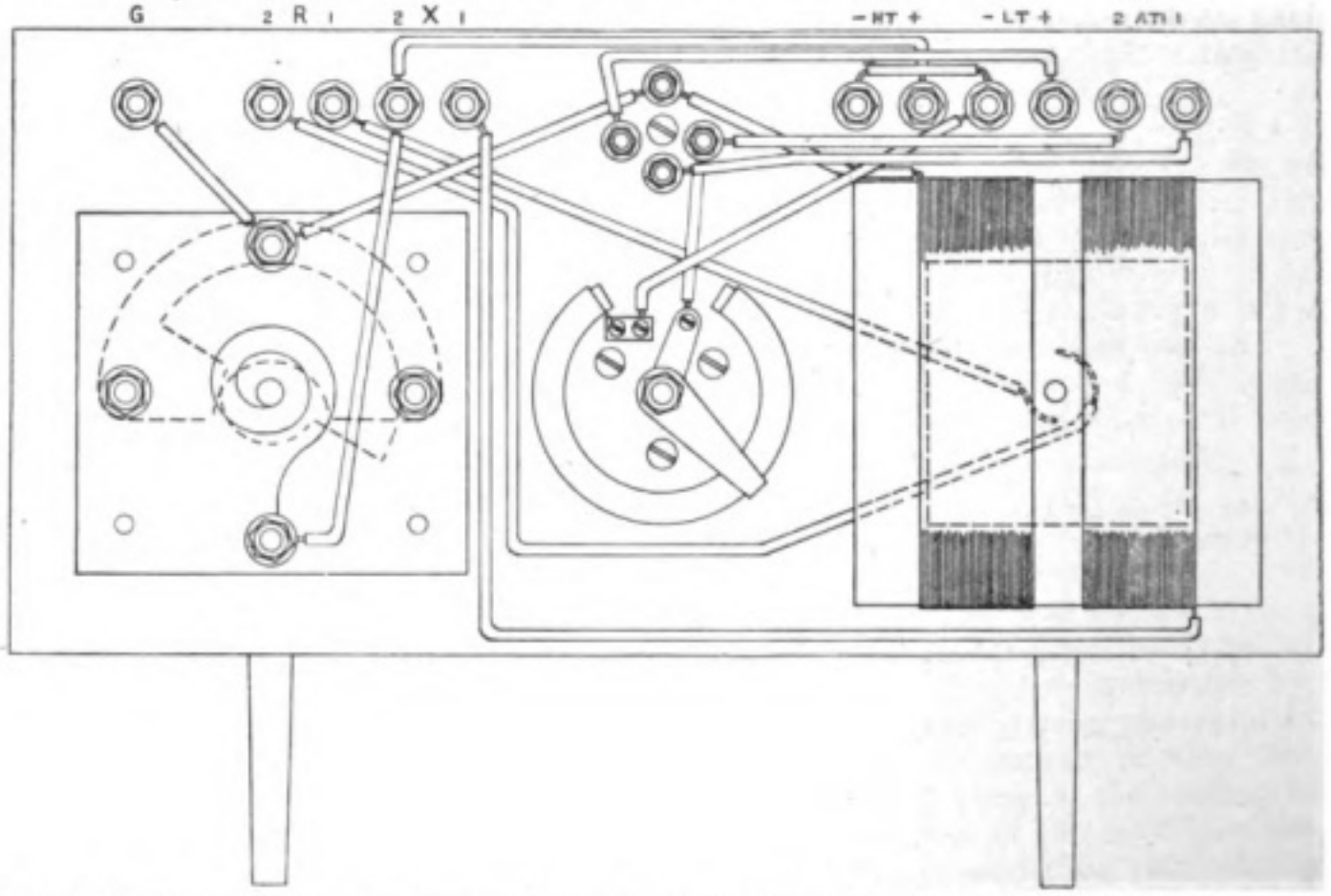


Fig. 6. Wiring diagram. Certain varieties of valves require tighter reaction coupling, which can be obtained by substituting a sliding inductance for the revolving pattern shown on the right. Half full size.

* Page 718, September 2, 1922.

degree of amplification is obtained, entirely free from any tendency to howl.

The windings given are suitable for reception on wavelengths of 350 to 550 metres. For longer wavelengths finer wire may be used for winding the inductances, or the turns can be pile wound.

The components are assembled on the panel as shown in Fig. 1. The levers are of a type already described and the scale lines marked on the top of the instrument must be slightly staggered in order that the pointers may lie along them. The scales may be either scratched on the ebonite or carefully drawn on paper and pasted on. It is better, of course, to have the scales and other labelling engraved and this can easily be arranged by carefully marking all labelling exact as to size and position in pencil and putting the panel in the hands of a firm undertaking this class of work. The faces of the panel should be carefully rubbed down as previously described, with very fine emery paper before assembling.

The wiring diagram is given in Fig. 5, and shows the H.F. amplifying unit coupled to the detector valve, which was formerly the first valve in the receiving set. It is to be noted that the grid leak is not connected across the grid condenser. For the guidance of those not familiar with the wiring up of instruments, a practical wiring diagram is given in Fig. 6.

Using this amplifier with an "R" type valve, the coupling provided by the turning inductance is usually sufficient to give reaction effects, and produce amplification. With "V 24" valves, which are specially designed for high frequency amplification, the sliding method should be adopted in order to produce sufficient coupling. The amplifying unit, when used on short wavelengths, will give a marked degree of amplification and by its use the experimenter can be sure that he is causing no interference with neighbouring stations.

F.H.H.

A French Wireless Exhibition

AN exhibition of wireless apparatus has recently been held in Paris as a section of the Concours Lepine. The majority of the French manufacturers of amateur radio apparatus and accessories were represented, and had on show a number of interesting instruments.

Apart from complete sets, amplifiers, etc., of the usual types, attention appeared to have been devoted largely to the construction of many novel forms of frame aerial for indoor reception, in which the actual loop wires were concealed in the parts of articles of furniture.

Several arrangements of unit systems were exhibited, some being of fairly conventional type in polished wood boxes, but others being of much smaller size and forming very neat receiving sets when coupled together. By the use of these devices, in conjunction with concealed frame aerials, the installation of a receiver for broadcasting becomes an extremely simple matter.

P.R.C.

The Position of the Grid Leak

IN sets which employ the leaky condenser method of rectification the position of the grid leak has a considerable bearing upon the quality of the results obtained. Among amateurs of experience the practice is increasing of connecting the leak direct between the grid and one end of the filament, and this position has much to commend it. In the case of reactance—or resistance—capacity coupling it is of course essential. To which end of the filament the leak is to be connected is a matter of some importance, and depends upon the valve used; a few valves seem to work equally well to whichever end it is connected, but the majority have a definite right and wrong position, negative in some cases and positive in others. Hence, the experimenter should never be satisfied that his rectifier is doing its best until he has tried both. A desirable refinement on one's set is a single-pole two-way switch to enable one to make the change without altering the internal wiring each time.

G.P.K.

Progress in the Broadcasting Scheme.

OFFICIAL STATEMENTS OF THE POSTMASTER-GENERAL AND OF THE MARCONI COMPANY

MANY statements have appeared in the general press with regard to the progress of arrangements for broadcasting since the Postmaster-General first gave his official sanction to the consideration of such a scheme in this country.

It has been realised by this Journal that this subject is one of the utmost importance and interest to all readers, and some impatience may have been felt at the absence of any detailed announcements of progress in this Journal. The reason for the absence of announcements up to the present time is a simple one, there having been no announcements to make which could be regarded as being in any way comprehensive or marking any definite step in progress towards the realisation of the broadcasting scheme.

The position to-day is, however, different, a real advance having been made, as indicated in the following official statement, made within the last few days by the Postmaster-General :

"A conference took place on September 12th between the Committee of Manufacturers and representatives of the Postmaster-General in regard to the criticisms which he has had occasion to make on the articles of association of the proposed broadcasting company, and on the terms of the proposed agreement between the company and the firms who will constitute its individual members. Several of the points raised by the Postmaster-General were satisfactorily met, and in two or three cases in which the Committee felt unable to accept his views they made alternative proposals. These have led to agreement in principle, and, so far as the Postmaster-General's criticisms are concerned, it only remains for his representatives and the Committee to settle certain details.

"It appeared at the conference that, apart from the Postmaster-General's criticisms, there were differences between members of the Committee themselves, which would have to be settled before the broadcasting company could be formed. It is understood, however, that considerable progress has also been made towards the solution of these difficulties.

"It was agreed at the conference that, as soon as a settlement had been arrived at in regard to the above matters, the Committee of Manufacturers should call a meeting of all the firms who desire to join the broadcasting company (who, it will be remembered, must be *bona fide* British manufacturers), at which the whole situation will be explained to them.

"In the meantime, the Postmaster-General and the Committee desire it to be known that membership of the broadcasting company will not, of itself, entitle a member to use the patents of other members in the manufacture of receiving apparatus. In particular, the Marconi Company claim to hold patents which are necessary for the construction and use of "valve" receiving sets. The company have stated that they are prepared to allow members of the broadcasting company to use these patents on terms which can be obtained on application."

In addition, the Postmaster-General states that he proposes to withhold until the definite formation of the broadcasting company the issue of the simple form of licence for broadcast reception.

This delay in the issue of *broadcasting* licences is not to hamper the issue of experimental licences which are still being issued to all who satisfy the Postmaster-General that they have a sufficient knowledge of wireless to enable them to make proper use of the licences granted.

This attitude of the Postmaster-General towards the issue of *experimental* licences is one which can hardly be regarded with satisfaction by amateurs and experimenters generally. In the past it has been customary to issue licences to conduct experiments in wireless telegraphy without it being necessary to satisfy the Postmaster-General as to any special scientific qualifications or previous wireless experience. The Wireless Society of London especially, is taking up the cause of the amateur in this connection, and it is to be hoped that the considerate hearing which the Postmaster-General has always given to the expression of opinion made by wireless amateurs and

experimenters as a community, through the channels of the Wireless Society of London, will result in a modification of these unsatisfactory restrictions to amateur activities.

But to return to the subject of broadcasting and the progress made. Since, in the announcement of the Postmaster-General's referred to above, special reference is made to the attitude of the Marconi Company with regard to patents and the construction of valve receiving sets involving the use of patents of this company, this Journal sought out an official of the Marconi Company, Colonel Adrian Simpson, and was able to obtain a statement which puts clearly the position of the Marconi Company with regard to their patents.

The following is the text of the statement made officially by Colonel Adrian Simpson, Deputy Managing Director of the Company.

> "In order to facilitate the formation of the British Broadcasting Company, Ltd., which will hold the Postmaster - General's licence for the conduct of the broadcasting service in Great Britain, my company has agreed to give to the British Broadcasting Company the free use of its patents for the purpose of erecting the necessary stations throughout Great Britain. Furthermore, my company has agreed to give to any *bona fide* British manufacturer who becomes a member of the Broadcasting Company a licence to use the Marconi patents for the purpose of manufacturing broadcasting receivers. Such receivers have to be of an approved type and conform with certain technical stipulations laid down by the Postmaster-General. A large number of the leading manufacturers have already approached my company and have accepted a licence. Full details regarding the terms on which these licences will be granted may be had by any *bona fide* British wireless manufacturer on direct application to my Company."

From an authoritative source, this Journal has been informed that only one or two minor points still remain to be settled before the Postmaster-General will be in a position to approve the Articles of Association of the Broadcasting Company. The moment that these Articles of Association have been approved, broadcasting will commence, and this Journal has good grounds for believing that it is now only a question of days before broadcasting in this country will become an established fact.

Notes

Broadcasting by the Prince of Wales.

His Royal Highness the Prince of Wales has graciously consented to "broadcast" by wireless telephony from York House through Marconi House **2 LO**, London, on the evening of October 7th, an Address to the Boy Scouts of Great Britain. This Address will be specially directed to those scouts who for various reasons are unable to be present in the afternoon of that day, at the great Rally being held in his honour at the Alexandra Palace, London.

The Prince will speak by wireless between 7.30 and 8 p.m., the Marconi House wavelength being 360 metres.

In order that a maximum number of scouts may listen-in on this occasion special arrangements are being made with the Wireless Societies throughout Great Britain whereby they place their services at the disposal of local troops.

Railway Experiments.

A system of transmission of telephony on electric trains has been experimented with in America. Messages are transmitted electrically, partly over a wire and partly through space. The experiments which were conducted by wireless engineers and repersentatives of four railways, were carried out at Schenectady. Efforts were made to communicate from a moving train to a sub-station three miles away. The trolley wire, carrying current to the electric engine or trolley car, was used as a carrier of telephone communication by means of another current of different frequency, which was superimposed on the wire.

This was the first demonstration, says *Practical Engineer*, of the application of "carrier current" communication to the problem of communicating between the head and rear ends of long goods trains, or to expedite train operations held up by faulty block systems.

Expansion of Service between America and Europe.

As stated in our issue of September 23rd, a new service has been opened in America of acceptance of messages at telegraph and cable offices for transmission by the Radio Corporation Company.

The Radio Corporation of America announced that an agreement had been signed between that company and the Postal Telegraph-Cable Company whereby every office of the Postal Company in the United States becomes an agency of the Radio Corporation for the acceptance of radiograms for transmission across the Atlantic Ocean and for the delivery of radiograms received from overseas for points in the United States.

This important linking up of radio and wire line services reflects the rapid growth of the Radio Corporation's overseas telegraph traffic since the return of its high power stations by the Government after the close of the Great War.

These stations transmit and receive radiograms directly to and from England, France, Norway and Germany, and through connecting stations abroad, to and from all countries in Europe, Asia and Africa.

D

The contract just signed gives to the inland commercial centres and the thousands of small points reached by the postal system equal facilities with those now enjoyed by the eastern cities mentioned, the Postal Telegraph Company performing the same service for radiograms of the Radio Corporation of America as it does for cablegrams to be transmitted by submarine cable.

With the coming development of high speed wireless telegraphy the new arrangement will permit the Radio Corporation of America to carry out its plans for the inauguration of a low rate plain language radio letter service to and from all points in the United States and Europe.

It will be remembered that the Radio Corporation of America is the outgrowth of the Marconi Company of America.

Communication in Mines.

Interesting results were obtained by Birmingham experimenters at the Baggeridge Colliery a few days ago. Efforts were made to transmit messages from a depth of 700 yards to the surface. A three-valve set was used. The aerial was erected by slinging a wire from a steel hoisting gear 100 feet high to a girder of a railway bridge. The earth wire was clamped to the lower part of a railway rail. At first the transmitter and its aerial were installed in the steel cage, but considerable screening effect was experienced. Tests were made at various distances down the shaft, and reception was found to be clearer when transmission was made at the lower points. This was thought to be due to absence of structural steelwork, which might have caused screening higher up. Another experiment was made by taking the transmitter along the workings and earthing was effected by bringing a length of cable along the floor. The aerial was slung between pit props. Signals were clearly received at the pit mouth, although owing to limited power of the transmitter telephony was weak. It was suggested that the carbon in suspension in the air was having an absorbing effect on the signals.

Calendar of Current Events

Friday, September 29th.

WIRELESS SOCIETY OF HIGHGATE.

At Highgate Literary and Scientific Institute, South Grove, Highgate, N.6. Annual General Meeting, Election of Officers, Annual Report, etc.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Oscillatory Circuits," by Mr. A. G. Warren, M.Sc.

WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.

At Brook Lodge, Ravenscourt Park, W.6. Lecture by Mr. F. E. Studt on "A Three-Circuit Variometer Tuner."

Saturday, September 30th.

Opening of First All-British Wireless Exhibition, to be held at Horticultural Hall, Westminster, S.W.1. Closing date, October 7th. Open daily, 10 a.m. to 10 p.m.

Sunday, October 1st.

Daily Mail Concert from The Hague, **PCGG**, 8 to 9 p.m. B.S.T., on 1,085 metres.

Monday, October 2nd.

ILKLEY AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. at Regent Café. Morse practice.

Tuesday, October 3rd.

Transmission of telephony at 8 p.m. on 400 metres by **2MT** Writtle.

GREENWICH WIRELESS SOCIETY.

At 7.45 p.m. At Rangers House, Blackheath. Ordinary Meeting.

Wednesday, October 4th.

PORTSMOUTH AND DISTRICT WIRELESS ASSOCIATION.

Lecture on "Portable Receivers," by Mr. Donkin.

WIRELESS AND EXPERIMENTAL ASSOCIATION.

"Gadgets" Competition.

WIRELESS SOCIETY OF EAST DORSETSHIRE.

At Branksome Liberal Club, Salisbury Road, Upper Parkstone. At 7 p.m. Formation of Winter Programme. First Lecture on "Construction of Single Valve Receiver."

Thursday, October 5th.

Daily Mail Concert as above.

GLASGOW AND DISTRICT RADIO CLUB.

At 200, Buchanan Street. First Ordinary Meeting of Winter Session. Ballot for Membership.

HOUNSLOW AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At H.Q., The Council House, Treaty Road, Hounslow. Lecture on "Wireless for the Man in the Street," by Mr. S. H. Nayler.

Sunday, October 8th.

Daily Mail Concert as above.

Monday, October 9th.

ILKLEY AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At Regent Café. General Meeting, followed by lecture on "Capacity and Condensers," by Mr. E. Stanley Dobson.

Tuesday, October 10th.

Telephony by **2MT** Writtle as above.

RADIO EXPERIMENTAL ASSOCIATION. (NOTTINGHAM AND DISTRICT.)

First Meeting in new H.Q.

Wednesday, October 11th.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At 111, Station Road, Redhill. Lecture on "Condensers," by Mr. Edwards.

PORTSMOUTH AND DISTRICT WIRELESS ASSOCIATION

Lecture on "Charging Accumulators by the Noden Valve off A.C. Mains," by Mr. R. Cole.

STOCKTON AND DISTRICT WIRELESS SOCIETY.

At 7 p.m. General Meeting.

Thursday, October 12th.

Daily Mail Concert as above.

Friday, October 13th.

WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.

At Stamford Brook Lodge, Ravenscourt Park, W.6. A popular lecture and demonstration of latest apparatus made by Messrs. Burndept, Ltd., by Mr. A. O. Gibbons.

Wireless Club Reports

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

Wireless and Experimental Association.*

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

The meeting of the Association at the Central Hall, Peckham, on Wednesday, 23rd inst., was marked by a good attendance and quite an eagerness of the amateurs present to put up and discuss the little difficulties which they had encountered in their experiments since the last meeting. It was to have been a wireless "gadget" night, with a competition for a prize offered by the Chairman, but so few gadgets materialised that an extension was made for the event to take place on October 4th.

A member had sent in a communication descriptive of the methods of staining and finishing the woodwork of home-made apparatus, but when read, it was found to be less helpful than had been hoped. The Secretary stepped into the breach, and starting off with the dictum that "the whole art of French polishing lies in the knowledge of when to leave off rubbing," gave the meeting the benefit of his somewhat extensive experience. Questions put, and other experiences detailed, showed that the chat had served the purpose intended.

Quite a lot of business was done in the matter of the rumoured threats to the amateur's liberties, and the Secretary was further instructed.

The Finchley and District Wireless Society.

Hon. Secretary (*pro tem.*), Mr. A. E. Field, 28, Holmwood Gardens, N.3.

The first meeting of the above Society was held at Squire's Lane Schools on Wednesday, September 13th. The following elections were made:—Chairman, Mr. Trussler; Treasurer, Mr. Smith; Secretary, Mr. Field; and Committee, Mr. Bishop, Mr. Macdonald Brown, Mr. Storey, Mr. Cooper, Mr. Turner and Mr. Campion. The future meetings will be held on Monday evenings at 8 o'clock.

Twenty-eight members were present. A number of suggestions were proposed, many of which were accepted. At the close of the meeting, the Committee met, when rules and subscriptions were decided upon. It is hoped that all amateurs in Finchley and district will become members; full particulars can be obtained from the Secretary.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of this Society at the Y.M.C.A., Hanley, on Thursday, September 14th, it was announced that permission had been received from Mr. Wenger to allow the members to use the roof of the Mecca Café building for the purpose of erecting an aerial.

Signals were received from several stations on the Society's single valve "Mediwaver" set, only using a frame aerial inside the club-room.

Mr. A. Hackney (member) continued with his series of lectures on the construction of wireless apparatus. He demonstrated a new method of winding inductance coils for tuners, to receive the transmissions sent out on short wavelengths by the broadcasting stations and wireless amateurs holding transmitting licences. A sample coil was constructed and exhibited.

Members who have wireless receiving sets that are not giving the expected results are invited to bring them along to the club-room on Thursday night, when they can be tested and faults cleared.

Liverpool Wireless Society.*

Hon. Secretary, Mr. C. L. Lyons, 76, Old Hall Street, Liverpool.

A meeting of the above Society took place at the Royal Institution, Colquitt Street, Liverpool, on Thursday, September 14th.

A demonstration was made of the Society's instruments, Mr. C. G. Williams explaining the C. Mark III three-valve amplifier.

The question box was then sent round and a very interesting batch of questions resulted, which Mr. N. D. B. Hyde dealt with in his usual lucid manner, illustrating his explanations with very clear blackboard diagrams.

Mr. F. P. Owen next demonstrated to the Society a very compact portable receiver, consisting of both crystal and single valve detector. This instrument was entirely home-made, including the outer case, switches, tuning coils, telephones, etc., and every item, including the L.T. and H.T. batteries, were housed in the one outer case. Although operated in conjunction with the Society's indoor aerial, signals were received on the valve detector. A vote of thanks was passed in favour of Mr. Owen, and the members were invited to bring along for demonstration at any subsequent meeting home-made apparatus of the same nature.

Mr. J. Coulton, who has been prominently associated with the Society for many years, gave a short address. All regretted to learn that Mr. Coulton has found it necessary to leave Liverpool for London for a considerable period, possibly for good. Mr. Coulton was elected the Society's accredited representative whilst in London.

Another meeting was held at the same address on Thursday, September 28th.

The first meeting of the winter session will be held on Thursday, October 12th, at the Royal Institution, Liverpool, when Professor E. W. Marchant, President of the Society, will deliver an interesting address.

Glasgow and District Radio Club.*

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

This Club resumed its activities with the Annual General Meeting which was held at the club's new premises, 200, Buchanan Street, on Wednesday, September 27th. At this meeting the election

of office bearers, etc., was carried out in accordance with the rules. Owing to pressure of private business the President and Hon. Secretary did not offer themselves for re-election, but suitable candidates for these posts were nominated by the Committee. There were some twenty-seven names before the Committee as candidates for membership, and these will be balloted for at the first ordinary meeting on Thursday, October 5th.

The club has arranged for a public exhibition and demonstration of wireless reception at the McLellan Galleries Hall, Sauchiehall Street, on Saturday, November 4th. The Exhibition will commence at 12 noon, and will continue till 9 o'clock p.m. The Committee hope to have a collection of both ancient and modern wireless apparatus, and trade firms who wish to be represented should send full particulars of offers to the Hon. Secretary as soon as possible. Two aerials will be available.

Professor G. W. O. Howe, D.Sc., M.I.E.E., has kindly consented to deliver an address at 3 o'clock p.m., and special messages from continental stations have been arranged for.

Tickets for admission are 1s. each (including tax), and can be had from all club members and the principal wireless dealers in Glasgow.

A syllabus for the ensuing season is in the course of preparation, and the Secretary will be glad to have the name of any gentleman who can give a lecture or otherwise contribute to the winter's programme.

Hounslow and District Wireless Society.*

Secretary, Mr. A. J. Rolfe, 20, Standard Road, Hounslow, Middlesex.

Asst. Secretary, Mr. J. H. Donithorne-Clark, "Lorraine," Argyle Road, Hounslow.

A meeting of the above Society was held on Thursday, September 7th, 1922, at the Council House, Treaty Road, Hounslow, the President, Mr. A. R. Pike, in the chair. On the Committee's recommendation it was decided to devote half-an-hour on alternate meeting nights to Morse practice in accordance with the wishes of a large section of the members who are extremely anxious to increase their speed. The following members were also elected to form an entertainments sub-committee to relieve the general committee from the work entailed in organising fêtes, public demonstrations and other social engagements which the Society purposes holding during the forthcoming winter months:—Lieut. Walker, Messrs. Blakeley, Clark (Asst. Secretary), Fletcher, Ladley and Myland, with the President and Secretary *ex officio*. The Society has also in the course of preparation its syllabus of lectures, and in addition to lectures by the more advanced members on general meeting nights, the following dates have already been booked:—Lieut. Walker, October 19th and November 23rd, 1922; January 18th and March 8th, 1923.; Mr. S. H. Nayler, October 5th, "Wireless for the Man in the Street," November 9th, "Wireless for the Beginner," December 14th, "Valves for the Beginner," January 4th, "Wireless—Pastime and Profession," February 15th, "Hints for the Teacher and Student of Wireless," March 29th, "The Ideal Wireless Man: His Character and Training."

At a further meeting of the Society on September 14th, at their headquarters, Mr. A. R. Pike in the chair, a most enjoyable evening was spent. In addition to a large number of new members being accepted, the Society had the pleasure of welcoming Mr. Fellows, of the "Fellows Magneto Co., Ltd.," as a Vice-President. He expressed his intention of assisting the Society in every way he could, and before leaving handed to the Treasurer ten guineas as an expression of goodwill. Lieut. Walker, also a Vice-President, then rose to address the meeting, stating that it was his intention to roughly explain some of the points which had recently been before the Committee. He described the necessity for an entertainments sub-committee, to which he strongly urged the members to bring their ideas. He explained to new members why arrangements for the working, etc., of the Society were submitted to the general meeting, the possibilities of amateur transatlantic transmission, and the still greater necessity for Morse practice. The rest of the evening was taken up with the demonstration of a portable set made by a member, Mr. Marchant, and included reception of telephony *via* the local Council's power mains.

The Secretary will always be pleased to receive applications for membership from any lady or gentleman.

The West London Wireless and Experimental Association.*

Hon. Secretary, Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

The meeting held Thursday evening, September 14th, was well attended.

Mr. O. S. Puckle, of the Wireless Society of London, gave a lecture entitled, "The Less Known Forms of Telephone Receivers." This proved to be a deep and interesting subject. The lecturer divided telephone receivers into four sections, and in turn sub-divided each section upon which he gave a very fine detailed description as to their functions and results forthcoming from various experiments carried out by himself and others that he had seen made.

At the termination of the lecture Mr. Puckle was accorded a very hearty vote of thanks. Questions were then asked and replied to fully.

By the kind permission of Major A. S. Angwin, D.S.O., M.C., the club meetings will in future be held at Stamford Brook Lodge, Ravenscourt Park, W.6., close to Stamford Brook (District Railway) station, and furthermore the weekly meeting night will now be held on Friday evenings, from 7.10 p.m. instead of Thursdays. It is hoped that the members will support the Committee's action, as undoubtedly the better accommodation and facilities offered will give the association better results. The Secretary will be glad to give full particulars of the association on application.

Forthcoming events include: September 29th, Mr. F. E. Studt, "A Three-Circuit Variometer Tuner." October 13th, Mr. A. O. Gibbon, of Engineer-in-Chief's Dept., G.P.O., A popular lecture and Demonstration of Latest Apparatus made by Messrs. Burndept, Ltd.

Belvedere and District Radio and Scientific Society.

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

At the Erith Technical Institute on Friday, September 15th, Mr. A. G. Warren, M.Sc., addressed

the weekly meeting of the above Society on "The Scope of Wireless." He mentioned that wireless, although in its infancy, was changing so rapidly that if one tried to construct the latest receiving apparatus it may be out of date before completion.

The speaker mentioned it was unfortunate that during his student days too little attention was paid to electrostatics, as this is the branch of the electrical science most in keeping with present-day wireless.

The President, in thanking Mr. Warren for his most interesting and instructive paper, remarked that in his early days he considered electrostatics, with its pith balls, etc., a confounded nuisance, but he now saw the usefulness of its application in wireless phenomena.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devenport.

The second Annual General Meeting of the Society was held on September 15th. The reports of the Secretary and Treasurer, showing the Society to be in a satisfactory and flourishing condition, were adopted unanimously.

Election of officers for the coming year then took place with the following results:—Chairman, Mr. S. G. Monk, B.Sc., M.J.I.E.; Vice-Chairman, Mr. S. F. Heal; Hon. Secretary, Mr. G. H. Lock, A.J.I.E.; Assistant Secretary, Mr. P. Arbery; Treasurer, Mr. C. E. Harris; Librarian, Mr. W. Tregilgas; Committee, Messrs. L. Voss, L. Currah, S. F. Heal, H. J. George, H. F. Downes and Dr. E. McCulloch.

An Extraordinary General Meeting was called for Tuesday, September 26th to consider a complete revision of the rules.

Full particulars of the Society will be furnished on application to the Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Devonport.

Sutton Wireless Society.

Hon. Secretary, Mr. E. A. Pywell, "Stanley Lodge," Rosebery Road, Cheam, Surrey.

The Rev. F. C. Lees, F.R.G.S., F.R.A.S., has very kindly accepted the Presidency of the Society, and his expert knowledge of radio and kindred subjects is of considerable benefit to the members. The roll now stands at 26, and is steadily increasing. A two-valve set on the unit system is to be installed, and the Society has already been presented with an L.F. transformer and 0·0003 variable condenser.

On Saturday, August 26th, by the courtesy of the Controller of Communications, Air Ministry, a party of 16 spent an extremely interesting and instructive afternoon at the Croydon Aerodrome. The wireless transmitting and receiving gear was seen, and the working explained to the visitors by the engineers in charge.

The members greatly appreciated the cordial reception accorded them.

The Fulham and Putney Radio Society.

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At a meeting held on Friday, September 15th, which was well attended, several new members were admitted. Some of the members, notably Messrs. Hart-Smith, Winnett, H. A. Gardiner and Calver, offered the Society a collection of technical books, and it was proposed that a librarian be elected. Mr. S. W. Martin was elected to this post, and he will in due course notify the members as to the books available.

The Morse buzzer class was started on September 22nd, and is in charge of Messrs. Winnett and Calver. The Society is to be congratulated on obtaining the services of two such highly technical instructors who have very kindly placed their services at its disposal.

After the close of the business, Mr. Calver introduced Mr. Adams, of Wandsworth, the winner of Messrs. Selfridge's wireless competition. Mr. Adams had brought with him the apparatus which had won the prize. This consisted of a very small and compact three-valve set with specially wound transformers, and coils, the whole being well made and finely finished. The time being limited, Mr. Adams could not go into much detail of construction, but with the assistance of Mr. Barker, with batteries and accumulator, the members present heard some signals which were rendered very loud and clear due to the special winding and wiring of the set. Mr. Adams has very kindly promised to explain the set in every detail at a future meeting. A very hearty vote of thanks was accorded to Mr. Adams for his very entertaining hour and offer. Mr. N. A. Brown had with him a two-valve set, also very neat and compact, which was tried with very good results. After more promises from members of sets and parts for trial, the meeting closed.

Judging by the liveliness of the proceedings, and the interest displayed, the future of the Society is well assured.

The Lowestoft and District Wireless Society.

Hon. Secretary, Mr. L. W. Burcham, "Gouzeacourt," Chestnut Avenue, Oulton Broad.

The above Society opened the winter session on Tuesday last, September 12th, when a very good muster of members were present.

Before the meeting started, the members' attention was drawn to the fact that the Society were indebted to Messrs. Chipperfield, Ltd., Radio Engineers, of Oulton Broad, for the excellent four-valve experimental panel, which measures about 2 ft. × 1 ft. 6 in., presented to the Society by them. The set is very quiet in working and gives excellent results, especially with telephony. When the members were finally drawn away from listening to "Writtle," Mr. R. J. Hudson delivered his lecture on "Wheatstone Receivers," which was thoroughly enjoyed by all present. Questions were numerous, but the expert knowledge of the lecturer enabled him to satisfy all queries.

Through the courtesy of Mr. C. Garrood a small party of members spent a very pleasant afternoon on August 20th in a motor boat on the river Waveney. A three-valve set was taken out and an aerial erected between two trees. Excellent telephony, etc., was received during the afternoon and Marconi House provided an hour's entertainment after tea, much to the delight of some farm hands working in a hayfield close by, also various owners of craft cruising on the river.

The Society now meets every other week as from the 12th inst. There is still plenty of room at the club-room, St. Margaret's Institute, Alexandra Road, Lowestoft, for more members.

Leamington, Warwick and District Radio Society.

Hon. Secretary, Mr. F. A. Sleath, 31, Archery Road, Leamington Spa.

The second general meeting of the above Society was held at the Spencer Street Schools on Thursday, August 24th with the Vice-President, Mr. G. H. Champ, in the chair. Mr. Marriott gave an excellent lecture on "Aerials and their Construction." The advantages and disadvantages of various types were dealt with, and methods of rigging up masts, spreaders, etc., explained. Mr. Champ operated one of his sets (two-valve), and some good results were obtained. The meeting terminated at 9.30 p.m.

The third general meeting was held on Thursday, September 7th, and in the absence of Mr. Hills, who was to lecture on the construction of a tuner, Mr. Sleath obliged with a few words on "Inductances," and explained the methods of winding various types. After discussion and questions on matters of interest, the meeting terminated at 9.30 p.m. Attendance at the last two meetings was poor. Any gentlemen in the district who are interested should communicate with the Hon. Secretary.

Fulham and Chelsea Amateur Radio and Social Society.

Hon. Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W.6.

A meeting was held on September 13th at the Society's temporary headquarters, the minutes of the previous meeting being read and accepted.

It was proposed by Mr. Saunders and seconded by Mr. Patterson that the Society should apply to become affiliated with the Wireless Society of London, this being generally accepted, the necessary steps will be taken.

During a discussion on reception Mr. Whitts, a member, kindly gave a short but exceedingly interesting lecture on the ether, which was much appreciated. There was an attendance of 37, of whom two were visitors. The total membership is now 60. Ladies are especially invited.

Swadlincote and District Radio Society.

Hon. Secretary, Mr. H. Shakespeare, 46, High Street, Newhall.

Inaugurated but a week or two ago, the Society is making rapid progress and already the membership numbers over 30. A meeting was held on Wednesday, September 13th, in the Hastings Road Schools at 7.30 p.m., when a discussion took place on the rules, which were passed as framed at the first meeting. It is hoped to find suitable headquarters shortly. As to the apparatus, the decision of the sub-committee that the members construct their own was endorsed. Six new members were enrolled, and more will be welcomed.

Wireless Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

A Wireless Society of Birkenhead in conjunction with the Y.M.C.A. is under formation. Will all those in the Birkenhead district requiring particulars apply to the Hon. Secretary.

Huddersfield Radio Society.

Hon. Secretary, Mr. C. Dyson, 14, Y.M.C.A. Buildings, John William Street, Huddersfield.

A Society has been formed with headquarters at the above address. The following officers have been elected:—President, Mr. Tom F. Brook; Hon. Secretary, Mr. C. Dyson; Hon. Treasurer, Mr. P. Priest.

The club rooms are open on Tuesdays, Thursdays and Fridays from 7 to 10 p.m. and the members hope to start making a receiving set for club use. Demonstations and lectures are being arranged, prominent local amateurs having offered their services. Membership is open to all having reached the age of 18 years. The subscription is 10s. 6d. per annum.

A technical committee is to be appointed who will be in attendance on club nights to give advice and assist members in making sets and improving existing sets. The Secretary would be glad to hear of persons desiring to become members.

The Durham City and District Wireless Club.

The meeting held on Friday, September 15th, was devoted chiefly to actual receiving sets. It was decided that the lecture on "Accumulators" by Mr. Geo. Barnard should be held over for a more auspicious occasion, the intention being to hold another open public meeting on somewhat similar lines to the event on Friday, September 1st, as advertised.

The Chairman, Mr. S. Kelly, opened the proceedings by requesting Mr. R. W. Holmes, M.I.M.E., to give a short address, which took the form of some carefully chosen queries, thereby opening quite a lot of discussion. Mr. R. W. Rushworth was then called upon to describe his set. While thoroughly appreciating the benefits of valve reception, he still had a great respect for the much despised crystal, and pointed out the advantages of an ordinary crystal detector. Upon the invitation of the Chairman the Hon. Secretary answered questions spontaneously, during which he revised again the action and function of a condenser, also the spark method of producing high frequency oscillations. He drew and explained simple transmitting circuits upon the blackboard.

A question put to Mr. Barnard by the Rev. Bothamley regarding resistance offered by the insulation of an air gap compared with the inertia of a strong inductive circuit was very ably explained diagrammatically. It was shown and proved conclusively that although the resistance offered by an air gap was much greater than that of a large solenoid, yet this insulation was broken down, causing a spark at the gap terminals owing to the inertia, that is, inductance of the solenoid.

Mr. Barnard was requested to describe types of aerial insulators and lead-in tubes. He handled this controversial subject excellently and exhaustively, during which the types used in the R.A.F. and Navy were described fully. At the close of the question period the Hon. Secretary drew a diagram (his own arrangement) of a two-valve receiver, which was copied by all present.

A hearty vote of thanks was given to the members who had so ably placed their knowledge at the disposal of the meeting.

Several new members were enrolled. The lecture by Capt. Donisthorpe, of the Marconi Co., will undoubtedly prove a great success. No efforts are being spared. Lantern slides and first class apparatus will be used. A special concert is to be transmitted at 9 p.m. from Newcastle for this event.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, anda ddressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requiremenent, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations, or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"L. McM." (Maidenhead) *asks for a diagram for a three-valve circuit to fulfil certain conditions. (2) If honeycomb coils may be used for* **FL.** *(3) Who are* **5 DH** *and* **5 DO.** *(4) If the circuit as suggested is the best way of using three valves.*

(1) Circuit of Fig. 1, page 435, of July 1st issue, is quite a good one. The L.T. battery is not shown, but should be connected straight across any one of the filaments. (2) Certainly. (3) We do not know. These are recently allotted. (4) With interchangeable plug-in transformers this one is the best circuit possible. A potentiometer to the first grid would be of some advantage.

"M.J.D." Brussels) *asks (1) What resistance to use with a 4-volt battery and "Ora" valves. (2) What H.T. to use. (3) If 4,000 ohms telephones would be safe under such conditions.*

(1) Very little will be required, say, 2 ohms as a maximum. (2) About 40 volts. (3) Telephones may be put in the H.T. circuit without risk, but it is unwise.

"E.L.G.R." (New Eltham) *asks re the super-regenerative circuit mentioned in the July 22nd issue (1) The maximum capacity of the variable condenser across the oscillation circuits. (2) What size basket coils to use for L1, L2 and L3 in the diagram. (3) If basket coils may be used for L4 and L5. (4) What should be the voltage of the grid batteries.*

(1) 0·0005 to 0·001 mfds. (2) L1, 80 turns; L2, 60 turns; L3, 40 turns; all of No. 24 wire with an internal diameter of 2". (3) No, use honeycomb coils of about 1,000 and 1,250 turns. (4) Up to about 12 volts, adjusted by experiment.

"L.S.D." (Brockley) *submits a sample of wire, and asks how much would be required to make a 300 metres flat basket coil on the lines described in the June 10th issue.*

The wire submitted is quite unsuitable for the purpose, as both the wire itself and the insulation of it are rather too heavy and stiff. If used, however, about 60 turns should be sufficient.

"———".—(1) No, special provision for control of the grid potential of this valve is primarily due to the special grid battery. We should be surprised if the circuit could be made to work with much positive on this grid. (2) Yes, with suitable adjustments of the other voltages. (3) It is undesirable that the frequency of the oscillation should much exceed this value. (4) The valve mentioned is quite good, but almost any good hard receiving valve should be suitable.

"D.S." (Switzerland) *asks (1) Whether his set would receive British broadcasting, Paris and Hague concerts. (2) If one detector valve, one H.F. and one L.F. would be a more suitable combination. (3) If a detector valve followed by two L.F. would be much improved by the addition of H.F. valve. (4) What voltages to use with one "R" and two "Ora" valves in this set.*

(1) You omit to give any description of the set, but you are very unlikely to obtain PCGG or British broadcasting in Switzerland. Paris should, however, be O.K. with any really good set. (2) This combination is a very good one. (3) Yes. (4) Six volts L.T. and 50 volts H.T. will be sufficient, unless resistance capacity H.F. amplification is used, in which case 70 volts would be desirable.

"J.G.C." (Ealing) *asks with regard to the Reinartz tuner* (1) *If, in order to get the Hague telephony it is better to use an external coil or to increase the internal coils and condensers.* (2) *If the internal coils are increased, whether this will decrease the efficiency on lower wavelengths.* (3) *Dimensions for suitable coils.*

(1) It is immaterial which is done. (2) No, unless any dead-end effects are found, and even this can be got over by the use of two or three dead-end switches to break up the coil. (3) The coil used might be 6" × 4", wound with No. 22 D.W.S.

"E.C.C." (Weybridge) *asks for a diagram of a five-valve circuit, arranged to give high frequency amplification, followed by two note magnifiers.*

See diagram, Fig. 1.

"DATA" (Manchester) *has a set which is capable of giving radiation, licence for which has been refused by the Postmaster-General. He asks for advice.*

The new Post Office regulations will not permit the use of reaction in any form which might energise the aerial, the object, of course, being to prevent careless operators from spoiling their neighbours pleasure in reception. The only simple way of bringing your single valve set into line with Post Office requirements will be to abandon the use of reaction. In the case of a multivalve set, reaction may be employed, providing that you do not react back nearer to the aerial than the anode circuit of the first valve, and that the degree of coupling between the tuning circuits and any part of the amplifier is manageable.

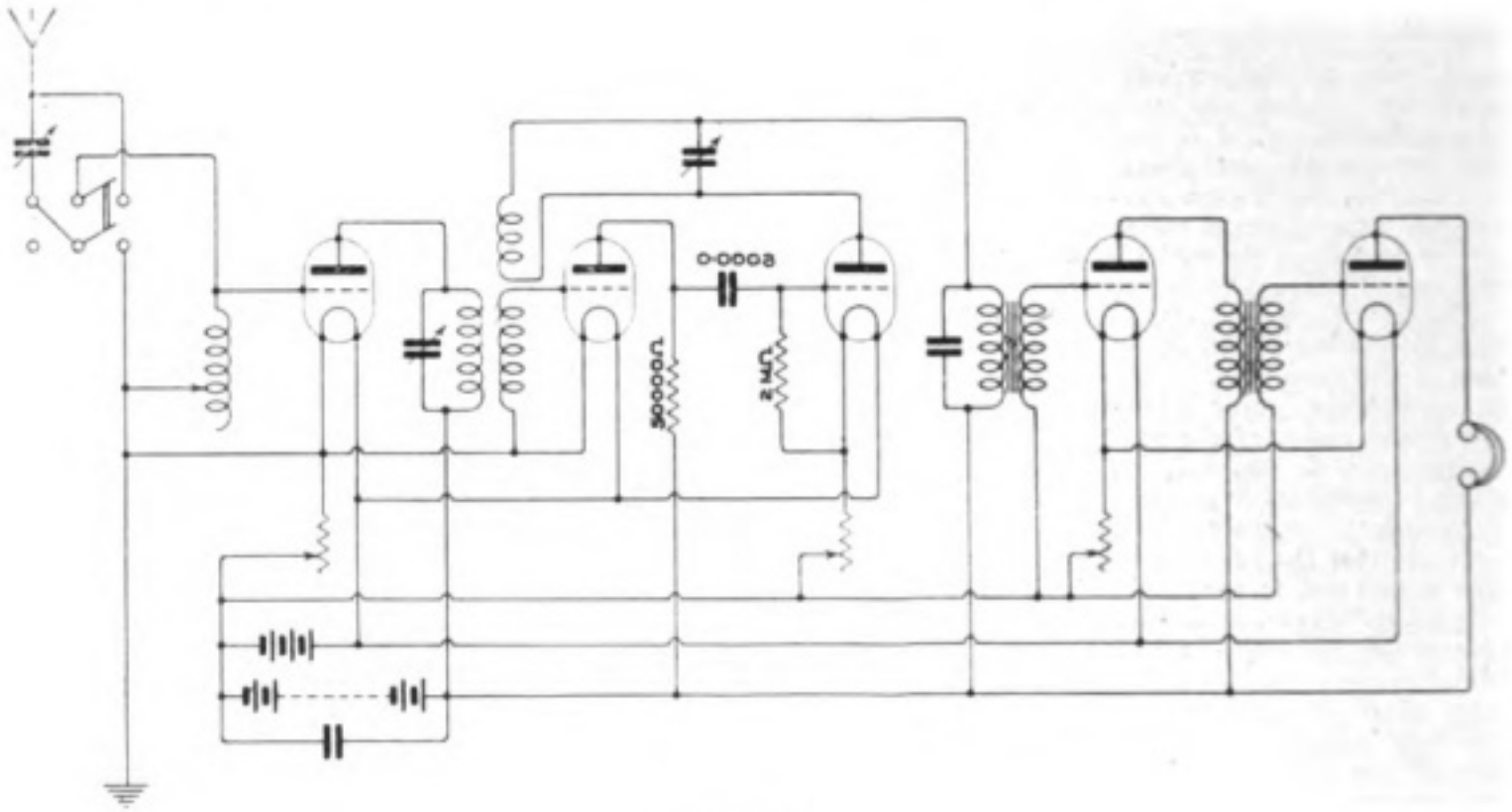


Fig. 1.

"G.O.N." (Liverpool) *asks* (1) *For an issue of "The Wireless World and Radio Review" containing a description of the code used in the Eiffel Tower meteorological reports, with alterations and additions, if any.* (2) *For dimensions and windings for H.F. transformers for* 400 *metres and* 1,000 *metres.*

(1) This information will be contained in an article shortly to appear in *The Wireless World and Radio Review*, in connection with the series which is now being contributed by Mr. W. G. W. Mitchell. Particulars of the time signal transmissions from Eiffel Tower appear on pages 545/550 of the issue of July 29th. (2) For 400 metres use No. 38 D.W.S., the windings being two layers of 40 turns each on a 1" former with about 5 mils. of paper between the windings. For 1,000 metres the transformers may be similar to the above, but with 85 turns per winding. Some experimental adjustment will probably be necessary to make the optimum values exactly right.

"R.B." (Carliol) *sends a circuit for criticism, and asks what stations he may expect to receive on it.*

The circuit shown is quite correct, but note recent remarks on the subject of reaction of the type shown. You might expect to obtain ships off the west coast, and also the proposed broadcasting stations of Manchester and Newcastle, and such land stations as Cullercoats.

"HETERODYNE" (Shiplake).—(1) From the symptoms you describe, we should suspect the grid leak, or possibly there is an intermittent action between the grid and filament on one of your valves. Try changing both leak and valve, and also test out all the connections thoroughly. (2) This circuit is not suitable for use for such a range. It is only intended for short wave work, say up to 1,000 metres. (3) Try Stanley's "Wireless Telegraphy," but practice has changed so much in the last few years that there is no really up-to-date work on the subject in existence. (4) This is not necessary unless a grid condenser is used.

"W.R.H." (Oldham) *is constructing a single valve receiver, and asks* (1) *The direction of windings of the inductances; whether the use of ¼" brass rod as a slider will have a detrimental effect; if the use of dead end switches will permit of reception of short wave telephony, and whether varnishing of inductances will be detrimental by way of increasing the capacity between the turns.* (2) *What tests should be made with a C. Mark II amplifier for the purpose of verifying that it is in good order, and what is the most suitable type of Osram valve for use with such a set.* (3) *Whether the three valves that he already possesses are suitable for use with the C. Mark II amplifier.* (4) *For the name of the manufacturer of a reliable type of H.F. transformer for addition at a later date to the three-valve L.F. set.*

(1) It is difficult to state the direction of the winding of the coils, but all you have to do in the event of the set not functioning correctly is to reverse the wires to the reaction coil. A brass rod slider will have no serious detrimental effect. Ebonite sliders cannot be recommended, unless of substantial dimensions, owing to the tendency ebonite has to become distorted when used for such a purpose. Dead-end switches are to be highly recommended in aerial and reaction circuits for the purpose of efficient reception of short waves. The coils may be shellaced, and should be thoroughly dried out before the varnish is applied. The shellac will slightly increase the self-capacity of the coil, and for this reason you should use double cotton covered wire for winding. (2) If you are in possession of a sensitive galvanometer giving several degrees of deflection per milliampere it will be quite easy for you to make tests on the amplifier. Alternatively telephone receivers may be used in lieu of the galvanometer, but you may have difficulty in distinguishing between the difference in the intensity of the clicks you will get, indicating whether the circuit is complete or broken. By using a 4-volt battery with the meter or telephone receivers in series with it, connect one lead to the H.T. terminal and tap the other on to the valve plate sockets. A deflection or loud clicks will indicate that the circuit is not broken. Tapping round over all other parts of the circuit will indicate whether a contact exists. This confirms the correctness of the primary windings of the transformer. To test the secondaries, join one lead of the L.T. minus terminal and tap out along the grids. The primary of the first transformer should be tested for continuity across terminals L1 and L2, and the secondary of the telephone transformer should be similarly tested by placing the leads across the terminals marked "telephones." "R" type valves are recommended, though the "R4" will give very good results. The voltages as stated, although not agreeing with those given on page 489 of a recent issue, are as in the figures you quote, and derived from measurements taken directly across the valve filaments. To advise an amateur that he is to place 3·8 or 3·5 volts across the filament is of little value, as practically all instruments are fitted with filament resistance, and all he wants to know is the voltage of the battery he must connect to the L.T. terminals. In order that a difference of potential of 4 volts across the filament of an "R" valve may be obtained when working through a resistance, it is frequently necessary to raise the accumulator potential to 6 volts, and particularly is this the case when a number of valves are in parallel across a low capacity accumulator. (3) If the valves you possess are in good condition they should be quite suitable. (4) We recommend you to wind your own transformers to data frequently given in these columns. The design of the transformer required depends upon the circuit in which you propose to connect it. We cannot advise the use of transformers produced by any particular manufacturer.

"REACTION" (Wood Green).—The loose coupler described is evidently part of a transmitter, and is not much use for reception, but might give fair results up to perhaps 400 metres. The aerial tuning condenser might be 0·002 mfds. in series with the A.T.I., and the closed circuit condenser could be 0·0007.

"J.G." (Paisley) *asks the number of layers to use for duolateral coils, namely No. 28 D.C.C. for an inside diameter of 2" and the winding width 1¼", for tuning from 150 to 25,000 metres with a 0·001 condenser.*

The number of layers required will be one for 150 metres up to 20 for 25,000 metres, with about six intermediate sizes to cover the whole range.

"G.S." (Marlborough) *has a heterodyne wavemeter circuit with a range up to 1,500 metres, and asks* (1) *For windings to extend the range in both directions.* (2) *If slab inductances mounted on a former with four split pins for making connections will be satisfactory.* (3) *Why the 12-volt flash lamp battery supplied for H.T. runs down quickly.* (4) *For a semi-aperiodic reactance capacity coupling for use up to 1,200 metres.*

(1) Various instruments of this type are made; you do not give us enough data to discriminate between them. We should advise the use of various honeycomb coils as listed by advertisers. The capacity of the condenser would probably be about 0·0015. This will enable you to choose suitable coils for any range you may require. (2) This mounting will be quite satisfactory, if it is so designed that the relative position of the coils can be kept rigidly fixed. (3) These cells should not run down rapidly unless there is a leak due to faulty insulation. We should advise you to test this out very carefully. (4) If you want any appreciable aperiodicity you should wind with about No. 47 Eureka– say 120 turns with taps at every 30—but we should much prefer No. 34 copper with variable tuning condenser.

"PILGRIM'S WAY" (Winchester) *asks for information with regard to certain wireless recording apparatus.*

We have no actual experience of the recorder you mention, but provided that it does not take more than 25 milliamps, the Weston relay should operate it satisfactorily. The signals to be recorded should be L.F. amplified up to the desired strength, preferably by means of your C. Mark III amplifier, in addition to the six-valve receiver, if this is mostly high frequency. After the L.F. amplification, you should again rectify through one or more valves in parallel with a suitable grid potential. The relay should be introduced in the anode circuit of these valves, and the recorder worked through a local battery, generally of about 24 volts, through the armature contacts of the relay.

"C.W.T." (Old Swinford) *is desirous of receiving local amateur telephony, also Croydon, Paris, The Hague and Writtle, and asks* (1) *For a good four-valve circuit.* (2) *The best type of tuner for reception of telephony on* 180/2,600 *metres.* (3) *If it is possible to obtain a transmitting licence for telephony only for the purpose of experimental directional work up to* 20 *miles without the necessity of passing a test in Morse.*

(1) See circuit Fig. 2. This is fitted with an intervalve H.F. transformer which is to be recommended, for although H.F. amplification does not magnify to the same extent as L.F., it will bring in signals which any amount of L.F. amplification would not render audible. As you are only desirous of receiving telephony, which, excepting Paris and Croydon, is always on 350 to 450 metres, one H.F. transformer specially wound for these wavelengths may be incorporated in the set. If you are desirous of tuning in telephony stations on other wavelengths, you must make the transformers interchangable. For 300/450 metres wind 250 turns of No. 40 S.S.C. wire on a 1" ebonite former, cover with a single layer of empire cloth, then wind on another 250 turns in the same direction for secondary; the finishing ends are taken to grid and plate. (2) Making use of the circuit given, you should wind the aerial tuning inductance with 25 turns of No. 22 D.C.C. on a 4" former, and the reaction coil with 40 turns of No. 26 S.S.C. upon a 3" former. (3) It is doubtful whether the P.M.G. would be prepared to grant you a telephony transmitting licence for directional experiments without you first satisfy him that you have a working knowledge of the Morse code. Why not write to the Secretary of the Post Office, stating the circumstances.

"ROMUS" (Brighton) *asks how to cut out interference caused by the generator and arc of a near-by picture palace.*

You might try screening the receiving circuits in an iron box; but the real method of cure would be the insertion of large condensers to earth in each lead of the picture-house arc supply. This however, you are not likely to be able to do. If possible, arrange your aerial pointing directly away from the offending picture-house.

"BERLICK" (Southend) *asks whether reception on a single valve set would be seriously affected by an aerial running parallel to overhead tram wires* 25′ *to* 30′ *away.*

This depends largely on the tram system. In some places induction under these circumstances would quite prevent reception; in others, some results might be obtained. The induction, of course, will not be quite so serious as that of a multivalve set. We should recommend you to turn the aerial at right angles to the tram wires, if this can possibly be done.

"KEEN" (West Kirby) *asks for a diagram of a four-valve receiver, using one H.F., 2 L.F. and one rectifying valve with A.T.I., C.C.I. and separate reactance coil.*

See diagram (Fig. 2).

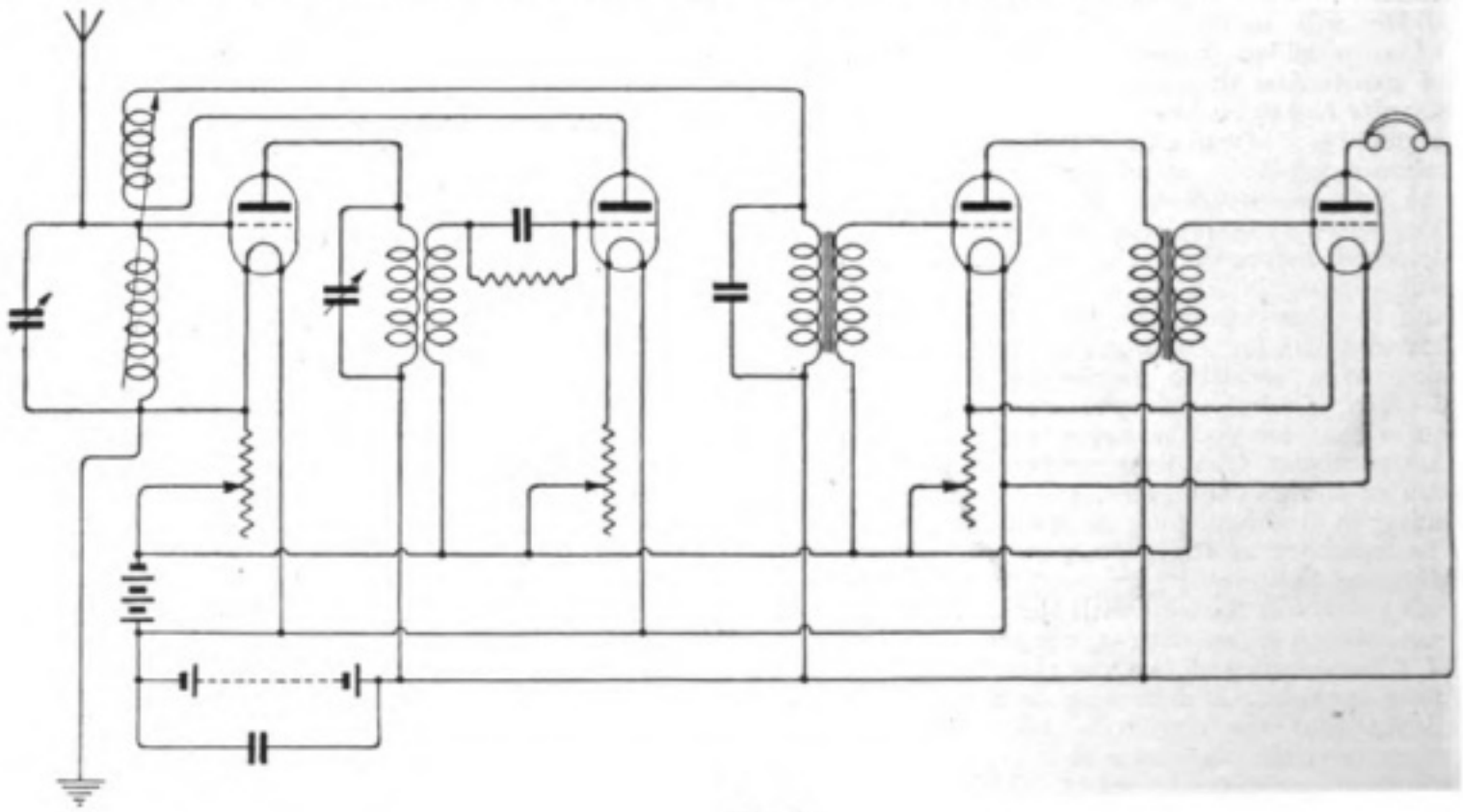


Fig. 2.

"BEGINNER" (Stanmore) *encloses a diagram of his set, and asks* (1) *If it is suitable for all telephony.* (2) *For details of construction of transformers and the capacities of the condensers* 1, 2, 3 *and* 4. (3) *For details of construction of A.T.I. and the wavelength of same.* (4) *If a certain coil would be suitable for the L.F. Transformer for his set.*

(1) Yes. (2) (*1*) 0·001 mfds.; (*2*) 0·0005 mfds.; (*3*) 0·0002 mfds.; (*4*) not strictly necessary. If used, should be 0·001 mfds. For transformer data see many recent replies. (3) For the A.T.I. 9" × 6" of No. 22. For closed circuit inductance, 7" × 5" of No. 26. (4) Core fairly satisfactory if wound with No. 46 S.S.C. Specimen wire quite unsuitable.

"H.G.C." (Bristol) *asks* (1) *Why his single valve set gives no signals, but only a continuous buzzing when the filament is brightened.* (2) *How to make a reactance coil to suit the A.T.I. of this set.*

(1) The circuit diagram is quite correct, but the information does not give us much help to diagnose the trouble. We are inclined, however, to suspect a very faulty grid connection, or a bad grid condenser. It is also possible that the grid of your valve is making intermittent contact with the filament. See if the noises still obtain when the grid condenser is shorted. Your telephones also may have a bad connection. (2) It is unlikely that the reaction will be allowed with a circuit of this type in the future, but if you insist on trying it, 4" × 2" of No. 24 might be a suitable size for your coil. Reduce the number of turns immediately if you find this amount sufficient to make the set oscillate.

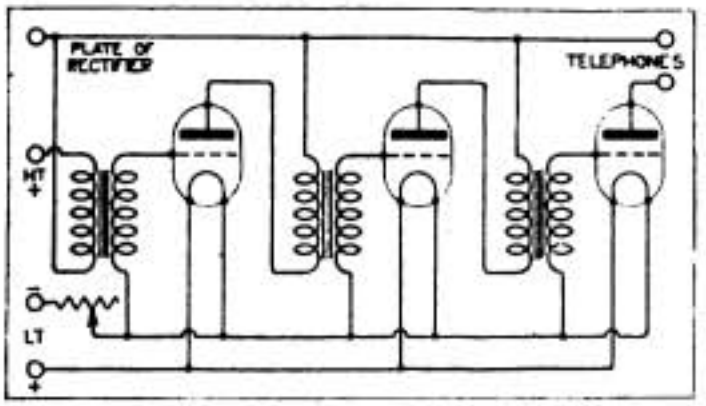


Fig. 3.

"A.E.F." (Finchley) *asks* (1) *Whether separate H.T. batteries are required for a five-valve set, using some "V.24" and some "Ora" valves.* (2) *For a wiring for a three-valve L.F. panel to comply with certain requirements.* (3) *For a book dealing with certain wireless control problems.*

(1) No. (2) See diagram (Fig. 3). (3) There is no publication which deals at all fully with this subject.

"L.H." (Bristol) *asks for data for constructing a tuner for use in aerial reaction circuits, and giving a range of 150-3,000 metres with his aerial.*

The coil in the aerial circuit should consist of 7" of winding of No. 26 D.C.C. on a 4½" former, and might be provided with 19 tappings at increasing intervals along the inductances. The reaction coil should consist of 3" of winding of No. 30 S.S.C. on a 3" former, and may have five tappings. You may find it difficult to tune as low as 150 metres with this inductance, in which case you might construct two flat coils specially for short wave work as described on p. 328 of the June 10th issue.

"M.F." (Folkestone) *submits a circuit diagram of a two-valve receiver, and asks for criticism and method of adding another valve circuit.*

Your circuit diagram is quite correct. We would suggest that you might extend the tuning range, and also obtain increased signal strength on shorter wavelengths, by arranging to connect the aerial tuning condenser in series or parallel across the A.T.I. This can be done by means of a double coil change-over switch. Both secondary and reaction coils should be tuned with air dielectric variable condensers. When operating several valves from a common H.T. battery, it is advisable not to connect one condenser right across the telephones and H.T. battery, but to use separate condensers, one having the value of about 0·001 mfds. for connection across the telephones and intervalve transformer, and the other of value up to 1 mfd. across the H.T. battery. The value of the grid condenser you show is rather high, and should be of the order of 0·0002 to 0·0003 mfds. There is no difficulty in adding a note magnifier by connecting an intervalve transformer in place of the telephone receivers, and taking the leads to grid and L.T. minus of the added valve, the telephones being connected between its plate and the H.T. plus. A wiring diagram making use of the circuits, very similar to the one you already have, is shown on page 37 of the April 8th issue.

"F.L." (Ilkley) *is making use of a six-valve receiver, and has difficulty in the reception of Paris telephony, is unable to receive* **PCGG**, *shipping signals only very occasionally, whilst amateur telephony cannot be heard, and asks for criticism of his circuit.*

Your circuit is in every way correct, and the use of tuning condensers across the secondary and reaction inductances is to be recommended. The condensers bridging the primaries of the H.F. transformers would certainly facilitate their action on the particular wavelength for which they are required. You might try connecting the reaction coil in series with the plate circuit of the third valve instead of with that of the first valve. You might try also connecting the leads from the transformer secondaries to the L.T. minus instead of L.T. plus as shown. Unfortunately you do not give the dimensions of your tuning coils. For the reception of short wave telephony we recommend you to construct some special coils to the design given on page 328 of June 10th issue. The detector valve should be one specially designed to give good rectification, such as an "R.4b" or "Q," and you should experiment with several grid condensers and leaks in order to get the grid potential correct. The use of a potentiometer to control the grid potential of the H.F. valves, and another to control the detector valve, may be found helpful.

"A.R.C.J." (Acton) *has a Mark I C.W. set arranged for telephone transmission and reception, and asks* (1) *For method of adding one H.F. and two L.F. amplifiers to same, and* (2) *Whether an inductance coupled to the old circuit with a microphone connected across its ends is a satisfactory arrangment for telephony.*

(1) We would recommend you to use an entirely separate circuit for reception, leaving your present set as it stands for use as a transmitter. A valve designed for transmitting purposes will not act as an efficient detector, as will be required for bringing in telephony. This journal is full of circuits comprising a great variety of H.F. and L.F. amplifiers. (2) This is quite a satisfactory arrangement for small power, though the extent of coupling between the two coils is critical.

"G.C.S." (Palmer's Green) *asks* (1) *For a circuit to use certain gear.* (2) *How inductive reactance is obtained with slab inductances.* (3) *If 6 and 60 volts are too high for "Ora" valves.*

(1) See Fig. 1, page 465, July 8th issue, and many similar circuits. (2) By bringing the coils close

together in almost any convenient way. (3) A filament resistance of say 5 ohms will be necessary. H.T. battery voltage is high but will do no harm.

"C.R." (North Devon) *is constructing a five-valve receiver, and wishes to know the number of plates required for the construction of the various condensers.*

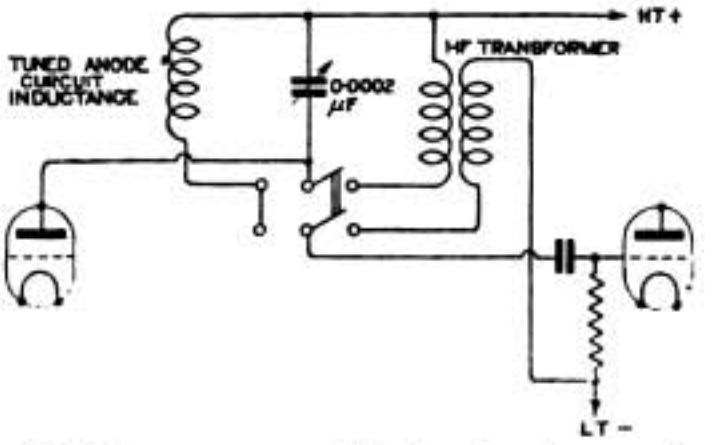
The aerial tuning condenser should have a capacity of between 0·001 and 0·0015 mfds. If the space between the plates is 5/64" and the plates have a thickness of 20 gauge S.W.G., then 31 fixed and 30 movable plates will give a capacity of approximately 0·0014 mfds. The grid condenser should have a value of approximately 0·0003 mfds, and should consist of three plates, with an overlap of 1" × ½" separated with mica two thousandths of an inch in thickness. The middle plate will form one terminal of the condenser and the remaining the other. The condenser that bridges the primary of the first L.F. transformer should have a value of about 0·002 mfds. and should consist of 15 plates of similar dimensions to those of the grid condenser. The condenser that bridges the H.T. battery may have a value up to 0·5 mfd., and should consist of about 21 tin foil plates 2½" × 4" with waxed paper dielectric.

"W.McN." (Stamford) *refers to the Armstrong super-regenerative circuit, and asks* (1) *Whether honeycomb or duolateral coils are suitable for the inductances.* (2) *What make of valve is recommended for use in the circuit.* (3) *The values of the variable condensers across the inductances and the fixed condenser across the telephones.* (4) *Whether a Brown loud speaker may be interchanged with head telephones, retaining the same condenser.*

(1) Coils of this type may be used. The inductances L1, L2 and L3 are of a suitable value for bringing in the required signals, and should preferably all be bridged with variable condensers. L4 and L5 are of large value such as will set up oscillations on wavelengths just above audible frequency. (2) This circuit was originally designed and recommended for use with special varieties of American valves, but it will work quite well with British valves of the usual "R" type. A "Q" or "R.4b" would give quite good results in the first valve circuit, whilst a "V24" might be connected in the oscillator circuit. (3) Maximum 0·0005 mfds. Telephone condenser 0·001 to 0·002 mfds. (4) The telephones may be interchanged with a Brown loud speaker, provided the loud speaker is of high resistance, though we do not think that by using this circuit you will obtain sufficient amplification for operating the loud speaker on telephony.

"T.T.C." (Southgate) *refers to the circuit given on page 573 of July 29th issue, and asks for sizes of coils, condensers, etc.*

Sizes of inductances depends entirely upon the range of wavelength to which it is desired to tune. We would recommend you to use interchangeable coils fitted with plugs and sockets. Within the aerial circuit may be a single coil arranged to plug into a socket fixed to the panel of the receiver, whilst the three in the second valve circuit may be the usual variety of three-coil holder to take the coil referred to. The condenser in the aerial circuit should be of the air dielectric type and have a maximum capacity of 0·001/0·0015 mfds., and should be arranged for connection either in series or parallel with the inductances. When tuning to very short wavelengths, such as are used for telephony, connect your aerial tuning condenser in series with the inductance, and in addition another small condenser having a value of about 0·0001 may be connected between the variable condenser and inductance. The condenser in the plate circuit of the first valve should have a maximum value of 0·0005 mfds. Similar condensers may with advantage be connected across the inductance of the grid circuit of the second valve, and also the plate circuit inductance.



Switching arrangement for interchanging tuned anode inductance and transformer in H.F. amplifying circuit.

"R.E." (West Kensington) *refers to the expression "loud speaker," and asks for details regarding the construction of such apparatus, and how it differs materially from a receiver with a trumpet attachment.* (2) *Whether it is practicable to use a frame aerial with six or more valve amplifier for the reception of broadcast telephony.*

(1) Several varieties of loud speakers consist merely of a receiver earpiece with a trumpet attachment, and if wound to a low resistance a step-down transformer is required when operated from the plate circuit of an amplifier valve. If you propose to construct one of these instruments, we would suggest that you take an ordinary telephone earpiece, say of the "Brown" type, with adjustable armature, and fit to it a trumpet of a shape which you may find by experiment will not produce too much distortion. The trumpet must be an airtight fit over the diaphragm and the column of air between the base of the trumpet and the diaphragm must be as short as possible. (2) Until broadcasting stations are established, it is difficult to say the range of reception on various types of apparatus, but with present transmission from Marconi House, we think you should have no difficulty in receiving them satisfactorily on a frame aerial, using the 6-valve amplifier as you suggest. This amplifier should consist of three high frequency valves, detector, and two note magnifiers, and the frame should, if possible, have sides of at least 4 ft. We recommend strongly, however, the use of a small indoor aerial run across the room, and we think that with so many valves such an aerial would give results superior to the frame. However, it is just a matter of simple experiment in your locality. Circuits comprising H.F. and L.F. amplifiers are to be found in nearly every issue of this journal: see pp. 570 and 572 of July 29th issue, also p. 607

of August 5th issue. A variable condenser is connected across the ends of the frame, and leads taken to the grid and L.T. minus of the potentiometer.

"A.M." (Plaistow) *has constructed the crystal receiver with flat coils as described in the article on Experimental Station Design in June 10th issue, and is able to receive* **2 LO,** *and, weakly,* **2 MT,** *and asks if there is any error in this arrangement.*

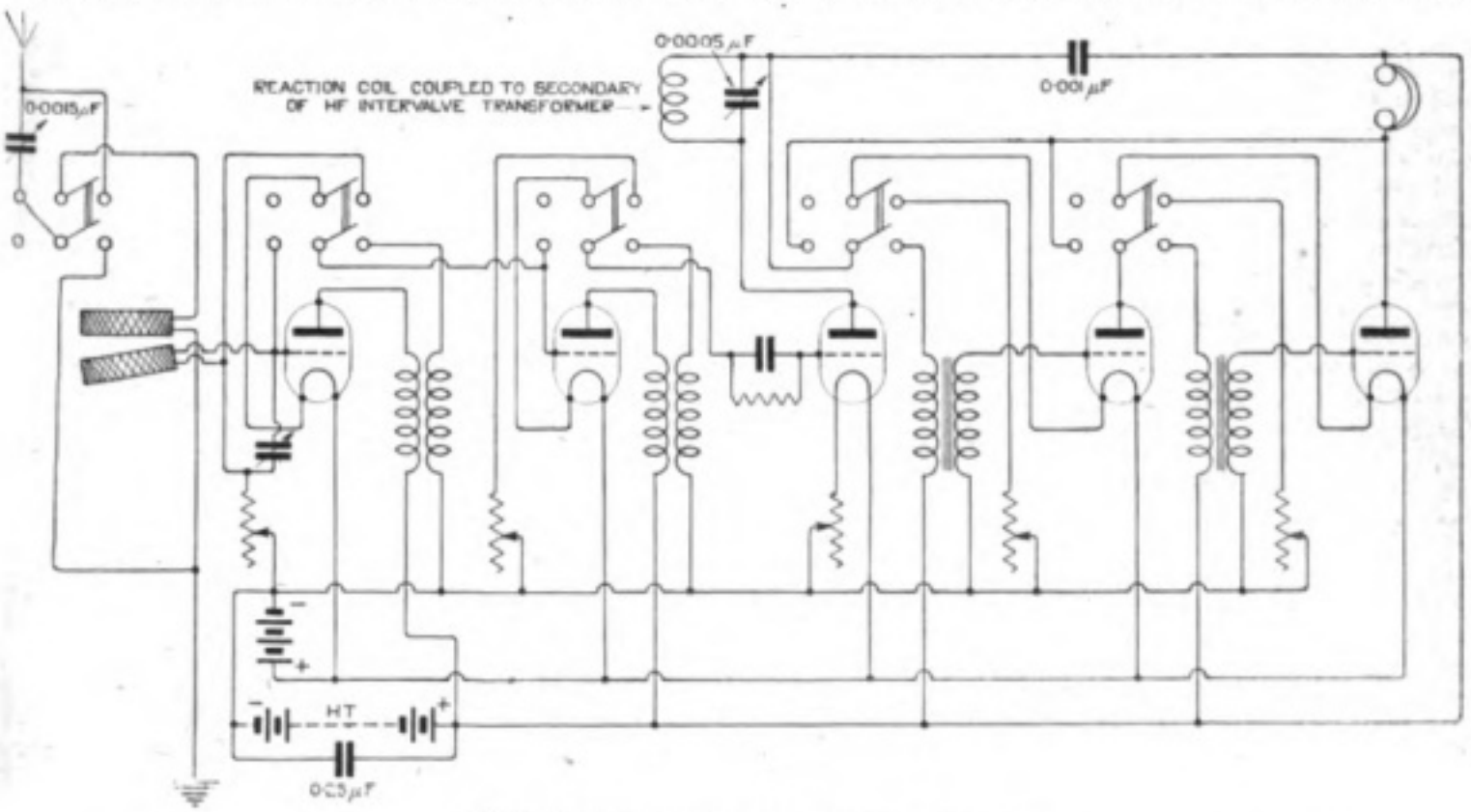
This is a very simple crystal receiver, which embodies neither secondary circuit nor aerial condenser, and was designed for the reception of telephony broadcasted on high power, such as it is hoped will soon be available, and for which purpose it would be quite satisfactory. The fact that you are receiving the telephony transmitted from Writtle on low power indicates that your set is working very well indeed, and when a service is organised making use of greater power, your present apparatus will prove quite useful for its reception. These articles have now described the construction of a single valve panel. If the range is as required, you might follow up your constructional work, and undertake to make all the apparatus described.

"S.T.N." (Windsor) *submits a circuit and asks* (1) *For criticism.* (2) *For the capacities of the various condensers.* (3) *Whether a condenser is required across the secondary of a high frequency intervalve transformer and* (4) *Types of valves most suited for use in this circuit.*

(1) The circuit is quite satisfactory, but you might arrange to connect your aerial tuning condenser either in series or parallel across the aerial tuning inductance. A condenser bridged across the reaction coil would facilitate fine tuning on short wavelengths. You do not describe the construction of the intervalve oscillation transformer, but if the two windings are fairly tightly coupled, you will only need to bridge the primary, that is, the one in the plate circuit, with a variable condenser. (2) 1.—0·001/0·0015 mfds. 2.—0·0005. 3.—0·0002/0·0003. 4.—0·001/0·002. 5.—0·01 to 1 mfd. 6.—0·0001 mfd. All of the variable condensers should have air dielectric. (3) A tuning condenser is very helpful across the primary of the transformer. (4) You are quite correct in your suggestions as to types of valves. Use "R," "V24" or "QX" for the first, "R 4b" or "Q" for the second, and for the third "R."

"BROWNING" (Eastbourne) *asks for numbers of French patents covering the construction and main features of the receiving valve.*

It is regretted that we cannot undertake to give information relating to patents. The information you require can be best obtained by searching the files of the Patent Office, or by consulting a Patent Agent who specialises in this class of work.



SWITCHING OF VALVE CIRCUITS.

Above is given a circuit diagram showing the method of switching in and out of circuit, high and low frequency amplifying valves. It gives the principle by which the number of valves in circuit is varied, and can easily be applied to circuits comprising any number of valves. The reaction coil can be coupled either to one of the H.F. transformers or to the closed circuit inductance.

"H.W." (Bolton) *is constructing a five-valve amplifier and asks* (1) *For criticism of the circuit he proposes to use.* (2) *Whether it is suitable for reception of* **2 MT, PCGG** *and* **FL,** *and* (3) *If potentiometer control is recommended.*

(1) The circuit is quite a good one, but the wiring up of the jacks and the high frequency circuits will require considerable care and jacks of the usual telephone type should not be used. A special type was advertised on the back cover of the July 22nd issue, and you should write to the manufacturers, asking them for jacks designed to suit your purpose, having very low capacity between the springs. The intervalve transformers must

be carefully made in order that those that are used together may cover identical wavelength ranges. (2) Yes. (3) Recommended.

"H.M." (Manchester) *is constructing a low power transmitting set and asks* (1) *Size of aerial inductance for use on wavelength of* 440 *metres with an aerial* 100′ *long and* 30′ *high.* (2) *Size of aerial tuning condenser.* (3) *Dimensions of grid circuit inductance.* (4) *Whether speech could be transmitted successfully with a circuit designed to transmit tonic train.*

(1) 25 turns on a 4″ ebonite former. Use No. 20 D.C.C. for winding, or better still, special flat strip wire may be used with a winding of thin string between each successive turn. (2) Variable, with a minimum value of about 0·001 mfds. (3) 30 turns of No. 24 D.S.C. on a 2″ former. You may find it helpful to bridge this inductance with a small tuning condenser. The extent of coupling between the grid and aerial inductance will depend upon the amount of power used, and if the size for this coil is 2″ in diameter, it would provide ample coupling when used on 10 watts. For lower powers you will need to increase the diameter and make the grid circuit inductance slide inside the aerial inductance. (4) Speech cannot be transmitted from an interrupted source of H.T. unless the aperiodicity is fairly high and a rectifying valve with chokes and condensers is connected intermediately between the source of supply and the transmitting valve.

"W.S." (Victoria) *refers to the reply given to* **"J.R.C." (Kilburn)** *on page* 527 *of the July* 27*th issue, and asks* (1) *Whether the secondary can be arranged at right angles to the A.T.I., inside which a coil is arranged to provide coupling, and also whether this coil should be made to swing through* 60 *degrees; whether a reaction coil wound on a spherical former and made to rotate inside the secondary would be satisfactory, or should the reaction coil be cylindrical and slide inside the secondary.* (2) *Whether we recommend the use of change-over switch for providing "tune" and "stand by."* (3) *Whether in making use of a three-valve low frequency amplifier he might break the plate circuit of his first valve and connect in a reaction coil.* (4) *Whether the set made up as indicated by his questions would be efficient for the reception of weak telephony on* 1,000 *metres.*

(1) The aerial with closed circuit arrangement would be satisfactory. The coil that provides coupling between primary and secondary should be made a close fit and arranged to slide away from the aerial winding. If pivoted, it may not provide sufficient coupling, but it should be arranged to move through 90 degrees. A spherical reaction coil may not provide sufficient range, and also may perhaps not provide sufficient coupling on long wavelengths, and that also should be arranged to slide inside the aerial coil. In the diagram referred to, it was intended that a three-coil holder should be used with a set of interchangeable inductances. (2) Yes, the use of such a switch would be found very convenient. (3) It is better to break the plate circuit between the plate and the lead to the intervalve transformer. The primary of the transformer must also be abridged with a fixed condenser of value of about 0·001 mfds. You may certainly connect several stages of high frequency amplification in front of the first valve of the amplifier which functions as a rectifier. (4) Yes; but we would recommend you to adopt c type proposed in (1).

"H.E.S." (N.16) *has access to a bat Leclanche cells and asks for an opinio superiority of such a battery over the usu*

Such a battery is very bulky, and r good deal of attention as to maintenance larly with regard to corrosion, creeping ar up of electrolyte, and for a single valve you would be well advised to use the n venient small type built up in 15 volt unit single valve receiver in frequent use, t small type of H.T. battery would have a *life* 12 months, and requires no attention. *If,* you are using a receiver with three or mor the use of the Leclanche battery may b more economical and worth while, owin heavier load taken from it. When usin battery for high tension supply, you m good care that all cells are well insulated f another and from earth. You might arra in sections in boxes standing on china in Such a battery is practically useless as of filament current, unless, of course, prepared to connect it up in a number of groups, such as connecting five cells in se all of these groups of five in parallel w another. Even with this arrangement the would require considerable attention, an not be as convenient as an accumulator.

"O.G." (Brierfield) *submits a diagram set, comprising one H.F. (tuned anode) dete L.F., with which he is not obtaining very good and asks for criticism.*

Your circuit is quite correct, and shou satisfactory results, and the fault must lie structional details. If you wish to make a in the circuit, however, you might conne reaction coil between the low frequency tran and the plate of the second valve, instead of c the tuned anode coil to the aerial circuit. essential to bridge the tuned anode coil variable condenser, and with the reaction a ment proposed you will find it helpful to c the condenser across the coil. Valves sp designed to function as H.F. amplifier, d and low frequency amplifier will consid improve results. The value of the grid con is important, and you might reduce it to a of about 0·0003 mfds., with a leak of 2 meg

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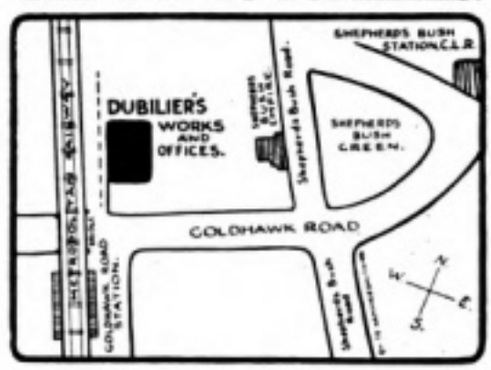

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THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON
A MAGAZINE DEVOTED TO WIRELESS TELEGRAPHY AND TELEPHONY

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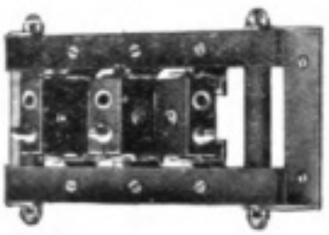
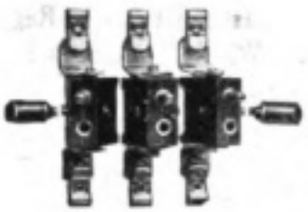
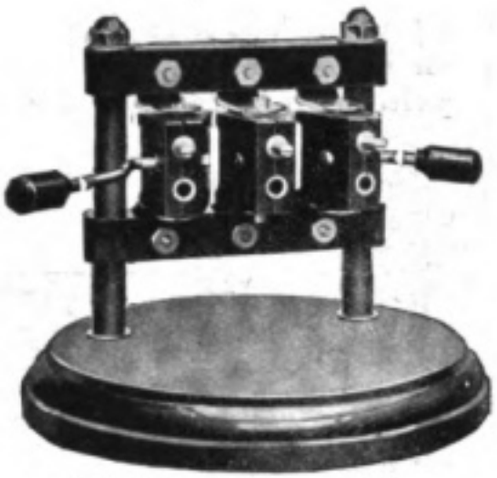


For mounting on panel.



Independent Plugs.



Completely mounted on pedestal.

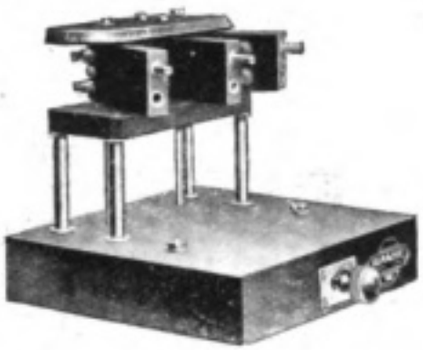
"TRIPLUG" COIL HOLDERS

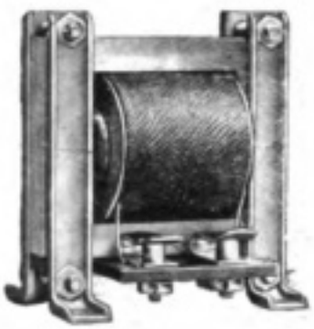
are supplied in three forms:

1. Completely mounted on base for table use.
2. Assembled for mounting on panel.
3. Independent Units for panel mounting.

MICRO-ADJUSTA COIL HOLDERS

These are of superior design, with worm adjustment for fine tuning. The worm can be engaged or disengaged by moving the operating knob to one side or the other, depending upon the coil to be adjusted. When disengaged, coils can be moved freely by hand. A spindle extension is supplied so that adjustments can be made without bringing the hand too near the coils.





INTERVALVE TRANSFORMER

A very efficient design—the result of extensive research.

See our

STAND No. 4

All-British Wireless Exhibition London

IGRANIC

ELECTRIC CO., LTD.,

147, Queen Victoria Street, LONDON.

Works: Elstow Road, Bedford.

ALSO

GLASGOW: 50, Wellington St.
MANCHESTER: 30, Cross St.
BIRMINGHAM: 73-4, Exchange Bgs.
CARDIFF: Western Mail Chambers.
NEWCASTLE: 90, Pilgrim St.
BRADFORD: 18, Woodview Terrace, Manningham.

1912—1922 *(Continued).*

BRITWIRE Precision Condensers.

Balanced for panel mounting, or mounted in solid mahogany cases.

·0002—Unmounted	.. ..	15 0
Mounted	.. ..	£1 6 6
·0005—Unmounted	.. ..	17 6
Mounted	.. ..	1 5 0
·001—Unmounted	.. ..	1 5 0
Mounted	.. ..	1 17 6

Owing to reduced manufacturing costs, we can now supply accessories at much reduced prices, while still maintaining our high standard of quality.

DUROS Cells, 2v. 45amps., ready charged	10/6
Ebonite knobs, finest quality ..	0/7
Engraved Condenser Dials, ebonite	3/3
Intervalve Transformers	22/6
Heavy type	25/0
Air Core Radio Frequency Transformers—300 metres	3/9
600 ,, ...	4/9
1,000 ,, ...	5/3
2,500 ,, ...	6/3
Telephone Transformers for panel mounting	13/6
Reactance Formers	6/0
Mounted in Mahogany Case ..	10/6
Polished Mahogany Battery Box, with wander plug and five sockets, for five Siemens units	12/6
Filament Resistances, finest quality	4/6
Knobs and Pointers, with brass bush, each	1/0
Ivorine Tabs, set of seven ..	1/10
Ivorine Scales, 0 to 180 0/6, 0/10 and	1/6
Valve Pins, per dozen	1/9
Valve Legs, per dozen	2/0
Best Polished Ebonite Valve Holders	1/3
Switch Arms, Phosphor bronze laminated arm, lacquered ..	2/6
Lacquered Contact Studs, per dozen	1/0
Anode Resistances, with clips, 50,000 to 80,000 ohms	2/6
Grid Leaks, resistance guaranteed, ½ to 5 megohms, with clips ..	2/0
Grid Condensers .. .. each	2/0
Condenser, with leak	4/0
Ebonite, cut square, any size, per lb.	4/3
Enamelled Aerial Wire, 8/23 and 1/20 stranded .. .. per 100 ft.	6/0
per 150 ft.	9/0
Shell Insulators .. .. each	1/1
Strain Insulators .. .. each	0/9
Egg Insulators .. .. each	0/6
Rotary Switches—5 point	4/0
10 point	6/0
19 point	7/0

We also have a very large stock of MAGNAVOX Loud Speakers, and can sell either as factors or retail. Trade enquiries invited. We now have large stocks at all our branches. All retail orders over 40/- in value carriage paid.

Send for Illustrated List. Post free **3d.**

POST ORDERS TO

BRITISH WIRELESS SUPPLY CO., LTD.

6, BLENHEIM TERRACE, LEEDS. Tel: 26926.

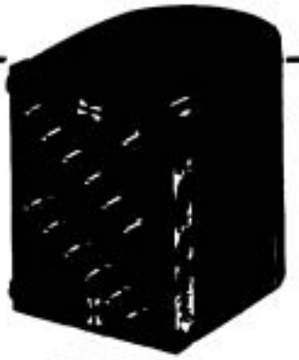
18, ELDON SQUARE, NEWCASTLE-ON-TYNE. Tel: 360 CITY.

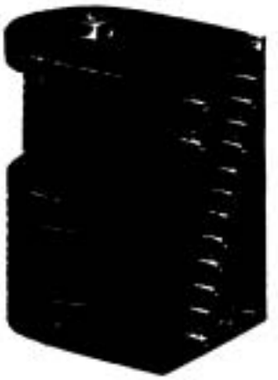
33, HIGH STREET, SOUTHAMPTON. Tel: 403.

11, CHURCH STREET, WEST HARTLEPOOL. Tel: 373.

WORKS: LEEDS.

The attention of Manufacturers and the Trade is specially drawn to this Announcement.





EXPERIENCE

AMPLIFICATION

RADIO FREQUENCY
AUDIO FREQUENCY

Whether you wish to amplify before or after rectification, we can supply you with scientifically designed apparatus for obtaining the maximum efficiency. This is backed up by the reputation of our engineers and designers who have received universal recognition for their work in the wireless industry.

Our complete range of radio and audio frequency transformers and reactance coils covers all requirements. Detailed information is given below, and we invite you to call and inspect the various items at our showrooms.

NOTE.—A complete working diagram is sent out wherever necessary.

IMPROVED ADJUSTABLE REACTANCE COIL.—This is recommended where one or two stages of radio frequency amplification are required. It is more stable than a radio frequency transformer. Twelve tappings are provided and the instrument is self-tuned, no variable condenser being required.

Suitable for wavelengths of 100-20,000 metres.

PRICE 25/-

WITH 12-POINT SWITCH .. .. 16/- EXTRA

For multi-stage radio frequency amplification we recommend our improved RADIO FREQUENCY TRANSFORMER. This is made in two ranges:—

(A) 100-4,000 metres, with 9 tappings.

PRICE 25/-

WITH 12-POINT SWITCH .. .. 16/- EXTRA

(B) 100-30,000 metres, with 12 tappings.

PRICE 40/-

WITH 12-POINT SWITCH .. .. 16/- EXTRA.

(B is approximately twice the size of A.)

TWELVE POINT SWITCH. This is a well-made laminated switch with extra large contacts. It is exactly as fitted to our own instruments and is the best switch it is possible to obtain for wireless work. The contacts are absolutely certain. **PRICE 16/-**

AUDIO FREQUENCY TRANSFORMERS. For intervalve audio frequency amplification and note magnifiers. The many testimonials received and the large number of these transformers sold prove this design to be considerably in advance of any previously available.

This transformer is suitable for use with the Magnavox as a pressure of 250-300 volts may be applied direct across the windings.

PRICE 25/-

TELEPHONE TRANSFORMER. For use with any type of loud speaker.

PRICE 20/-

DELIVERY FROM STOCK.—We hold stocks at present but it is advisable to lose no time in placing your orders.

RADIO INSTRUMENTS, LTD.

Managing Director: J. Joseph, M.I.E.E., late Manager to Mr. H. Sullivan.

Chief Designer: W. A. Appleton, M.B.E., M.I.R.E., late Admiralty Technical Research Officer.

ONLY ADDRESS. Works, Offices, Showrooms:

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Telephone: Regent 1906. 'Grams: "Instradio, London."

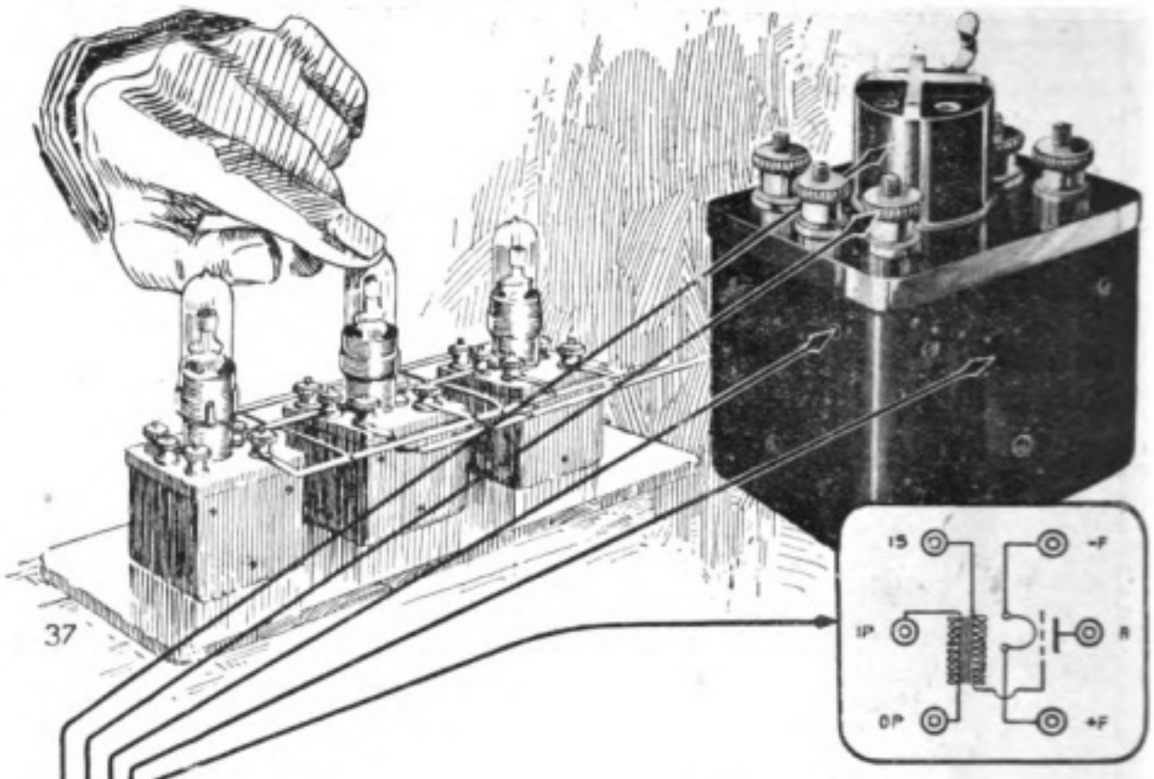
Get a Copy of the R.I. Catalogue.

Now ready. Full of valuable information. Up-to-date. Authoritative. Indispensable. 6d. per copy.

Visit our Stand No. **37**. All-British Wireless Exhibition, Horticultural Hall, September 30th to October 7th.

(E.P.S. 8).

G 2



No need to spend time making these connections. The Elwell note magnifier contains them ready made.

The intervalve transformer is contained in an iron case, allowing units to be placed close together without howling.

Tapped holes in two sides and base make fixing easy. The unit will also stand alone.

All connections are embedded in compound and brought out to terminals. No soldering necessary. The perfect insulation of the grid connection ensures silent operation.

The valve holder has specially long leakage paths and an earth clip.

This patented amplifying unit, when provided with a valve and connected as marked on the terminals, is all that is necessary to give one stage of note magnification to your existing set.

Two, three or more units may be coupled as shown, to give as many stages of note magnification as required.

PRICE 39/6 each.

AMPLIFYING MADE EASY

When building a valve set, do not buy intervalve transformers. Use Elwell Amplifying Units. They save time, money and trouble.

When buying a valve set, select one using these units. They enable the manufacturer to give you a better job at a lower cost.

The unit featured is a note magnifier.

A similar design of unit is available as an oscillation amplifier and a third design as a rectifying unit.

WRITE US OR CALL.

C. F. ELWELL, LTD., *Radio Engineers,*

CRAVEN HOUSE, KINGSWAY, LONDON, W.C. 2

Telephone : REGENT 421.

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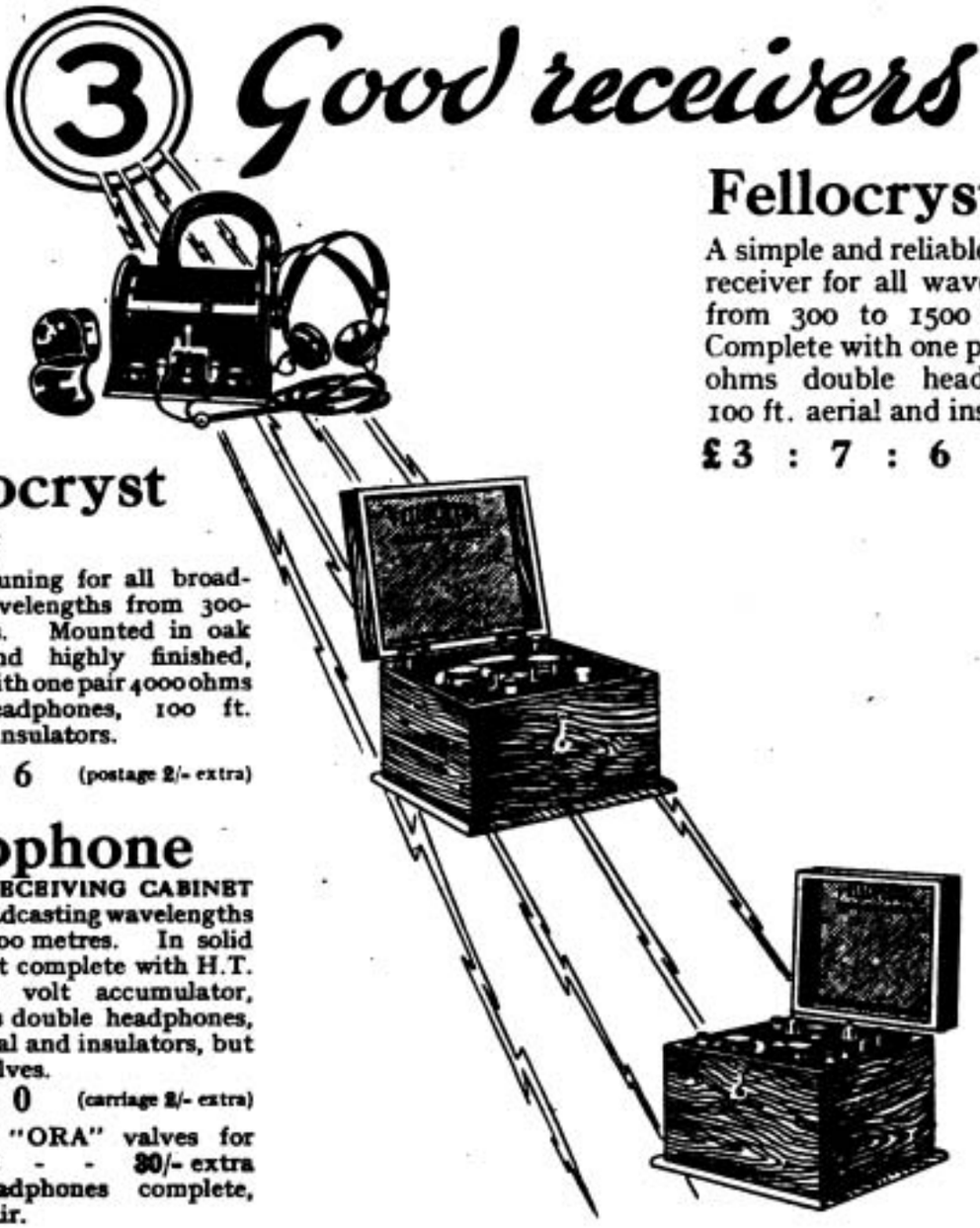
WIRELESS BROADCASTING

3 Good receivers



Fellocryst

A simple and reliable crystal receiver for all wavelengths from 300 to 1500 metres. Complete with one pair 4000 ohms double headphones, 100 ft. aerial and insulators.

£3 : 7 : 6 (Postage: 1/6 extra)

Fellocryst Super

For fine tuning for all broadcasting wavelengths from 300-500 metres. Mounted in oak cabinet and highly finished, complete with one pair 4000 ohms double headphones, 100 ft. aerial and insulators.

£4 : 7 : 6 (postage 2/- extra)

Fellophone

2 VALVE RECEIVING CABINET

For all broadcasting wavelengths from 300-500 metres. In solid oak cabinet complete with H.T. battery, 6 volt accumulator, 4000 ohms double headphones, 100 ft. aerial and insulators, but without valves.

£9 : 0 : 0 (carriage 2/- extra)

2 Mullard "ORA" valves for Fellophone - - 30/- extra
Extra headphones complete, 30/- per pair.

"for they are jolly good Fellows"

5.

FELLOWS MAGNETO CO., LTD.

Telephone: Willesden 1560-1.

LONDON, N.W.10.

Telegrams: Quixmag, Phone, London.

Visit our Stand No. 10. All-British Wireless Exhibition, Horticultural Hall, Sept. 30 to Oct. 7th.

(B.P.S. 3)

THE WIRELESS WORLD EXCHANGE AND MART

TARIFF. Advertisements are accepted for this Section at the rate of twopence per word, with a minimum charge of two shillings. The advertiser's name and address will be charged for, and single letters and single figures will be counted as words. Compound words will be counted as two words.

DEPOSITS. All advertisements must be prepaid in the form of Postal Orders, the remittance being forwarded to Messrs. Bertram Day & Co., Ltd., 9 & 10 Charing Cross, S.W.1.

Intending purchasers may deposit the purchase money of any article advertised or sold by advertisers with Messrs. Bertram Day & Co., Ltd., who will acknowledge its receipt to the vendor and the depositor, the full addresses of whom should be given. Subject to special agreement between the parties, it is understood that all goods are sent on approval, each party paying carriage one way in the event of the goods being returned. The deposit will be retained until due advice of the completion of the purchase has been given or until the articles have been retained and accepted. In order to cover postage, etc., a fee of 6d. in respect of sums of £1 and under and 1s. for sums in excess of £1, must be paid at the same time as the deposit. For persons not resident in the United Kingdom these fees are doubled. We cannot undertake to receive any deposit less than 2s. 6d.

TRADE **Grelco** MARK

FILAMENT RESISTANCES SUPERIOR MAKE AND FINISH. SMOOTH ACTION, EASY TO MOUNT, WILL NOT WORK LOOSE, 4 -.

Knobs, Best Quality, with 2B.A Brass Bush inset, excellent finish	4d.
Perikon Detectors, mounted on Ebonite complete	4 -
Valve Holders, with Screwed Legs	1 -
Aluminium Condenser Vanes, per doz.	1 -
Inductance Tubes, 12" × 3"	6d.
" " 12" × 4"	9d.
" " 12" × 5"	1 -
" " 12" × 6"	1 3
Dewar Switches (Multiple Contact)	4 6
Condensers Panel Mtg., ·001	18 6
" " ·0005	12 6
H.T. Batteries, 15v. guaranteed	3 -
Brass Studs, ¼" dia. × ¼" high per doz.	1 -
" " ¼" dia. × ½" " "	1 3
" " ¼" dia. × ¾" " "	1 3
Grid Leaks and Clips (2 Megohms)	2 -
Sliders, with Spring and Plungers	6d.
A.E.G. and Siemens Halske Valves	10 6
Adapters for R Type Holders	3 -

Postage Extra.

The above items only represent some idea of our various stock.

You are invited to inspect.

Catalogue in course of preparation.

Grafton Electric Company

Showrooms—54, GRAFTON STREET, TOTTENHAM COURT ROAD, LONDON, W.1. *Telephone—Museum* 241.

FOR SALE.

Two-Valve Variometer Receiver, 500-5,000 metres with valves, Marconi 4-volt, also 4-volt 7 amp. accumulator, £6.—SWALLOW, Apseheath, Sandown, I.W.

Aerial Insulators, Shell pattern, 1s. 2d. each, Egg-shape, 4d. each. Sterling Telephones, brand new, never been used, 4,000 ohm, 47s. 6d.; 2,000 ohm, 45s. Aerial Wire, 7/22 copper, 4s. 9d. per 100 ft. Moulded valve holders, 9d. each. "De Luxe" 4,000 ohm Telephone Head Sets, guaranteed, 32s. 6d. pair. Crystal sets, 3,000 metre, all ebonite insulation, polished mahogany frame, 27s. 6d. each, guaranteed. "Broadcasting" crystal sets, on ebonite panel, fitted in oak box, 20s. each.—"RADIO," 8, Fairlight Avenue, Harlesden, London, N.W.10.

Scooters, Scooters, Scooters.—All boys and girls write for free particulars of how to obtain one.—GRAND, 114, Fernlea Road, Balham.

Surplus.—Three-valve amplifier boxes, with holders, resistance, battery box, etc., 7s. 6d. Valve holders, 10d. Telephone transformers, 6s. 6d. Transformer coils, 1s. H.T. Batteries, 36-volt, in polished case, terminals on ebonite, 9s. 6d. Crystal sets with telephones, 59s. Valve panel with resistance, 10s. 6d. ·005 Condensers in polished case, 16s. Large terminals, 2s. 3d. doz.—SAUNDERS, Morland Road, Croydon.

Loose-Coupler (primary and reaction), 350 to 3,000m. 45s., photo on request. ·0003 Variable air dielectric condenser, 15s.—KING, 17, Kingsland Road, Birkenhead.

Mark III* Tuners, Marconi make, brand new, ex-Government, splendid instruments, £10 each.—TAYLOR, 41, Newlyn Road, Tottenham.

Red-Seal High Tension Batteries are Guaranteed. 15v. Standard size. Sample, 2s. 11d., three for 7s. 6d.—LITCHFIELD CO., 12, Great Castle Street, W.1.

Crystal Set Short Wave Coils, Variable Condenser. Complete, £3.—RAHA, 7, Scroop Terrace, Cambridge.

Marconi Units 1 and 2 (with coils), as new, £12.—"K," Brook Park, Northop, Flint.

Headphones.—Two pairs, 8,000 w., perfect condition with cords, 30s. each.—RUSKIN, 68, Constance Road, Leicester.

Amateur has for sale (1) Four-valve Receiver, 1 rect., 3 L.F. valves, fitted into stained oak writing bureau. All valves out of sight. Burndept coils and 3-coil holder with change-over switch to a Sullivan Inductance. Range 150-30,000 metres. Can also use L.F. as separate amplifier. Price £22 with valves. (2) Burndept "Ultra" II, in perfect condition, price £10. (3) Morse Inker and 20,000 ohm Siemens Relay, price £12, or would sell separately. (4) Brown's Loud Speaker, price £3. All in perfect condition. Apply in writing in first instance to G. SKINNER, Falconhurst, Parkside, Wimbledon Common.

Double-Slide Tuning Inductance, 300-4,000 m., polished mahogany ends, handsome instrument, 25s. 20 ft. Hollow Spar, weighs 11 lb., offers.—IOSCELYNE, Rushmere, Braintree.

Mark III* Tuner (New), converted single valve, £15. Another converted three-valve (two L.F.), £22 10s. Seen working appointment, evenings.—GILLETT, Maddox Park, Bookham.

Fibre Sheet.—Best hard vulcanised, at greatly reduced prices, per square foot, 5/16 in., 2s. 6d.; ⅜ in., 4s.; ½ in., 5s.; 9/16 in., 6s. 6d.; other sizes pro rata. Postage extra. Trade enquiries invited.—F. W. HOLT, 120, Arbor Vale, Slough.

Wireless Masts.—Improved girder type, light and strong, 30 to 50 ft. at 1s. ft., 50 to 100 ft. at 1s. 6d. ft. Cash with order, carriage forward.—F. ARMSTRONG, Weybridge.

4,000 Ohm Headphones, new and guaranteed, 35s.—G. D. HINKS, Hardington, Yeovil.

Wireless Instrument Cases, Walnut or Mahogany, finest finish, 12 ins. by 7¾ ins. by 4 ins. (outside), 8s. 6d. Second quality, 7s. 6d. Any size proportionately, prompt delivery. Trade inquiries invited.—HITCHCOCK, Colchester.

4,000 ohms Complete

25s. with lead, etc. Postage 1s. extra

Double HEADPHONES

THIS is another of our wonderful bargains. Send for a Set. Fully guaranteed and money refunded if dissatisfied. Only a few left. Everyone interested in Wireless should send for our lists, post free 4d. (purchase money refunded).

We are actual manufacturers. Trade enquiries solicited.

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'Phones: 4321 & 2800

I Buy Wireless Gear of every description.

Send your particulars to:

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SAME ADDRESS SINCE 1900.

Your Case Work

Let us quote you for your wireless casework. We are specialists in this class of work and feel sure our workmanship and prices will interest you.

Phone: L.W. 2720.

CARRINGTON & NEWBERY LTD.,

18/20, Normans Buildings, Old Street, E.C.

HEATH & Co., Ltd.

Instrument Works, New Eltham, S.E.9

are prepared to undertake in their fully equipped works—**Wireless Apparatus** and Parts for the trade. Quotations given to Blue Prints. Immediate attention.

Phone—Lee Green 301. *Wire*—'Polaris, London.'

THE WIRELESS WORLD EXCHANGE AND MART

Radio Accessories

High Class Aerial Insulators. Following best High Tension Electrical Practice. High insulation under all conditions. Drip Ring: 3½" diam., weight 5½ozs., breaking load, 860 lbs. **Price 2/-** each, postage extra. Ordinary barrel type, ditto, length 2½", diameter 1½", weight 4½ ozs., 1/- each, postage extra.

Aerial Wire. Bare copper.
Size 3/20, 4/- per 100', postage **9d.**
Size 7/22, 5/- per 100', postage **9d.**
Size 7/20, 7/- per 100', postage **1/-.**

Galvanised Steel Stay Wire.
Size, 3/16, **2/6** per 100', weight 7 lbs.

Galvanised Malleable Pulley Blocks.
Size 1½" .. .. .. each **1/2**
Size 2" .. .. .. each **1/8**
Size 2½" .. .. .. each **3/-**
Postage extra.

"Salunite" Fusible Alloy for Crystal Mounting. Non-oxidising. Melting point 195 deg. Fahr. In 1 oz. bars, **1/6** each, post free.
Trade inquiries invited.

H. LOUGTON, A.M.I.Mech.E.,
43, Johnson Street,
Westminster, S.W.1.

Send us your enquiries for

BOXES, CABINETS,

SPREADERS, CONDENSERS and parts, LEAD-IN-TUBES, and all accessories, to the Trade.

COMPETITIVE PRICES
PROMPT DELIVERIES

The Central Aircraft Co.

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Phone—Hampstead 4403-4 8018.

F. E. BOYNTON,
Electrical and Scientific Instrument Maker.
Wireless Component parts a speciality. Condenser Vanes, Spacing Washers, Spindles, Screwed Rods, Two and Three-Coil Holders, Ebonite Plugs. Complete sets made to specifications. Prompt deliveries.
The manufacturer with over 25 years experience.
Works: 391, St. John St., Clerkenwell, E.C.1

Wireless Headphones

4,000 ohms, 24/6. Post Free.

Don't confuse these with the cheap foreign-made 'phones now on the market. These are BRITISH French Make. Satisfaction guaranteed or money returned. List Free. LIBERAL DISCOUNT TO TRADE.

W. JOANES (PARIS AND LONDON)

42 Jenner Rd., Stoke Newington, London, N.16

THOMPSON'S SURPLUS DEPOT.

CRYSTALS! CRYSTALS! CRYSTALS!
Having purchased another huge stock of crystals of different types, we can do same at knockout prices—

Bornite.—Uncut crystal, best quality, per lb. **12/-**
Price per gross cut crystals .. **10/-**
Silicon.—Uncut crystal, Selected, per lb. .. **25/-**
Per gross cut crysta's **10/-**
Galena.—Uncut crystal, the best, per lb. .. **7/6**
Price per gross crystals **6/-**
Chalcorprite used in all government sets, per lb. **8/-**
Per gross crystals **7/**
Carborundum.—The best as used in government sets. Price per lb. uncut .. **10/-**
Price per gross crys'a's **9/-**
Zincite Crystals, per gross, selected.. .. **35/-**
Wood's Metal.—The purest used by government. This will not destroy crystals like different alloys that are used. Per lb. **8/-**

All these prices are subject to a fair trade discount, and traders should be able to purchase a complete winter's stock for a small outlay.

For the benefit of amateurs wishing to experiment with various crystals, we are doing the undermentioned—

Selected, 2 Bornite, 2 Silicon, 2 Galena, 2 Chalcorprite, 2 Carborundum, 2 Zincite, 4 sticks Wood's metal for setting, 6 sheets Ruby Mica ·002 thick 4½ × 3½, 12 Patent Spring Interchangeable Crystal Holders. Price **6/-** the lot. Worth 14/-

Wireless Spark Coils, 1½" spark, beautiful fittings on ebonite. Leading makers, cost £4 each, our price **10/6**, post 1/-. Always useful.

1" Wireless Spark Coils (by Sterling), same quality new, cost £3, our price **8/6**, post 1/-.

Mica.—For condensers ·002 and ·003 thick, 3½ × 4½ sheets. **20/-** per gross sheets. **2d.** per sheet.

For Trench Units, Valves, 'Phones, Magnetos, Accumulators, Switches, Generators, Transmitters, Condensers, etc., send for list, free.

T. W. THOMPSON & CO.,
Government Surplus Depot,
39, London Street,
Greenwich, S.E.10.

FOR SALE—continued.

Loud Speaker Horns.—Guaranteed acousticany perfect. All sizes from 3s. 6d. Usual trade terms.—COVENTRY TANKERS, LTD., Hearsall Works, Coventry.

Valves! Valves! Valves! Thirty excellent receiving valves, to be cleared at 12s. each, worth double this price.—ROBBERDS, 369, Hither Green Lane, S.E.

120 Ohm Sullivan Headphones, with cords, 8s. pair. Carriage, 9d. 120 ohm Telephone Transformers, with condensers, 8s. each, carriage 1s. Siemens Polarised Relay, for recording, 50s., carriage 1s. 6d. Morse Sounder. Instrument finish, 8s., carriage 9d.—COTTNAM, Greta Hall, Newton Mearns, N.B.

Honeycomb, Duolateral, Basket Coils, with or without tuning curves. Wavemeters calibrated, Brown's telephones re-wound, send for particulars to WIRELESS RESEARCH, 14, Purewell, Christchurch, Hants.

Single Valve Reaction Set, No. 141. By F. O. Read, complete with valve, £6. Scribo Morse learning instrument, complete with telephone, 30s. DEAVIN, 84, Hawley Road, Dartford.

Aircraft Three-way Crystal, with three-valve amplifying set, £10 10s. Aircraft crystal set, £5. Both splendid condition. Bargains. Also other sets for sale. Write or call after 6.30, 121, Adelaide Road, Chalk Farm, London.

Steel Tubular Masts, 10 ft., 15s.; 20 ft., 25s.; 30 ft., 35s. Painted, galvanised guy wires, pulley, base plate. Also fixing irons supplied.—ABBEY ENGINEERING WORKS, Walton, Norfolk.

B.A. Screws, Nuts and Washers, assorted gross 2s., lists 2d.—J. H. BENNETT, Station Road, Willesden Junction.

WE CAN SUPPLY FROM STOCK
CONDENSER VANES.
TERMINALS.
CONTACT STUDS.
SPACERS SPINDLES.
VARIABLE CONDENSERS.
DETECTORS.
POINTERS.
LAMINATIONS, ETC.
WRITE FOR LIST.

Also Spinnings, Stampings and Press Tools made to Specifications.

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225, Pentonville Rd., London, N.1
Telephone: Holborn 4714.

RADIOPHONE TUNERS,
200-1,400 ms. 38/-
Valve Panels for above .. 21/-
0005 Variable Condensers .. 16/6
Above 3 make an Ideal Receiver.
Broadcast Concert Coils, pair 2/-
Grid Leaks and Condensers .. 3/6
Fixed Condensers 2/6
5-Plate Condensers 6/6
2-Valve H.F. Amplifier Panels 32/-

Get our New Bargain List.

AMATEUR SUPPLIES,

134, COREFORD STREET, TOOTING, LONDON, S.W.

For Wireless Cabinets

SEND TO

J. A. JONES & CO., LTD.,

CABINET CASE MAKERS,
Progress Works, Park Road, Aston, BIRMINGHAM.
Phone—EAST 234.

TO THE TRADE

The firm of ASTON & MANDER was established 1789 and have been making scientific Instruments for over 133 years.
We are now making all forms of WIRELESS ACCESSORIES AND PARTS. Can we quote you for your Designs & Apparatus in METAL, WOOD, EBONITE, etc.?

ASTON & MANDER (1917) LTD.
ALBANY WORKS, WILLESDEN, N.W.10.

RADIO CONCERTS.
Two-Valve Receivers, designed for broadcast music, resistance coupling .. 45/-
One-Valve Receiver, with necessary condensers and rheostat, etc. 20/-
Two broadcast basket coils supplied with above receivers.
One-Valve Note Magnifier, complete .. 40/-

WIRELESS APPARATUS,
4, Cumberland Avenue, Gravesend.

THE WIRELESS WORLD EXCHANGE AND MART

FOR SALE—continued.

Wireless Masts.—Thirty-two ft. mast, with six guy wires, steel sleeve, iron cap and ring, pulley, cleat, 100 ft. 7/22 enamelled copper aerial, six porcelain insulators, 54 ft. hemp rope, carriage paid England, 40s.—BARKER, 61, Arthur Street, Derby.

BOOKS.

Radio Magazines, all the latest, "Radio World," 10½d.; "Popular Radio," 10½d.; "Radio Broadcast," 1s. 6d.; "Radio News," 1s. 6d.; "Science and Invention," 1s. 9d.; "Scientific American," 2s. 6d. Post free.—INTERNATIONAL NEWS COMPANY, LTD., 15, Bream's Buildings, London, E.C.4.

Radio Chart.—"Care and Maintenance of Accumulators," 1s. Post free.—Publishing Branch, G. D. HINKS, Hardington, Yeovil.

SITUATIONS WANTED.

Wireless Operator (24), First-class P.M.G. desires position. Fitting, erecting or salesman demonstrator. Spark, Valve, C.W. experience, at present in charge of C.W. station.—"Radio," 120, Sheldon Road, Edmonton, N.18.

Young Man wishes to change his present position. Holder of 1st Class P.M.G. Certificates in Marconi, Poulsen Arc, and Telefunken Systems, also good practical knowledge of valve gear and engineering, offers his services as Demonstrator, Salesman, or any other capacity.—Box M.5, BERTRAM DAY'S ADVERTISING OFFICES, 9 and 10, Charing Cross, S.W.1.

Gentleman requires position in London, thorough knowledge of wireless and manufacturing. Inventor.—Box M.4, BERTRAM DAY'S ADVERTISING OFFICES, 9 and 10, Charing Cross, S.W.1.

SITUATIONS VACANT.

Smart Youth required for Engineer's Shop and office in W. London, conversant with wireless and electrical contracting, etc. (no others need apply). State full particulars and wages.—Box L4, BERTRAM DAY'S ADVERTISING OFFICES, 9 and 10, Charing Cross, S.W.1.

TRADE ENQUIRIES.

Radio Instrument Maker desires private orders for construction of apparatus or components to special requirements or dimensions. Repair work and telephones rewound. Thorough workmanship.—C. BOXWELL, Beech Hill, near Reading.

Wireless Parts to Pattern or Sketch. Special prices for quantities.—KYLE, 31, Riverview Grove, Chiswick, W.

Wireless Sets designed and blue prints supplied. Sound advice and information given. All types of motors designed and windings calculated.—O. S. PUCKLE, Buckhurst Hill, Essex.

Man with Workshop and Plant would undertake manufacturing of radio parts. Filament rheostats made to any specification at lowest manufacturer's prices.—BEDFORD, 7, Thane Works, Seven Sisters Road, Holloway.

MISCELLANEOUS.

East Ham, Wanstead, Ilford, Manor Park and Forest Gate. Amateurs should not fail to come to the RADIORENDEZVOUS, 709, Manor Park Broadway (over Liptons). Club open till 10 p.m. nightly.

Wireless Exhibition.—Will be held by Glasgow and District Radio Club, on Saturday, November 4th, at McLennan Galleries Hall, Sauchiehall Street, Glasgow. Admission, 1s. including tax. Trade exhibits, ancient and modern, specially invited. Send particulars of offers to Hon. Secretary, ROBERT CARLISLE, 40, Walton Street, Shawlands, Glasgow.

"EULOGY."

The Advertisement Manager,
"Wireless World and Radio Review,"
9 and 10, Charing Cross,
London, S.W. *August 29th*, 1922.

Dear Sir,

We would like to advise you that owing to the tremendous number of replies we have received from our small advertisement which appeared on the 26th inst., we have completely sold out the line we were advertising, and have had to return large numbers of orders and remittances, being unable to cope with anything like the number of orders received.

We would mention we have tried other mediums for advertising from our Wireless Dept., with the result that we have given these all up in view of the extremely large number of replies we receive in comparison from The Wireless World and Radio Review.

We feel you may like to publish this letter of appreciation from us as we are confident that others who have not tried your advertising columns will do so in future, with splendid results.

Yours faithfully,
R. L. NYE.

Service Sale & Exchange,
8, Gt. Southsea Street, Southsea, Hants.

MISCELLANEOUS—continued.

Wireless Dealers are advised to stock parts for making radio apparatus, as so many amateurs prefer to make their own instruments. There is also the additional profit in making your own sets from stock parts. Raw materials and partly machined parts can be had direct from the factory at the right price.—THE "NEWTONIA" WIRELESS FACTORY, 13/15, Whitcomb Street, London, W.C.2. Regent 643 and 5469.

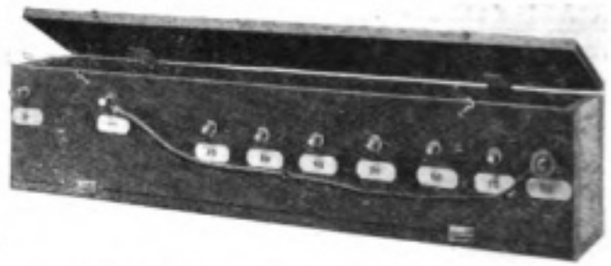
THE WIRELESS WORLD EXCHANGE AND MART

At York Terrace, Clapham. (20 yds. from Clapham Road Tube & Railway Stations.)
Valuable Stock of WIRELESS, ELECTRICAL GOODS, SURVEYING & other INSTRUMENTS, SAFES, &c., Comprising :—1, 2 & 3 Valve Sets, 300 small Transmitting Sets, 400 pairs Headphones, 200 Potentiometers, 250 Condensors, large quantities of earpiece parts and terminals, 300 buzzer sets, 30 Simplex Telegraph Sets, 1,000 Telephone and Battery Boxes, 150 S.H. Accumulators, 600 Handphones, 100 Telephone Sets, 250 Electric Fans (low volt), 70 Galvanometers, 80 Starters and Switches, 500 Electric Lamps, 220 Volt. Large quantities of Field Levels, Abney Pocket Levels, Sight Rules, Telescopes, Baragraphs, 1,000 max. and min. Thermometers, 300 Ship's Liquid Compasses, Logs, and Lamps, etc., etc., together with 30 Safes and Money Chests.
To be sold by auction WITHOUT RESERVE on Wed., Oct. 4th, 1922, at 1.30 p.m. Catalogues of the auctioneers :
THE SOUTH LONDON MERCHANDISE MART, 25 York Terrace, S.W.
Phone : Chancery 7720. On view Mon. and Tues., Oct. 2nd and 3rd, and morning of sale.

The ROWCELL

Reg. No. 22588
HIGH TENSION "WIRELESS" BATTERY CABINET

SIMPLICITY.



ECONOMY.

1. No Internal Wiring, Soldering or other connections necessary.
2. 7 Tappings.
3. Capacity: 20 Flashlamp Batteries or less may be used. Cells can be instantly replaced, singly or otherwise.
4. Volts obtainable : 20, 30, 40, 50, 60, 70, 80.
5. Spent
6. PERFECT contact.

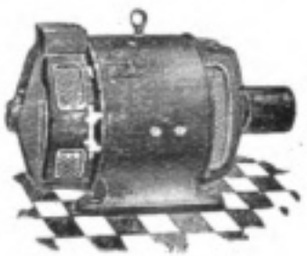
METHOD OF CHARGING. Open cabinet, slip in flashlamp batteries, close cabinet and an automatic and perfect connection is made.

PACKING & POSTAGE FREE 15/-.

Messrs. ROWCELL & Co., 28, Rendezvous Street, Folkestone.

ELECTRADIX RADIOS

Tate Dynamos and Motors of 100 to 60,000 Watts. British and best.



W T Alternators, £3 to £7.
Battery Charging Dynamos, 6v. to 20 v., **£4 10s., £5 10s.** and **£8 10s.**

12-Volt Motor Generator for H.T. 750 volts for transmission, quite new, **£15.**

1 K.W. 220 Volt Charging Set, £30.

Electradix Wires in all coverings. Highest Conductivity at Lowest Prices.

Gauge.	D.C.C.	S.C.C.	D.S.C.
16	1 9	—	—
18	2 1	1 9	2 7
20	2 3	1 11	3 3
22	2 9½	2 1½	3 8
24	3 2½	2 5	4 3
26	3 10	2 7½	5 2
28	4 4	3 -	5 10
30	4 11	3 2	7 -
32	6 -	4 4	8 6
34	7 1	6 2	10 -
36	8 7	—	11 8
38	11 6	—	16 6
40	—	—	22 2

All sizes in stock. Prices at per lb. Postage extra. 7/22 Aerial Wire, at **6/-** per 100'.

Breast Plate Transmitter, in case, **10 6.**

Receiving Sets.—Trench pattern, Calibrated Receivers, Marconi 300 600 metres. Crystal and 2 valves, **£5 10s.**

Mark 2B, two-valve in polished mahogany case, new and guaranteed, **£7 5s.** Crystal Sets, variable condenser, detector and fixed inductance, mahogany case, **45 -.** Pole Testers, **6d.** Single Plug and socket, large, **1 6** pair. G.P.O. Galvos, Q. & I., **10 6,** with shunt switch **15 -.**

Plug Sockets and cord of all kinds, solo, **1 -** pair, twin **1 6,** four-way **2 -.**

Terminals, dozen, **2 6** and **3 -.**

Condensers, 2 M.F. **1 6,** 4 M.F. **5 -.** Variable for panel, **4 9, 10 -** and **11 6.** Cabinet, **32 6.** Murdoch rheos., for panels, **7 3,** with Vernier extra lever, **8 -.** Our make, **3 9.**

Valve legs, **1d.** each.

Panel Potentiometers in case with switch, **12 6** each.

CASH PRICES

Marconi 'Phones in stock, 2,000 ohms, **49 -**; 4,000 ohms, **50 -**; 8,000 ohms, **57 -**, per pair. Complete with cord and tags. Sullivan's L.R. head 'phones, with cords, **15 -** per pair. Ex-Govt. L.R. set of head 'phones, **10 -** per pair with cords. New 1,500 ohms, **20 -** per pair. Single receivers, **4 6** each.

Large Stocks of ammeters and voltmeters, milliamps and hot wire.

Crystal Detectors, complete on ebonite base, **4 6.**

Buzzers for Crystal Tuning, Townsend type, **4 -** each.

Aerials, 7/20. Stranded copper enamelled wire, **6 -** per 100'.
Lightning Arrester parts, brass, **6d.**

Rubber Aerial Cords, 35/40, copper, 12 yards, **1 6.**

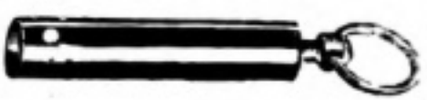
Pulleys, Duralumin, brass bush, **2 -** and **1 9** each. Cord, **1 6** doz. yards. Earth Clips, any pipe, **6d.** each. Earth spikes, **1 -** each. Earth Mats, **10 -** each. Leading in Tubes, 12", Porcelain lined, **Switches,** Aerial to earth, **2 9** each. Dewar flush type three-way lever switches for panel, **3 6.** Eight-way Lever, for A.T.I., **8 -**; 30 amp. D.P., **16 -.**

Switch Arms, **2 -.** Studs, **1 6** doz.

Transformers. Telephone **15 -,** Intervalve **20 -** for panel mounting.

Connecting up wire, 23/40's, rubber covered, **1d.** per yard.

R.A.F. light weight ebonite Insulators, **6d.** each.



Bells. 4" Gong, on oak base, metal cover, **2 6.**

Rubber Primed Tape, **6d.** per roll.

H.T. Battery Boxes, **7 -** and **5 -.**

H.T. Battery Units, **4½** volts, **6d.** each. One-Valve Accumulators, **£1.**

Catalogues **3d.**

We have the Largest and Most Varied Wireless Stock in the City of London.

Thousands of component parts in stock.

LESLIE DIXON & Co., 9, Colonial Avenue, Minories

Close to Aldgate Station, Metropolitan Railway. First on the left in Minories

Printed by Sanders Phillips & Co., Ltd., Chryssell Road, London, S.W.9, for the Proprietors and Publishers, The Wireless Press, Ltd., 12-13, Henrietta Street, London, W.C.2; Sydney, N.S.W., 97, Clarence Street; Melbourne, 422-24, Little Collins Street; New York, 326, Broadway.