The Wireless Constructor

6D MONTHLY

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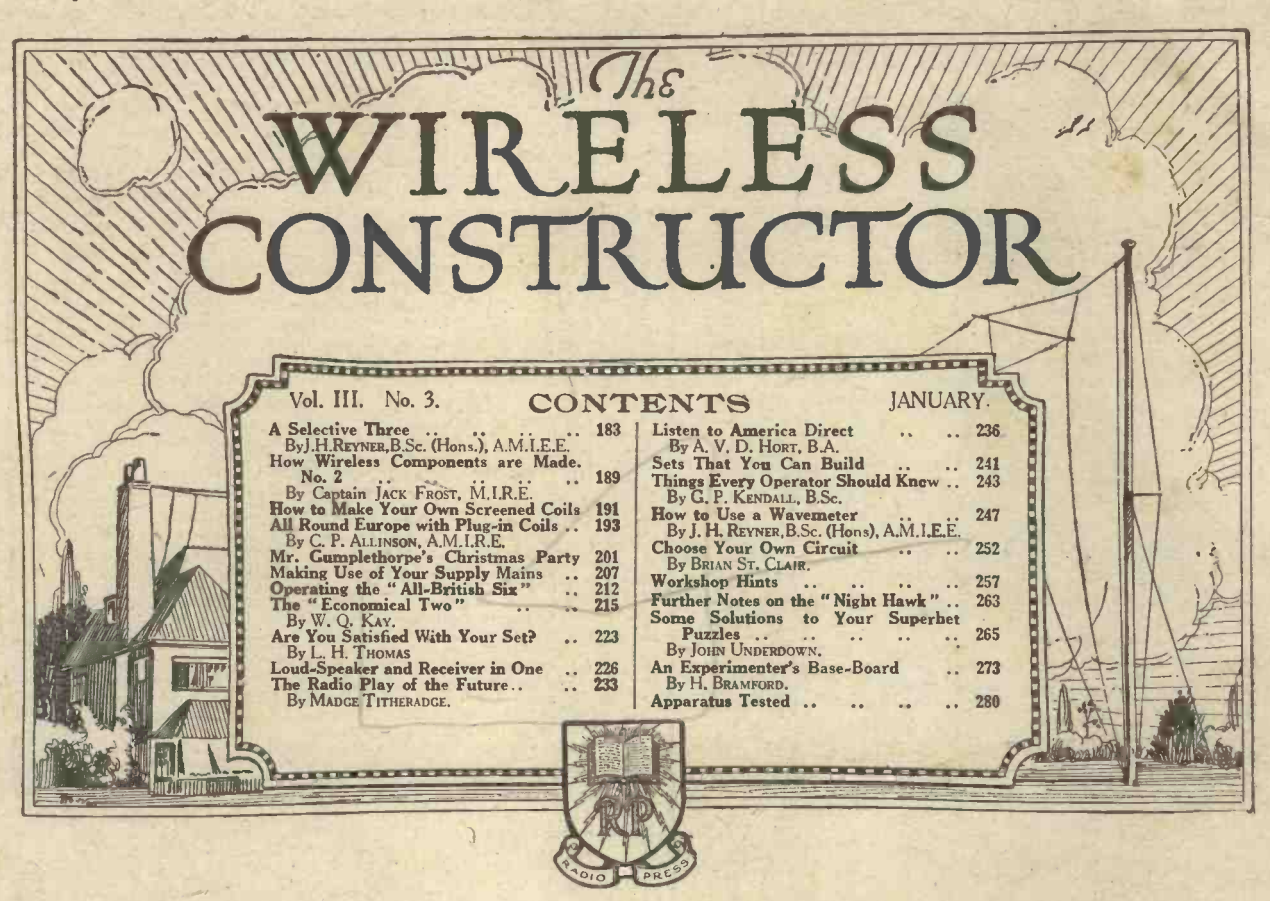
RADIO PRESS

A Set in time for Xmas!

SPECIAL DOUBLE NUMBER

H.A.SCRIVENER



Vol. III. No. 3. JANUARY.

CONTENTS

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A SELECTIVE THREE

By J. H. REYNER
B.Sc. (Hons.), A.M.I.E.E.

Here is the set to build for this Christmas! The construction is simple, the coils you can make up yourself, the set is easy to operate and you can expect excellent results from its up-to-date circuit and design.

THERE are many readers nowadays who wish to avail themselves of the latest developments in high-frequency amplification, but who prefer if possible to make up their own high-frequency transformers. Recent improvements have been confined principally to the production and standardisation of various types of plug-in high-frequency transformers made to fit a standard 6-pin base, so that they may be used either inside or apart from the copper screening cases which are now so familiar.

Home-Made Transformers

In the present set a more or less standard circuit has been utilised, but special home-constructed transformers have been made for the benefit of those readers who prefer actually to construct their own apparatus. At the same time, by winding the coils specially, it is possible to obtain an increase in efficiency over the usual arrangement, with the result that a very selective receiver is obtained.

The circuit used for the receiver in question is a standard split-primary arrangement. An ordinary auto-coupled aerial circuit is utilised to apply the signals to the grid of the first high-frequency valve. The anode circuit of this valve is transformer-coupled to the grid of the detector valve, the secondary of the tranformer

A Selective Three—*continued*

being tuned. The primary is wound in two sections, one being the primary proper and the other the neutralising section.

A Popular Arrangement

A straightforward transformer-coupled note-magnifier is included for the third stage, thus giving the very popular combination of one high-frequency, detector, and one note-magnifying valve.

Screening has not been employed, in order to minimise the cost of the arrangement. The presence of an electro-static screen between the first two stages would undoubtedly be beneficial, but excellent results can be obtained without its use, and it has been omitted in the present instance.

No Radiation

In order to obtain a satisfactory degree of sensitivity a reaction winding has been placed on the transformer to permit capacity-controlled reaction of the "Reinartz" type to be obtained as required. Since a definite reaction is provided in this manner, the first valve can be perfectly neutralised, which enables the receiver to be handled without any danger of interference to the neighbours due to radiation.

It must be borne in mind, however, that this non-radiating condition only obtains when the first valve is definitely and correctly neutralised. When this is the case the last stage may be permitted to oscillate without danger. It is possible, however, to obtain a stable position on the receiver when it is not quite correctly balanced. In such cases a small amount of energy will filter through to the aerial and cause radiation. Particular care should be taken, therefore, to neutralise the receiver correctly in the manner described later, when no danger from this trouble will arise.

Aerial Coil Winding

The first operation in the construction of the receiver is the making up of the high-frequency transformer and aerial coil. For these, some special 3-in. diameter flanged ebonite tube has been utilised. The particular tube in the present instance was obtained from Messrs. Redferns, and had eight flanges thereon. The aerial coil carries 50 turns of "Litz" wire, this being composed of 9 strands of 38 gauge. Similar conductor to this may be obtained from the London Electric Wire Co. Tappings are taken on this aerial coil at 5, 10, and 15 turns. Tapping this "Litz" wire is a matter of some difficulty, owing to the fact that no broken strands must be permitted, or the use of the stranded wire gives rise to a higher resistance than would be obtained with a solid conductor. In the present instance, therefore, the three tappings have been made by looping the wire out to the terminal and back again, and just baring the insulation at the actual point of contact without breaking the wire itself.

Dealing with "Litz"

Particular care must be taken in carrying out this operation that none of the strands of the 38-gauge wire are broken. It is best to clean the

TEST REPORT

The following stations were received, all on the loud-speaker, using an aerial about 60 ft. by 20 ft., 12 miles north of London:—

Station.	Reading on Aerial Dial.
Rosenhugel	44
Brussels	46
Barcelona	49
Birmingham	53
Ecole Superieure	62
Frankfurt	71
Bern	79
Glasgow	84
Hamburg	87
Toulouse	90
Manchester	95
London	103
Cardiff	110
Breslau	125
Newcastle	135
Bournemouth	145
Münster	148
297-metre band	152
294-metre band	157
288.5-metre band	163
Cassel	180
Malmö	190
Gleiwitz	220

The tapping on the aerial coil requires occasional alteration for the best results. The readings on the second dial are about 10 degrees lower than those given above.

BUILD THIS SET WITH:

One ebonite panel, 21 in. by 7 in. by ¼ in.
One suitable cabinet, with baseboard, 8¾ in. deep. (Peto-Scott Co., Ltd.)
Two .0005 and one .00025 "lateral action" variable condensers. (Ripaults.)
Two 3¼ in. and one 2¾ in. diameter ribbed ebonite formers, each 3 in. long. (Redferns.)
Three valve holders. (Lotus.)
Three fixed resistors, to suit valves used. (Peto-Scott Co., Ltd.)
One L.F. transformer, A.F.3. (Ferranti, Ltd.)
One H.F. choke. (Metro-Vick.)
One .0003 fixed condenser. (T.C.C.)
One 2-megohm leak. (Dubilier.)
One baseboard mounting neutralising condenser and three dial indicators. (A. F. Bulgin & Co.)
One on-off switch. (Wright & Weaire.)
Four terminals.
One battery plug and socket, 7-way.
One spring clip.
Two pieces of ebonite 2 in. by 4½ in., by ⅛ in.
Litzendraht, 9/38, about 40 yds. (London Electric Wire Co. & Smiths, Ltd.)
Quantity of Glazite and a few inches of flex.
Radio Press panel transfers.
Approximate cost, £9.

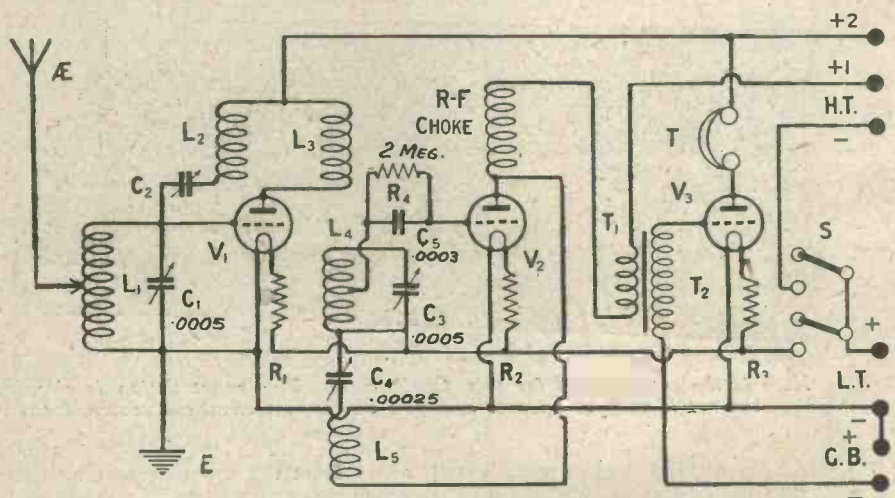


Fig. 1.—The switch disconnects both the L.T. and the H.T. batteries.

A Set in Time for Christmas

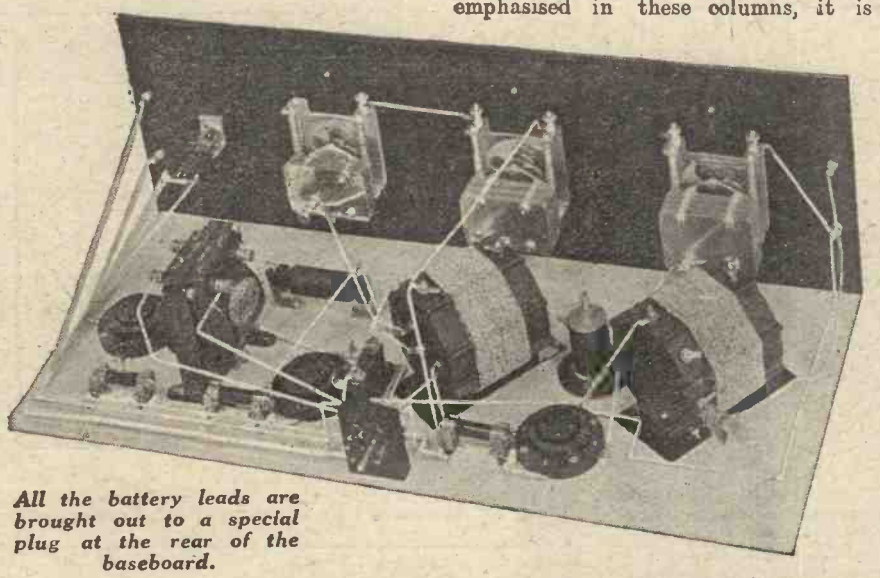
wire with a very small piece of fine emery cloth. First remove the covering over the whole conductor, and then gently clean off the enamel on the individual strands by means of the emery cloth. The conductor may then be soldered to the particular terminal in question.

The actual method of bringing out the connections both on this coil and on the high-frequency transformer is worthy of note. Holes are drilled at the end of the former, through which small 6 B.A. screws are inserted. They are held in position with a nut, while on top of this a soldering tag is held in position with a second nut. Both the wire from the coil and the connections to it are soldered to this, the wire from the tapping point being brought through a hole in one of the flanges along the top of the former under the winding proper.

H.F. Transformer

The high-frequency transformer is constructed in a similar manner. The secondary coil consists of 50 turns of Litzendraht, as with the aerial coil. There is, however, a separate tapping on this winding which is taken to the grid of the detector valve, as will be seen from the circuit diagram. By this means the detector valve is not connected across the whole of the tuned circuit.

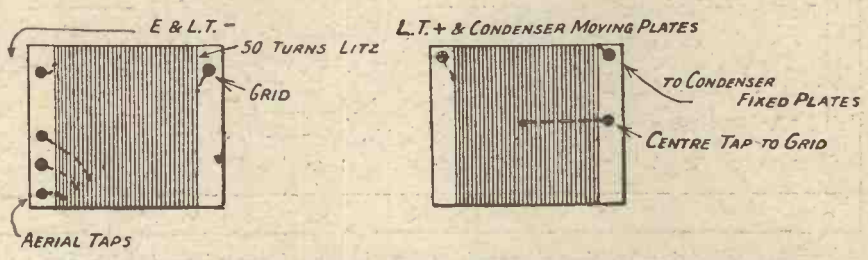
As is well known, when grid-rectification is used, the valve introduces a certain amount of extra damping into the circuit. The effect of this is very considerably minimised by tapping the



All the battery leads are brought out to a special plug at the rear of the baseboard.

valve across a portion of the circuit only, and in this case, using a D.E.5B or similar type of valve for the detector, a tapping at about half the coil is satisfactory There is actually an optimum tapping point for each different valve, but provided the detector valve is of a high impedance, a tapping at about half-way across the coil will be found to give considerably sharper tuning without appreciable loss in signal strength.

This system has therefore been adopted in the case in question, and the centre-tapping on the Litz winding should be made by looping the wire out to the terminal and back again without definitely breaking the wire in an exactly similar manner to the tappings on the aerial coil.



Figs. 2 and 3.—Details of the aerial coil (left) and the secondary of the H.F. transformer (right).

Two Formers

The primary, neutralising, and reaction windings are placed on a similar former of 2 in. diameter, which slides inside the secondary former. The overall diameter over the flanges is just over 2½ in., so that the former just fits comfortably inside the secondary former.

With the split-primary method of neutralising, as has previously been emphasised in these columns, it is necessary to have a very tight coupling between the primary winding and the neutralising winding. In the case of the standard transformers this is obtained by a definite over-winding, one winding being wound on top of the other. In this case it has been obtained by winding two wires together side by side.

It is therefore necessary to cut off a length of 10 or 12 ft. of wire and then to wind these two lengths together on the former, so that we have alternately a wire of the primary and then a wire of the neutralising winding throughout the whole length, thus obtaining a very tight coupling. For these windings 22-gauge wire was utilised for mechanical considerations and ease of winding, but if desired finer gauges of wire may be used with equal efficiency.

Connections

The actual method of winding is shown in Fig. 7, the primary winding being from A to D, and the neutralising winding C to B. It is important to remember these connections and to ensure that they are connected in the correct manner when actually wiring the receiver up. If the connections are wrongly made, then the neutralising winding will be connected in the wrong direction. This point, however, will be dealt with later on in the article.

Direction of Windings

The primary former also carries the reaction winding, which consists of 20 turns of a suitable gauge of wire. In this case 30 gauge wire was employed for the purpose. The reaction winding is wound in the same direction from start to finish as the neutralising and primary windings, and when the connections are complete the primary former is inserted into the secondary former in such a direction that all the windings are in the same direction. The direction is again important, as otherwise the reaction winding will be in the wrong direction and will produce extra damping instead of an increase in signal strength. This, however, is not such a serious fault as having the neutralising winding wrong, because it can easily be seen whether the reaction winding is wrong, whereas if the neutralising winding is incorrectly connected the fault is somewhat difficult to trace.

A Selective Three—*continued*

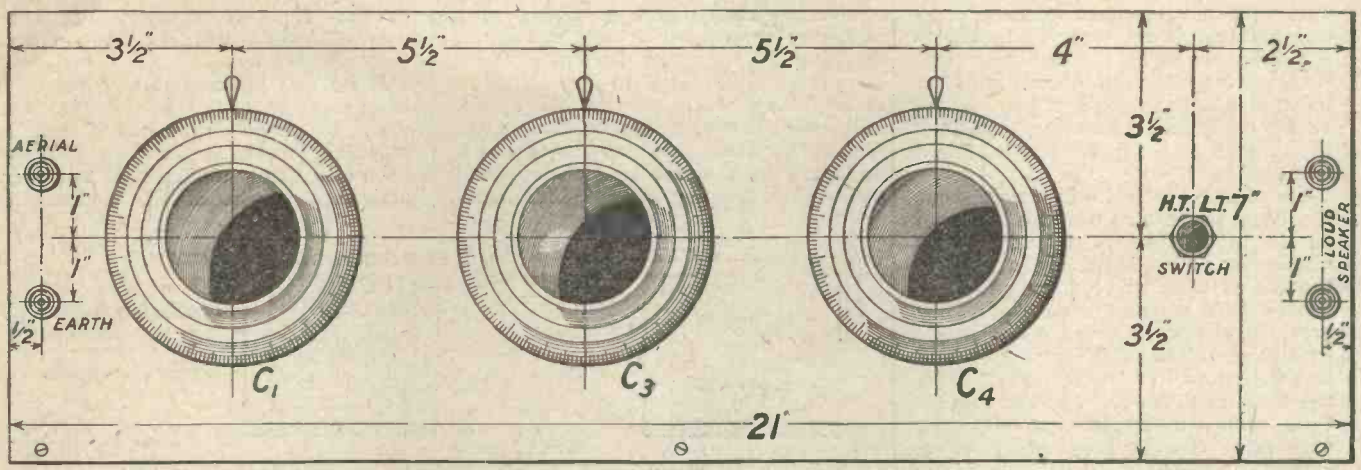


Fig. 4.—Drilling dimensions for the panel are given in this scale drawing. Blueprint No. C1073A.

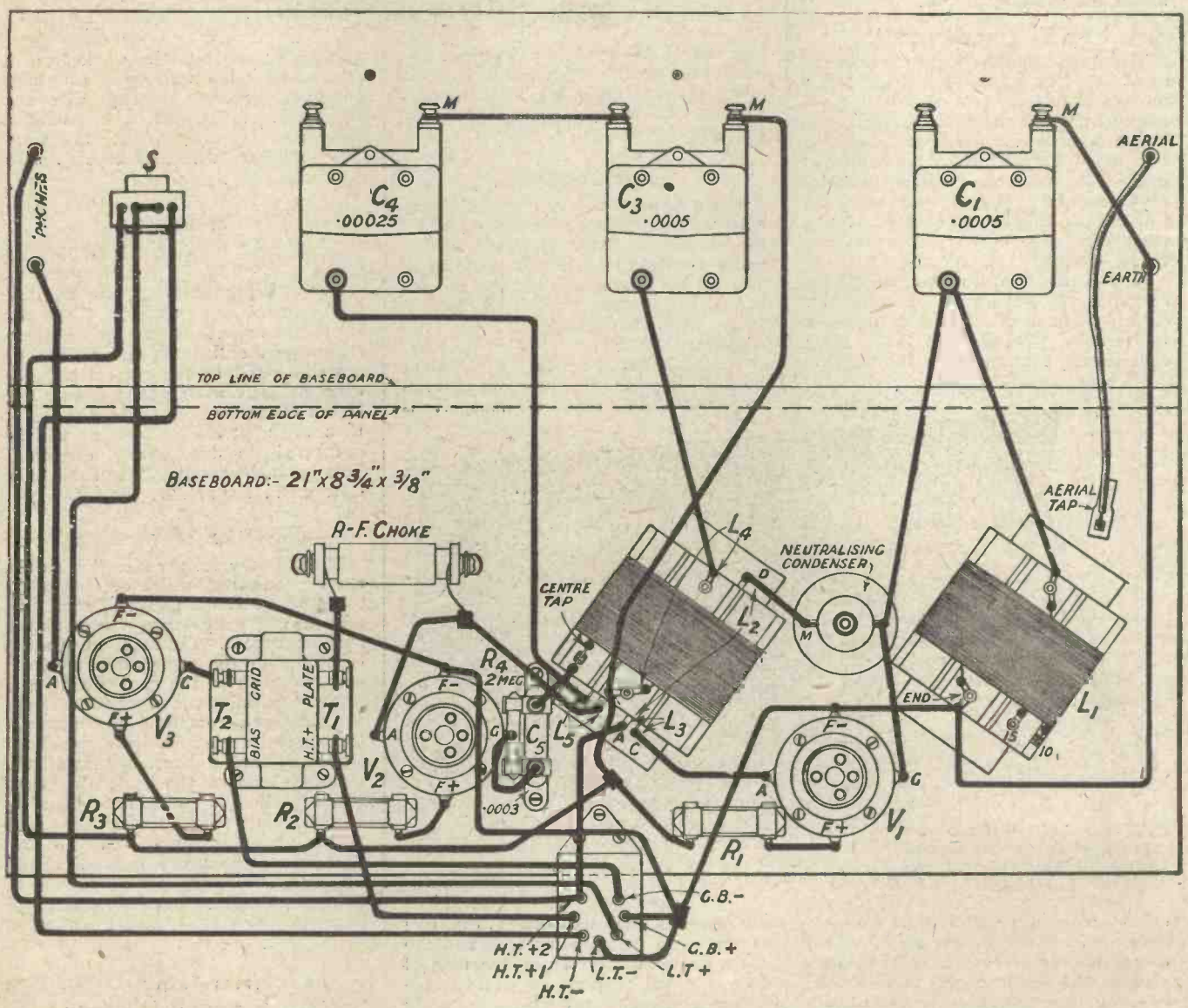


Fig. 5.—The coils should be mounted in the positions shown here. Blueprint No. C1073B.

A Selective Three—*continued*

Mounting

These transformers may then be mounted on the baseboard in the position shown in the wiring diagram by simply screwing them down on the baseboard, a small piece of leaf ebonite or insulating cloth being placed in between the formers and the baseboard in order to prevent leakage across the windings.

The assembly of the remainder of the set is comparatively straightforward. Mount up the three condensers, the on-off switch, and the four terminals on the panel in the positions shown in the panel diagram.

WIRING IN WORDS

Join a flexible lead with spring clip to Aerial terminal.
Join Earth terminal to moving vanes of variable condenser C1, to one end of L1, to one filament contact of V1, V2 and V3, and to L.T. – and G.B. + pins of Multi-plug.
Join other end of L1 to fixed vanes of C1, to fixed vanes of neutralising condenser C2, and to grid of V1.
Join remaining filament contacts of V1, V2 and V3 to one end of resistors R1, R2 and R3 respectively.
Join together remaining ends of R1, R2 and R3, continue to one end of L4, moving vanes of variable condensers C3 and C4, and to one outer contact of switch S.
Join anode of V1, to C end of L3.
Join moving vanes of C2 to D end of L2.
Join fixed vanes of C3 to remaining end of L4.
Join A end of L2 (and L3) to H.T. + 2 pin of Multi-plug, and to top telephone terminal.
Join centre tap of L4 to one end of fixed condenser C5 and leak R4.
Join other end of C5 and R4 to grid of V2.
Join one end of L5 to fixed vanes of C4.
Join other end of L5 to one end of R.F. choke, and to anode of V2.
Join other end of R.F. choke to PLATE terminal of L.F. transformer T1 T2.
Join H.T. + terminal of T1 T2 to H.T. + 1 pin of Multi-plug.
Join GRID terminal of T1 T2 to grid of V3.
Join GRID BIAS terminal of T1 T2 to G.B. –pin of Multi-plug.
Join anode of V3 to lower telephone terminal.
Join remaining outer contact of S to H.T. – pin of Multi-plug.
Join two centre contacts of S to L.T. + pin of Multi-plug.

When the condensers are mounted, the three dial indicators may be inserted in the correct positions. The panel should then be screwed to the baseboard and the remainder of the components mounted on the baseboard in the positions indicated. Ample space is provided, and no difficulty should be experienced at this stage. The instrument is then ready for wiring up.

Wiring

Wire up the receiver in the manner shown. It will be noted that all the battery connections have been brought to a Multi-plug, which consists of a number of pins arranged round the circumference of a circle. The battery leads themselves are taken to a plug carrying a number of sockets which fit over the pins and thus make connection to the receiver. This is made in such a way that the plug cannot be inserted in the wrong manner, so that the arrangement provides an adequate safeguard against wrong connection of batteries.

A particular point is the double-pole push-pull switch used for switching the set on or off. This not only breaks the filament circuits, but disconnects the H.T.– from L.T.+, thus rendering the set "dead" when it is switched off. This saves the windings of the L.F. transformer and also avoids

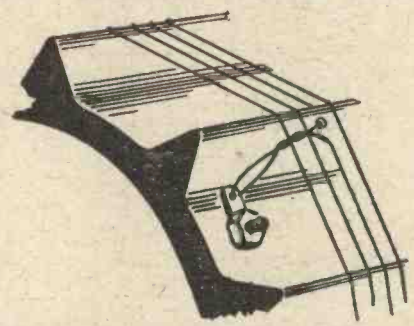


Fig. 6.—Showing how the tappings are brought out to soldering tags.

trouble if it is desired to make any alterations to the set when it is still switched on.

Battery Leads

Having completed the wiring of the set, it is next necessary to connect the leads on to the plug of the Multi-plug connector unit. All the contacts on this plug will be found to be engraved plainly. It is very convenient to use one of the battery cords now on the market, such as, for example, the "Lewcos" or the "Magnum." These consist of a number of flex wires of suitable lengths, fitted with plugs at one end and terminal tags at the other, and bound up into one complete cord. For our purpose, of course, it is necessary to cut off the terminal tags, which normally go under the terminals of the receiver, and to connect the wires direct on to the Multi-plug.

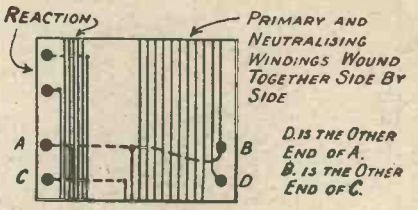
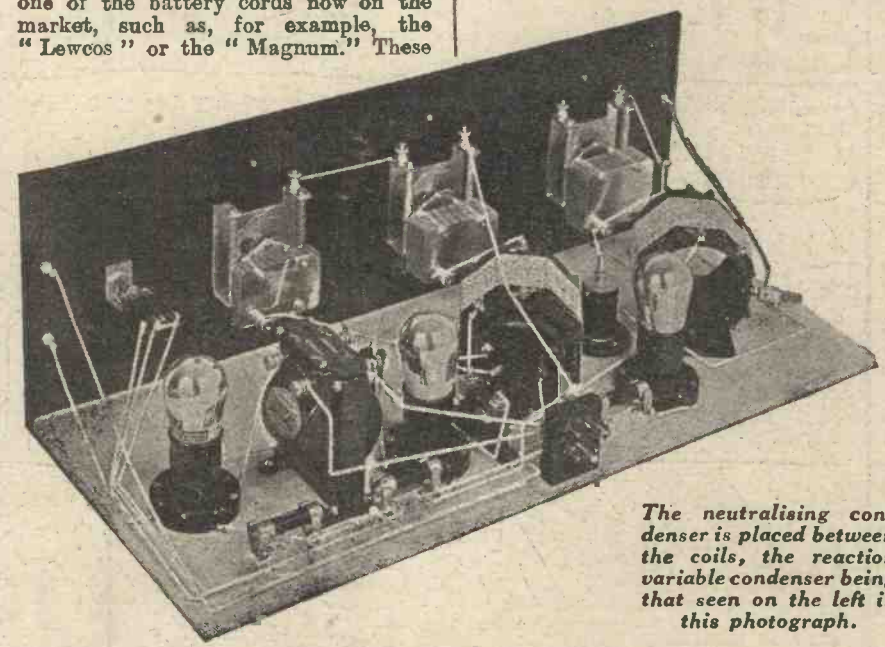


Fig. 7.—The arrangement of the windings on the inner former of the H.F. transformer.

Testing

Having made these connections, the set is now ready for test. It is advisable to utilise some form of safety device when first testing out, in case any connections have been made wrongly. One of the simplest devices is to include a fuse or small flash-lamp bulb in the negative lead from the high-tension battery. Should the H.T. circuit then inadvertently come in contact with the L.T. circuit, the currents will burn out the fuse or flash-lamp bulb before the valves are damaged, and in this way considerable expense can be saved.

In testing out, place the reaction condenser, on the right-hand side, to the minimum position (with the plates all out). Then set the two tuning condensers approximately to the same reading and tune in to the local station. The approximate settings will be obtained from the test report which is given elsewhere.



The neutralising condenser is placed between the coils, the reaction variable condenser being that seen on the left in this photograph.

Neutralising

The receiver may now be neutralised,

(*Concluded on page* 229.)

A MERRY CHRISTMAS !

HOW WIRELESS COMPONENTS ARE MADE

No. 2.

THE MAKING OF THE RECEIVING VALVE. (Continued)

BY

CAPTAIN JACK FROST, M.I.R.E.

Continuing the description of the construction of receiving valves, commenced in last month's issue, Capt. Frost deals with the fixing of the electrodes and the bulb, the process of evacuating the valve and the final tests before the finished product is ready for your receiver.

I DESCRIBED in my last article the making of the foot of the valve and of the anode, grid and filament, and to me these minor parts of the valve have become most interesting and have a most important part to play in the function of the valve which, in turn, is essential to reception where valve receivers or valve amplifiers are used. All these odd parts have to be assembled, and this is how it is done.

Fixing the Electrodes

The foot of the valve with its supports has to be attended to first of all. The supports themselves have to be bent into the correct position to take the parts to be fixed to them. You may have noticed that in various types of valves the filament, grid and anode are in different positions. The positions of the electrodes just depend on the type of valve which is being made.

To fix these the supports for the electrodes have to be bent. A very wonderful machine is used for this. First of all the foot of the valve with its supports is put into the front of the machine, a stamp comes down and bends the support wires to the required position. Down a little shoot and out of the machine comes the valve foot. This shoot is just like those used for underground railway ticket machines. A girl examines the valve foot and passes it into another machine which simply deals with the two filament supports, and flattens the ends of them or bends them so that the filaments may easily be held. Then another machine takes that valve foot and also the length of filament wire which I described last month as being cut up and tabbed, and fixes it to the filament supports.

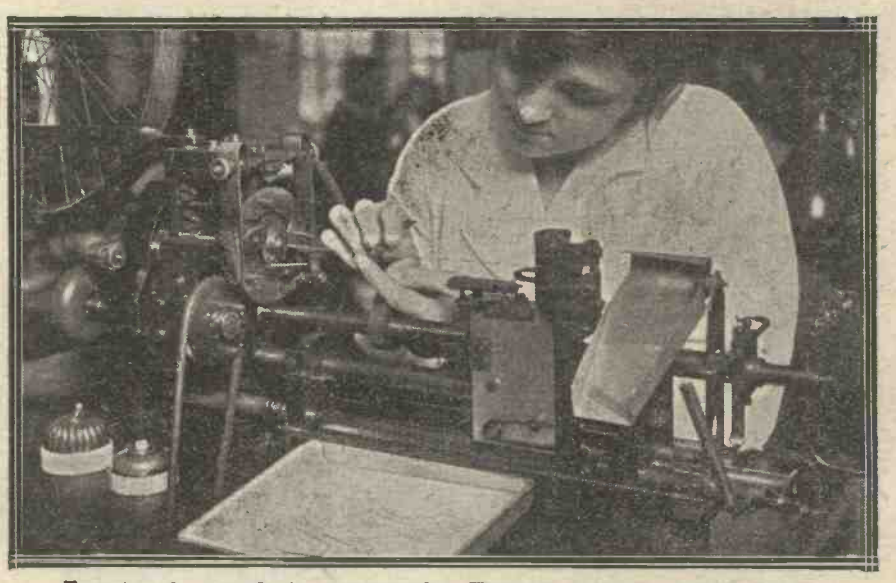
Electric Welding

The next journey which the foot of the valve makes is to another bench, where a girl attaches the grid of the valve to its support by electric welding, and the anode of the valve to its support in the same way. The little machine which does this welding looks very much like a tiny vice, the two sides of the vice being two poles through which a current of electricity is passed. A spark jumps across the gap between the two parts of the vice-like instrument, and as it jumps, melts a tiny portion of metal of the support, which very quickly becomes solid again, holding the anode to the piece of metal which forms its support.

With very special types of receiving valves the anode and grid have to be adjusted ready for fixing before they are actually welded. For this, special examiners with tiny instruments adjust the exact distance between the three parts of the valve and then pass them to the welder. The examiners make quite sure that the length of the filament and the disposition of grid and anode are correct.

The Bulb

The next step in the making of the valve is the making of the bulb. The glass bulbs go into the valve works looking very much like empty electric light bulbs, open at the narrow end. A girl takes a bulb, and, twisting it quickly in her fingers, puts the closed end of the bulb into a hot gas flame. This softens the glass at the centre and top of the bulb. With her other



Forming the spirals for valve grids. The tray in front contains grids ready for mounting.

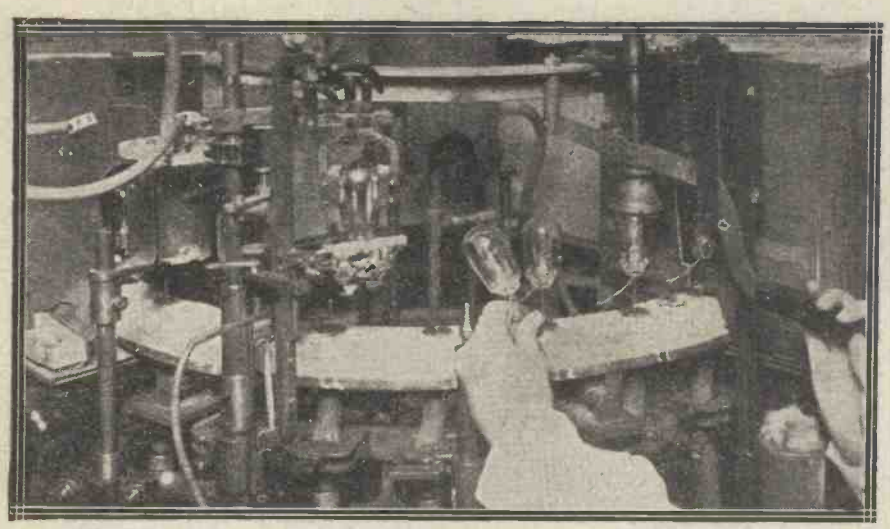
How Wireless Components are Made—*continued*

hand she takes a thin glass tube, and softening this too, sticks the thin tube on to the top of the softened bulb, pulling it out a little to make a tiny hole where the two meet, and turns it quickly with both hands all the time that it is cooling down in the air. The bulb now appears just like a diver's helmet with the air tube fixed to its top. You could easily blow down the thin glass tube into the bulb.

Shaping the Bulb

The bulb then goes to another instrument with dollies similar to the one which I described last month, used for the making of the glass foot of the valve. The bulb is put into a dolly, and passes into a flame which cuts off the unwanted piece of glass at the bottom of the bulb, making the whole bulb of the correct length for the valve which it is to be. As the dollies revolve and pass through hotter and hotter gas flames, a steel instrument opens out the softened glass at the foot of the bulb to the correct distance to take the flange of the foot, which I described in my last article.

Another machine with dollies takes the bulb and also the foot of the valve, with its grid, anode and filament attached to it, and with the four wires which run to the supports of the electrodes fixes it into the bulb. The glass is joined together after



The glass tubes attached to the bulbs, through which the gases are withdrawn from them, may be seen on the valves to the right.

being softened by hot gas flames. After coming out of this machine we have our valve looking just as your valve does now, except that it has attached to the top of it this funny looking glass tube and, of course, it has not yet any legs or any marking. When it leaves the gas flame it has to go through an annealing oven, which allows it to cool gradually to avoid strain and possible breakage to the glass.

Exhaustion

The next step is pumping. For this the valve is turned upside down and the thin glass tube sticking to its top is attached to a similar tube on the pumping machine by softening the glass by heating. The pumps are set to work and all the air and gases are sucked out of the valve. Whilst pumping is going on, a cover is drawn over the valve and it is really then in a type of oven which is heated to about 400 degrees Centigrade. This throws gas out of the actual glass of the bulb and the pump sucks the gases out of the bulb itself as fast as the glass throws them into it. The valve then gradually cools down.

Whilst pumping is still going on, the four small wires from the foot of the valve are connected to electric circuits, which pass a current through the electrodes. The filament is heated by this means almost to melting point, in order to liberate gases from the metal of which the filament is composed. The anode of the valve is heated until it is bright red and is also subjected to what is known as "electron bombardment" from the filament. This liberates gas from the anode as well as from the filament, and the pump sucks the gases away whilst this is happening.

Sealing-Off.

The number of volts to which the anode of the valve is subjected varies between 300 and 2,000, dependent upon the type of valve being constructed. The voltage applied to the filament of the valve is low, by comparison, and yet is slightly higher than the voltage which will ordinarily be used when the valve is sold and used on the receiving set. This applied voltage is connected for about 30 minutes, pumping taking place all the time. Then the current is cut off and the bulb of the valve is heated at the point where the thin glass tube has been connected to it. Our valve has now been sealed at both ends and

A general view of the exhausting room in a valve factory.

exhausted of air and of gas. The glass and the metal of the electrodes have been made to give out any gases which they may contain, and these gases have been taken from the valve. All of this can only occur to bright emitter types of valves.

Dull Emitters

With *dull* emitters the process is the same up to and including the freeing of gases from the glass of the valve by baking it at 400 degrees Centigrade. The valve is then sealed off in the manner which I have just described, and is passed to what is called the "eddy current bench." We still have, in the case of dull emitter valves, the freeing of the anode from gases. This is done by heating the anode by means of what is called an "eddy" current. There is magnesium in the anode of the dull emitter valve and the eddy current process causes the magnesium to be volatilised.

When this takes place the gas given off by the anode of the valve is sucked up and is taken on to the inside of the glass walls of the valve and is kept there by the volatilised magnesium. This gives to the dull emitter type of valve which is treated in this way the silvered appearance which you all know so well. Both types of valves are then carefully examined for what is called "filament emission" characteristic, and to test the hardness of the vacuum inside the valve.

(*Concluded on page* 285.)

How to Make your own Screened Coils

By W. Q. KAY

Many constructors are anxious to try the new screened coils, which have been embodied in a number of well-known and successful sets recently, but have been prevented from doing so by considerations of expense. From the instructions given here you will be able to make your own coil screens.

THERE are many people who wish to try the new circuits incorporating screened coils but who are unable or unwilling to purchase the commercial components now on the market. In such cases it is possible to make up one's own screened coil, and this has already been done in a large number of cases. There are, however, certain factors which have to be taken into account, as otherwise the results will be of a disappointing nature, and it is in order to clear up any misunderstanding on this point that the present article has been written.

The Original Design

The original screened coils were designed as a result of careful research, in order to ascertain definitely the effect of bringing metal screens near to a coil. The screening works by virtue of the fact that eddy currents are set up in the screen, and these produce magnetic fields which act in opposition to the magnetic field of the coil. At the same time the screens, if they are connected to earth, form a static shield around the coil so preventing any capacity coupling from the coil to other parts of the circuit.

Little Efficiency Lost

This electro-static screening, as the elimination of capacity effect is

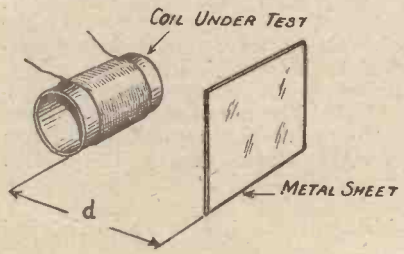


Fig. 1. — The distance between the screen and the coil has a considerable bearing on the efficiency of the latter.

called, has very little effect on the efficiency of the coil. It is the presence of the eddy currents in the metal (by means of which the magnetic screening is produced) that gives rise to the additional losses.

This must be obvious, since the eddy currents must be produced from somewhere, and the energy which produces them must be absorbed from the coil itself, so detracting in some measure from its efficiency. The actual screened coils, as used in the various receivers, are in the form of

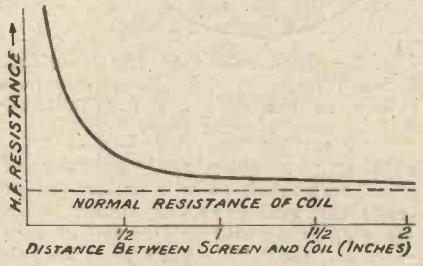


Fig. 2. — Illustrating graphically the effect on the coil resistance of placing the screen in different positions.

a compromise between the consideration of efficiency and the equally important consideration of compactness. One of the advantages of the screened coil lies in the fact that the receiver can be built up into a much smaller space than would otherwise be possible, and there is no doubt that a compact construction in a receiver is very desirable.

Now the farther away we go from a coil the less does the strength of the magnetic field become. Consequently the less must be the counter-magnetic field produced by a screen, and thus the less the eddy currents set up therein. The eddy currents in the screen, in fact, automatically adjust themselves to counteract the effect of the magnetic field existing at that particular point, so that the further away we remove the screen from the coil, the less does the energy loss become, while the screening remains every bit as effective in that the effect of the magnetic field outside the coil is still practically negligible.

Experiments

The experiments were conducted in the first place and were made with a view to ascertaining how far the screen should be from the coil in order to obtain reasonably satisfactory results. Fortunately it was found that the losses introduced into the coil obeyed a somewhat peculiar law. A simple coil was taken and its high-frequency resistance was measured. A sheet of metal was then brought near to the coil at decreasing distances as shown in Fig. 1. It was then possible to observe the effect of the distance upon the resistance of the coil, and this is shown in the curve given in Fig. 2.

It will be observed that at distances away from the coil of 2 in. or more the effect of the screen is practically negligible, the resistance of the combination being almost the same as that of the coil itself. At a distance of 1 in. the effect of the screen is appreciable, while at a distance of ½ in. it is beginning to increase somewhat rapidly. Beyond this point the resistance rises very rapidly indeed, and very heavy losses are introduced into the circuit, but it will be realised from the curve shown that at ½-in. distance the effect is not very serious.

Another Type

A similar series of experiments was carried out with the screen at the end of the coil, instead of at the side as shown in Fig. 1, and here it was found that the distance at which the losses began to increase rapidly depended largely upon the shape of the coil. With a short, fat coil, it is necessary to have a distance of 1½ in., but with a somewhat longer coil a distance of 1 in. sufficed.

These results, therefore, were collected and co-ordinated, and the result was the production of the screened coil as we now know it. It is

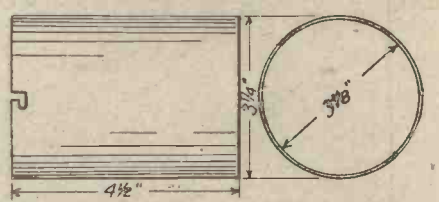


Fig. 3.—The dimensions of the screen are given here.

because of this necessity for an adequate clearance between the coil and the screen that a certain supervision at Elstree has been exercised on the various makes of screened coils, in order that they shall all comply with the necessary conditions.

Minimum Dimensions

It is not possible to reduce the size of the coils very much if they are to retain their efficiency, but it was

HOW TO MAKE YOUR OWN SCREENED COILS—*cont.*

found that a 2-in. coil could be made reasonably efficient. This means that the screen must be at least 3 in. in diameter, if it is made circular, and should preferably be a little more, if this can be afforded. There is, in fact, an increasing tendency nowadays to make the screens somewhat larger in diameter, and this is all to the good, provided that a suitable arrangement can be made as regards the connections, so that the base does not become unduly large.

End Clearance

Apart from the diameter, however, the actual depth of the screen from top to bottom is of considerable importance, and in many cases this is made too small. A clearance of 1 in. above and below the coil itself should be provided, and, if possible, still more clearance is desirable. The actual height of the screen, then, depends upon the size of the coil in use, but this question of clearance at the end is one which makes considerable difference to the efficiency of the resulting arrangement, and should be borne in mind very carefully.

In order to render the screen as flexible as possible, so that interchangeable coils can be used for the different wavelength ranges, different circuits, and such-like, a six-pin type of coil was devised, with six sockets in the base of the screen, so permitting a wide variation in the type of coil in use. When making up a screened coil, therefore, the first thing to do is to obtain six valve sockets, or other suitable sockets fitting a standard $\frac{1}{8}$-in. pin. These should be mounted up in a Southern Cross formation, the arrangement of the pins being shown in Fig. 5. The spacing between the centres of the pins is $\frac{1}{2}$ in. on both arms of the cross. These pins should be mounted centrally on a circular disc of ebonite or wood of a suitable diameter to fit the screen with which it is proposed to use it.

The Screen

The screen itself may be made of copper tube, or may be made by

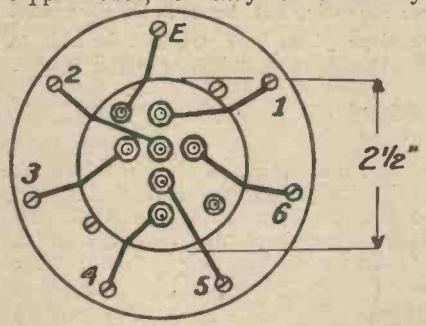
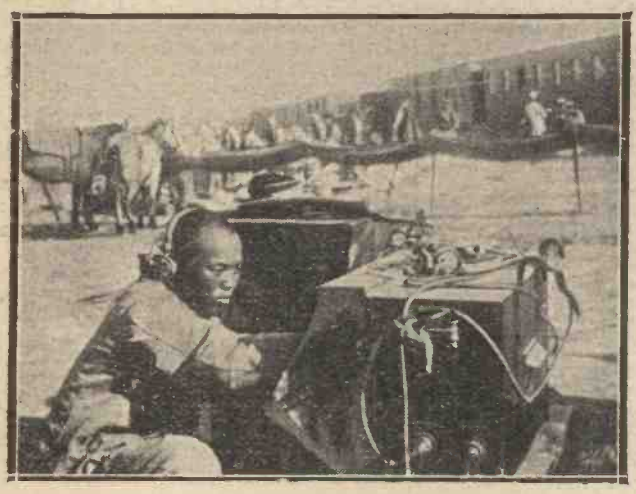


Fig. 4.—Connections to the terminals beneath the base. The dimension given refers to the hole cut in the outer ebonite ring.

obtaining a cylindrical cylinder of some sort, such as a circular box or cocoa tin, and wrapping round this a piece of fairly stiff copper foil or thin copper sheet. This may then be soldered up to make a complete tube, after which it can be withdrawn from the cylindrical mandrel. A cocoa tin should not be used for the screen itself, as it is constructed of tinplate, which is iron covered with a coating of tin, and this will introduce very heavy losses. The metal used for the screen should be either copper or aluminium.

Brass may be used if it is good, soft brass, but this has a much higher resistance than copper, and is not so good as either of the other two metals. In particular, hard brass has a tendency to be magnetic, and this will introduce further losses, so that copper or aluminium is preferable.

(*Concluded on p. 272.*)



Up-to-date wireless equipment is used by the combatants in the war in China. A 120 watt combined transmitter and receiver is seen in this photograph.

NEWS IN ADVERTISEMENTS

Now that the Christmas buying season is almost here our readers will have an active interest in the advertisements appearing in this issue. Below will be found a few paragraphs, giving in brief, the main points of interest contained in current announcements.

Messrs. Collinson Precision Screw Co., Ltd., are announcing an additional item to their range of low-loss inductance formers. This manufacturers' series of coils are all in conformity with the standard six-pin arrangement, but the ribs may now be obtained either plain or threaded.

* * *

It is interesting to note in the advertisement of Messrs. Metro-Vick Supplies, Ltd., that the first four prize-winners in the 4-Valve Receiving Set Class, in a competition organised by the "Sunday Chronicle" and "Evening Chronicle," held at the Manchester Wireless Exhibition, used certain types of "Cosmos" S.P. Valves.

* * *

It is suggested by Messrs. Gent and Co., Ltd., in their advertisement that by investing in a Tangent H.T. Battery Eliminator your radio will not let you down during the Christmas holidays.

* * *

A Christmas appeal is made by Messrs. Will Day, Ltd., in whose announcement many interesting products are featured.

* * *

It is stated in the advertisement of Messrs. A. C. Cossor, Ltd., that after 2,000 hours of continuous use—a period equivalent to two years ordinary wear and tear—the Cossor filament is as supple and as pliable as it was first made.

* * *

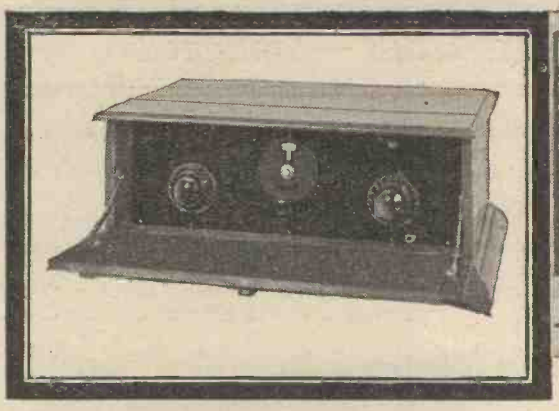
The "Layerbilt," a new H.T. battery by the manufacturers of the Columbia Battery, is now being marketed by Messrs. J. R. Morris. It is claimed in this company's advertisement that the life of this new battery is 35 to 52 per cent. longer than Columbia Extra Heavy Duty H.T. Battery.

* * *

Messrs. S.T., Ltd. show in detailed tabular form the recommended types in the S.T. series of radio receiving valves for use in receivers ranging from one to six valves.

* * *

Messrs. Rexo Engineering are announcing an exceedingly useful product in the shape of the "Junit Self-Soldering Wire." This line will make a very strong appeal to readers whose experience with the soldering iron may be limited, and to them it is recommended for use.



ALL ROUND EUROPE WITH PLUG-IN COILS

By C. P. ALLINSON, A.M.I.R.E.

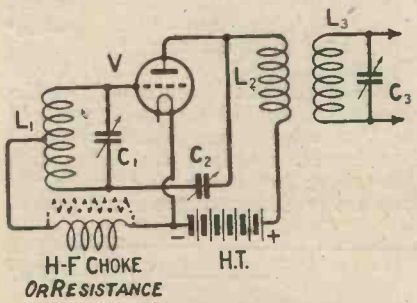
A three-valve set with two stages of high-frequency amplification, the design of which needs no special coils or transformers, but enables you to use plug-in coils of standard pattern. The H.F. stages are neutralised and the set is non-radiating.

THERE must be thousands of wireless experimenters who possess a number of plug-in coils of the conventional type who would like to use them in a thoroughly up-to-date H.F. amplifying circuit and who have so far given little heed to most of the present neutralised circuits on account of the fact that special coils are required, these being either of the centre-tapped type or else inductances mounted on special bases.

I therefore decided to go into the question and see whether it would not be possible to evolve a high-frequency amplifier which, while fully neutralised, would nevertheless enable ordinary plug-in coils to be employed. The rather obvious solution of using two small coils in series, with a connection going between them, was at once ruled out, since it meant that nearly double the number of coils would be required for a receiver incorporating any such scheme as this, and I therefore put the problem on paper

SOME SPECIAL FEATURES OF THIS SET

1.—You can use your old plug-in coils, yet a fully neutralised circuit is employed so that full amplification is obtainable from both H.F. valves.
2.—The set is selective because it is neutralised, and its selectivity can be controlled.
3.—You can obtain the full benefit of reaction in the detector circuits, thus securing the maximum range and selectivity.
4.—The set is simple to handle, a gang-controlled condenser reducing the tuning controls to two, while the set is completely stable except when you wish to make it oscillate by the use of reaction.
5.—The set is non-radiating.



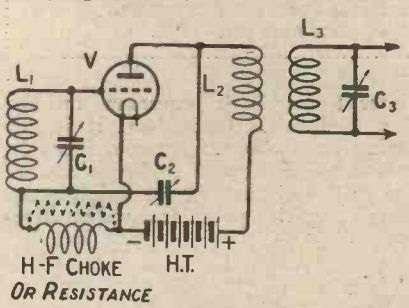


Fig. 1 (left) and Fig. 2 (right).—In order to simplify these diagrams, the H.T. battery is shown connected to L.T. –, the L.T. battery being omitted. In practice H.T. – would go to L.T. +.

before me to see whether some method could be arrived at theoretically which would hold possibilities of working in practice.

Evolution

I have for some time been working with a form of neutralised H.F. circuit in which a centre-tapped grid coil is used, and in order that the reader may see exactly what has been done I show this in skeleton form in Fig. 1. The tuned grid circuit consists of an inductance L1 tuned by a variable condenser C1, which is connected as shown, with one side going to the grid and the other going to the anode through a small adjustable capacity C2, which is used for neutralisation. The centre of the grid coil is connected through a high-frequency choke or a resistance to L.T. –. The output inductance L2 is the primary of a high-frequency transformer, of which the secondary is tuned, a suitable degree of coupling being arranged between the two.

In the original circuit, as it first became known, the centre point of L1 was connected directly to low-tension. I found, however, that placing a high-frequency choke (as shown), or a high resistance of the order of 100,000 or 250,000 ohms, in this lead resulted in a greater degree of amplification being obtained, while any trouble due to parasitic oscillations was also guarded against.

Parasitic Oscillations

This question of parasitics is a very important one, since it becomes exceedingly difficult to use more than one or two stages of high-frequency amplification if a circuit is at all liable to generate them. Even the circuit shown in Fig. 1 might conceivably develop trouble of this description if four or more stages were employed. I have used four stages successfully with this circuit, but it is possible that a slightly different lay-out might have introduced the trouble that I was trying to avoid.

If, therefore, I could find a scheme whereby the centre tap was abolished, not only would the circuit be suitable for plug-in coils, but it would also entirely eliminate any chance of trouble occurring through parasitic oscillations being produced.

The Solution

The solution to the problem is shown in Fig. 2, and it appears so ridiculously simple that I can almost hear you say, "Why, anyone could have thought of that!" And so they could—but, as far as I am aware, they have not done so.

As will be seen from the simplified circuit in Fig. 2, what has been done is, that the choke (or resistance if preferred—some circuits work better with

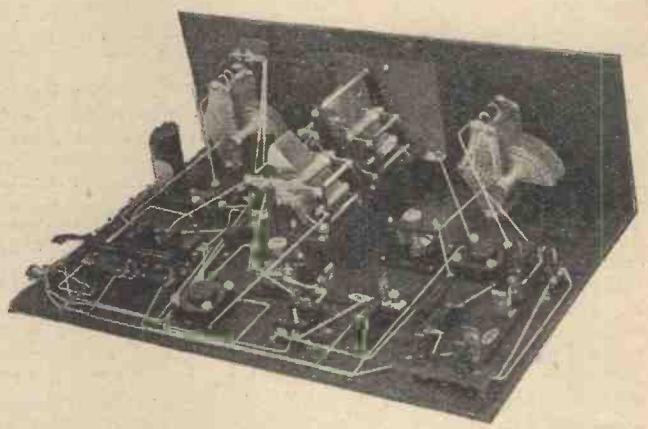
All Round Europe With Plug-In Coils—*continued*

the one rather than the other) has been transferred to the bottom of the coil L1. It is obvious that this choke does not provide a return path to the filament for H.F. currents in the Fig. 1 circuit. If it does, it is not acting as a choke. Its sole function indeed would appear to be to anchor the grid and prevent its building up a high negative potential, and so effectively stopping the valve from working by preventing any flow of plate current. This would undoubtedly occur in nine cases out of ten if the grid of the valve were left free. That increased efficiency is obtained by the use of this choke as indicated in Fig. 1 has been amply proved by a number of experiments.

BUILD THIS SET WITH—

One ebonite panel, 21 in. by 7 in. by ¼ in. (Ebonart).
One cabinet for same, with baseboard, 13½ in. deep (Peto-Scott Co., Ltd.).
One .0005 Cyldon double gang condenser (Sydney S. Bird).
One .0005 and one .0003 variable condenser square-law type (Igranic Electric Co., Ltd.).
Seven base-mounting single coil holders (Wright & Weaire).
One H.F. choke (Lissen, Ltd.).
Two 100,000 ohm resistances (Varley Magnet Co.).
Three "Clearertone" valve holders (Benjamin Electric Co.).
Three fixed resistors (Burne-Jones & Co., Ltd.).
Two vernier dials (Beard & Fitch).
One on-off switch and one slow-motion "Indigraph" (Igranic Electric Co., Ltd.).
Two neutralising condensers (Peto-Scott Co., Ltd.).
Two .002 fixed condensers, type 600A, and one .0003 grid condenser and 2-megohm leak (Dubilier Condenser Co., Ltd.)
Two terminals, Aerial and Earth (Belling & Lee, Ltd.).
One set of battery cords, five-way (London Electric Wire Co. & Smiths, Ltd.).
Two telephone terminals, two strips of ebonite, screws, etc., for mounting components.
Quantity of Glazite for making connections.
Radio Press panel transfers.
Approximate cost . . £12.

The coils and leak resistances have here been removed, to show clearly the layout of the components



The Final Circuit

If, therefore, the sole function of the choke is to prevent the valve from getting blocked, it does not much matter at what point on L1 it is connected. If it is to be removed from the centre, then the logical place to put it is at the bottom of the coil as shown in Fig. 2, and this is the basic circuit which is used in the receiver which is described here.

A number of photographs are given on this and other pages showing the general appearance of the receiver. I have made this a three-valve set, consisting of two stages of high-frequency and a detector valve. No low-frequency amplifying valves have been included, for the simple reason that most experimenters either have their own ideas, and very definite ones, I find, about low-frequency amplification, or else they already have an amplifier which has specially been constructed with a view to adding it to an existing H.F. amplifier.

Layout

An examination of the photos will show that everything that is not absolutely required on the panel has been removed from it, and the only components mounted thereon are the two tuning and one reaction condensers and the on-off switch. The left-hand condenser tunes the aerial, the gang is in the centre, and to the right is reaction. Batteries are connected to the set by means of special battery cords, while aerial, earth and telephone terminals are mounted on the baseboard behind the panel. In order that the 'phones may be most conveniently connected to the set, the telephone terminals are close to the panel, through which a hole has been drilled. The telephone cords are passed through this hole, and the experimenter is not unduly tied down to the set on account of half his 'phone cords being used up in reaching to terminals at the back of the cabinet.

If you will next have a look at the views taken behind the panel, you will see that all the components are well spaced out, ample room being left everywhere for the wiring, while the coils are spread well apart and put at

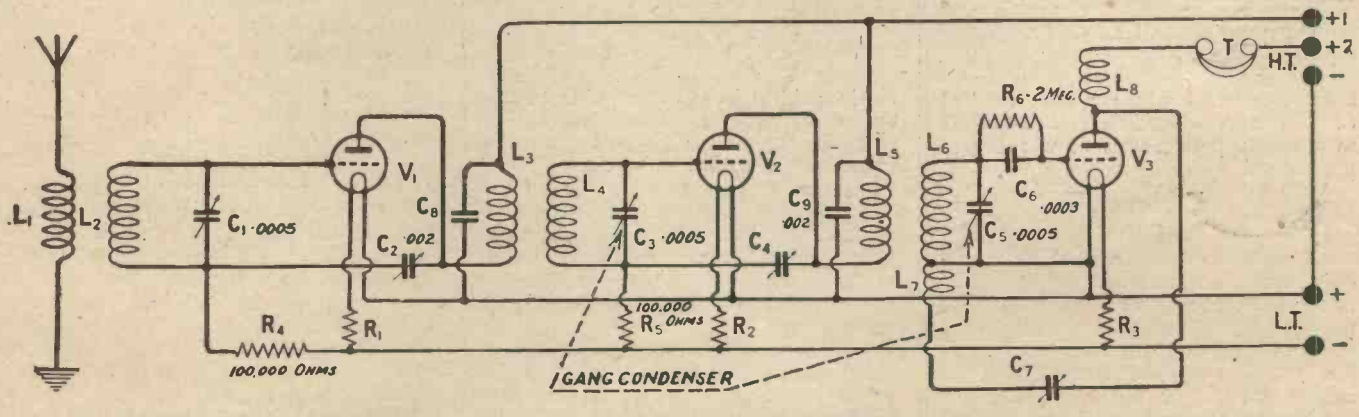


Fig. 3.—The complete circuit of the set described. C_2 and C_4 are neutralising condensers, while C_7 is the variable condenser for reaction control.

All Round Europe With Plug-In Coils—*continued*

right angles to each other so as to reduce, as far as possible, any interaction.

Double Gang Condenser

The double gang condenser seen in the centre is used to tune the second H.F. and detector circuits, while, since the aerial is coupled to the first H.F. valve, a separate condenser has been used to tune it, so as to allow for any variation. There are settings at which the aerial seriously affects the tuning of the first H.F. valve, so that the use of a three-gang condenser was decided against as likely to reduce efficiency. Even with the double gang there is a very slight loss at the bottom of the scale, but it is so slight as to be more than compensated by the greater ease in handling that results from the use of the gang.

The theoretical circuit diagram is shown in Fig. 3, and this gives the full details required for wiring the set to those who are used to reading diagrams of this description. For those who prefer a diagram showing the actual connections on the set itself, this will be found on another page.

Points in the Circuit

The aerial is loosely coupled to the first valve and is untuned, the coupling between the aerial coil L1 and the grid coil L2 being fixed. Different degrees of coupling may, however, be obtained by using different sizes of coil in the aerial. This also enables the maximum efficiency to be extracted from the receiver on the different wave bands.

The first two valves utilise the same circuit, the neutralising condensers being shown at C2 and C4. High resistances have been used intead of chokes, and these are connected between the bottom of the grid coils and L.T. –, being shown at R4 and R5, while L8 is an H.F. choke which is used in the plate circuit of the detector valve so that Reinartz reaction may be used. The use of resistances was decided on, since chokes are rather liable to pull into tune on the long waves and uncontrollable oscillation may result.

Matched Coils

The two coils L4 and L6 are tuned by two condensers C3 and C5, which are gang controlled, so that only one dial is required to be adjusted to tune these two circuits. It is therefore advisable that L4 and L6 be as nearly matched as possible, and if you have not got a pair of accurately matched coils I would advise you to get them. Coils made by manufacturers of known reputation are, however, produced to such near limits of accuracy that it will in general be found that two coils of the same size made by the same firm will be nearly enough matched for use in this receiver.

All the coils used in this receiver, except the H.F. choke, are plug-in coils, and although it is usually understood that a special coil should be used in a Reinartz circuit, the use of plug-in coils has one definite advantage that, to my mind, far outweighs any disadvantage they may possibly have.

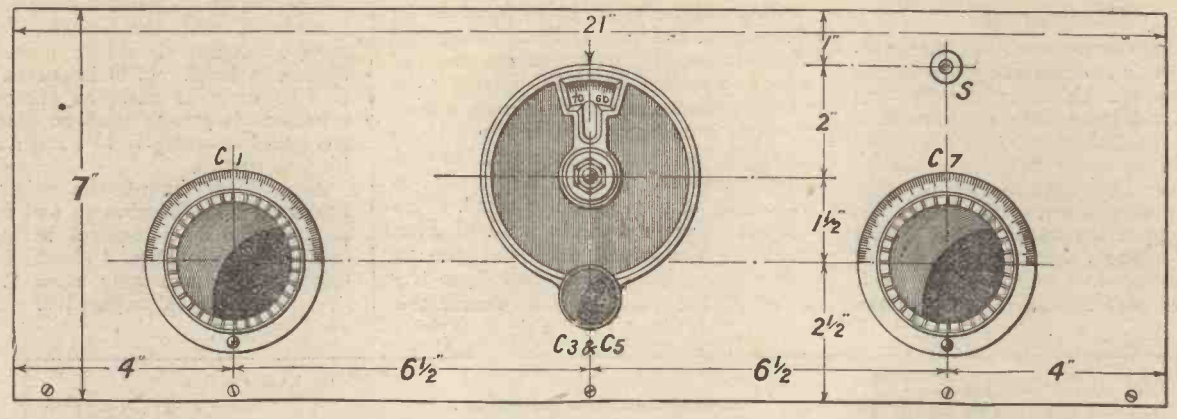
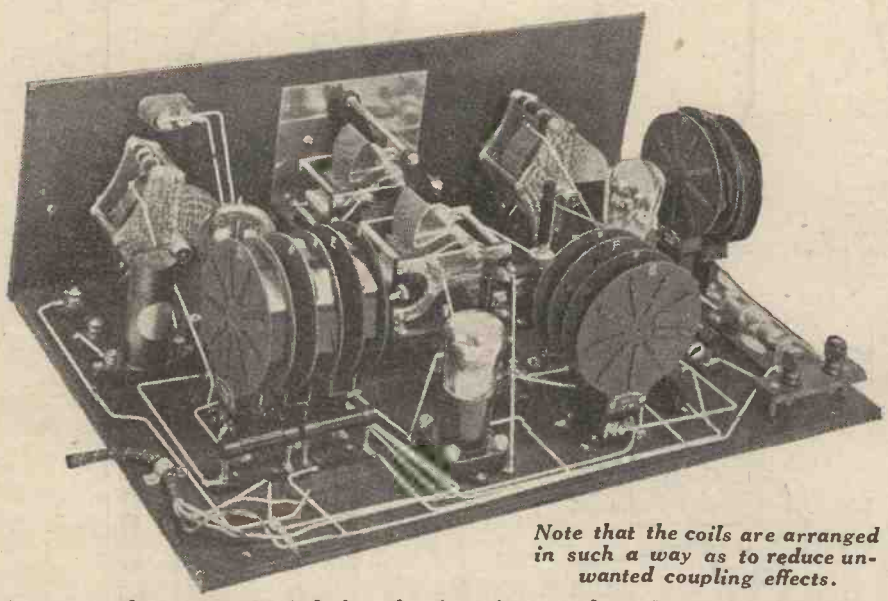


Fig. 4.—Drilling dimensions may be taken from this front-of-panel drawing. Blueprint No. 10C74A.



Note that the coils are arranged in such a way as to reduce unwanted coupling effects.

Reaction

I have found in the course of experiment that the most efficient conditions for reception using the Reinartz circuit are obtained when the reaction winding is not only as small as possible, but also as loosely coupled to the grid circuit as possible, while as small a value of capacity as possible is used. I have found that this effect is very marked, though the values of coupling and inductance required do not appear to be very critical.

By using a plug-in coil for the reaction coil in the receiver I am describing it is possible to try out various sizes of coil in this position, while it is a simple matter to loosen the coupling. The actual position of the coil as I have got it in the set allows

All Round Europe With Plug-In Coils—*continued*

a small reaction coil to be employed, while little more than a third of the reaction condenser is usually required to make the detector oscillate.

Judging by the results obtained, I think the constructor will be well advised to place the coil holder in the same position as I have done.

Components

The components required for constructing this receiver are given in the accompanying table. Though the names of the manufacturers have been given, so that those who wish to copy the set in its every detail may do so, I would say here that the use of these definite makes is not essential to the functioning of the set, provided always that any parts substituted are of equal quality to those I have used. Particular care should be taken in the choice of a gang condenser, and if another one is to be used instead of the make I have fitted it should be chosen with the greatest care, or else the performance of the receiver may be seriously affected.

Drilling

Only four large holes need to be drilled in the panel, these being for the spindles of the condensers and the on-off switch (a $\frac{3}{8}$-in. drill does these); the holes for the fixing screws for the condensers and the panel are small ones, and, therefore, are a simple matter. It is advisable that in the case of the big holes small drills be put through first, to act both as a guide to the larger drill and also to allow the drilling to be done from the front of the panel. Then should the ebonite split away at all as the drill comes through, such damage as is done will be at the back of the panel, where it does not matter. The fixing screws for the condensers should be well countersunk, so as not to foul the vernier dials which have been fitted.

Having mounted the components on the panel, this should be fixed to the baseboard, and the support for the gang condenser should be adjusted so that it is level. It is important that this be done at once, as otherwise a considerable strain may be placed on the panel, causing it to warp and lose its flat surface.

After this, mount the other components on the baseboard, and for this purpose the back-of-panel wiring diagram shown in Fig. 5 should be consulted, since not only does it show

(*Continued on page* 199)

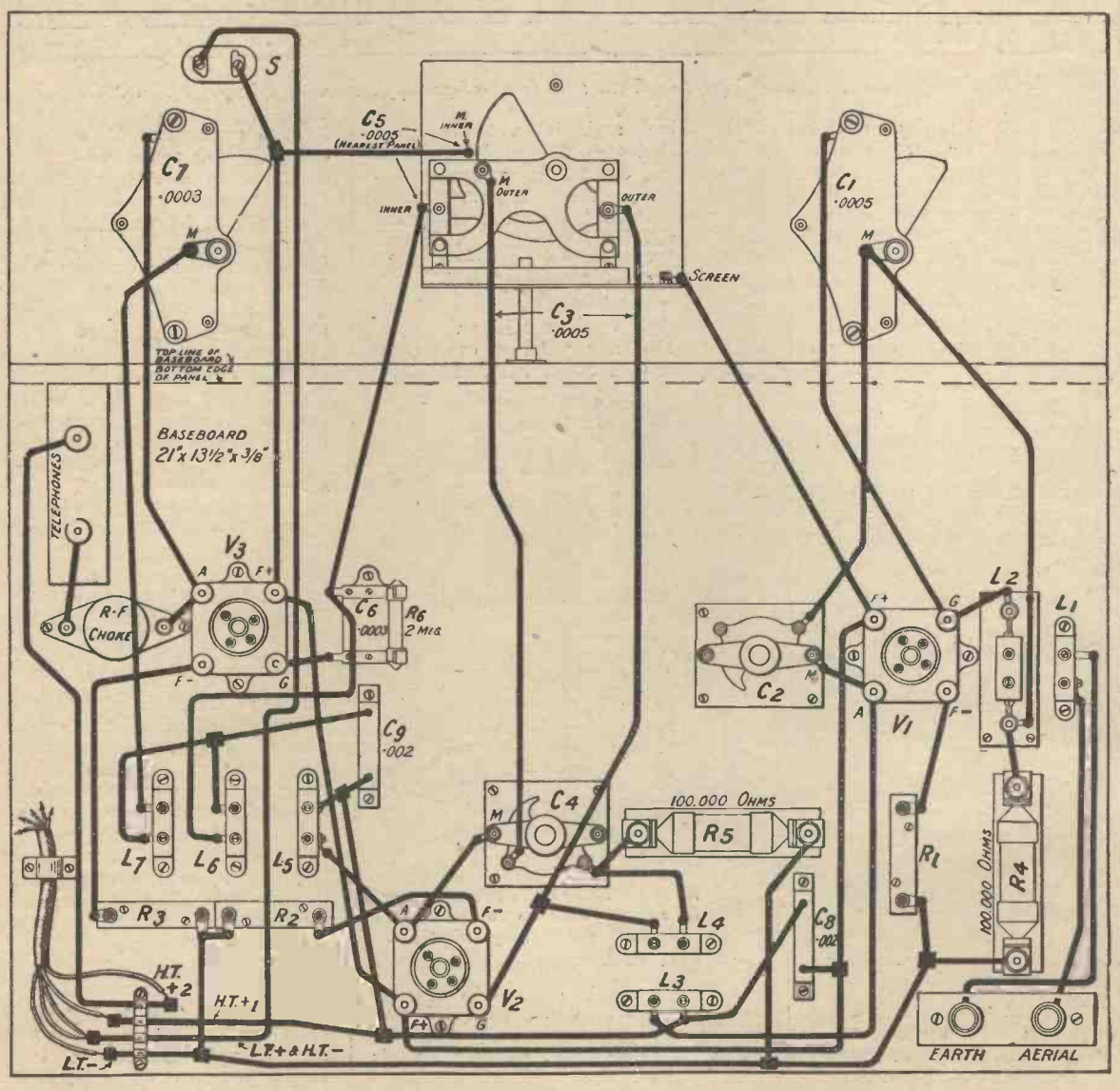


Fig. 5.—The layout shown here should be carefully followed. Blueprint No. C1074B

Heat
—*the Destroyer*

WITHIN every valve lurks the grim spectre of heat. Sometimes—as in the case of a bright emitter—he completes his deadly work speedily. The frequent stretching and contracting when the current is turned on. The crystalisation of the metal due to the filament being incandescent. These are his two favourite avenues of attack.

But even Dull Emitters are not free from his insidious onslaughts. Quite a number work at a comparatively high temperature and the fragile filaments fall easy victims.

There is one valve however, which bids him do his worst. The Cossor with its Kalanised filament. Because not even a suspicion of a glow is visible when the

Cossor bids him do his worst

new Cossor Point One is working you have direct evidence that the harmful effect of heat has at last been countered. After 2,000 hours of continuous use the Cossor Kalanised filament is as supple and as pliable as on the day it was first made. This is equivalent to two years of ordinary wear and tear.

Small wonder that tens of thousands of wireless enthusiasts are turning to this long-life valve as a means of cutting down the cost of Radio. For the Cossor Point One in addition to giving an exceptionally long service—consumes only one-tenth of an ampere. Seven of them take less current than one bright emitter. While its electron emission is so intense and the user obtains such a wonderful wealth of power and richness of tone that Broadcasting takes on a new standard of performance.

See your Dealer about these new valves without delay—they will improve any Receiver.

The Valve with the Kalenised filament

TYPES AND PRICES.

No. 210D. With Black Band. An ideal super-sensitive Detector. Consumption .1 amp. at 1·8 volts **14/-**

No. 210H. With Red Band. Pre-eminent among H.F. valves. Consumption .1 amp at 1·8 volts **14/-**

The new Cossor Stentor Two

No. 215P. With Green Band. For Power Valve use—ideal for Super Sets. Consumption .15 amp. at 1·8 volts - - - - - **18/6**

Cossor Point One

Issued by A. C. Cossor Ltd., Highbury Grove, London, N.5.

Gilbert Ad. 6300.

With the Bowyer-Lowe Super Heterodyne Kit, all the components are of the highest quality and each carries an unqualified guarantee in keeping with Bowyer-Lowe Standards.

Built according to the diagram supplied these components will make a set that will bring Radio to its peak of power and performance.

Include the Bowyer-Lowe Super Heterodyne Kit in your Gifts this Xmas—it will bring lasting and constant pleasure. Supplied in an attractive Box,

£10.

List of Components supplied in the Bowyer-Lowe Super Heterodyne Kit:—

1 Panel, 24 by 8 by ¼, drilled, polished, and engraved.
1 Panel, 5 by 3 by ¼, drilled, polished, and engraved.
1 Panel, 2 by 2 by ¼, drilled, polished, and engraved.
1 Panel, 22 by 2½ by ¼, drilled and polished.
1 Baseboard, 24 by 9 by ½, and four supports, 2½ by 2¼ by ⅜.
1 Set of Four Matched Intermediate Frequency Transformers.
1 Oscillator Coupler, 500—2,000 metres.
1 Base to hold above.
2 Square Law Condensers .0005.
2 Vernier Condensers.
1 Single Filament Control Jack.
7 Anti-capacity Valve Holders.
2 Brass Brackets.
36 Tinned Copper Soldering Lugs.
24 Lengths 1/16 Square Tinned Copper Wire.

THE "POPULAR" CONDENSER
is an example of Bowyer-Lowe precision and quality. Tested and guaranteed accurate before dispatch. Recommended by foremost experimenters. Supplied with 3 in. dial
.0003 M.F... .. 10/-
.0005 M.F... .. 10/6

THE SUPER HETERODYNE KIT

THE BOWYER-LOWE RADIO NEWS
contains particulars and illustrations of all our trustworthy components—also two constructional articles of interest to amateurs. A Portable Set and a Four Valve Receiver are fully illustrated and described. 1½d. in stamps will secure your copy—Get it now.

TESTED RADIO
Bowyer-Lowe
APPARATUS

Announcement by the Bowyer-Lowe Co., Ltd., Letchworth, Herts.

All Round Europe With Plug-In Coils—*continued*

(*Continued from page* 196.)

the actual connections of the receiver, but it is also a scale drawing of the baseboard.

I would strongly urge the constructor not to depart from the lay-out used, and this for a number of reasons. The most important of these is that the positions of the coils have all been carefully chosen so as to reduce any stray coupling to a minimum, and the two coils that are to to be seen on the back edge of the baseboard are placed further away from the detector circuit than from the H.F. circuit. This has been done owing to the fact that reaction is used in the detector circuits.

Wiring

Before commencing the wiring, the two terminal strips for aerial, earth and 'phones should be made and fixed into position, and then the low-tension side of the wiring should first be completed, while a hole should be drilled in the panel to let the 'phone cords come through. Next put in the H.T. leads, which may, as far as is convenient, be bunched with the L.T. leads, and complete the rest of the connections afterwards. If there is any doubt as to the polarity of the plug-in coils to be used, especially in the case where an assortment of coils is on hand, it would be as well to arrange the wiring so that leads may easily be reversed till the correct connections have been found. This is most simply done by connecting the coil holders with short lengths of flex; when the best way of connecting the coils has been found the permanent leads may be put in.

Battery Connections

In connecting the battery cords to the set, I have cut off the spade tags at the set end, and soldered the leads direct to four wires which have been fixed under a small brass strap; this will clearly be seen in Fig. 5. This is a convenient arrangement, since it enables the wiring up of the set to be completed first, and the battery cords to be connected afterwards. The H.T.— lead is connected to L.T.+ as marked. A brass strap has also been fixed over the battery cord, so that, in the event of an accidental pull being given to this, the connections to the wiring of the set itself will not be strained or pulled out of place. The lead ending in a green wander plug is the H.T.+ for the H.F. valves, and the red one is for the detector, the black one being the H.T.—.

Testing

Now test out the L.T. and H.T. circuits. For this plug any assortment of coils into the various holders, and insert three valves into the holders, the correct resistances being used in conjunction with them and the particular L.T. battery that is being used, Next connect the L.T. leads to the battery, and, pulling out the switch, see that all three valves light up correctly. Also, remove the three resistors one at a time, and see that the corresponding valves go out. Now connect the 'phones, and plug the H.T. negative wander plug into the H.T. battery, and, joining the two positive plugs together, insert them first in the lowest positive tapping, carefully watching the valves the while, so as to see that no variation in their brightness occurs. If this does not happen, try a higher value, and, if all is well, the set may be connected to the aerial.

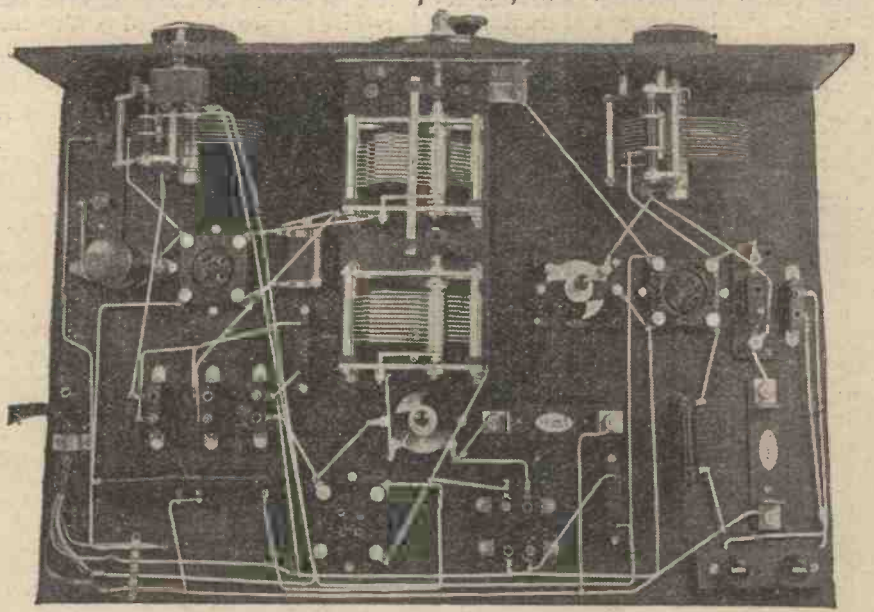
Coil Sizes

It is now necessary to plug in the correct coils, and the following are the sizes I have found most suitable:—L_1 and L_2 will be 35 and 50 respectively, or a Gambrell A and B, while for wavelengths above about 400 metres a larger coil may be used in the aerial, such as a 40, or even a 50 on some aerials, or a Gambrell B1 or B. Below 300 metres, a smaller aerial coil will be found an advantage, and I have used a 20 or 25 (or a Gambrell "a") with better results than those given by the larger coil.

L_3 and L_4 will be both 50's (or two

WIRING IN WORDS.

Join Aerial terminal to socket of L1 coil holder.
Join Earth terminal to plug of L1 coil holder.
Join grid contact of V1 to socket of L2 coil holder and to fixed vanes of C1 variable condenser.
Join plug of L2 coil holder to moving vanes of C1, fixed vanes of C2 neutralising condenser and one side of resistance R4.
Join other side of R4 to one side of resistors R1, R2 and R3, one side of resistance R5, and to L.T. — lead of battery cord.
Join other side of R1 to one filament contact of V1.
Join remaining filament contact of V1 to screen of gang condenser C3 C5, to one side of fixed condenser C8, to one filament contact of V2 and V3, to one side of switch S and to fixed vanes of C5 (gang condenser nearest panel).
Join remaining filament contact of V2 to remaining side of R2.
Join remaining filament contact of V3 to remaining side of R3.
Join anode contact of V1 to moving vanes of C2 and to socket of L3 coil holder.
Join plug of L3 coil holder to remaining side of C8, to one side of C9, to plug of L5 coil holder and to H.T. + 1 lead of battery cord.
Join remaining side of R5 to fixed vanes of C4 neutralising condenser, to socket of L4 coil holder, and to moving vanes of C3 (gang condenser remote from panel).
Join plug of L4 coil holder to grid contact of V2 and to fixed vanes of C3.
Join moving vanes of C4 to anode contact of V2 and to socket of L5.
Join remaining side of C9 to socket of L6 coil holder and to plug of L7 coil holder.
Join plug of L6 coil holder to one side of fixed condenser C6 and leak R6, and to fixed vanes of C5 (gang condenser nearest panel).
Join other side of C6 and R6 to grid contact of V3.
Join anode contact of V3 to one side of R.F. choke and to fixed vanes of variable condenser C7.
Join moving vanes of C7 to socket of L7 coil holder.
Join other side of R.F. choke to one telephone terminal.
Join other telephone terminal to H.T. + 2 lead of battery cord.
Join remaining side of switch S to L.T. + and H.T. — leads of battery cord.



This view of the set should be studied in conjunction with the wiring diagram and instructions.

All Round Europe With Plug-In Coils—*continued*

Gambrell B's), while L_5, L_6, and L_7 should be 50, 50, and 20 or 25 respectively (B, B, and "a" in the Gambrell range).

L_5 and L_6 should be as nearly matched as possible, since these are the two coils which are tuned by the gang condenser, and various coils should be tried till a well-matched pair is found. How this is to be done will be described later in the article.

If greater selectivity is required the size of the aerial coil and the primary coils L_1 and L_7 may be reduced. This effectively loosens the coupling between the various circuits and gives the required added sharpness of tuning.

Long Wave Coils

On the long waves the following coils were used and the results given will guide the listener in searching for the various stations. There was no need to readjust the gang condenser, since the tuning was flat enough to allow any slight difference to be neglected. The use of resistances instead of chokes at R_1 and R_3 was absolutely necessary, for if chokes were used it was impossible to use the receiver for long-wave reception. As it is, it is perfectly stable on both long and short waves and forms an ideal receiver since both can be received with equal efficiency.

The coils used are aerial 150 and L_2 250, and 200 and 250 for L_3, L_4 and L_5, L_6 respectively, while a 100 will do for reaction. The actual coils I employed were Gambrell's, and these were D and F for aerial and L_2, E and F for L_3 and L_4, and E, F and D for L_5, L_6 and L_7. This covered a range of about 1,000 to 3,000 metres, and the readings given in the table of stations received were obtained with these coils.

Sharp Tuning

If you are at any distance from the local station, it may take a little finding, since the tuning on this set is rather sharp. Once it has been found, the effect of reaction should be tried. If increasing the value of the reaction condenser does not produce any increase in signal strength, the connections to the reaction coil L_4 may need to be reversed. If, however, an increase in signal strength is obtained without the set oscillating, even at the highest reading of the reaction condenser, a larger reaction coil should be tried.

Neutralisation

I have found that the circuit employed results in far less capacity than is usual being required to stabilise the set, and, with the two neutralising condensers set at zero, with some makes of valve the set is perfectly stable over the whole range. If there is any doubt, however, the set may be neutralised in the usual manner by turning out the valve and rotating the neutralising condensers till a point is found at which the signal is either entirely eliminated or reduced to a minimum; this may, of course, occur at the lowest settings of the neutralising condenser.

Distant Stations

Both valves are dealt with in this manner in turn, and a distant station may now be searched for. In view of the fact that the gang condenser is probably not balanced up correctly for use with your particular coils, it may be necessary to increase reaction till the receiver is oscillating gently. Having picked up a good strong carrier, resolve it by reducing reaction and returning as may be necessary till the transmission is heard clearly without distortion, retune on the aerial condenser, and bring the station in as loudly as possible. Now loosen the grub screw which locks the back condenser on to the operating arm, and insert a tommy bar into the adjusting disc (which is provided with holes drilled round its periphery for this purpose), and rotate the two halves of the gang condenser independently till the greatest signal strength is obtained from the station heard.

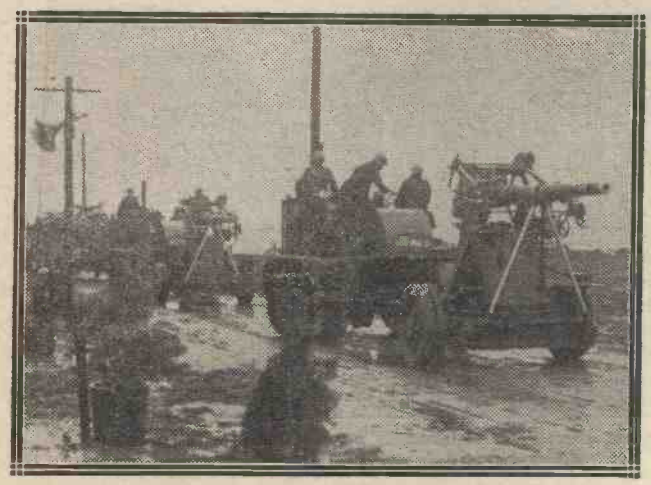
This adjustment should preferably

(*Continued on page* 287).

TEST REPORT.

The dial readings for stations received with the set are given in the following table. These readings were taken after the new wavelength scheme had come into operation.

Dial Setting.	Station.	Wave Length.
11.5	Karlskrona	196
13.5	Kristinehamn	202.7
23	Karlstadt	221
25	Umea	229
27.5	Koenigsberg	241.9
30	Gleiwitz	250
30.5	Stettin	252.1
31	Kiel	254.2
32	Malmö	260.9
33.5	Antwerp	265.5
38	Dortmund	283
40	Dresden	294.1
42	Münster	303
42.5	Bournemouth	306.1
43	Newcastle	312.5
44.5	Dublin	319.1
46	Belfast	326.1
48.5	Petit Parisien	340.9
52	Cardiff	353
52.5	Leipzig	357.1
53	London	361.4
56.6	Stuttgart	379.7
57.5	Manchester	384.6
58.5	Toulouse	389.6
59.5	Frankfort	394.7
60.5	Glasgow	405.4
64.5	Rome	422.6
65.5	Hamburg	428.6
73	Elberfeld	468.8
74	Lyons	476.2
75.5	Berlin	483.9
77	Birmingham	491.8
79	Zürich?	500
81.5	Brussels	508.5
84	Rosenbügel	517.2
12	Hilversum	1050
39	Berlin	1300
40	Daventry	1600
47	Radio-Paris	1750



Amplifiers and loud-speakers are used for many purposes besides wireless entertainment. At a demonstration of tanks before the Dominion Premiers the orders given to the tanks were made audible to the spectators by means of loud-speakers.

Mr. Gumplethorpe's Christmas Party

IT is always rather a trying time for fathers of families, like you and me (if by any chance you are not a father of a family you are at any rate a son—or possibly a daughter—and therefore know what fathers have to put up with), when the young return from school for the Christmas holidays. The period from the middle of September to the middle of December is one of the happiest of the glad wireless year. The new autumn set has been brought into commission and as the nights grow steadily longer and longer our prospects become brighter and brighter.

A Beautiful Dream

With the lads safely away at school life is really worth living, for there is no one to laugh at us when we accidentally touch H.T. – and extra H.T. + at one and the same time; there is no one to guffaw when we speak of the crackling noises that come from the loud-speaker as atmospherics; no one to giggle when the blob of solder that we have been carefully conveying towards an intended joint falls off on to our left thumb;

. . . . a blob of solder . . . . falls on to our left thumb.

no one to point with a smirk to the dangling earth lead when we have spent a couple of lurid hours in a fruitless search for the cause of "no signals"; no one to borrow our best two-volt dull-emitters, and to run them, resistor-less and bright, from a six-volt accumulator; no one to conduct in our absence experiments with our high-tension battery to see how big a spark it will give; no one to unscrew the caps of our telephones in order to discover what is inside them; no one to replace the said caps omitting the diaphragms—if this ever happens to you, as it once did to me, I'll wager that you will spend more than an hour or two in tracing *that* fault. There is no one to borrow our grid batteries for driving electric motors; no one to play havoc in our workshops or to deplete our stocks of screws, nuts, studs, plugs, pins and washers.

The Awakening

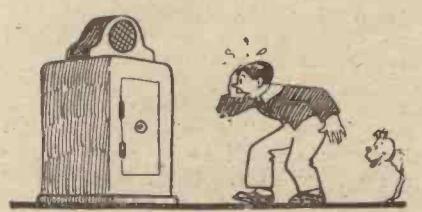
Yes, life during that period is a beautiful dream, almost too good to be true. We feel all along that we shall wake up soon, and sure enough we do one day in December, when the house is suddenly filled with the strange noises that announce the return of the young to the bosom of the family. Glad though we are to see them again, we realise that the best days for wireless are over for another nine months, for by the time that they have left us again the nights will be growing shorter and the horrible summer season will be slowly but surely beginning to draw on; we must look forward to results that grow slowly less and less wonderful.

A Seasonable Design

The wise man spends some of his spare time just before the holidays begin in constructing a completely boy-proof receiver, housed in a locked steel cabinet, which will bring in the local station and nothing else, which cannot be made to howl, because it has no knobs to twiddle, which cannot be picked up and dropped, because it is screwed to the table, which cannot be short-circuited, because the batteries and all the leads are inside the locked case, which cannot be "improved" by young enthusiasts, because its interior is completely inaccessible. Another fairly successful course is to buy half a ton of the assorted wireless scrap advertised by disposals firms and to turn them loose on this. With any luck they will be so busy sorting it out first of all and then in constructing things that they will not be ready to howl until it is time for them to go back to the seminary of learning, where, if you are to believe their statements, they are fed, despite the vast bills that you receive, on nothing but stale bread, rancid margarine, defunct horses, dish water and rice pudding.

Mr. Gumplethorpe Differs

Mr. Gumplethorpe was quite annoyed with me when I talked to him in this strain at the beginning of December. He said that it was wrong to take such an attitude. If my boys did things like that they must have been very badly brought up. His, he assured me, were always perfect little angels, and it was a sheer pleasure to have them about when he was engaged in either the construction or the operation of a wireless receiving set. I could not help remembering as he spoke how in the past he had come almost weeping to my study for consolation when Horace and young Ben had immersed his superheterodyne in the bath in order, as they said, to see if it would work under water, or when they had half-filled his accumulator with washing soda in order to give to a young friend a practical demonstration of what they had been learning at school about the chemical action of acids and alkalis. However, I said



. . . . a completely boy-proof receiver.

nothing, for it was quite delightful to meet a soul like Mr. Gumplethorpe, who could be cheerful even in the face of approaching adversity.

The Invitation

It was shortly after the return of our families that, meeting me in the street one day, he told me that he and his wife were arranging a Christmas party for some forty or fifty youngsters

Mr. Gumplethorpe's Christmas Party—*continued*

and begged me to come in and give him a hand. "Of course," he said, "I am going to give them a wireless show; there's nothing they like better than that. Both Horace and Ben are jolly helpful, I can tell you. They have joined the wireless club which was started at their school last term, and they know quite a lot about it now. I get them to do all sorts of odd jobs for me. In fact I have hardly been inside my workshop since they came home." "And if I were you," I remarked, "and wished to preserve my present cheerful frame of mind, I would refrain from going inside it. It was only yesterday that Horace and Ben were telling me what a job they'd had to make a hole through a brick wall with your three-eighths inch drill." Mr. Gumplethorpe turned a little pale for a moment, but brightened up at once when he remembered (as I had forgotten), that he had borrowed that drill from *me* the previous week. Feeling that I should certainly be needed to help at the party, I agreed to go and to do my best.

The Pièce de Résistance

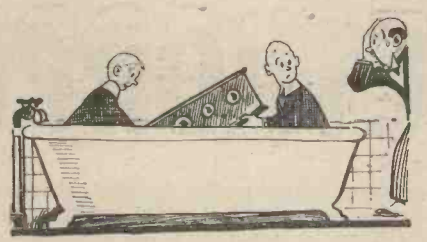
The first couple of hours of the party passed off without a hitch. Mrs. Gumplethorpe had provided an ample tea, and so heartily did the youngsters slip into it that they seemed quite quiet and drowsy for some little time after. They were just beginning to recover their animal spirits (and probably to think about supper) when Mr. Gumplethorpe announced that he would now let them hear some wireless. A screen in a corner of the room was removed, and behind it was disclosed his latest set, surmounted by a giant loud-speaker. I looked for both Horace and Ben, wanting them to give me a hand in moving the screen, but they appeared to have vanished. I presumed that Mr. Gumplethorpe had sent them on some useful errand, and thought no more about it.

Dance Music?

"First of all," said Mr. Gumplethorpe, "we will have some dance music from 2LO. Now, boys, choose your partners!" With a beaming smile he switched on. From the spout of the loud-speaker there issued the most appalling din that I have ever heard. It was as if plates were being smashed by the hundred, tea-trays banged with hammers, cannon crackers exploded and gigantic sheets of American cloth slowly ripped from end to end. Bewildered, Mr. Gumplethorpe stood stock still for a minute or so, not knowing what to do.

Quality?

He was just going across to the set when the din suddenly ceased. "Some little thing gone wrong," said Mr. Gumplethorpe cheerily. "Never mind, I will put it right in a minute, and then you will hear what wireless really should sound like. I want you all to tell your fathers when you go home



. . . . had immersed his superheterodyne in the bath . . . .

what wonderful reproduction of music you have heard." He switched off, fiddled about with things, and then switched on again. There was a brief silence, which was rudely torn by the strains of what sounded like the world's worst gramophone with a sore throat. It was braying out some antediluvian dance tune. When this came to an end a shrill and rather queer voice told us that we had just heard the Savoy Havana Band, and that we were now to have a foxtrot from the Trocadero. "I did not know that they had lady announcers at 2LO," I said to Mr. Grumplethorpe. "Everything seems to have gone mad to-night," wailed he.

Round Europe

As the foxtrot was even worse than the previous piece, Mr. Gumplethorpe decided that he would now leave London alone — "something wrong with their transmitter, of course"— and go over to Hamburg. With the

Horace pointed to a large notice.

aid of a wavemeter he tuned in. As before, there was a moment of silence to begin with, though Mr. Gumplethorpe was quite sure that his wavelength was right. Then a voice, amazingly like that of 2LO's lady announcer, said: "Guten Abend, everybody. Wie geht es Ihren? Haben Sie meinen Pfeder gesehen? Nein, aber ich habe die Tinte gesehen," or something like that. The lady announcer appeared to have rather a queer German accent, but I supposed that she was a little nervous about her new job. Another curious thing was that Hamburg gave us the same tune as London had started with, and followed this up with the same foxtrot ("Von dem Wursthaus"). Madrid, when we got there, had also a woman announcer, who told us that we would now have uno foxtroto. It was followed by the ancient dance with which London and Hamburg had started. "Splendido danso por los kiddos," said the announcer.

A Discovery

"Horace! Ben!" called Mr. Gumplethorpe, looking worried. "I wonder where those boys are. I wish they'd come and give me a hand." "I'll go and look for them," I called, making for the door. I went quietly upstairs to their room and peeped in. Ben was sitting holding to his ear a piece of rubber tubing which protruded from the wall—I realised then the reason for the hole that had been made with my drill. Horace, as I entered, was speaking with his lips close to a microphone button—I had given him one for a Christmas present. On the table beside him was an antediluvian gramophone and two records. "Broadcastinga stationе di Roma," I heard as I came in. "Habebimus nuoc unam foxtrotam. Spaghetti, vermicelli, andante ma non troppo." He turned on the gramophone, looked round and saw me.

"What on earth . . . ?" I began. Horace placed his fingers to his lips and pointed to a large notice—SILENSE. When the foxtrot had come to an end he moved the switch and came towards me. "Isn't it topping?" he inquired. "We were sure that dad would have a breakdown, so we arranged to see him through. It took us quite a long time to rig it all up." "I expect," I said, "that it will take your father quite a long time to live it all down. Meantime, I rather think that he wants you, and perhaps you would not mind telling him that I have just heard that I am urgently required at home."

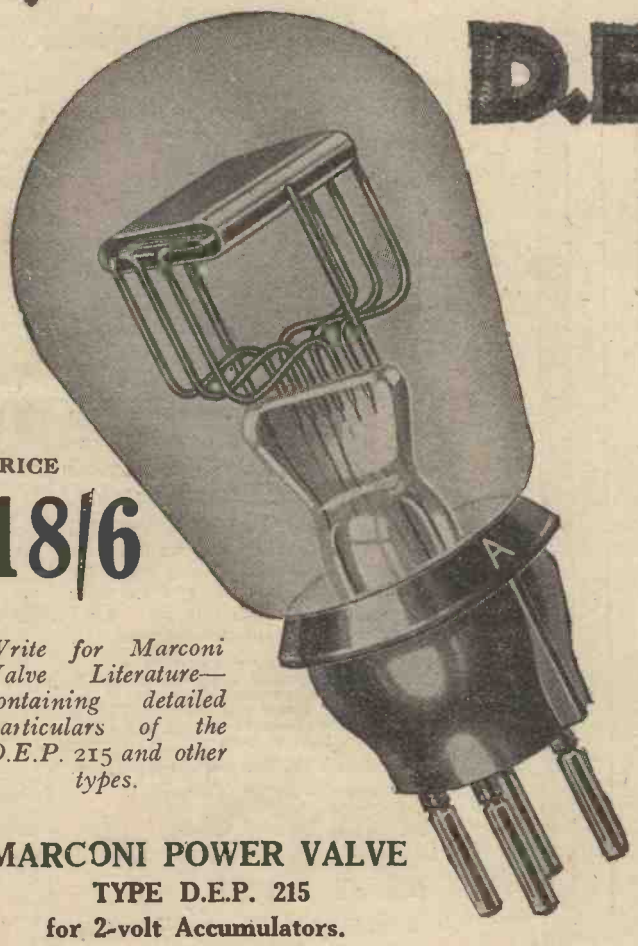
A SELECTIVE ONE-COIL SINGLE-VALVE SET

WE regret that in the description of the above set, which appeared in the November, 1926, issue of THE WIRELESS CONSTRUCTOR, the circuit diagram (Fig. 2 on page 33) was incorrectly shown. The variable condenser C_1, shown connected across the top half of the coil L_1 in Fig. 2. should be connected across the lower half of this coil. The wiring diagram of the set (Fig. 4) is correct in this respect.

MARCONI

THE NEW POWER VALVE

D.E.P. 215



PRICE

18/6

Write for Marconi Valve Literature—containing detailed particulars of the D.E.P. 215 and other types.

MARCONI POWER VALVE
TYPE D.E.P. 215
for 2-volt Accumulators.

Fil. volts	... ...	2·0 max.
Fil. current	... ...	0·15 amps.
Anode volts	... ...	120 max.
Amplification factor	... ...	6.25
Impedance	... ...	6250 ohms

AN ENTIRELY NEW type of Dull Emitter Power Valve combining outstanding performance with economy in operation.

The D.E.P. 215 is for use in the last stages of Receivers or Amplifiers operating from a two-volt accumulator.

It embodies just those characteristics which combine to make the ideal power valves :—

MAJESTIC VOLUME,

CRYSTAL-CLEAR TONE,

LONG LIFE and

VERY LOW CURRENT CONSUMPTION.

The filament is exceptionally robust and rigid, and has a large emission surface.

Type D.E.P. 215 used with the correct H.T. and grid bias voltage recommended in the accompanying table will handle great volume with a purity of reproduction hitherto unobtainable.

	Marconi Valve Type	Position	Filament. Volts	Filament. Amps	Grid Bias Volts	High Tension. Volts	High Tension. M. Amps.	Low Tension Battery Supply.
Two-Valve Set	D.E.2 H.F. D.E.P. 215	Det. L.F.	1.8 1.8	0.12 0.15	+2 −9	60 120	1.6 4.6	Two-volt Accumulator.
Three-Valve Set	D.E.2 H.F. D.E.P. 215 D.E.P. 215	Det. 1 L.F. 2 L.F.	1.8 1.8 1.8	0.12 0.15 0.15	+2 −3 −9	60 60 120	1.0 2.5 4.6	
Four-Valve Set	D.E.2 H.F. D.E.2 H.F. D.E.P 215 D.E.P. 215	H.F. Det. 1 L.F. 2 L.F.	1.8 1.8 1.8 1.8	0.12 0.12 0.15 0.15	0 +2 −4.5 −9	60 60 80 120	0.8 1.0 3.3 4.6	

Marconi Type D.E.R. or other 2-volt valves are also suitable for the high frequency detector or first low frequency stages.

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THE NEWEST RADIO TRIUMPH

OUR READERS' VIEWS

WHAT IS DAVENTRY DOING?

SIR,—I am afraid that I may be accused of regarding wireless periodicals as mediums for complaints of every description, but I feel sure that I shall not be thought selfish if I voice my grievance in connection with the Daventry station.

The Earl of Clarendon (left) arriving in England after his visit to Canada. Lord Clarendon is to take over the duties of head of the new B.B.C. next January.

Why is 5XX, with its 25 kilowatts, relegated by the B.B.C. to the position of a mere relay station? Here in the south-west of England it is safe to say that all owners of valve-receivers, if they want a good alternative programme, turn, not to Daventry (from which it is never forthcoming) but to Hamburg and other German stations, which are more easily received than any of the B.B.C. stations except the local (6BM), and also send out really enjoyable programmes.

Daventry was, I thought at first, to be a station which would show the rest of Europe "how it should be done." Instead, it is little more than an automatic repeater of 2LO's programmes, on a wavelength which has very few advantages and many "snags." Perhaps if the B.B.C. realised how many of us are turning to the foreign stations for amusement they would take some active steps in the matter.

Yours truly,
J. L. COWLING.

Dorchester, Dorset.

LOUD-SPEAKER TONE CONTROL

SIR,—With regard to the letter from Mr. M. K. O'Dwyer, pubished in November issue, under the heading of "A Loud-Speaker Hint," I really do not see how any advantage can be gained by shunting the last L.F. transformer primary instead of the loud-speaker itself. My own experience is that a condenser of about .001 across the last L.F. transformer has just the same effect as one of .003 or so across the loud-speaker itself. Similarly, if more than one note-magnifier is used, about .0005 across the *first* primary should put things right. It is all a question of choosing the right capacity.

Yours faithfully,
M. J. LOVATT.

Folkestone.

IS "LOW-LOSS" OVERDONE?

SIR,—Although I should not think of belittling the numerous improved makes of components now on the British market, is there not a danger that we are carrying the "low-loss" idea too far? When it was the special privilege of a few of the highest-quality components to be stamped "low-loss," this coined word possessed a meaning. Now, however, any new components that are produced are almost automatically branded as "low-loss." Surely, in comparison with the very best of each type, many of them must be seriously inefficient! Is it not time that we started again, and applied terms like "low-loss" only to those components that were really worthy of the name?

Yours faithfully,
HOWARD CHILTON.

Addiscombe, Surrey.

DOUBTFUL IMPROVEMENTS

SIR,—I read Mr. C. P. Allinson's admirable article on "Gearing as an Aid to Wireless" with much interest, but I cannot refrain from asking

Mr. Eric Dunstan, well known as an announcer at 2LO, has been appointed General Manager of the Indian Broadcasting Company.

whether it is really as necessary as we seem to think nowadays. When one really thinks things over, did we not do just as well and derive just as much enjoyment from radio with the old ebonite-end "high-loss" condensers, and even those made at home from sets of plates? Does one obtain any stronger signals nowadays, and is the process of tuning-in very much easier? I shall always keep pleasant memories of my first three-valve set, with seven controls on the panel, all equipped with brass pointers and ivorine scales!

What do other readers really think about this?

Yours faithfully,
JOHN H. HUNT.

Bedford.

Evolved to meet the new conditions of Radio

THE new Oldham O.V.D. cannot be compared with any other accumulator. It is unique. It has been specially evolved to meet the new conditions created by the growing popularity of dull emitter valves. The O.V.D. is the first slow discharge accumulator which can be charged rapidly. The idea of a slow discharge accumulator is not new. They have been on the market for years. But—owing to the thickness of their plates—the greatest possible care has been necessary to ensure the full charge being given. Common sense will prove why this is so. The ordinary slow discharge accumulator holds its charge because it has two thick plates—negative and positive. But because its plates are so thick it takes many hours for the electrolytic action to penetrate its inmost recesses. And long slow charging is a nuisance.

Oldham saw the disadvantages of the thick plate and has evolved the new laminode plate possessing all the advantages of thickness but none of its disadvantages. The Laminode plate fitted to the O.V.D. is three plates in one. It uses a girder-like construction which prevents buckling. And yet because of its greater surface area it can be charged within 8 hours. Any Oldham O.V.D. will hold its charge for weeks—even months—without attention. Local action has been practically eliminated.

FACTS FOR VALVE USERS.

If you have a one-valve Set an O.V.D. will last you 180 hours at a charge if you use the new valves taking 1 amp. With a two-valve Set you will get 72 hours use. If you use 06 valves you will require two O.V.D cells in series. Under these conditions the two-valve Set user will get 140 hours and with three valves 80 hours. The O.V.D. is thus the most economical accumulator you can buy for dull emitter use.

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—the slow discharge Accumulator which can be fully charged in 8 hours

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Denton, Manchester
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(Charged ready for use —merely add acid)

: Made by the Makers of the :
: Oldham H.T. Accumulator :

60 volts £2 10 0 80 volts £3 6 8
100 volts £4 3 4 120 volts £5 0 0
Solid oak base 3/6 extra if required.

Gilbert Ad. 6328.

MAKING USE OF YOUR SUPPLY MAINS

(Continued)

By J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

Charging Accumulators from A.C. Mains—Rectification Methods—High-Tension Direct from the Mains —Smoothing Circuits—A.C. Systems for Direct Supply.

IN the last issue of THE WIRELESS CONSTRUCTOR some of the methods available for charging accumulators from D.C. mains were discussed, both high-tension and low-tension batteries being considered, and it was shown that the requisite apparatus need not be by any means complicated.

The Problem with A.C.

In the case of charging accumulators from A.C. mains, the problem is a little more difficult. It will be obvious that simply connecting the A.C. mains across the accumulator in a similar manner to that adopted with direct current would not be of any use whatever, because the current first is flowing in one direction and then in the other, and the effect on the accumulator would be to charge it and then to discharge it immediately afterwards, so that the overall result would be nil.

Rectifying

It is therefore necessary to adopt some form of rectifier in order to obtain the necessary charging effect. By this means we arrange to cut out the current in one direction, and only leave the current in the other direction. If then we connect the battery up in such a way that the current that does flow is in the direction necessary to charge it up, then we shall obtain a continual charging effect, since the current which would tend to discharge the battery has been eliminated.

Vibrating Reed

These rectifiers may take various forms. They may be of the vibrating reed type, in which a form of buzzer is employed, which is made to vibrate backwards and forwards at the same frequency as that of the supply. By careful design the device can be so arranged that it only completes the circuit through the battery when the current is in the right direction, and during the other "half-cycle," as it is called, when the current is in the opposite direction, the circuit is suitably broken.

Such devices are somewhat difficult to design, and unless care is taken they are not altogether satisfactory. There are, however, models on the market which are capable of giving good hard service. A particular example of this type of instrument has been running at Elstree for some two months, practically day and night, and has given very little trouble.

Chemical Rectifiers

Another method of rectifying the current is to use some form of chemical rectifier. Certain metals when inserted in a chemical solution possess the property of passing current better in one direction than in the other, and, in fact, almost completely suppressing the reverse current, so that again the necessary rectification effect is obtained. Several such rectifiers will no doubt be known to readers.

Valves

Another method is by development of the thermionic valve principle, in which an ordinary two-electrode valve is made with a very large filament capable of passing several amperes. The well-known Tungar Rectifier is an excellent example of this system.

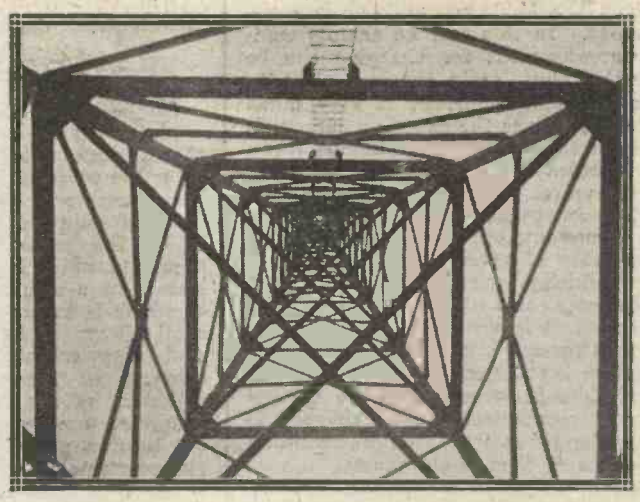
Advantages of A.C.

We have therefore considerably more trouble when charging with A.C. than D.C. owing to the necessity for provision of this rectifying arrangement. There is, however, one advantage which offsets this to a large extent, and that is the fact that instead of having to insert series resistances such as lamps, or suitable resistors, it is possible by using a transformer to step down the voltage to a suitable value.

One of the advantages of alternating current is that it is possible by utilising a transformer, similar in general construction to the ordinary low-frequency transformer used in a wireless receiver, to vary the voltage of the supply. We can put in a voltage of 220 volts on one side, and take out a voltage of 6 or 8 on the other side without any difficulty. Moreover, if on the 6-volt side we take a current of 4 amperes, then on the 200-volt side we should only take a current of between one-tenth and one-fifth of an ampere, depending upon the efficiency of the transformer, so that we actually consume very much less current in charging than is the case with D.C. In the direct-current charging we have to waste energy by passing it through a resistance, whereas in the case of A.C. the energy wasted is very much less.

Generators and Converters

Another method of charging accumulators from the alternating-current mains is by the use of a motor-generator or rotary converter. These are instruments in which the alternating current is made to drive a small motor. This motor is then coupled to a generator which supplies



Modifications have recently been made in the 2LO aerial, to cure certain "blind spots" within its range of service. This novel view is taken from the base of one of the masts.

Making Use of Your Supply Mains—*continued*

direct current at the required voltage. Various modifications of this principle are often employed. For example, the motor may be made to drive the rotating rectifier, which is supplied with alternating current through a transformer arrangement, so that the necessary rectification effect is

A typical rectifying valve, as used for A.C. rectification.

obtained by a rotating device. There are quite a number of different charging plants which partake in varying degrees in one or other or both of these principles.

Valve Rectification

Charging H.T. accumulators from A.C. mains can be effected in a similar manner. All that is necessary in this case is that the transformer ratio shall be so chosen that the voltage applied across the H.T. accumulator is satisfactory. In this case an exactly similar arrangement for charging can be adopted, but, as in the case of D.C., the necessary current is very much smaller. Since the charging current is only of the order of 50 milliamps, it can be handled by a fairly small two-electrode valve. The ordinary types of valves on the market do not pass sufficient current, but there are now quite a number of special rectifying valves from which a selection can be made.

In some cases where suitable circuits are used, it is possible to dispense with a transformer altogether, although a rectifier is still necessary. This is only advisable, however, where the voltage of the accumulator to be charged is somewhere near, although naturally lower than, that of the mains.

The problem of supplying low-tension and high-tension current direct from the mains is much more difficult because arrangements have to be made so that no deleterious effects such as hum or other noise shall be noticed in the wireless receiver, and considerable trouble has to be taken in order to overcome this tendency.

Direct H.T. Supply

We now come to the question of supplying high-tension voltage direct from the mains. We have here the difficulty that any fluctuation whatever in the high-tension voltage will cause a hum to be set up in the receiver which is connected to the H.T. unit. Obviously if we are utilising alternating current for power supply we have a very large fluctuation. What happens is that we rectify the current so that only one half of the wave is utilised, so that we are really obtaining a series of pulses of current all in the same direction, but not by any means of steady value.

A.C. Hum

If we applied this raw A.C., as it is often called, to the receiver, we should obtain a powerful hum which would completely drown any signals which would otherwise be received. Even on the local station the hum would completely swamp any signals, and arrangements must therefore be made to eliminate the effect of this

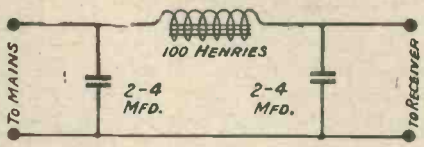


Fig. 1.—A suitable smoothing circuit for eliminating current fluctuations.

variation of voltage to such an extent that it is possible to receive signals from distant stations.

D.C. Ripple

In the case of direct-current supply, we have not the same fluctuation, but there is nevertheless a small variation due to what is usually known as "commutator ripple." Direct current is supplied by a machine in which the current is collected from segments of a large rotating switch known as a commutator, the purpose of which is to ensure that the voltage shall always be in the same direction and approximately at the same strength at the moment when it is collected by the brushes. There is, however, a very small variation as the brushes pass from one segment of the commutator to the next, and this produces what is known as commutator ripple.

There are also other slight fluctuations known as "tooth ripples" which are produced by a peculiar formation of the armatures of the generators, all of which have a very small but perceptible effect. We cannot therefore apply these voltages to our receiver, or we shall again have a hum, this time not so powerful as in the case of raw A.C., but nevertheless sufficient to introduce unpleasant disturbances.

Remedies

Now there are two ways of overcoming this trouble. In the first place we can connect a large condenser across the positive and negative leads coming from the mains unit to the receiver. If we have a bucket with a hole in the side, and we fill it with water above the level of the hole, then we shall obtain a jet of water coming from the hole, due to the pressure of water above. Now we can fill this bucket with a jug periodically, and provided we keep the level of the water above the level of the hole from which the jet is coming, we shall obtain a more or less steady stream of water.

In a similar manner we can connect an electrical bucket or condenser across the leads from the H.T. unit. We draw off from this condenser a supply at a certain voltage. We feed into the condenser pulses of current every so often which may be likened to the filling up of the bucket with water from a jug. In this way we shall obtain a fairly steady supply on the output side, so that the condenser thus tends to reduce the effect of the pulses.

How it Applies

Referring back to our bucket analogy, it will be obvious that if the level of the water is only just a little higher than the level of the hole, then the actual force at which the jet will emerge from the hole will vary continually. When we have just put a fresh jugful in, the water will come up fast, and as the water runs away so the pressure will gradually fall off and the jet will come out with less force. The extent of this variation depends upon the relative rates of the flow of water from the jet, and

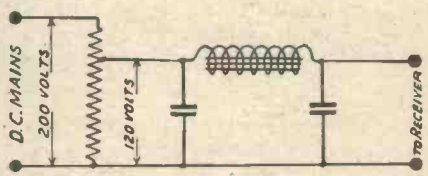


Fig. 2.—The required H.T. voltage may be tapped off in the manner shown.

the filling up of the bucket by means of the jug. In other words, in the high-tension unit it depends upon the demand made upon the unit in high-tension current and the actual feed current from the rectifiers.

It will be obvious that if we have a large condenser we have a greater reservoir action than if we have a small one. We can take a given current out of a large condenser without producing such a serious drop in voltage as would be the case with a

(*Continued on page* 211.)

Making Use of Your Supply Mains—*continued from page 208*

small condenser. Thus, the larger the condenser, the greater is the smoothing effect, and in fact condensers of 2, 4, 6 microfarads, or even more, are used in order to provide an adequate reservoir action.

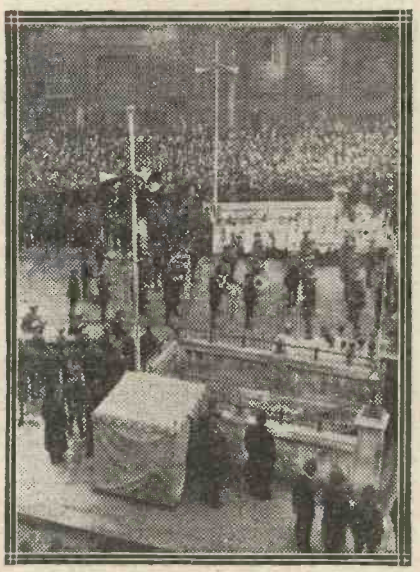
Another Method

We have, however, a second method of smoothing the effect of the fluctuations of current, and that is by using a choke coil. It is well known that an inductance coil offers a high impedance to any varying current, although its only effect on a steady current is that due to the resistance of the wire itself. If, therefore, we have a coil having a large inductance it will offer a very high impedance to any varying current, but will not affect the steady direct current which we require for high-tension purposes.

For smoothing units it is customary to use iron-cored chokes, and something similar to the primary of an ordinary low-frequency transformer, or even a choke coil as used for a choke-capacity unit, is suitable for the purpose. The effect of this is to smooth out still further any variations of current which are not taken account of by the reservoir condensers connected across the mains.

A Further Addition

A simple circuit like this, however, is not quite suitable for wireless purposes, because the presence of a choke coil such as this in the high-tension feed circuit may introduce coupling between the various valves in the receiver and cause oscillations to be produced. We all know the effect of a high resistance in the high-tension battery due to a defective cell or a run-down battery. Any resistance such as this is often quite sufficient to set the receiver in a state of continuous oscillation, and this cannot be checked by any means other than elimination of the faulty component. A choke coil in the high-tension lead would tend to produce a similar effect, and to counteract this a large condenser is placed on the receiver side of the choke coil, so tending to obviate any coupling due to its presence.



By means of loud-speakers a large crowd was enabled to follow the Armistice Day service at the Royal Exchange.

Practical Details

The final smoothing circuit therefore is as shown in Fig. 1, consisting of two large condensers with a choke coil in between them. If values are used such as are marked in the diagram this will be found to provide adequate smoothing in the majority of cases.

The application of this principle to the various types of supply is quite simple. Consider the case of direct current first. We need only connect across the mains a high resistance capable of carrying a fairly heavy steady current. For example, if we have 200-volt mains, and we connect across them a resistance of 10,000 ohms, then this resistance will carry a steady current of 20 milliamps. In addition to this, we shall have the current taken by the receiver in question, which will have to flow through part of the resistance, and this therefore must be added to the current-carrying capacity of the resistance. Altogether a resistance capable of carrying about 60 milliamps should be used in order to provide for an adequate margin of safety.

If such a resistance is connected across the mains as shown in Fig. 2, then we can take a tapping on the resistance which will reduce the voltage from 200 to 120, which is what we require, and across this we can connect our smoothing unit as shown in the figure. This will remove any trace of commutator ripple, and will supply us with a steady high-tension voltage of 120 volts.

An Alternative

In place of a resistance we can use a series of lamps if we so desire. For example, if we have 200-volt mains, we can connect two 100-volt lamps in series. This will divide the voltage into two equal portions of 100 volts, and we can take a tapping at the centre point, so obtaining 100 volts high-tension supply. This is in many cases a more practical proposition. Further subdivisions may, of course, be obtained by using other voltages of lamps. For instance, three 100-volt lamps would divide the voltage into three parts. In this case the lamps would not glow at their full brilliancy. We could, again, use four 50-volt lamps, which would give us four tappings, the arrangement being fairly flexible.

A.C. Systems

In the case of alternating current supply we can if desired use a similar method, or we can utilise a transformer in order to supply the voltage we require from the mains. In this case, however, we have to provide a rectifying valve in order to make the current or voltage uni-directional, and it is also very convenient to light the filament of this valve from the mains as well. Generally, we require a step-down transformer to light the filament

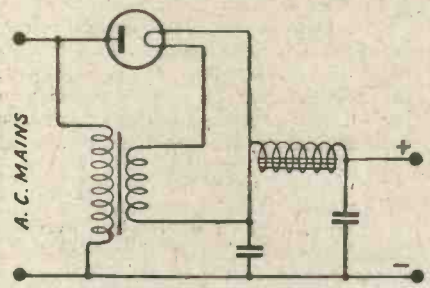


Fig. 3.—When valve rectification is used with A.C. mains, it is convenient to light the valve filament from the mains, rectified current for H.T. supply being drawn from the terminals on the right.

of the valve. The circuit in Fig. 3 shows the simplest arrangement, in which the voltage of the mains is taken through a rectifying valve direct to the smoothing unit.

Earthing

The disadvantage of the circuits in Fig. 2 and Fig. 3 is that one side of the mains is usually connected to earth. As the H.T. negative is also connected to earth, there may be some trouble arising from this fact if it so happens that the positive of the H.T. is connected to earth on the mains, as may easily be the case. In order to avoid this, therefore, the receiver should be connected to earth, not direct, but through a large 2 microfarad condenser, if either of the circuits shown in Fig. 2 or Fig. 3 is to be used. There are other arrangements, however, more particularly when alternating current mains are to be used, which obviate this difficulty. These are some of the problems which have to be considered in the design of suitable smoothing units, the construction of which need not be outside the scope of the average constructor.

OPERATING THE "ALL-BRITISH SIX"

By H. E. HASSALL

Suitable Valves and Voltages—Neutralising — Calibration — Operating Notes — Settings for Long-wave Stations.

FULL constructional details of the "All-British Six" were published in the last issue of THE WIRELESS CONSTRUCTOR. The following additional notes will, it is hoped, be of assistance to those readers who have already made up the set or are contemplating its construction.

Valves

The H.F. transformers are designed to match valves having an average impedance of 30,000 ohms and an amplification factor of 20. This type of valve should therefore be used in the H.F. stages and as the detector. Using six valves, the first L.F. stage may have one of the small power valves, such as the S.T.62, D.E.8 L.F., D.E.5, P.M.6, etc. The last stage must be a power valve of a low impedance type capable of handling considerable volume, as otherwise overloading will occur.

When using six valves the following combination will be found to give the fullest amplification, combined with selectivity and tone quality:—

H.F. Stages.—D.E.5B.
Detector.—D.E.5B.
First L.F.—S.T.62.
Second L.F.—S.T.63.

Grid Bias

It is important to have at least 18 volts grid bias on the second stage L.F. valve, if the S.T.63 is used. If other valves of this type are used, a manufacturer's list should be consulted as to the correct grid bias.

A large number of stations come in at loud-speaker strength with the first L.F. stage only in use, and in many cases overload this valve. To overcome the consequent bad quality it was necessary to transfer the power valve in the last stage to the first L.F. holder, increasing the grid bias accordingly. It is, of course, important to do this, otherwise little difference in the quality of tone will be apparent.

High-Tension

The detector lead (H.T.1) should be tried with 60 volts. If this tends to make the reaction control too lively it may be reduced. 60 volts is a good average value. The H.F. lead (H.T.2) may have 120 volts. The writer found the fullest amplification was possible with this voltage, and the receiver was perfectly stable. In some cases, owing to slight differences in wiring, etc., the H.F. stages may be found difficult to control with this voltage. The remedy is to reduce the H.T. and try, say, 90 volts as an average value.

LONG-WAVE STATIONS

On a set of transformers wound for the longer waves the following stations were received at good loud-speaker strength with the first L.F. stage alone:—

Station.	Condenser Setting.
Radio-Paris ...	164
Daventry ...	152
Moscow	136
Karlsborg ...	126
Königswusterhausen (Berlin)	118
Soro	102
Kbely	95
Hilversum ...	88
Lausanne	64

The remaining lead to the L.F. amplifiers must have at least 120 volts.

Neutralising

The neutralising condensers controlling the 3 H.F. valves are mounted to the right of each holder, and it is necessary to neutralise each valve properly before any attempt is made to receive distant stations.

First of all place the moving vanes about a third of the way in, then tune in the local station, plugging the loud-speaker in the first L.F. Each dial must be accurately tuned for the strongest signal. Take out the fixed resistor (of the first valve) from the holder. Signals should still be heard. Rotate the condenser until the signal is entirely or almost eliminated. Replace the resistor and proceed to neutralise the second and third H.F. valves in a similar manner. Care should be taken to obtain the point of silence or minimum signal in each case, as unless the valves are properly balanced the receiver will not function efficiently.

Calibrating the Dials

Those readers who are not used to handling a set of this description will find the tuning fundamentally different from that of the ordinary non-selective receiver. There are four dials, and until all are turned accurately to the station you wish to receive, you will not hear anything (unless you are close to the local station).

Plug in a pair of telephones in the first L.F. stage. Say, for example, that we wish to obtain Oslo, Sweden.

Operating the "All-British Six"—*continued*

This station comes in on my receiver at 108 on each dial. At the first test the actual readings were:—1st dial (from left) 110, 2nd 109, 3rd 108, and 4th 106. Get a friend to hold the rotor of the fourth dual condenser. Unscrew the dial from the spindle and move it up two degrees. It will now read 108. Alter the dials of the second and first condensers to read 108. It is important that the rotor should not move when this adjustment is carried out.

The dials will now all read 108, and this setting will be accurate over the whole scale of the second, third and fourth condensers. The first (aerial) condenser will also be approximately the same. It may possibly vary one or two degrees on the lower end of the scale. During the preliminary operation the reaction condenser plates should be in the zero position.

Using Reaction

Assuming that we have got Oslo at 108, try the effect of increasing the reaction control. It will be found to build up signal strength, and the set should go smoothly in and out of oscillation without "backlash." If this is not possible, try the effect of reducing the voltage on the detector valve.

It is necessary to calibrate the dials on a distant station, as the local station signal is too strong to enable this to be done accurately. Suppose we want another station, Bournemouth, for example—Oslo is at 108—move each dial to 110 and Bournemouth will come in. A touch on the reaction control to just under the oscillating point, and the station should be at full loud-speaker strength.

It is a golden rule to move each dial in succession only one or two degrees at a time.

Practice is Necessary

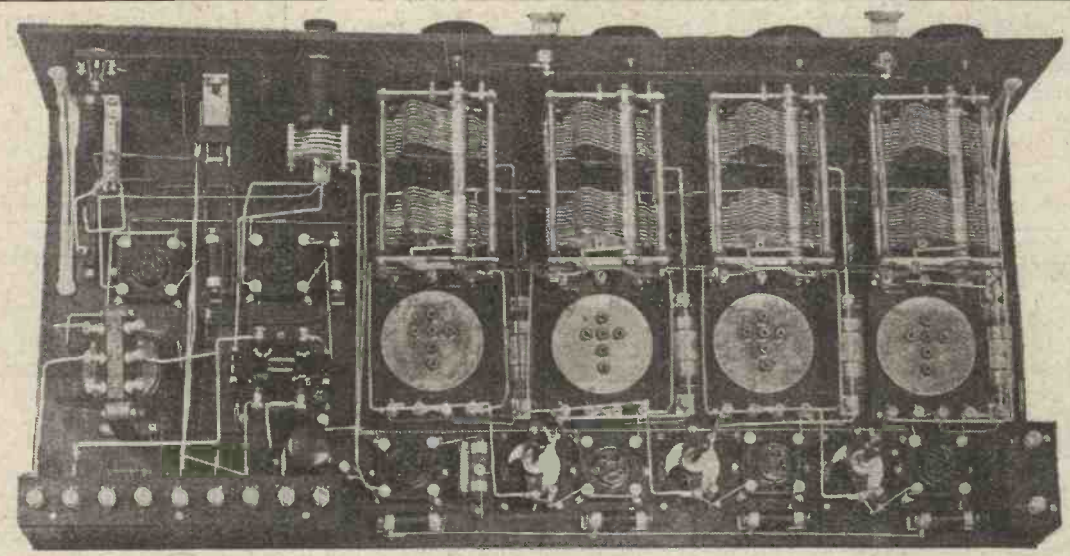
Do not be disappointed if you do not get a large number of stations the first night. Rome was not built in a day, and readers who have no experience of receivers with H.F. stages must be prepared to devote an hour or so to learning the correct manipulation of the controls. I have suggested previously that telephones should be used for the preliminary tuning stages. As soon as one becomes familiar with the handling these can be dispensed with, and the loud-speaker plugged in. It is perfectly easy to tune in any station on the loud-speaker once the set is calibrated without resorting to telephones.

Once you have tuned in a distant signal accurately it is a simple matter to go round the stations, and at night, when all stations on the broadcast band are working, they come in on the loud-speaker all round the dial.

Removing the Shields

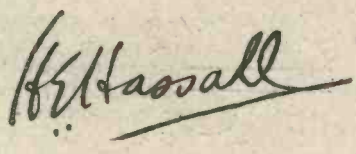
It is desirable to point out to experimenters who make up this receiver that they should take care when removing the shields not to drop them in the set, as although the Glazite wiring used has an insulating covering, a short may be caused on soldered joints, with consequent destruction to the valves. The writer has twice dropped the shields in the set, but luckily the contretemps was unattended with any evil results. There is always, however, a possibility of fusing the filaments, and it is thought necessary to advise readers to take care.

It should be pointed out that the dial settings given above for certain stations were those which applied to the old wavelengths. The general principles of calibration remain, of course, unaltered.



FOR THE BEST RESULTS NOTE THESE POINTS:—

Insert the special H.F. transformers in the screened coil bases.
Place valves of the types recommended in each of the six valve holders.
Make sure that the fixed resistors are the right ones for the valves and accumulator used.
Neutralise the H.F. stages with the three neutralising condensers on the baseboard.
Move the dials slowly, one or two degrees at a time, keeping them relatively in tune.
Use reaction sparingly to increase the volume from the station located.



CONTROLLING THE BROADCAST WAVELENGTHS

The New Wavemeter at the London Station

IN order that the broadcasting stations of Europe may keep as accurately as possible to the positions assigned to them under the new scheme of wavelengths, which came into operation on November 14, 1926, each station is provided with a special wavemeter.

These wavemeters are all calibrated at one central Bureau, thereby ensuring the greatest possible accuracy.

Before the new wavelengths were actually tried out, it was thought that possibly crystal control of the various transmitters might be employed. By this means the transmitting apparatus would be so controlled that practically no deviation from a predetermined wavelength would be possible.

Captain Eckersley (fourth from left) demonstrated the new wavemeter, which can be seen on the table, to representatives of the Press.

London's Wavemeter

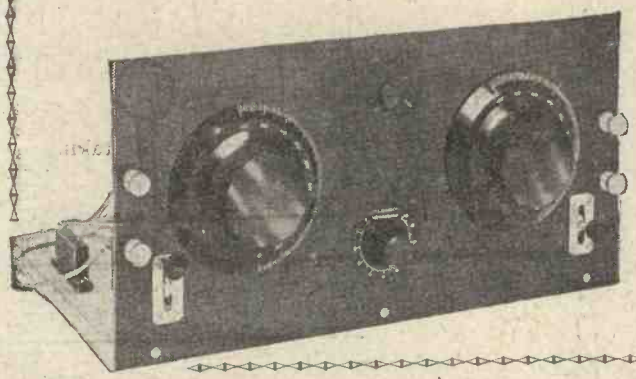
The actual wavemeter to be used at the London station was demonstrated a few weeks ago by Capt. Eckersley, the Chief Engineer of the B.B.C. The crystal-control method is not used, the wavemeter being simply an accurately calibrated instrument for keeping a check on the actual wavelength on which transmission is taking place. A separate wavemeter is provided for each station, each meter being designed to cover a frequency band of 20 kilocycles.

Indicating Devices

The wavemeter consists of an inductance shunted by a capacity, and suitable indicating devices. A flash-lamp bulb is used to give a rough indication of the wavelength of the transmitter, the lamp glowing most brightly when the transmitter and wavemeter are in tune. For more accurate readings a thermo-couple and galvanometer are provided.

In practice the wavemeter can be used to check the wavelength of the station to which it belongs, and also to note the positions of the stations on either side, since a frequency separation of 10 kilocycles is the general rule. The central reading of each meter records the wavelength of the station immediately concerned.

THE "ECONOMICAL TWO"



By W. Q. KAY.

This dual-purpose set may be used for local or distant reception with equal efficiency. By means of panel-operated switches, the two valves may be used as H.F. and detector or detector and L.F., reaction being provided with either combination.

IN a recent article in *Wireless*, entitled "Economical H.F.," some circuits were given showing how the benefit of a high-frequency valve could be obtained concurrently with other benefits which tended to reduce its effective cost. For example, although the advantages of H.F. amplification are becoming realised, there are many people who do not feel justified in adding a high-frequency valve simply and solely for the purpose of increasing their range.

If, on the other hand, arrangements can be made so that the high-frequency valve can be put to another purpose when distant stations are not being received, then the extra advantages obtained from such a circuit will compensate for the additional cost. Various circuits were given in the article in question, and the present receiver is a modification of one of the circuits so put forward.

Possible Circuits

In this particular receiver two valves are employed. An arrangement of switching is incorporated so that it is possible to use the receiver in three different ways:—

(a) A high-frequency valve and detector with tuned-anode coupling.

(b) A high-frequency valve and detector with resistance coupling.

(c) A detector valve and low-frequency resistance-coupled amplifier.

Special Valves

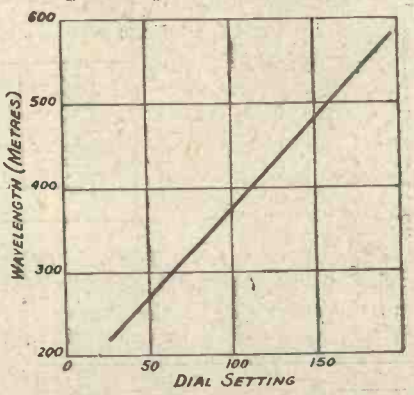
When the last of these three is used, namely, a detector and resistance-coupled note-magnifier, it will give comfortable loud-speaking on the local station, sufficient for a small room.

TEST REPORT

The following stations were received at good 'phone strength on an aerial about 60 ft. long and 20 ft. high, 12 miles north of London:—

Münster, Breslau, Bournemouth, Newcastle, London, Hamburg, Glasgow, Frankfort.

The settings on the aerial condenser are given on the accompanying graph. The settings on the tuned-anode condenser were about 10 degrees higher in each case.



BUILD THIS SET WITH—

One ebonite panel, 14 in. by 7 in. by 3/16th in. (Radion.)
One suitable cabinet, with baseboard 9 in. deep.
Two .0005 ultra low loss S.L.F. variable condensers with 4 in. dials. (Formo Co., Ltd.)
Two double pole change-over switches. (Wright & Weaire.)
Two "Dimic" coils and bases. (For the lower broadcast band, two No. 1 coils will be required, while for Daventry one or two No. 3 coils may be used, as will be seen in the description of the set.) (L. McMichael, Ltd.)
One filament rheostat. (Etherplus.)
One panel mounting neutralising condenser. (Igranic Electric Co., Ltd.)
Two valve holders. (W. & B.)
Two fixed condensers, .0003 and .001, two 2-megohm leaks and one .25-megohm leak. (Dubilier.)
Four terminals.
One 7-way battery cord. (London Electric Wire Co., & Smiths, Ltd.)
Quantity of Glazite.
Radio Press panel transfers.
Approximate Cost: £6.

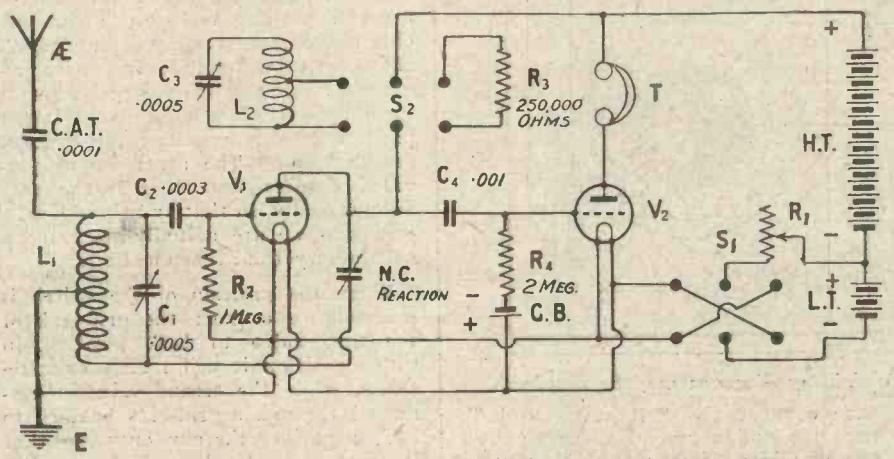


Fig. 1.—The switch S1 is used to reverse the filament battery connections to the set as required.

In order to do this it is necessary to use a very high-impedance valve. There are several types of valve now on the market having an impedance of 70,000 or 80,000 ohms with an amplification factor of about 35. Such valves are the Cosmos Blue-Spot, which may be obtained in either the 2-volt or the 6-volt series, or the Ediswan R.C.2, which is a 2-volt valve of similar characteristics. The use of this type of valve is also beneficial when the circuit is being used as a high-frequency amplifier, as will be seen shortly.

The "Economical Two"—*continued*

Circuit

The circuit of the arrangement is shown in Fig. 1. It will be seen that there are two switches provided. The anode circuit of the first valve contains a double-pole change-over switch, by means of which either a tuned circuit or a resistance can be included in the circuit. When the receiver is to be used as a tuned-anode H.F. set the tuned circuit is included. If it is to be used as either a high- or low-frequency resistance-coupled amplifier the resistance is included in the circuit. The selection of one or other of these last two arrangements is obtained by the use of a second switch, which reverses the connections from the L.T. battery.

Changes Required

The three possible combinations are drawn up in skeleton fashion in Fig. 2. It will be seen that in the first case, *i.e.*, H.F. and detector with tuned-anode coupling, we require the grid-leak on the first valve to go to the negative of the filament, while the grid-leak on the second valve should go to a more positive potential. In the second case, *i.e.*, high-frequency and detector with resistance coupling, the same arrangement of the grid-leak is required, but the tuned circuit is replaced by the resistance. In the third case, where we require a detector and resistance-coupled note-magnifier, we have to connect the grid-leak of the first valve to the positive of the filament so that it may act as a detector, and that on the second valve should go to the negative of the filament, preferably through a grid-bias battery as shown.

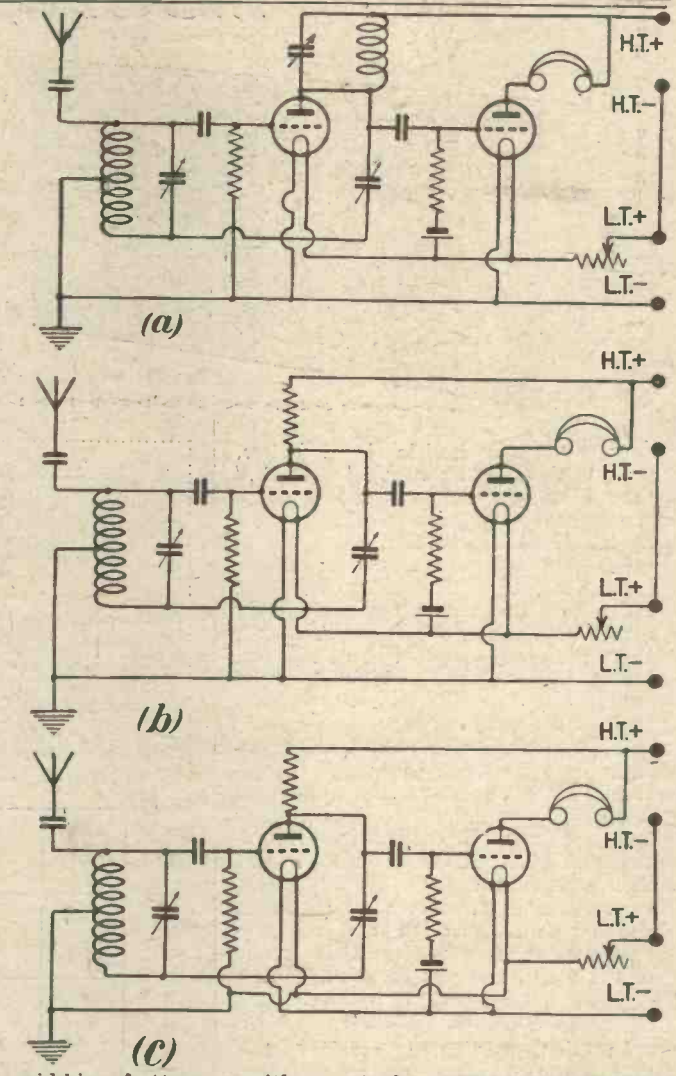


Fig. 2.—These are the circuits available in the set. (a) H.F. (tuned anode) and detector—both switches "down." (b) H.F. (resistance coupled) and detector—S1 "down" and S2 "up." (c) Detector and L.F.—both switches "up."

Reversing Switch

This necessity for change-over has been allowed for by the incorporation of a simple reversing switch on the L.T. battery. The grid-leak on the first valve has been connected to one side of the filament, and the grid-leak on the second valve has been connected through a grid-bias battery to the other side of the filament. By placing the switch in one position we then connect the first valve to L.T. negative and a second valve through the grid-bias battery to L.T. plus.

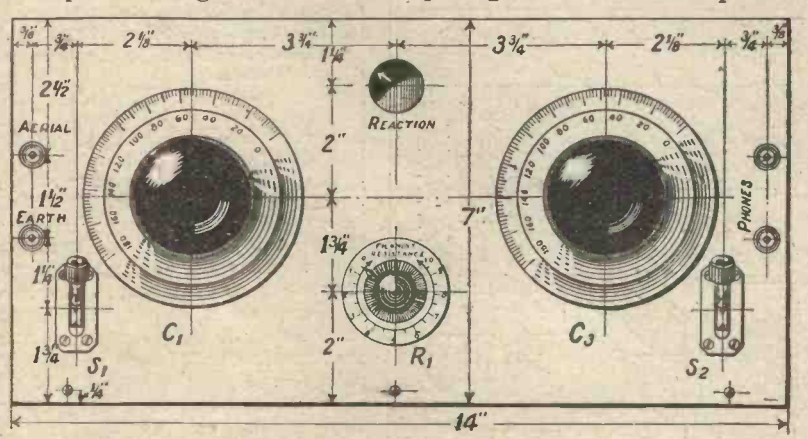


Fig. 3.—Blueprint No. C1075 A of this drilling diagram may be obtained.

Now, since the grid bias necessary with a single stage of resistance-coupled L.F. is only of the order of 1½ volts, then we shall get the difference between this voltage and the voltage of the L.T. battery applied to the grid leak. In any case it will be a small positive voltage, so that we obtain the necessary rectifying effect. Moreover, the 2-volt valves only require a small positive voltage, whereas for the 6-volt class a somewhat larger positive bias is required for efficient rectification. The arrangement provided ensures that this is the case automatically, so that by using 1½ volts grid bias we are actually obtaining a satisfactory condition of affairs.

When the position of the switch is reversed we connect the grid-leak of the first valve to L.T. positive, in which position it will rectify satisfactorily, while the second valve is connected through a grid-bias battery to L.T. negative, thereby ensuring that it gives distortionless L.F. amplification.

Who earns your money? Who spends it? Who chooses your parts for you?

No set published by any periodical could use only one make of parts or could use the same make of transformer, for instance—it would not be fair to advertisers if they did not all have a share in this kind of mention. BUT YOU ARE FREE TO CHOOSE YOUR OWN PARTS.

Your transformer, for instance. Never again pay a high price for your transformer no matter what may be specified—the new LISSEN has revolutionised all previous ideas of transformer price and performance.

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AND GUARANTEED FOR 12 MONTHS.
TEST IT FOR SEVEN DAYS.
Turns ratio 3 to 1
Resistance ratio 4 to 1
Use it for 1, 2 or 3 stages L.F.

It will suit every circuit and every valve you will want to use.

USE LISSEN FIXED CONDENSERS, TOO.

Mica and Mansbridge Type.

MICA TYPE.

Small energy-conserving condensers—note the new case which enables the condenser to be used upright or flat. At present the new case is available only in the most used capacities, but will quickly become a LISSEN standard.

Capacities:—.0001 to .001 1/- each (much reduced)
.002 to .006 1/6 each (much reduced).

Accurate to 5%—they never leak—they never vary.

LISSEN Mansbridge Type CONDENSERS.

To a fine LISSEN quality condenser is added the specially moulded case—the condenser cannot short circuit on to its case. The new LISSEN case protects you if the condenser is used in any circuit connected straight on to the electric light mains. And due to our new policy of direct-to-dealer distribution this LISSEN Condenser costr no more than the ordinary type.

.01 to .09	..	..	..	2/4
.1	..	..	..	2/6
.2	..	..	..	2/8
.25	..	..	..	3/-
.5	..	..	..	3/4
1.0	..	..	..	3/10
2.0	..	..	..	4/8

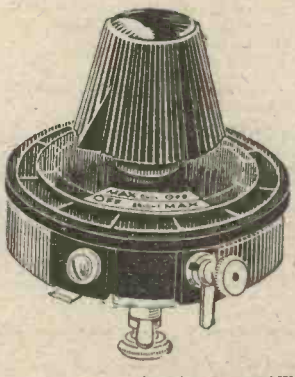
LISSEN FIXED GRID LEAKS.

A case of these was left on our factory roof during the summer of 1925, soaked in rain, baked by sun and the resistance value of these leaks never altered. All capacities. Previously 1/8. Now 1/- each.

Improve every circuit by using LISSEN parts wherever you can—save money too—for now you get keen prices as well as fine quality.

QUALITY RHEOSTATS.

Previously 4/-
NOW - 2/6



LISSEN quality—look how they are made—the wires cannot move and short circuit—the contact brush rides firmly yet smoothly—the heat-resisting former cannot soften—there are accessible terminals—and the combined knob and pointer will fit flush with the neat photo-engraved dial when mounted. Lastly, note the irresistible appeal of the price, made possible by our big production programme, backed by our new direct-to-dealer distribution policy, which cuts out all wholesale profits.

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LISSEN	7 ohms rheostat, patented	4/-	..	2/6
"	35 " " "	4/-	..	2/6
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NOW 1/- each.

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Many are using LISSEN Transformers in "N" Circuits. L134

B

THE "ECONOMICAL TWO"—

continued

Layout

The layout of the receiver is simple and straightforward. The two tuning condensers have been mounted symmetrically on the panel, while the filament resistance controlling the two valves is mounted at the bottom in the centre, and the neutralising condenser, which is also used for reaction purposes, is mounted at the top. The two change-over switches are mounted at the two bottom corners of the panel; the one on the left-hand side operates the change-over between the tuned circuit and the resistance, while the other switch operates the change-over on the battery connections.

Neutralised H.F.

Reference to the circuit shown in Fig. 1 will show that a neutralised arrangement has been adopted for the high-frequency valve. This ensures that adequate results may be obtained when the receiver is being used for long-distance work. At the same time with the system incorporated reaction effects may be obtained by increasing the neutralising condenser, which provides a smooth and progressive increase in signal strength up to the oscillation point. The particular arrangement is such that this reaction effect is obtained on the first circuit only, irrespective of whether the second tuned circuit is in operation or not. It is thus possible to obtain the desired reaction effect whichever of the three arrangements are being utilised in the receiver.

Construction

No terminal strip has been provided on this receiver, but a battery cord has been utilised instead. The ends of the wires have been taken direct to the appropriate points on the receiver. This will save the expense of a terminal board, and is quite as efficient. The first operation in making up the receiver is to lay out the components on the panel, and mount them up as required.

The panel may then be screwed into position on the baseboard and the various components laid out at the back. The layout is quite simple, and no trouble will arise if the diagram is followed. The receiver is then ready for wiring up. The wiring has been taken by the shortest route, and is very simple. It will be observed that the moving plates of the condensers obtain their contact in two ways. First of all, there is the connection on the bracket itself, which is in contact with the moving spindle, while in addition there is a flexible pigtail on the end of the moving plates, which has been soldered to a small extension piece coming from the main connection.

The "Economical Two"—*continued*

Testing

Having completely wired the receiver, it may then be tested out. Connect it up to the batteries in the normal manner. A voltage of 60 to 100 volts should be used on the high-tension, the higher the better. Actually the receiver was tested on 60 volts only, and gave very good results, but an increase in the high-tension voltage to 120 volts resulted in considerably louder signals.

First of all place both the change-over switches in the "up" position. This connects the arrangement as a detector and low-frequency amplifier. The local station may then be tuned in on the left-hand dial in the normal

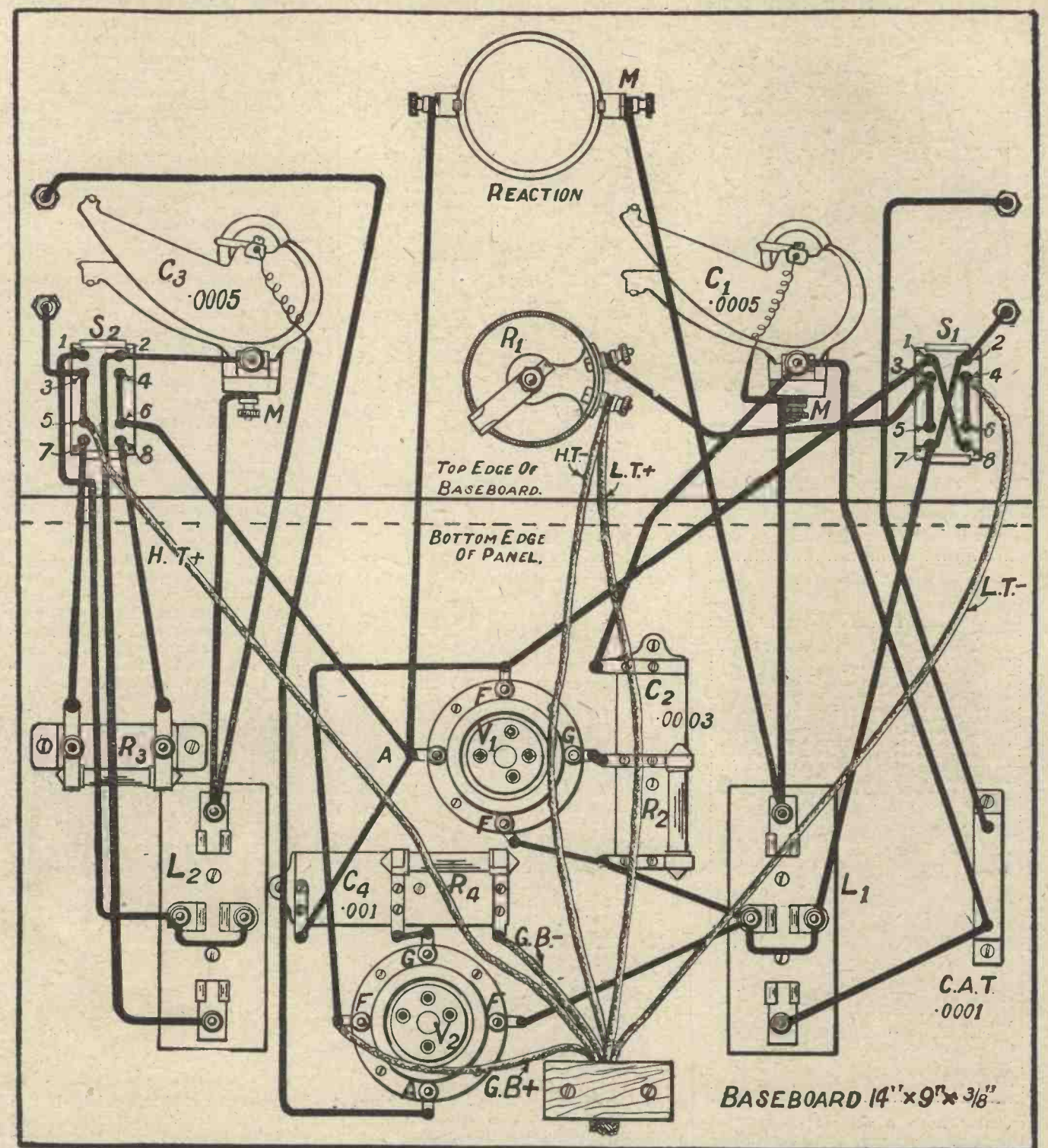


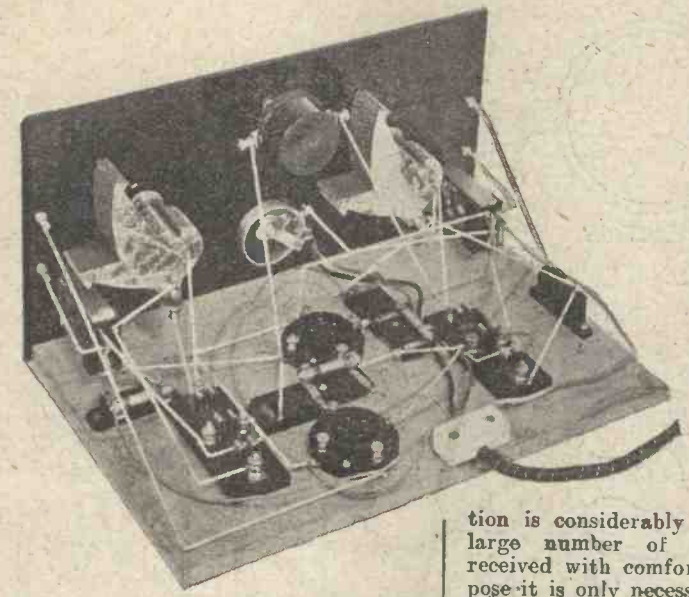
Fig. 4.—Care should be taken that the two switches are correctly connected. Blueprint No. C1075B.

The "Economical Two"—*continued*

manner, and reaction effects may be obtained on the neutralising condenser at the top of the panel.

Reaction Control

In order to obtain smooth and progressive control of the reaction the filament rheostats should be adjusted to give the best conditions. Unless this is done the reaction will be found to go in with a plop, and may conceivably have a certain amount of backlash. This may be remedied by suitable adjustment of the H.T. voltage and the filament brilliancy.



The baseboard components are so disposed as to allow of the simplest wiring arrangement to the switches.

WIRING IN WORDS.

Join earth terminal to contacts 2 and 7 of switch S1, to centre tap of L1 coil base, to one filament contact of V1 and V2, and to one side of leak R2.

Join aerial terminal to one side of C.A.T. condenser.

Join other side of C.A.T. condenser to one end of L1 coil base, to fixed vanes of variable condenser C1, and to one side of fixed condenser C2.

Join the remaining sides of C2 and R2 to grid contact of V1.

Join other end of L1 coil base to moving vanes of C1, and to moving vanes of reaction condenser.

Join together contacts 1 and 8 of S1, continue to remaining filament contacts of V1 and V2, and attach the G.B. + battery lead.

Join one side of fixed condenser C4 and leak R4 to grid contact of V2.

Join other side of R4 to G.B. — battery lead.

Join the other side of C4 to anode contact of V1, to fixed vanes of reaction condenser, and to contacts 4 and 6 of S2.

Join together contacts 4 and 6 of S1, and attach the L.T. — battery lead.

Join together contacts 3 and 5 of S1, and continue to one terminal of rheostat R1.

Join H.T. — and L.T. + battery leads to other terminal of R1.

Join contact 2 of S2 to fixed vanes of variable condenser C3, and to one end of L2 coil base.

Join contact 1 of S2 to centre tap of L2 coil base.

Join contacts 7 and 8 of S2 to opposite ends of leak R3.

Join remaining end of L2 coil base to moving vanes of C3.

Join together contacts 3 and 5 of S2, continue to one telephone terminal and attach the H.T. + battery lead.

Join the other telephone terminal to anode contact of V2.

By placing both switches in the "down" position we change over to the high-frequency arrangement with tuned-anode combination. When this is done the signal strength will, of course, be somewhat reduced, but it will be found that the range of reception is considerably increased, and a large number of stations can be received with comfort. For this purpose it is only necessary to adjust the second dial to a position approximately the same as that of the first.

Searching

The reaction control should be adjusted so that the receiver is just off the oscillating point the whole time. It will be found that the same setting of the filament rheostat which gives the best results with the detector and low-frequency arrangement also gives excellent results with the H.F. and detector setting. Start off by tuning in to the local station as before, and adjusting the reaction so that the receiver is clear of the oscillation point. Then proceed to move the dials together little by little a few degrees at a time. It will be found by this means that a little practice enables the various stations to be picked up quite easily, and the reaction setting will be found to remain in a sensitive condition over a considerable portion of the scale. Once the station has been found, its strength may be increased by careful retuning and readjustment of the reaction.

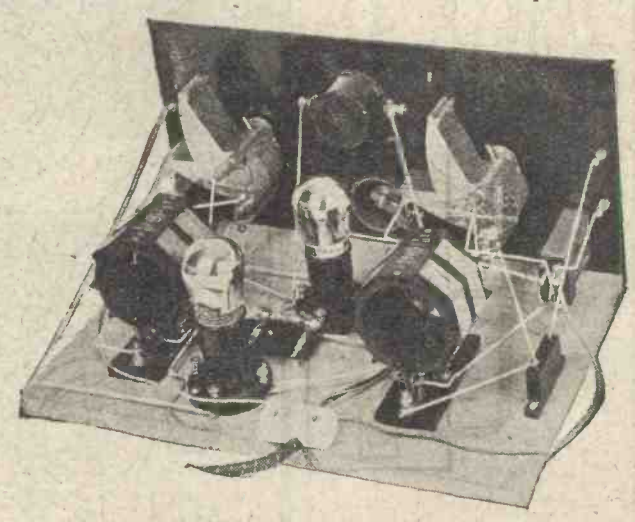
A Warning

Particular care should be taken not to allow the receiver to oscillate any more than is necessary, because it is *not non-radiating*, and any oscillation which is produced will cause radiation from the aerial with interference to the neighbours. After a little practice it will be found quite easy to pick up all the stations required without oscillating, and simply using the reaction condenser as a means of increasing the strength when the station has been finally tuned in.

Results

As a guide to the positions in which the stations will be found the accompanying test report will be of service. This is by no means a complete test report of the number of stations which can be received on the set, but it serves to indicate the positions at which the various stations may be expected, and the reader will no doubt be able to log a considerably greater number of stations.

For the reception of Daventry only, a single No. 3 Dimic coil may be used in the first circuit and the resistance-coupled L.F. arrangement used. For Radio-Paris and other long-wave stations the resistance-coupled H.F. scheme may be used as a trial. If this is not satisfactory, a second No. 3 coil should be obtained and the tuned-anode arrangement employed. This will be found to give every satisfaction.



The battery cord is secured in position by means of a wooden block with a recess on the lower side.

SUPER POWER

Do your signals improve in quality as you tone them down in strength? If they do, it is a sure sign that your valves are being overloaded. Don't blame your loudspeaker or transformers. Ninety per cent. of that huskiness or diaphragm rattle which spoils the sudden glorious high notes of a soprano or the rich low notes of the organ is attributable solely to the fact that your last valve will not handle those sudden increases of grid voltage, amounting sometimes to 1,000%. Your valve begins to rectify either because of grid current or through momentarily operating on a bend of the anode curve.

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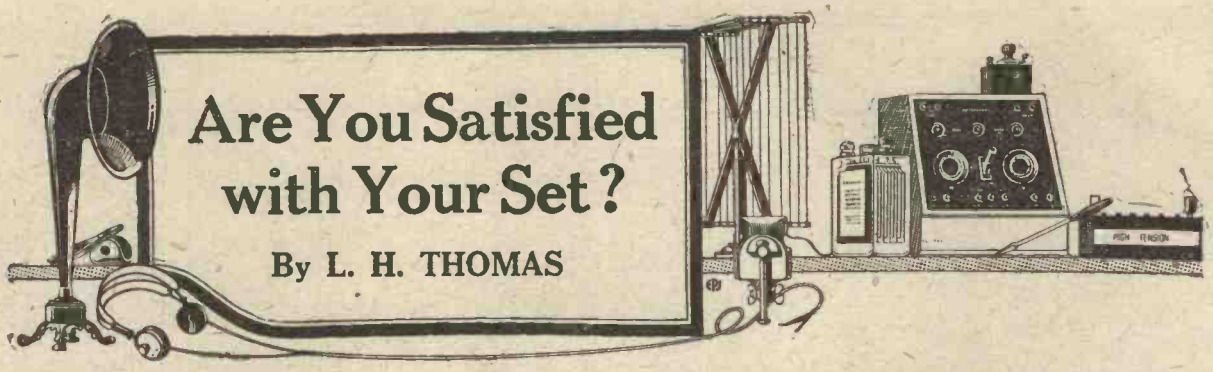
You only need one of them, so buy it for your Christmas festivities. It is a new type of valve altogether, having a very long and straight dynamic curve, every user will enjoy music that is vivid and alive. Get yours now.

Price
S.T.43 for 4-volt accumulator
S.T.63 for 6-volt accumulator **22/6**

SEE ALSO PAGES 182 and 237.

The Valve with the Golden Voice



Are You Satisfied with Your Set?

By L. H. THOMAS

There are a number of minor alterations which can be made in existing sets, which may give improved results. Selectivity is essential in these days and satisfactory reaction control is an immense aid to good reception. How to improve your set in these directions is discussed in these pages.

IT is probably quite safe to say that most of us cannot conceive the sensations we should feel if we owned a receiver which would receive any station we liked to name, free of all interference of any kind; in short, in a manner worth listening to. This is probably because those who design receivers are often apt to be a trifle short-sighted on one point, namely, that whatever is done to a receiver to make it more sensitive to weak signals will be a hindrance, and not a help, if interference from some unwanted source is being received at the same time as those signals.

Interference

The very first point of all radio reception is to obtain a signal (no matter

What would the Duke of Wellington have thought? For the Armistice Day celebrations at the Royal Exchange, public address loud-speakers were placed at convenient points.

how weak) free of all interference. This is, unfortunately, nothing like so easy as it sounds. Many, perhaps, do not realise that, once this end has been achieved, the greatest problem of modern radio reception has been solved.

It is obvious when one thinks it over, however, that once a signal of any kind whatever has been received clear of all interference, it may be amplified up to practically an infinite degree, and will still be received with just its original clarity.

Here, then, is a definite goal to aim at. It is, in fact, simply the question of selectivity, which is now the first requirement in any receiver that is not intended simply to receive the local station and nothing else at a distance of five or six miles.

To amplify a signal received on a non-selective set is simply to make matters infinitely worse; to amplify a signal from a selective set has nothing whatever against it. It has, in fact, been said that about 50 per cent. of the radio reception of to-day consists of amplified interference.

Improving Selectivity

First of all, to produce a selective circuit, all stray resistances must be cut down to the bare minimum. High resistance in any radio circuit is recognised as having very bad effects, but it is the resistances of which we are unaware that cause trouble. To tune sharply it has been proved time after time a circuit must have a low resistance. One is rather apt, on remembering this, to instal a set of "low-loss" coils and condensers and leave the matter at that. There are, however, other considerations. The aerial and earth must have as low a resistance as possible; there are few aerial systems that could not be improved by 15 or 20 per cent. as a result of an afternoon spent on them. The wire is not the only part of the aerial that can account for excessive resistance—it must be remembered that anything, whether it is a conducting material or not, that comes too close to the aerial can cause a very material increase in its resistance, thus broadening the tuning.

The aerial must therefore be kept well away from walls, gutter pipes, chimneys, trees, and the mast itself. In most cases it would pay to shorten the aerial by five feet simply for the purpose of removing it from its supporting mast by this distance. One too often sees aerials with the free ends within eighteen inches or two feet

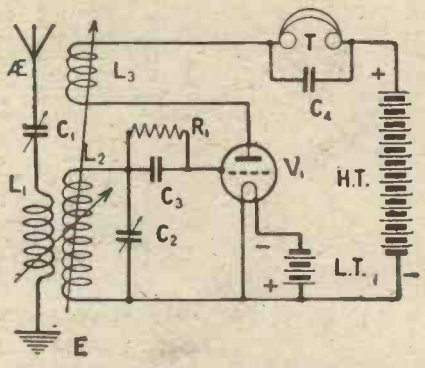


Fig. 1.—This is the conventional circuit employing magnetic reaction. Compare with Fig. 2.

of a metal mast—and even wooden masts behave as earthed bodies in wet weather.

What to Expect

The earth, also, may in nearly every case be improved. Large buried plates are infinitely preferable to water-pipes, but good buried lengths of wire laid out underneath the aerial are even better. One must not expect, however, to improve the aerial and earth system and then go in to the set and tune in stronger signals than were ever received before—it is the selectivity, not the sensitivity, that will be greatly improved. It must be remembered throughout that what is wanted is not a loud noise—it is a clear signal that can be amplified into a strong signal.

If the aerial system is poor, i.e., of high resistance, much of this poorness may be communicated to the secondary circuit by being "coupled into it." The loosest possible coupling should then be used, so as to confine any bad effects of the aerial circuit within that circuit as much as possible. Once more, a weaker signal may result, but it will be a clearer signal.

Now Grannie *can* listen!

"THAT Wireless" Grannie used to say, "was no good—she never *could* hear what the man was saying!" That was before the **Brown** Crystal Amplifier came. Now she sits and listens to the Loud Speaker working from the little Crystal Set. For hours and hours! Now she appreciates the boon broadcasting can be. Mostly everyone, now, can work a Loud Speaker from a Crystal Set without the use of a single valve. If you live within fifteen miles of a B.B.C. Station (or eighty miles from Daventry) the **Brown** Crystal Amplifier will enable you to obtain pure, faithful Loud Speaker reproduction from your Crystal Receiver. No Valves. No accumulators. Just the Crystal Amplifier connected to your Set and the Loud Speaker. The only accessory needed is a 4½ volt dry battery. What more ideal way of enjoying the broadcast? You get the results of your friend the valve-user without any of the worry, trouble and expense his accumulators cost him.

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Price of Crystal Amplifier,
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20 inches high
2000 or 4000 ohms.
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ARE YOU SATISFIED WITH YOUR SET?—*continued*

Short Leads

To keep the resistance of the aerial circuit down, if possible, take a lead straight from the lead-in tube to one end of the primary coil, the other end, of course, going to earth, also in as direct a manner as possible. The same

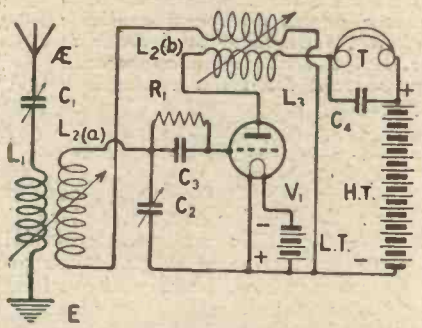


Fig. 2.—By splitting the secondary coil and applying reaction to one half, the effect on tuning of varying the reaction coupling will be reduced.

should be done with the secondary circuit—the lead from the "top" end of the coil should be taken as shortly and directly as possible to one end of the grid condenser, the other side of which should be soldered directly on to the grid terminal of the detector valve. (The same remarks apply, of course, if high-frequency amplification is employed.)

The secondary tuning condenser must be of the very best possible quality, and the moving plates should, of course, be connected to the filament and earth, or bad hand-capacity effects will result.

Reaction Difficulties

Now, dealing with the reaction circuit, many difficulties are encountered. In the standard "three-coil tuner" (Fig. 1), the great trouble is that when the degree of reaction is varied, the coupling of the reaction coil has an effect not only upon the secondary circuit L2, C2, but also on the primary circuit. Thus these three circuits really "interlock," and an alteration in any one of them makes it necessary to re-tune the other two. When the coupling of the reaction coil to the secondary coil is loosened, the wavelength of the secondary circuit drops immediately, and a constant "fumbling" with both hands is necessary.

A Remedy

This difficulty may be easily surmounted by "splitting" the secondary coil into two portions, set at right angles to each other. The aerial coil may then be coupled to one and the reaction coil to the other. The variations of coupling of the reaction coil will then not act inductively through the secondary coil and primary circuit. The circuit is now as shown in Fig. 2. The whole of the secondary coil is still tuned; also note that it is the half on the "earth" side that is coupled to the reaction coil.

Advantages

A further advantage of a set rigged up in this fashion is that, on account of its very loose aerial coupling, and also its "split" secondary, radiation is reduced. The method of placing the coils should be as in Fig. 3. Note that the two halves of the secondary coil should not only be at right-angles, but also as far away from each other as can conveniently be arranged.

Actually the coupling of the primary to its associated half of the secondary should be of the order of 45 degrees. The reaction coil and the other half of the secondary may be arranged with fixed coupling, control of the degree of oscillation being obtained by means of a condenser across the telephones and the H.T. battery, or by some other equally well-known method. This is, however, unnecessary, since by splitting the secondary circuit it has been made possible to control reaction by means of the coils alone without upsetting the tuning.

The construction of a receiver on the lines indicated will be found well worth while; if signals are weak they

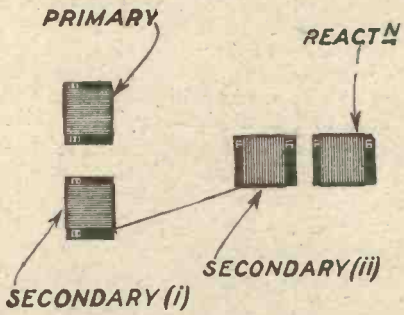


Fig. 3.—The coils of the Fig. 2 circuit should be arranged as shown here to minimise unwanted coupling effects.

can be amplified with the knowledge that they will still be intelligible, and not swamped with interference from a hundred sources.

* * *

NEAT TAGS FOR FLEX LEADS

WHEN flex leads are used, whether in the form of telephone cords, or as connections in a set, the ends of the flex quickly fray out with use if they are not finished in some way. Neat tags which form a secure and convenient method of connection to any type of terminal can be made in a manner to be described here.

Materials

The materials required are as follows:—A few inches of brass tubing, 5/32-in. diameter, and a length of 3/32-in. diameter brass rod. The internal diameter of the tubing should be such that the rod just fits it easily. To make a tag a piece of tubing 1 in. long is required, and ⅜-in. from one end a slot is cut in it nearly half way through, as shown in Fig. 1. Next a 1½-in. length of the brass rod is cut off and scarfed at one end (see Fig. 1).

Assembling

Now bare ¼-in. at the end of the flex lead which is to carry the tag, turn back the braid covering and tie

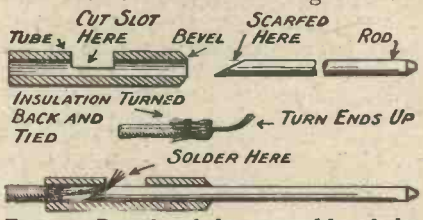


Fig. 1.—Details of the assembly of the tag are given in these drawings.

it down securely with a few turns of cotton. Bend up the ends of the wire strands slightly and push the flex into the tube till the bared ends just emerge from the slot. The scarfed end of the rod is then pushed in from the other end of the tube as far as it will go, thus wedging the ends of the flex. The assembly should now be clamped in a vice to hold the rod in the tube, and the slot filled up with solder. Any superfluous solder may then be filed off, when the joint will be practically invisible.

Finishing

The rod may be left straight as it is, or it may be bent round into the shape of a hook, as shown in Fig. 2. In either case a "flat" should be filed on the projecting part of the rod, since this will make it much easier to clamp under a terminal head. If the hook is made wide enough to pass over a 2B.A. terminal shank, it will also usually be possible

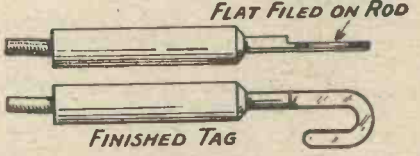


Fig. 2.—A flat filed on the finished tag will enable a terminal to secure a better grip on it.

to use this form of tag with telephone terminals, by passing the point of the hook through the hole drilled in the terminal body.

An improved finish will be given to the tag if the end of the tubing at which the rod is inserted is bevelled off for a short distance.

E. J. C.

LOUD-SPEAKER AND RECEIVER IN ONE

By R. J. O'CONNELL

There is much to be gained by building your loud-speaker into the receiver cabinet, especially where appearances and available space are considerations. No elaborate constructional work is involved in the design given here, and the attractive appearance of the completed receiver will be apparent from the photograph on this page.

IN the United States of America it is quite common practice to build the loud-speaker into a receiver designed to operate normally with this accessory. For some reason this system does not seem to have caught on in this country, and it is the writer's intention to show in this article the advantages of building receivers on these lines. Modifications are obviously possible, but the arrangement shown should be found quite satisfactory.

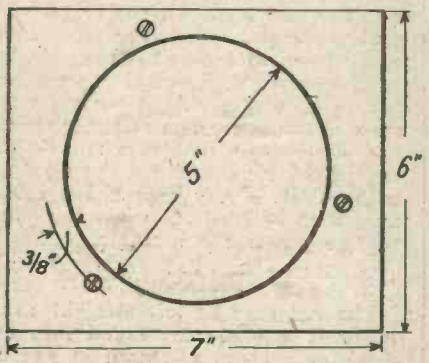


Fig. 1.—This gives the dimensions of the wooden panel carrying the loud-speaker.

It would be very unusual to use a gramophone which had a horn several feet away from the instrument. In the writer's opinion it is just as inconvenient to use a wireless set separated from its loud-speaker by long leads. When a set is built in a cabinet which also contains the loud-speaker, these long leads are avoided and the whole general appearance of the receiving apparatus is improved.

Suitable Circuits

Of course this idea is applicable to any receiver which will operate a loud-speaker, but it is most useful when a set employed merely for local station reception on the loud-speaker is to be used. A set of this type may be built from a number of simple circuits, and some indication of suitable arrangements may be useful. It is desirable that the controls be few in number, and this condition is fulfilled by a two-valve set, comprising a detector valve without reaction and a single low-frequency amplifying stage. There is in such a circuit only one control, the aerial tuning condenser, and once the local station has been tuned in, the receiver may be turned on or off by a suitable switch arranged in the filament battery circuit.

At Greater Distances.

At a distance of more than 15 miles from the local station another valve will probably be required to bring the signals up to good loud-speaker strength. This additional valve may be added as a low- or high-frequency amplifier, and the function which the additional amplifier is to perform must depend on the particular circumstances of the case. It will usually be found best to add a high-frequency valve if the distance from the local station is more than 30 miles. By using an aperiodic transformer for the H.F. coupling, the controls of the receiver will not be increased in number. The author's own receiver was designed for use at a distance of about nine miles from the London station, and as the greatest possible purity was desired in the reproduction of this station's programmes, a circuit was used consisting of a crystal detector followed by two resistance-capacity coupled valves; this gives really excellent results.

Cabinet Design

Having decided on the circuit to be employed, the next step is the design of the receiver itself. If the cost of the cabinet is to be kept low, the smallest efficient loud-speaker that can be obtained should be used.

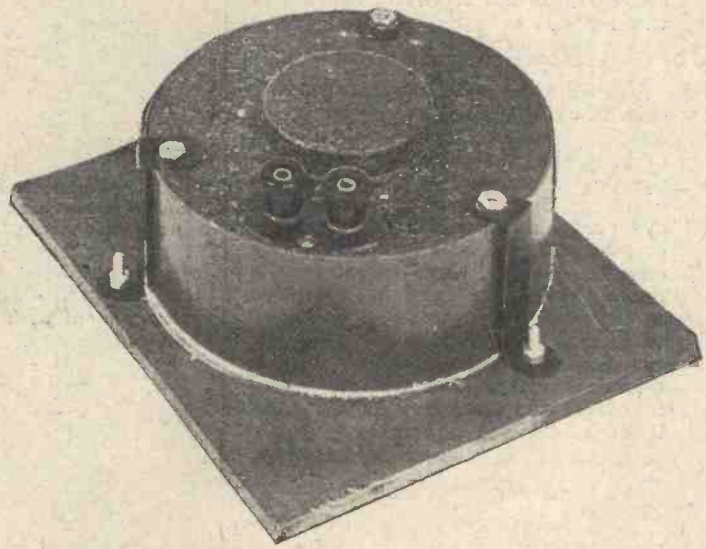
The cabinet which contains the author's loud-speaker set is shown in the photographs and drawings. Should the reader desire to construct a duplicate of this design, the following particulars are given.

Components Required

For constructing the loud-speaker part of the set the following parts are required:—

One cabinet, special type, with baseboard measuring 6 in. by 7 in. by 17 in. (Peto-Scott Co., Ltd.)

One hornless loud-speaker. (Ultra Elec. Co., Ltd.)



The loud-speaker is held to the panel by three angle brackets.

LOUD-SPEAKER AND RECEIVER IN ONE—*concluded*

One piece of polished wood, 7 in. by 6 in., having a circle of a diameter of 5 in. cut out of the centre. (Carrington Mfg. Co.)

Three small angle brackets, quantity of cotton wool, small bolts and nuts, and woodscrews.

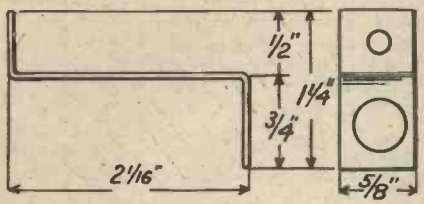


Fig. 2.—The three brackets may be made of strip brass from the details shown.

Construction

The constructional work is quite simple and should be commenced by fixing the loud-speaker to the small board. First of all place the screen face downwards over the hole cut in this board, and next fix the loud-speaker in position by putting the small brackets over each of the three nuts and securing them to the board by means of bolts and nuts. The board may now be screwed to the base-board and the construction of the set commenced.

The Receiver

The receiver should be built so that the first valve of the set is the furthest from the loud-speaker and the last valve nearest to it. The variable condenser and all the components should preferably be of types which can readily be mounted on the base-board. The battery lead may be one of the multi-way battery leads now obtainable. A hole is drilled in the back of the cabinet, through which leads pass out. The high-tension positive lead is connected direct to the negative terminal of the loud-speaker, and a lead from its positive terminal is taken out to the high-tension battery.

Conclusion

When the receiver part is finished it may be placed in the cabinet, after which the last operation should be carried out. This consists in filling in the space round the loud-speaker with cotton-wool, which should be lightly packed in between the loud-speaker, the sides of the cabinet and the base-board. This will minimise any slight resonance or jarring effects which might otherwise be noticeable.

A PLUG AND JACK REFINEMENT

WHEN using a plug and jack in conjunction with a loud-speaker it is often necessary to provide upon the actual receiver two additional terminals, as well as the jack, in order to be able to connect up the telephones if necessary, either together with the loud-speaker, or separately. Matters may be simplified, as described in this article, by those who are fond of small constructional jobs, by adding to the plug two small terminals, as shown in the accompanying diagram. The drawing shows a plug of the type obtainable from Messrs. Igranic, Ltd., but those of an ingenious turn of mind will, no doubt, be able to adapt the idea to other types of plugs.

It will be seen from the diagram that two small holes are drilled through the ebonite side pieces of the plug in identical positions with the holes to be found in each of the connection tags. These tags are then secured by means of two small terminals, as will be seen in the drawing, the two halves of the plug being clamped together finally in the usual manner.

The Device in Use

Supposing that we have a jack only upon the receiver and that the plug is connected in the usual way to the loud-speaker, the device would be used in the following manner:—A represents the tip of the plug, which, being positive, should make connection to the positive side of the loud-speaker via the connection tag A_1, A_2 representing this lead. B represents the sleeve of the plug, which provides connection with the B_1 tag, lead B_2 passing to the other side of the loud-speaker. The

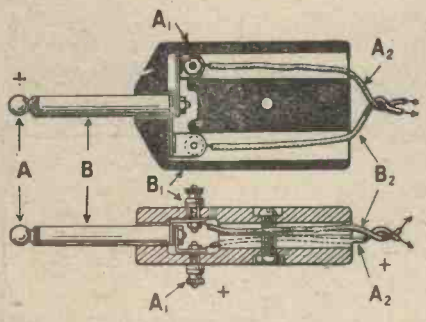


Fig. 1.—The addition of the terminals A1 and B1 adds to the utility of the plug.

positive side of the telephones is therefore connected to terminal A_1, and the remaining side to terminal B_1. The loud-speaker and telephones may be used at one and the same time when these connections are made, or the telephones may be disconnected, using the loud-speaker only, or the loud-speaker may be disconnected from the instrument end, using the telephones only.

H. B.

A SELECTIVE THREE

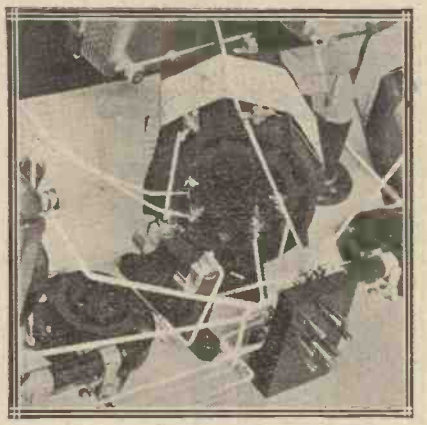
—concluded from page 187

and for this purpose telephones should be connected across the output terminals. Now remove the fixed resistor controlling the first (high-frequency) valve. Signals will probably still be heard at fairly good strength. Retune the two tuning condensers until the signals are accurately tuned in. Now screw down the neutralising condenser with the ebonite screwdriver supplied, until a position is obtained where the signals vanish. The locking nut should be slackened off during this process, in order to enable the screw to travel to its fullest extent. When the correct position has been found the locking screw may be screwed down, and the condenser thus fixed in position.

The actual minimum point will be found to be fairly sharply defined, and a little care should be exercised in this operation to ensure that the receiver is correctly balanced. When this operation has been satisfactorily performed, the fixed resistor for the first valve may be replaced, and the receiver is ready for use.

Tuning

Tuning-in is simply a matter of rotating the two dials together, using the reaction control to increase the strength. When first searching for the various stations, it is permissible to allow the receiver to oscillate by increasing the reaction control. The carrier of the station may then be tuned in, and the reaction rotated back until the receiver is just not oscillating.



Showing the connections to the H.F. transformer.

Provided the receiver has been correctly neutralised as previously described, this operation will not cause any interference, but at the same time need only be adopted during the preliminary trying out of the receiver, because once the positions of the various stations have been definitely logged it will be found possible to tune in the stations required on the two dials, utilising the reaction control simply to maintain the receiver in a sensitive condition.

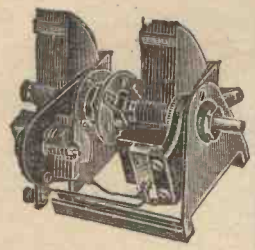
Valves

The valves in use should be of the high-impedance type for the high-frequency and detector valves, and a suitable L.F. or power valve for the last stage. Valves such as the D.E.5B., P.M.5, P.M.3, P.M.1H.F., B.4H., B.5H, Cossor Point One H.F. and similar types are suitable for the first two, while any corresponding power valve is satisfactory in the last stage

Results

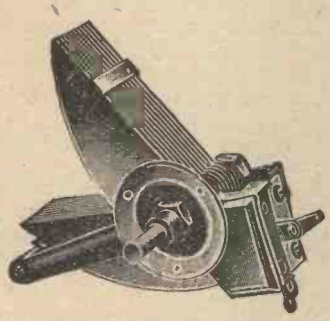
The list of stations shown in the attached report gives some idea of the settings for the various stations. It was taken just after the change-over in wavelength occurred, so that a full and complete test report was not deemed advisable in view of the possible alterations before this article appeared in print. The various readings, however, will serve to indicate the approximate positions on the dials of the principal stations, and the actual settings of other stations may easily be logged after a little experience has been obtained on the receiver.

Igranic Gang Condensers.



Igranic Gang Condensers are fitted with small "Micro" Condensers with which the sections can be accurately balanced without altering the relative settings. The accurate square law tuning is thus preserved and the full tuning range is maintained. Each section .0005 mfd. square law.

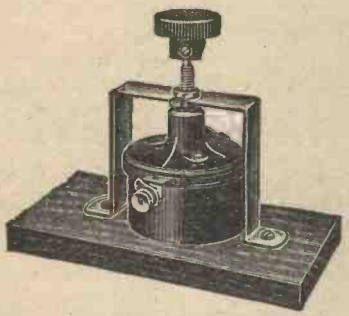
Twin Gang .. £2 10 0
Triple Gang .. £3 15 0



Igranic-Pacent S.L.F. Condensers.

Igranic-Pacent S.L.F. Condensers give true-straight-line-frequency tuning. The plates are of brass rivetted and soldered together, losses are negligible and minimum capacity extremely low. Substantial dust-proof bearing ensures smooth, silky turning movement.

PRICES: .00035 mfd. 14/6
.0005 " 18/6



Igranic Micro Condenser.

The Igranic Micro Condenser is a miniature condenser which is particularly suitable for neutrodyning and for all cases where extremely small capacity variations are required. Suitable for panel or baseboard mounting. The Bakelite cover protects the plates from dust or damage. Maximum capacity approximately .00004 mfd.

PRICE, with Knob 5/6
With 1¼ in. "Indigraph" Knob and Dial 6/6
Bracket for Baseboard Mounting ... 6d.

Igranic "Indigraph" Vernier Knob and Dial.

The Igranic "Indigraph" Vernier Knob and Dial is a very handsome slow motion dial with an extremely smooth movement, entirely free from backlash. Two scales provided reading in opposite directions from 0 to 100. Space is provided on the dial for recording readings.

PRICE 7/6

RADIO IGRANIC DEVICES

for Receivers described in this issue

BUILD your receivers with Igranic Radio Devices and assure yourself lasting satisfaction.

Every Igranic component is designed and manufactured with scrupulous care by highly-skilled engineers, and each component contains special features which make it unique.

Here are some of the Igranic components which you will need for receivers described in this issue. Others are:—

- **Igranic Coil Holders.**
- **Igranic Valve Holders.**
- **Igranic "on" and "off" Switches.**
- **Igranic Fixed Condensers and Grid Leaks.**
- **Igranic Terminals, Sockets, and Wander Plugs.**
- **Igranic Filament Rheostats.**
- **Igranic Square Law Condensers, etc., etc.**

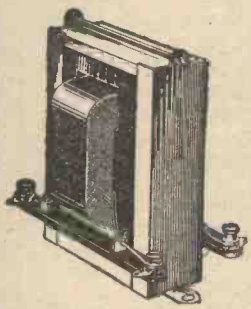
WRITE FOR THE NEW IGRANIC CATALOGUE LIST :: No. J. 180. ::

Igranic "XLLOS" Coils (Extra Low Loss).

Igranic "XLLOS" Coils are wound in a special method ensuring very high efficiency and low self capacity. Sealed Bakelite shell protects windings against damage and atmospheric changes, ensuring absolute constancy in tuning. Spacing of plug and socket variable from 9/16 in. up to 2 in., with air space between.

Made in 10 sizes for wavelengths from 220 to 3,200 metres. PRICES: from 3/9 each.

Igranic-Pacent Super "Audioformer."



The Igranic-Pacent Super "Audioformer" has a remarkable amplification curve resulting in uniformity over a very wide range of the audible frequencies. Massive iron circuits and unique coils result in the reproduction being extremely pure and uniform. The robust construction and the care taken in its manufacture ensure long trouble-free service.

PRICE 24/6.

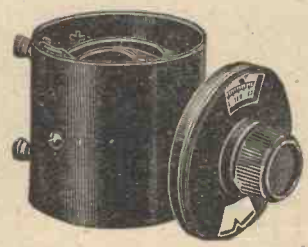
As used in the "Monodial."

Igranic-Pacent Variable Resisters.

The Igranic-Pacent Variable Resisters combine all the advantages of fixed resisters with the adjustability of a rheostats. The contact arm is easily adjusted so that any resistance within the range of the resister can be obtained quickly and easily.

Made in resistances of 6, 10, 20, 30 and 50 ohms, variable over the whole range.

PRICE .. 1/8 each.



Igranic Variometers.

Igranic "B" and "BL" type Variometers are literally "wound on air," no solid supporting material being used on the windings. Losses are consequently reduced to the minimum, whilst self capacity is also extremely low. A very small air space separates rotor and stator windings so that the variometers have a wide tuning range. A paxolin tube surrounds the windings as a protective measure.

Igranic "B" type Variometer, range 280–650 metres. PRICE 12/6

Igranic "BL" type Variometer, range 700–2,400 metres. PRICE 18/-.

IGRANIC ELECTRIC Co. Ltd.
149, QUEEN VICTORIA ST., LONDON
WORKS, BEDFORD.

Notes & Jottings

A page of information of interest to all constructors.

ANYONE who has dismantled an old receiver in order to use the parts for a more modern set will have met with the difficulty of removing nuts from terminal shanks to which connections have been soldered. A certain amount of solder usually remains in the end threads of a terminal shank when the connecting wire has been pulled off, so that the nut becomes fixed so tightly when an attempt is made to unscrew it that it has eventually to be cut off.

A die of the correct size for the terminal shank is invaluable on such occasions. With its aid the thread of the shank may be cleaned up in a few moments, making the removal of the nut a simple matter, and leaving the terminal as good as new.

WHENEVER a length of threaded rod is to be cut, a great deal of trouble in trimming up the cut end will be saved if a die is first run on to the rod. After the cut has been made, either with a hacksaw or a pair of wire-cutting pliers, the die is run off again over the cut end, leaving a clean thread for nuts to be put on. This does away with the filing of the end which would otherwise be necessary.

PLUGS and jacks, as developed nowadays to perform quite a number of switching operations, provide a simple and attractive method of puting the telephones or loud-speaker in circuit, and possibly, too, of switching low-frequency amplifying valves in and out of circuit. Care should be taken, in connecting up the jack contacts which connect with the telephone plug, to see that the same side of the plug, and therefore of the telephones, is always connected to high-tension positive.

The conventional practice is to arrange for the tip of the plug to go always to H.T. positive, and the jacks should be wired accordingly. In Fig. 1, for example, the tip of the plug makes connection with the bent contact blade, while the sleeve connects with the body of the plug. Particular care is necessary to avoid confusion when a double circuit closed jack (Fig. 2) is used. Here the body of the jack is not used electrically at all, the sleeve of the plug connecting with the upper bent contact and the tip with the lower one. High-tension positive, in this case,

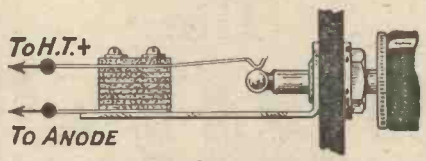


Fig. 1.—In the single open circuit jack the tip of the plug connects with the upper contact.

therefore, goes to the lower bent contact, though in most other jacks it will be taken to the upper contact.

FOR those who like to study economy in battery current consumption a point worth noting is that it is more economical, where this is possible, to connect valves in series rather than in parallel. Assuming that a 6-volt accumulator is used, when 6-volt valves are employed, they must obviously be wired up in parallel in the ordinary way. When 2- or 3-volt valves are in use, however, three of the former or two of the latter may be in series across the terminals of the accumulator. The current taken from the accumulator is then that of one valve only.

This method of connection is specially applicable to low-frequency amplifiers, in which the valves con-

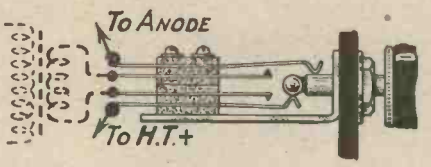


Fig 2.—The tip of the plug, in this double closed circuit jack, connects with the lower contact. The primary of an L.F transformer may be cut in or out as indicated.

nected in series are all performing similar functions. It is not usually satisfactory to use valves of the .06 ampere type in this way, however, since the effect of the anode current of one valve passing through the filament of the other may cause overrunning of the filament.

It should be noted that when valves are used in this way it will be best to use separate grid-bias cells for each valve, with their positive terminals connected to the filament negative of the valve concerned. This is advisable since the filaments of the valves will be at different potentials relative to the negative terminal of the accumulator.

THOSE who are converting their old receivers with magnetic reaction coupling to use circuits of the "parallel feed" type with a variable condenser for reaction control would do well to note that the smooth action of this control depends in large measure on the employment of a suitable H.F. choke between the valve anode and the telephones or L.F. transformer. It may sometimes be necessary, for example, to utilise different chokes for the short- and long-wave broadcasting stations. A choke which is suitable for the lower band may come into resonance with the grid tuned circuit on the longer waves, causing uncontrollable oscillation.

HOW many people, one wonders, study the slip of paper which manufacturers enclose with their valves? This sheet ordinarily gives full data about the correct filament, anode and grid voltages to use, and usually a series of characteristic curves for different anode voltages. The maximum filament and anode voltages are usually to be found on the valve itself, but the correct grid bias to use with, for example, a low-frequency amplifying valve cannot be given satisfactorily except by means of the curves. It is a good scheme to keep these valve data with the set, so that the required information is to hand when it is wanted. If you increase the anode voltage on the last valve of your set, for instance, from 60 to 100 volts, you can find out in a moment the correct amount of grid bias to add for good reproduction and economical operation.

THE RADIO PLAY OF THE FUTURE

Miss Madge Titheradge.

By MADGE TITHERADGE

Radio plays are something new in the history of the drama, and ordinary stagecraft is inadequate for the new conditions. Is there a future for the radio play? What does broadcasting demand of the author and producer? The views expressed by Miss Madge Titheradge on these and other questions that arise are of special interest at the present time, when there is a wide divergence of opinion on the suitability of drama for broadcasting.

IT is at once easy and amazingly difficult to prophesy concerning what developments will take place in the performance of plays by radio. It is easy because there is no past to draw upon; radio plays are an entirely new branch of art, as yet almost unploited, and with a technique, too, as yet hardly defined. The producer of wireless plays is still often in the dark as to the best way to "get over" a certain effect which he wants to make; he has an entirely new technique to learn, or, more correctly, perhaps, to create, for there is no one to guide him, since ten years ago a broadcast play was still unknown.

Prophecies

For this reason it is easy to dogmatise about what might happen. There is always a chance that one may be right! But in view of the immense potentialities latent in radio drama, it is equally likely that the prophet may be quite wrong; that he will entirely overlook some clever innovator who might come along some day and introduce new notions of his own which will entirely revolutionise the present ideas of what a radio play should be; ideas which to a certain extent are at present naturally an extension or a modification of those applying to the production of plays on the legitimate stage.

A New Technique

That a new technique is necessary is amply proved by the fact that a radio play is different, by reason of the limitation of the medium in which it is expressed, from any other form of art. The novel, where every action important for the development of the theme can be described, every character painted with scrupulous detail, every essential conversation recorded, and every detail reproduced with the fidelity of a painting, is probably the most complete form of expression.

Next in completeness is the stage play, which is similar but more concentrated, and limited by the exigencies of the theatre and of time. The technique here is more difficult than that involved in writing a novel, but at least the dramatist knows that in presenting the play to the public much of the character of his *dramatis personæ* can be suggested by make-up, facial gestures, costume, scenery, and all the other subsidiary arts which go to the production of a good play. He may even have the satisfaction of seeing his play immensely strengthened by the personal charm and appeal, or good acting of one actor or actress.

The scene in the studio of the London station during the broadcasting of a play—"The Passing of the Third Floor Back."

Difficulties

The author of the radio play is without any of these aids. He is writing for a band of performers who will be invisible to his audience. His action must either be suggested by effects in the studio or related by one of the actors. In direct contradistinction to the writer of a screen scenario, he is writing a play in which everything must be spoken and nothing seen. He has no tradition of technique to guide him like his fellow-craftsman who writes plays for the theatre.

Fresh Scope for Authors

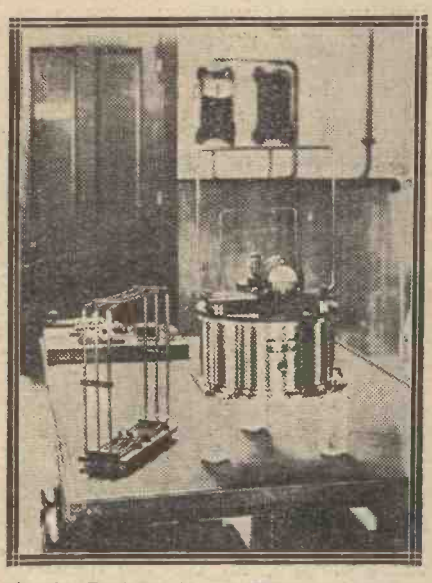
It will therefore be realised that writing for the radio "stage" will have to become quite a separate branch of play-writing, and as the general opinion is in favour of a great future for radio drama, it seems only reasonable to anticipate that very clever brains will be attracted to the task of writing it. It is, of course, foolish to suggest that radio plays can ever take the place of the conventional theatre, for the two forms of entertainment are utterly different. They can exist side by side and are by no means mutually exclusive, as some have rather superficially supposed.

What Does Radio Demand?

There are a few characteristics of the radio play which will survive, no matter what innovations are introduced by the new race of radio playwrights. In the ideal radio play there will probably be but few characters,

THE RADIO PLAY OF THE FUTURE—*continued*

because the audience have only one slender means of identifying them, e.g., by their voices. These characters will have to be very clearly defined, and, as it were, "characteristic" characters; personalities which reveal and suggest themselves by the words they say and their manner of saying them, so that the audience of listeners shall have no difficulty in identifying each one as he or she speaks. "The Play's the Thing," is a very old but a very true dictum, and it is particularly so of the broadcast play, where



At the Bodmin Beam Wireless Station, opened for communication with Canada. This picture shows the standard wavemeter.

there is perhaps less scope than on the legitimate stage for outstanding "star" actors, and a very definite demand for competent acting and consummate elocutionary powers.

Catering for all Listeners

It is very difficult to theorise about the type of play which is most likely to find favour. Certainly in consideration of the vast diversity of taste among the millions of listeners great care will have to be taken to see that whatever is produced possesses as wide an appeal as possible, whether it is drama, comedy, or farce. Here again the technique of the playwright will be taxed to the utmost. He will have to produce something which appears to be true to life, and to produce this effect under the limitations of the broadcast performance must, I think, be extraordinarily difficult. Great credit is due to those pioneers who have already succeeded.

It is often said that "a play worth seeing is worth seeing twice." Such a statement is true of every worthwhile book or play, for apart from the universal pleasure of recognising something which is already loved and familiar, it is also true that new and unsuspected beauties reveal themselves at a second hearing. This type of stage play, written, of course, without the slightest intention in the world of its ever being broadcast, is particularly suitable for radio purposes.

The Best Way

The man or woman who listens to an unknown play broadcast may find at times that it is difficult to follow, if it is one which has not been written specially for broadcasting. He misses the visible spectacle, all the little actions on the stage which count for so much in the interpretation of the piece.

But he is in a supremely happy position if the broadcast play is one which he has already seen performed on the stage, for then his memory supplies all the blanks, and being already familiar with the show, he is able to follow it pleasurably and easily. The recent broadcast of certain of the Gilbert and Sullivan operas was an excellent example of this liking for the already familiar, this pleasure of the known.

A High Standard Needed

But in order to stand a second, third or fourth hearing a play must be very good of its kind, and it seems possible from this that next in popularity to plays specially written for broadcast performance by writers versed in its particular technique will be the classics of the legitimate stage, from Shakespeare down to the more prominent dramatists of the present day. Such plays always merit a second hearing; the listener, aided by his memory of performances in the theatre, will appreciate much that he failed to notice before.

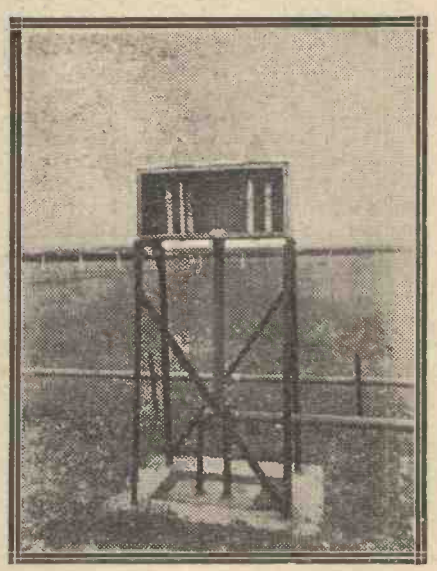
Incidentally, the cause of drama will benefit, for in spite of Charles Lamb's statement that plays lose by being performed, there are thousands who would not care to read a good play, but who will be delighted to listen to it, and in doing so open for themselves fresh avenues of pleasure in life.

RADIO PRESS SETS AT SEA

SIR,—Having built several radio sets from particulars given in your various publications, I thought you might like to know the performance of same. First, I built two reflex sets, one of which was splendid on my aerial (which is a poor one, being in a valley, and badly shielded on three sides by a tall building and trees, and only 70 ft. total length). The other was installed near a tram route on a very bad and low aerial; it was poor, the local station being only just heard on the loud-speaker, but by adding another stage of L.F. the set worked satisfactorily, and has been in use for twelve months.

My next was the "Melody Three" (*Modern Wireless*, March, 1926), which gave splendid results, receiving London, Bournemouth and Cardiff on L.S. and many other B.B.C. stations on 'phones from Southampton, also many foreign stations on L.S. and 'phones. This set was so good that I made another "Melody Three," and hoped to enter it in the World's Fair recently held in New York, but through a technical defect, which I had trouble in locating, I could not get the set to work right, and when I did locate the defect it was too late to enter my exhibit. I only had half an hour to try out the set in New York before I returned to England. Still, during that time I got in quite a number of stations with very good selectivity and purity. This set I tried at Southampton with splendid results. The set is now installed at Liverpool with, I believe, very good results indeed, receiving many stations on L.S. and 'phones.

My next and last set is the "Davlow Three," which I tried out recently in New York (I am an engineer on s.s. *Olympic*), on an aerial consisting



Another view at the Bodmin Station showing the aerial coupling coils.

of an ordinary electric 3/22 cable hanging down the ship's side, with the ship as "earth." Seventeen stations were received, covering 263-492 metres. WEAF at 4 miles could be cut out in 4 degrees on the dial. All who heard this set remarked upon its wonderful selectivity and volume with purity. I tested this set out against an American 5-tube "Federal" set and an English set, "The Best That Money can Buy" 4-valve set, and could at any time pick

RADIO PRESS SETS AT SEA

—continued

out more stations clear with no background, and with far greater volume and purity. Selectivity is "hair-fine."

Through hearing this set, several friends are making same for themselves.

Lately I have been working this set on my aerial at Southampton, with the following good results:—

Bournemouth.—Good L.S. strength on two valves; too much on three, all out.

London.—Moderate L.S. strength on three valves.

Madrid.—Moderate L.S. strength on three valves.

Barcelona.—Moderate L.S. strength on three valves.

A new wireless station was recently opened by the Post Office at St. Albans. The receiver of which the panel is seen here is used for high-speed automatic reception.

Vienna.—Moderate L.S. strength on three valves.

Newcastle.—Quiet L.S. strength on three valves.

Also several unidentified foreign stations on L.S. and 'phones.

On the high wavelengths results are poor at present. Daventry very weak on L.S., others just heard on 'phones. Shall try a different coil and H.F. choke later on.

I hope soon to make the "Monodial" (*Wireless*, Vol. 5, No. 11).

I must thank you and your staff for your most interesting publications and articles, which are so clear and helpful to all interested in wireless work.

Wishing the Radio Press future success,

Yours faithfully,
CECIL J. HARNETT.

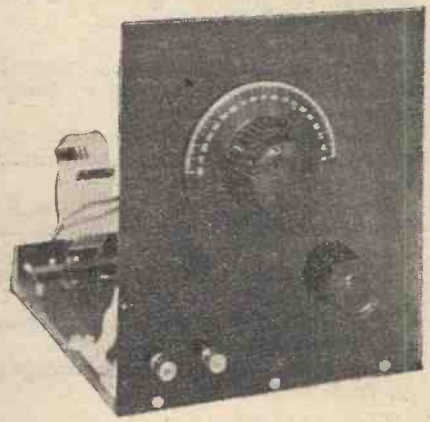
Southampton.

LISTEN TO AMERICA DIRECT

A SINGLE-VALVE SHORT-WAVE SET

By A. V. D. HORT, B.A.

A simply constructed short-wave set, covering a wide range of wave-lengths, with which you may expect to hear the short-wave American broadcasting stations and many other interesting transmissions.



THE relaying of the greeting to the B.B.C. from America during one of the B.B.C. birthday week programmes must have come as quite a pleasant surprise to a number of listeners. Admittedly the words of the speaker were not so clear and free of extraneous noises as those of the London announcer. Nevertheless the speech was perfectly intelligible. For the purpose of this relay the station 2XAF, one of the short-wave transmitters used by station WGY at Schenectady, New York, was picked up at Keston.

Receiving America Direct

Now 2XAF transmits regularly on a wavelength of 32.79 metres, and owing to the considerable carrying power of these short waves, it is quite possible on most nights now to pick up the transmissions from this station direct with a single-valve set. Stages of L.F. amplification may, of course, be added, if it is desired to have greater volume. Another transmission which is available to the short-wave listener is that from KDKA, well-known for some time now. This station, however, is not usually quite so easy to hear well as 2XAF, at any rate in the experience of the writer. The wavelength used by KDKA is somewhere in the neighbourhood of 60 metres.

Points of Design

The design of a short-wave set usually has certain distinctive features, and simplicity should in general be in aim. When a set is called upon

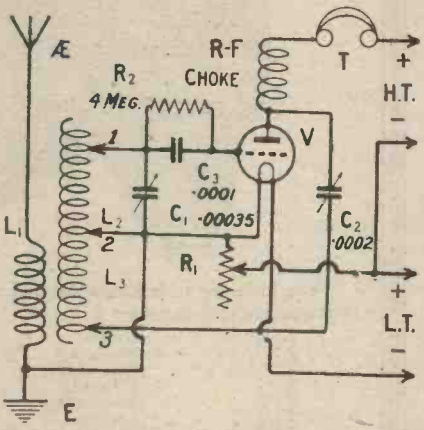
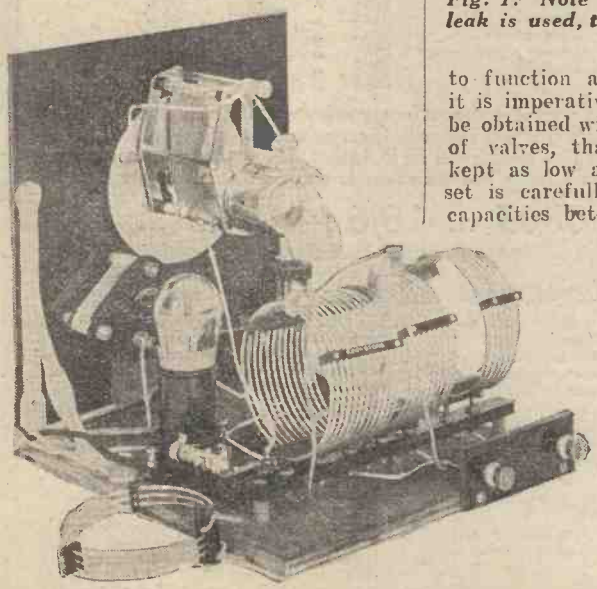


Fig. 1.—Note that a high value of grid leak is used, to give smooth control of reaction.

to function at such high frequencies it is imperative, if good results are to be obtained with the minimum number of valves, that stray capacities be kept as low as possible. Unless the set is carefully arranged, such stray capacities between different parts of the circuit will prevent it from going so far down the wavelength scale as it might. Unsuitable components have also to be avoided, and insulation must be beyond reproach.



The disposition of the coil sockets allows of the coils being inserted in various combinations.

Simplicity

The short-wave single-valve set described in these pages has been kept simple, while at the same time its wavelength range is quite wide. The operating controls comprise one tuning dial and a knob for reaction. The wide range of wavelengths is provided for by means of interchangeable coils, with clips for attaching the connections to them at suitable points. The tuning condenser is of large enough capacity to furnish ample tuning overlap between the different coil sizes, while the use of a slow-motion drive type of component greatly facilitates the required fine control of tuning.

BUILD THIS SET WITH:

One ebonite panel, 9 in. by 8 in. by 3/16 in.
One baseboard 8 in. by 9 in.
Two panel brackets. (Carrington Mfg. Co., Ltd.)
One .00035 S.L.F. slow motion variable condenser. (Ormond Engineering Co., Ltd.)
One .0002 variable condenser. (Jackson Bros.)
One fixed condenser .0001, type 600 with clips, and leak 4 megohms. (Dubilier.)
One valve holder. (C.E. Precision)
One baseboard mounting filament rheostat. (Lissen, Ltd.)
One H.F. choke. (Varley Magnet Co.)
One set short-wave coils and mount. (Stratton & Co.)
4 terminals.
Piece of ebonite, 3 in. by 1 in., Glazite and flex for wiring.
Approximate cost, £3.

Circuit

The circuit does not call for any particular comment. An untuned aerial coil is coupled to the grid and reaction coils, which consist of one continuous winding. Clips on this latter winding allow of variations in the positions of each of the connec-

(*Continued on page 240*)

The Championship Winner's Recommendation.

MESSRS. S.T., LTD., have received a letter (open to inspection at their Offices) from Mr. R. W. Emerson, the British Amateur who won, in the face of world-wide competition, the championship at the International Exhibition at Amsterdam. This letter is of extreme interest to "The Wireless Constructor" readers, because it bears eloquent testimony to S.T. valves and further offers readers the opportunity of hearing them for themselves. You cannot do better than follow the advice of the world's leading amateur and use S.T.s in your Elstree Six, Solodyne, or other set.

Extract from Mr. Emerson's Letter:—

You will, no doubt, be interested to hear the results I have obtained with the new S.T. valves, which I immediately obtained on seeing the announcements. First of all I tried them in the actual Elstree Six with which I won the International Gold Medal at Amsterdam. Using S.T.61, S.T.62, S.T.63, in this order, I obtained with the set results considerably better than those given by other makes I had been using, and that is saying a great deal. I have since tried them in several other sets I have built, including the Solodyne with equal success, and I am frankly delighted with the results, and as the current consumption is so small they are extremely economical. They give really high amplification and are exceptionally pure in reproduction. My Elstree Six has created so much interest that I am having to give demonstrations to friends, etc., and I shall be happy to let anyone hear it working with S.T. valves if an appointment is made.

3, St. Ann's Terrace, St. John's Wood, N.W.8. **R. WALDO EMERSON.**

1 VALVE.

		2 *Volt.*	4 *Volt.*	6 *Volt.*
Detector ..	1	S.T. 22	S.T. 41	S.T. 61
Dual valve and crystal ..	1	S.T. 23	S.T. 42	S.T. 62

2 VALVES.

Detector and L.F. (transformer)	1	S.T. 22	S.T. 41	S.T. 61
	2	S.T. 23	S.T. 42	S.T. 62
Detector and L.F. (resistance or choke)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 23	S.T. 42	S.T. 62
H.F. and detector	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 41	S.T. 61
Dual, crystal and L.F. (e.g. S.T. 100, Elstreflex, etc.)	1	S.T. 23	S.T. 42	S.T. 62
	2	S.T. 23	S.T. 42	S.T. 62
Dual and detector (e.g. twin valve)	1	S.T. 23	S.T. 42	S.T. 62
	2	S.T. 22	S.T. 41	S.T. 61
Two duals and crystal (e.g. Distaflex)	1	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
	2	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63

3 VALVES.

Detector & 2 L.F. (both trans.)	1	S.T. 22	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 42	S.T. 62
	3	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
Detector and L.F. (choke or resistance followed by transformer)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 42	S.T. 62
	3	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
Detector & 2 L.F. (two resistances or two chokes)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
H.F., detector, L.F. (transformer), e.g. Spanspace Three. All Concert. Simplicity Three	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 41	S.T. 61
	3	S.T. 23	S.T. 42	S.T. 62

3 VALVES—*continued.*

		2 *Volt.*	4 *Volt.*	6 *Volt.*
H.F., detector, L.F. (resistance or choke)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 23	S.T. 42	S.T. 62
2 H.F. and detector	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 41	S.T. 61
Dual, detector, L.F. (e.g. 3 Valve Dual)	1	S.T. 23	S.T. 42	S.T. 62
	2	S.T. 22	S.T. 41	S.T. 61
	3	S.T. 23	S.T. 42 or S.T.43	S.T. 62 or S.T.63
H.F., dual and detector (e.g., Mewflex)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 23	S.T. 42 or S.T.43	S.T. 62 or S.T.63
	3	S.T. 22	S.T. 41	S.T. 61

4 VALVES.

H.F. detector, 2 L.F. (transformer) e.g., Monodial, Four-valve Family	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 42	S.T. 62
	4	S.T. 23	S.T. 42 or S.T.43	S.T. 62 or S.T.63
H.F., detector, 2 L.F. (resistance or choke followed by transformer) (but in Everyman Four the 3rd valve should be same as 2nd)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 42	S.T. 62
	4	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
H.F., detector, 2 L.F. (transformer followed by resistance or choke)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 22	S.T. 41	S.T. 61
	3	S.T. 22 or S.T. 21	S.T. 42 or S.T. 41	S.T. 62 or S.T. 61
	4	S.T. 23	S.T. 42 or S.T.43	S.T. 62 or S.T.63
2 H.F., detector, L.F. (transformer)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 41	S.T. 61
	4	S.T. 23	S.T. 42	S.T. 62
2 H.F., detector, L.F. (resistance or choke)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 23	S.T. 42	S.T. 62

5 VALVES.

2 H.F., detector, 2 L.F. (transformer), e.g., Solodyne, Magic Five, 1927 Five.	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 41	S.T. 61
	4	S.T. 22 or S.T. 23	S.T. 42	S.T. 62
	5	S.T. 23	S.T. 42 or S.T.43	S.T. 62 or S.T.63

5 VALVES—*continued.*

		2 *Volt.*	4 *Volt.*	6 *Volt.*
2 H.F., detector, 2 L.F. (resistance or choke followed by transformer), e.g., Nighthawk	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 22 or S.T. 23	S.T. 42	S.T. 62
	5	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
2 H.F., detector, 2 L.F. (transformer followed by resistance or choke) e.g. Special Five	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 22	S.T. 41	S.T. 61
	4	S.T. 22	S.T. 41 or S.T. 42	S.T. 61 or S.T. 62
	5	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63
2 H.F., detector, 2 L.F. (two resistances, two chokes or one of each either way round)	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 22 or S.T. 21	S.T. 41 or S.T. 42	S.T. 61 or S.T. 62
	5	S.T. 23	S.T. 42 or S.T. 43	S.T. 62 or S.T. 63

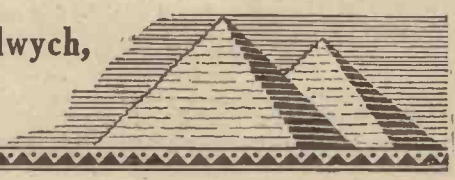
6 VALVES.

3 H.F., detector, 2 L.F. (transformer) grid rectification e.g., All British Six	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 22	S.T. 41	S.T. 61
	5	S.T. 22 or S.T. 23	S.T. 42	S.T. 62
	6	S.T. 23	S.T. 43 or S.T. 42	S.T. 63 or S.T. 62
3 H.F., detector, 2 L.F. (transformer) anode bend rectification, e. g., Elstree Six	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 23	S.T. 42	S.T. 62
	5	S.T. 23	S.T. 42	S.T. 62
	6	S.T. 23	S.T. 43 or S.T. 42	S.T. 63 or S.T. 62
3 H.F., detector, 2 L.F. (resistance or choke followed by transformer), grid or anode rectification	1	S.T. 21	S.T. 41	S.T. 61
	2	S.T. 21	S.T. 41	S.T. 61
	3	S.T. 21	S.T. 41	S.T. 61
	4	S.T. 21	S.T. 41	S.T. 61
	5	S.T. 22 or S.T. 23	S.T. 42	S.T. 62
	6	S.T. 23	S.T. 43 or S.T. 42	S.T. 63 or S.T. 62

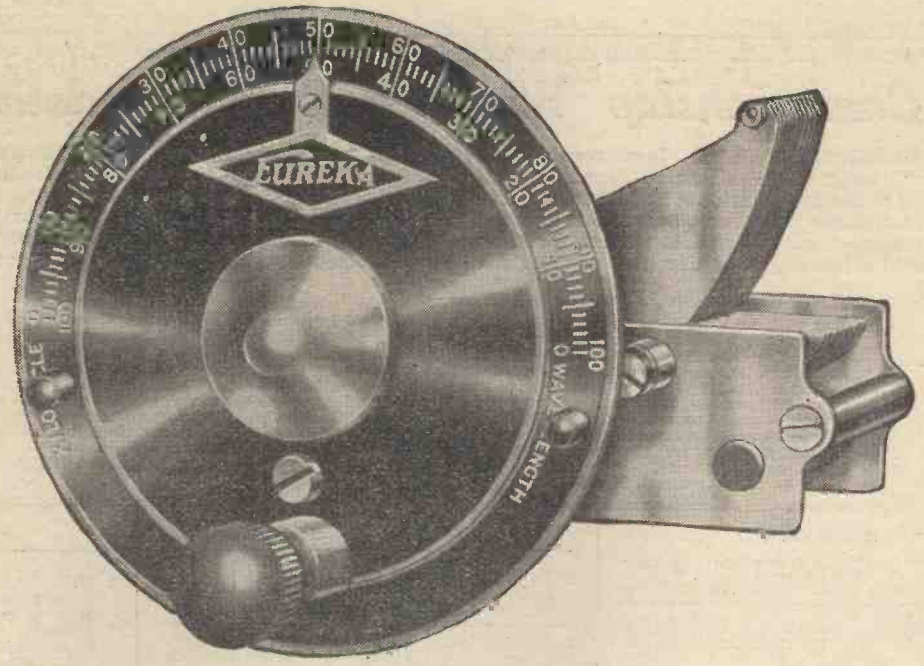
If you are unable to obtain an S.T. valve from your local retailer write direct to us or call. All valves will be sent by post and insured by us against breakage. C.O.D. orders executed on receipt of post-card.

See also pages 182 and 221.

S.T. LTD., 2, Melbourne Place, Aldwych,
LONDON, W.C.2.
(Next to Australia House.)



In two sizes:
·0003 mfds. ... 14/6
·0005 mfds. ... 15/6
Vernier Dial as illustrated 4/6 extra.



Is there anything so absurd?

—under the new Geneva plan the ordinary Condenser covers 39 Wavelengths between 0 and 10 on the dial, but only 2 wavelengths between 90° and 100°.

WITH Jazz Bands and Grand Opera almost inextricably intermixed in an overcrowded ether no wonder the new Geneva wavelength plan was necessary! What is this plan and how does it affect you?

Briefly, the Geneva plan is to apportion a share of the ether to all countries wishing to Broadcast. Not every country can obtain as many wavelengths as it requires. Great Britain receives nine exclusive wavelengths. But—and here is the great point to bear in mind—there is to be a separation of 10 kilocycles between each wavelength. Not 10 metres but 10 kilocycles. Metres have been ignored in these calculations. The Eureka Condenser also abandons metres and deals with kilocycles. It gives orthocyclic tuning. That is to say, it gives an even separation between wavelengths no matter where they may appear on the dial—crowding is impossible. With the Eureka Orthocyclic 10 degrees cover 10 wavelengths precisely—no more, no less. From end to end of the dial therefore 100 wavelengths each of 10 kilocycles separation are covered.

The Eureka gives you real selectivity

But compare this new standard of performance with the ordinary condenser. From 0 to 10—bearing in mind of course, that all other conditions are unaltered—the ordinary condenser covers 39 wavelengths. Practically 4 wavelengths to every degree on the dial, while at the opposite end of the scale the last ten degrees will barely span 2 wavelengths.

How absurd! Such a jostling of stations just where we need the most effective separation.

The new conditions of Broadcasting demand the use of a Eureka Orthocyclic with its even separation, step by step, all the way up the scale.

Instal these magnificent Condensers on your Set now and enjoy real selectivity. The velvety smooth Vernier dial—all metal and therefore a perfect shield—is a pleasure to use. Because gears are eliminated, backlash is impossible, while the superb workmanship of the whole instrument will improve the appearance of any Receiver. Order them from your Dealer without delay.

EUREKA ORTHO-CYCLIC CONDENSER

Listen to America Direct—*continued*

tions to it. The reaction condenser, C_2, must be of sound construction, since contact between its plates will obviously result in short-circuiting the high-tension battery. If any trouble is experienced here, such as noises owing to dust on the plates, a fixed condenser of about .001 capacity may be placed in series with the variable.

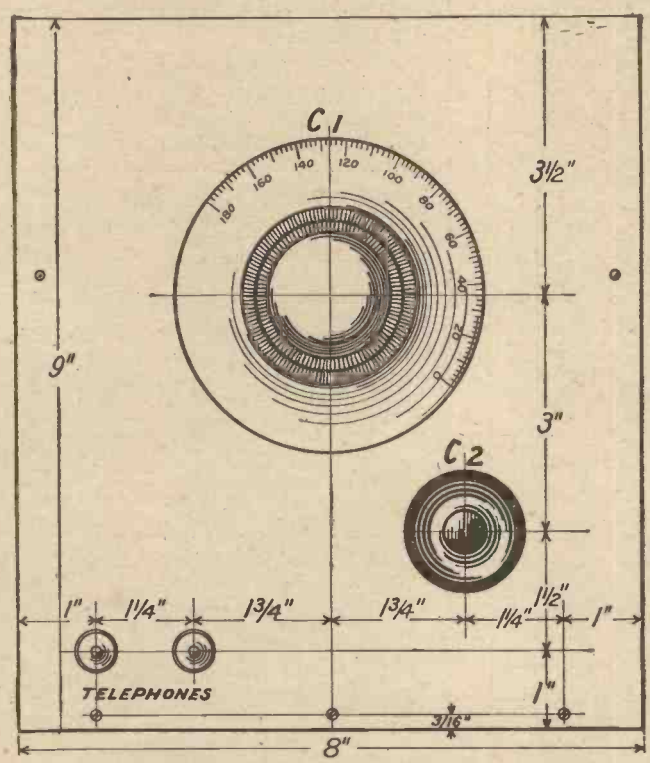


Fig. 2.—The holes required in the panel are few in number. Blueprint No. C1076A.

Components

The list of components required for building the set will be found in the accompanying table. It will be noticed that no cabinet is included in this list. Constructors may obtain a cabinet for the set if they desire to do so, but it is recommended that the set be used normally without one. Apart from the fact that the presence of the wood in close proximity to the coils might detract somewhat from the performance of the set, it would not be so easy to move the coils or to adjust the coil tapping clips inside a cabinet when altering or adjusting the wavelength ranges.

Construction

The construction of the set is not a difficult matter. The baseboard components should be mounted first, including the angle brackets which support the panel. Three bushes are provided by the makers of the coils to hold the coil plug strip away from the baseboard. One of the screws holding the valve holder to the baseboard passes also through the hole at one end of the grid condenser, the latter component being so placed that one of its soldering tags may be secured direct to the grid terminal of the valve holder.

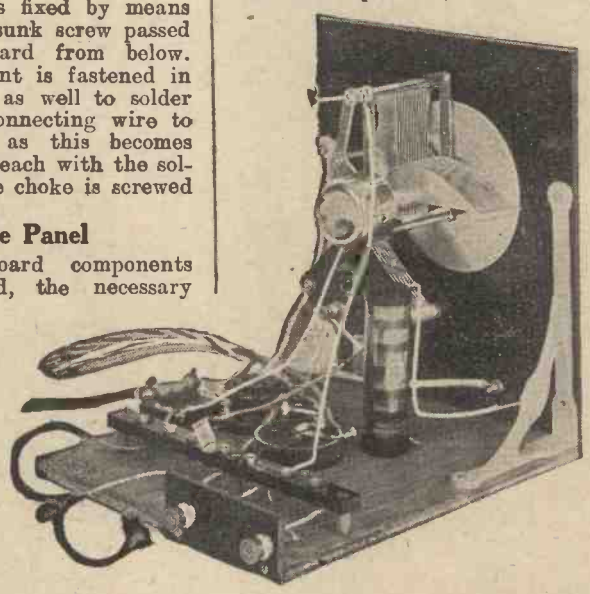
Mounting the H.F. Choke

The H.F. choke is fixed by means of a 4 B.A. countersunk screw passed through the baseboard from below. Before this component is fastened in position, it will be as well to solder a short length of connecting wire to its lower contact, as this becomes rather awkward to reach with the soldering iron when the choke is screwed down.

Fixing the Panel

When the baseboard components have been mounted, the necessary holes should be drilled in the panel for the tuning and reaction condensers, the telephone terminals, and also for the wood-screws along its bottom edge. Before fixing the condensers, attach the panel to the baseboard with three screws, and then, laying the panel face downward, drill the holes for the angle brackets through the holes in the brackets themselves. In the set illustrated on these pages these holes were tapped out, 4 B.A. and cheese-headed bolts inserted from the back. Clearance holes may be drilled if preferred, and bolts countersunk in the panel used, with nuts at the back of the panel to hold it to the brackets.

The flexible leads to the batteries should not be made longer than is necessary.



External Connections

The condensers may now be mounted on the panel, and the wiring carried out. For low-tension positive, low-tension negative, high-tension positive, and high-tension negative, the terminals on appropriate components are used. For the aerial and earth, two terminals are required, mounted on a small piece of ebonite attached to the baseboard.

Operation

The flexible leads required for the battery connections will be noted in the wiring diagram and wiring instructions. When the set is complete, a valve, preferably of the high-impedance type, should be inserted in the holder, the L.T. leads connected to the accumulator, and the rheostat set to the correct position for the valve used. About 40 to 60 volts H.T. may be plugged in, after testing in the usual way to see that the wiring is correct, and that the H.T. is not across the valve filament.

The 6-turn coil may be placed in the aerial position, with the 9-turn and 12-turn coils in series in the other sockets. Place the grid (1) and reaction condenser (3) clips on the end turns of the resulting 21-turn coil and the earth clip (2) at the inner end of the 9-turn portion. With reaction at zero, set the tuning con-

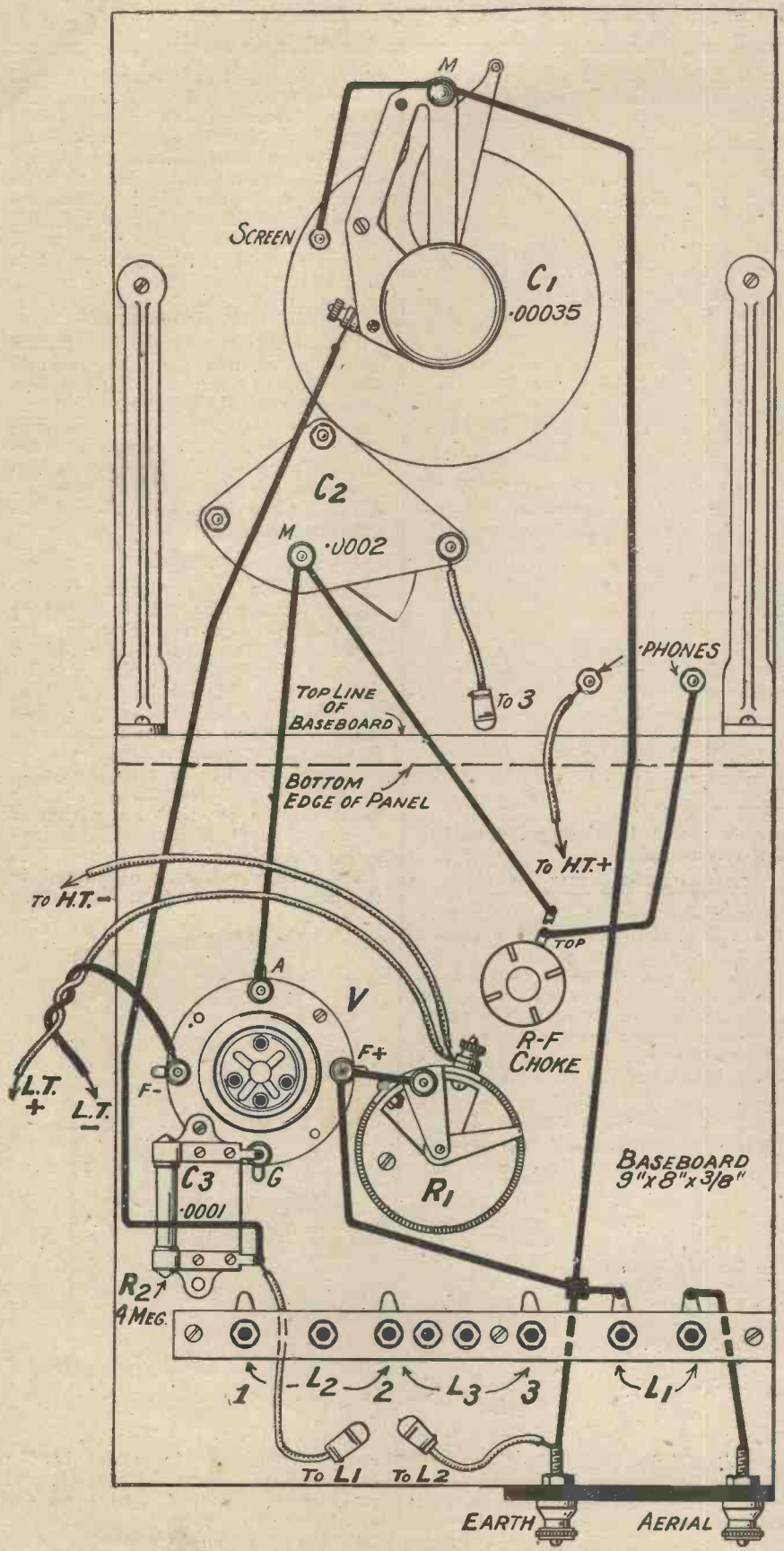


Fig. 3.—The layout is quite straightforward and ample room is allowed for the components. Blueprint No. C1076B.

LISTEN TO AMERICA DIRECT
—continued.

denser to about the middle of its scale. Then slowly increase the reaction condenser, when about one-third of the way round its scale oscillation will commence.

Adjustments

If this is in order, rotate the tuning condenser over its whole scale, and see that oscillation can be obtained at every point. If there are any "dead spots," that is to say, points at which the set refuses to oscillate, this can usually be put right by changing the aerial coil and inserting the smaller one. For the best signal strength, however, when dead spots are not troublesome, the larger size of coil should be used.

When a station has been located on the tuning condenser, an improvement in signal strength can be effected by moving the earth clip towards the reaction clip end of the coil. The setting of the tuning condenser will then be decreased, while the reaction setting will need to be increased slightly.

Some Results

When the receiver was first tested, for example, KDKA on about 60 metres was tuned in with the grid and reaction clips in the positions given above, and the earth clip at seven turns from the reaction clip end. Shifting the earth clip three turns towards the reaction clip produced a noticeable improvement in signal strength, the words of the announcer being quite clear and undistorted. This was during the KDKA "Dinner Hour Programme," which is transmitted between 11.15 p.m. and midnight, G.M.T.

The reaction control should act smoothly for the best results, no click being produced as the set goes in and

(*Concluded on page 279.*)

WIRING IN WORDS.

All directions are given as viewing the set from the back.

Join Aerial terminal to first socket at right end of coil mount.

Join anode contact of valve holder to moving vanes of variable condenser C_2, and to lower end of R.F. choke.

Join top end of R.F. choke to one telephone terminal.

Join a flex lead to the other telephone terminal, and attach a battery wander plug to its free end for connection to H.T. +.

Join one filament contact of valve holder to one terminal of filament rheostat R_1, to Earth terminal, to moving vanes and screen of variable condenser C_1, and to second socket from right end of coil mount.

Join two flex leads to remaining terminal of R_1, attaching a battery wander plug to one for connection to H.T. −, the other being for connection to L.T. +.

Join a flex lead to the remaining filament contact of valve holder, for connection to L.T. −.

Join grid contact of valve holder to one side of fixed condenser C_3 and leak R_2.

Join other side of C_3 and R_2 to fixed vanes of C_1.

Join flex leads with clips to the following points:—(1) Side of C_3 and R_2 which is connected to C_1; (2) Earth terminal, and (3) Fixed vanes of C_2.

SETS THAT YOU CAN BUILD

"AUSTRALIA ON TWO VALVES"

SIR,—With reference to your request for reports of American transmissions on the "Australia on Two Valves" set, described by Percy W. Harris, M.I.R.E., in the August issue of THE WIRELESS CONSTRUCTOR, I beg to report that the American Station WGY was logged last evening at 22.40 hrs. B.S.T. I enclose a detailed report. I made the set as specified by you with the exception that a different H.F. choke was used from the one specified; I have had it in use some four weeks now. The only difficulty experienced was with the reaction, which would "plop"; but this has been cured by using a 4-megohm grid leak, instead of the 2-megohm, so that the reaction is delightfully smooth.

Some more articles in your various periodicals on the short waves would, I am sure, be very well received.

Thanking you for your past courtesies, also for many happy and instructive hours.

Yours faithfully,
N. JONES.

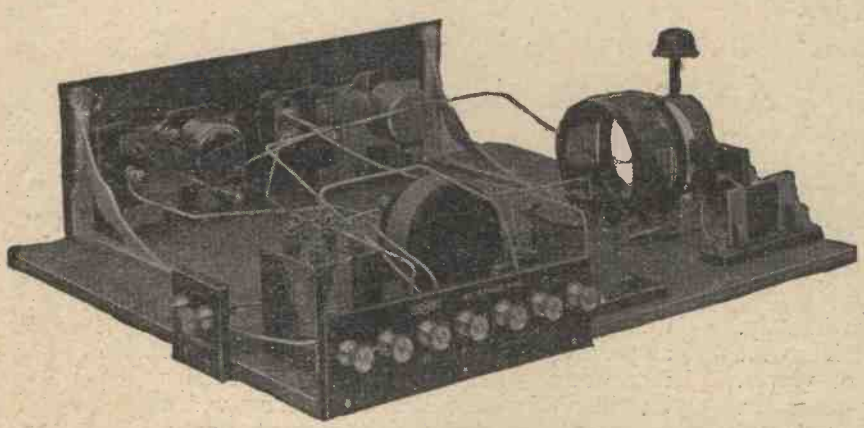
The reception from WGY was as follows:—September 27, 1926. 22.40 hrs. B.S.T. Aerial—40 ft. twin, 30 ft. high. Earth—buried sheet of zinc, with 25 ft. of wire.

The Station was tuned in at the exact moment that the announcer was opening the programme. He stated that they were about to broadcast a special programme for the benefit of British listeners, to enable them (WGY) to receive reports. Then followed the wavelength, 32.79 metres. Afterwards a short programme of music followed, including syncopated songs and dance music. The Station finally closed down at 22.59 hrs. B.S.T., the announcer's concluding remarks being: "We are now closing down. It is now 4.59 p.m. Eastern Standard Time. Good afternoon, everybody."

All announcing and the items were perfectly clear (crystal strength), but subject to a small amount of fading.

Nailsworth, Glos.,
September 28, 1926.

P.S.—My "stud" of sets includes the "Midget," one of your crystal sets, and one of your L.F. amplifiers.



The "Australia on Two Valves" short-wave set, described in the August issue of "The Wireless Constructor."

* * *

SIR,—I have constructed the "Australia on Two Valves" set as given in the August issue of THE WIRELESS CONSTRUCTOR, with a few alterations in components used. My short-wave coils are home-made, and all three coils are made up the same way with large gauge wire. I understand that you are anxious to have reports on this set. I have not heard KDKA, perhaps on account of my not having the correct size coils in use.

My aerial is a standard 100 ft., 35 ft. high, and earth a copper sheet about 2 ft. 6 ins. by 2 ft., sunk about 5 ft. in the ground. I am using a BTH power valve B4 for detector, and a Marconi DE8LF for amplifier.

I must say it is a very interesting little set, especially to those who are well up in Morse.

Wishing THE WIRELESS CONSTRUCTOR every success.

Yours faithfully,
E. W. H. HELPS.

Bath.

[Our correspondent sends a list of 35 stations heard on the set, between approximately 38 and 50 metres.—ED.

* * *

SIR,—I have constructed the two-valve short-wave receiver ("Australia on Two Valves") described by Percy W. Harris, M.I.R.E., in the August WIRELESS CONSTRUCTOR. You may be glad to hear the results.

The coils, by the way, are home-made, being self-supporting, of No. 14 S.W.G. bare copper wire.

Amateur Morse stations come tumbling in from all quarters—Brazil, France, Germany, Italy, U.S.A., and, not least, two Australians.

The "star" performance was on October 3. At 12.30 a.m. (Summer Time) I heard the station 2XAF, Schenectady, commence their evening's programme. The wavelength as announced was 32.79 metres. The whole of the programme, until the station closed down at 2.40 a.m., was heard perfectly.

At 2.40 the announcer gave out that the station was closing down until the time signal at 9.30 Eastern Standard Time.

2XAF joined with Stations WGY, WFBL, WHAM, etc., for a relayed programme from Buffalo Theatre. A special time signal (at 7.12 E.S.T.) in connection with an expedition in Brazil was also broadcast.

My aerial is a standard PMG, 40 ft. high at the free end. The earth is a buried plate. There was very little fading, and atmospherics were not troublesome.

Yours faithfully,
E. R. WESTLAKE.

Shrewsbury.

THE "SCREENED COIL SINGLE-VALVE" SET

SIR,—May I be allowed to express my appreciation of the "Screened-Coil Single-Valve" Set, described by Mr. W. H. Fuller in the September WIRELESS CONSTRUCTOR? I should like to see still more sets employing screened coils, for the selectivity obtainable from this single-valve receiver is really astounding. Although I am within a mile or so of the Birmingham station, I very seldom employ the wave-trap at all. I have received nearly thirty stations already.

Yours faithfully,
K. C. BARKER.

Birmingham.

THINGS EVERY OPERATOR SHOULD KNOW

By G. P. KENDALL, B.Sc.

Calculating Fixed Resistors—Dangers of Excessive H.T.—Using a Super-Power Valve.

MODERN practice is tending more and more in the direction of the use of interchangeable fixed resistors for the filament control of valves, and while it is beyond question that this method possesses great advantages in the way of compact lay-out and exact control, it involves certain difficulties in such cases as the working of two- and six-volt valves in the same set which require consideration.

Easily Solved

The difficulty is not a serious one, and once the user has worked out the solution for himself the matter becomes very simple, with a pleasing degree of exactitude of control which is a real safeguard to the newer types of "invisible glow" dull-emitters.

The amount of arithmetic involved is slight, since the calculation solely concerns the current through and the voltage drop across the fixed resistor. The first step is to find the voltage which must be dropped across the resistor to bring the supply down to the correct voltage across the valve filament. To do this, simply subtract the rated voltage of the valve from the voltage of the accumulator; thus, a two-volt valve used with a six-volt accumulator gives a drop of four volts across the resistor, and the next proceeding is to find the value of resistance which will pass the desired current when four volts are applied across it.

How to Calculate It

Ohm's law will serve our purpose, and we require to use the form which states that the resistance is equal to the voltage divided by the current. In the case considered the filament current may be, say, a tenth of an ampere. Dividing four by one-tenth we obtain forty ohms for the value of the necessary fixed resistor, and the same process will give us the required information for each valve in the set.

"Invisible Glow" Valves

Mention of "invisible glow" valves reminds me that there is a warning which should be strongly impressed upon all new users of these types. With these valves it is really impossible to use the rough-and-ready method of judging by eye when the correct filament temperature has been reached. A very strict rule should therefore be made never to use these valves with an accumulator of much higher voltage than the filament rating with a variable filament rheostat unless some definite precaution can be taken to lessen the risk of overrunning.

Dangerous

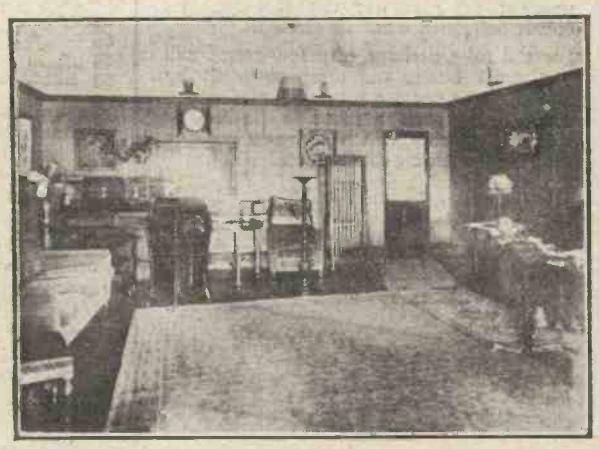
For example, to run an "invisible" type of filament rated at 2 volts or even 3.8 volts from a 6-volt battery with a variable resistance and no means of checking the voltage applied to the valve is simply asking for trouble. If a variable rheostat must be used in such a case, probably the safest course to adopt is to buy or borrow a reasonably good voltmeter, connect it directly across the filament terminals of the valve socket itself, and then turn up the rheostat carefully until the meter shows just the figure recommended by the makers of the valve *and no more*. Note the exact setting of the rheostat, and be careful never to exceed this value in future. Incidentally, does not this recommendation of a rather elaborate procedure constitute a strong argument in favour of a properly-calculated fixed resistor?

Excessive H.T.

Another valve point over which I myself have gone wrong in the past and which may be a stumbling-block to others concerns the amount of H.T. which it is safe to apply the ordinary type of small power valve. The makers of these valves usually specify a maximum value of 120 volts, but it is a temptation to use rather more at times when one is trying to make a valve of this type do duty for one capable of handling a bigger output.

Caution Needed

No doubt the figure given by the makers is one which allows a reasonable margin of safety, and it can be exceeded in moderation, especially for short periods, without harm, but the use of high voltages for any length of time may easily result in a spoiled valve. Therefore it is evident that the only safe way of handling a large output correctly is to use one of the larger types of power valve with a sufficiently long available curve for the variations of grid voltage which are applied to it.



The studio at the 3LO, Melbourne, Station is attractively furnished, as this photograph shows.

THINGS EVERY OPERATOR SHOULD KNOW

—*continued from page 243*

Super-Power Valves

When these newer types of super-power valves are used, however, there are again pitfalls for the novice, and some hints may perhaps be helpful. In the first place, the user must radically revise his ideas of grid bias and its magnitude, for these valves require a very much larger amount to bring their anode current down to reasonable proportions and to make full use of the virtues of this type. Actually, something in the neighbourhood of 20 volts will generally be needed when working with the maximum permissible H.T. voltage.

A Heavy Load

Even then the anode current is still fairly large, and it is really not satisfactory, in my experience, to attempt to use these valves with anything but the larger-sized H.T. batteries. I am at present using one of them with the maximum H.T. voltage which seems safe, and the anode current is 14 milliamps.

Probably this is a little more than is necessary, but it gives an idea of the sort of demand which the H.T. battery must be prepared to meet, and it is evident, when the consumption of the rest of the set is remembered, that the ordinary small-cell H.T. battery would be seriously overworked. Personally, I always use H.T. accumulators for such work.

A READER BUILDS THE 'SPANSPACE THREE'

SIR,—I am writing to thank you for the design of "The Spanspace Three" in the November issue of THE WIRELESS CONSTRUCTOR. Since the publication of your "Star" programme I have wanted to try my hand at one of them, but have been deterred by the cost. The "Spanspace Three," however, being so reasonable, I built it, and completed it over the week-end. The first station I tuned in was Toulouse, and I then got London, Bournemouth, Newcastle, and nine or ten Continental stations (which I did not stop to identify) in about half an hour. The volume is greater and the tone better than detector and two L.F.s which I built the new set to replace.

Yours faithfully,
H. B. EVERSHED.

Woking.

HOW TO USE A WAVEMETER

By J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

One of the most useful accessories which the listener can possess is a wavemeter. Such an instrument is simple to use and invaluable as a guide to unknown stations and as an aid to tuning them in without tedious searching. Mr. Reyner describes here how a buzzer wavemeter works, how it should be used, and how by the use of a suitable circuit it will give quite sharp tuning.

The circuit of the "Razor-Sharp Wavemeter" shown here is discussed in these pages.

THERE is an increasing demand to-day for the use of wavemeters among wireless experimenters. Even those who possess receivers with which they are well satisfied and who are not contemplating any change can nevertheless find considerable use for an instrument of this type. It will be of interest, therefore, to review the mechanism of a wavemeter, and how it can be used. It will readily be seen that there are a variety of uses to which a wavemeter can be put, and that it repays its value time and time again in actual practice.

How It Works

A wavemeter is to all intents and purposes a small miniature transmitter. It produces trains of damped oscillations similar to those radiated from a spark transmitter. The powerful interference caused by a spark transmitter is only too well known. A buzzer wavemeter produces

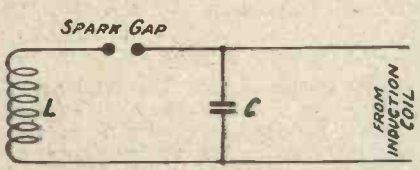


Fig. 1.—The elementary circuit of a spark transmitter.

a similar sort of effect, only on a much smaller scale, so that the signal produced is not unpleasant, but is nevertheless easily picked up and tuned in.

Types

Wavemeters may be of two kinds. There is first of all the buzzer wavemeter, which consists essentially of a tuned circuit energised by means of a simple buzzer. Secondly, there is the heterodyne wavemeter, which produces continuous oscillations, sustained by means of a valve. Although the uses of this latter instrument are many and varied, it requires for its operation the presence of high- and low-tension batteries, not to mention the valve, so that for the average purpose it is not a convenient instrument. In the majority of cases, therefore, the former type of instrument, namely the buzzer wavemeter, is of more general service.

A Simple Transmitter

The simplest type of wireless transmitter consists of a condenser and a coil. Arrangements are made to charge the condenser to a high voltage and then to permit it to discharge through a coil, which it does in an oscillatory fashion. That is to say the current first of all discharges through the coil, but owing to the inductance thereof it does not stop flowing when the condenser is completely discharged. The effect, therefore, is that the condenser charges up to some extent in the opposite direction, overshooting the mark as it were.

When this cycle of affairs is finished the condenser is charged, but in the opposite direction. It therefore will discharge again, producing a pulse of current in the opposite direction. This again overshoots the mark, and so the condenser is charged up once more in the same direction as at first. This continual charging and discharging of the condenser proceeds for some time, the successive charges becoming smaller and smaller owing to the loss of energy due to the passage of the current through the coil, and other factors, so that in time the oscillation dies away.

Actually something like 10 or 12 discharges take place in an ordinary circuit, but owing to the extremely high frequency of these discharges the whole operation only occupies something like one fifty-thousandth of a second.

The Spark

Now in a spark transmitter the condenser is charged up to a very high voltage by means of an induction coil or a transformer. The coil is not connected directly across the condenser but there is a spark gap in series, as shown in Fig. 1. When the condenser voltage reaches a certain limit, the insulation of the spark gap breaks down and the current flows through the coil and across the gap, producing a spark.

It is by this means that the periodical charging of the condenser

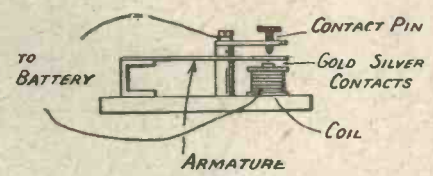


Fig. 2.—The essential parts of a buzzer suitable for a wavemeter are shown in this drawing.

is obtained, the discharge occurring, as we have just seen, when a critical voltage is reached. The discharge takes place very rapidly, so that the apparatus is in a condition of equilibrium again when the condenser is next charged up, and we obtain one train of oscillatory current every time the condenser is charged.

Wavemeter Operation

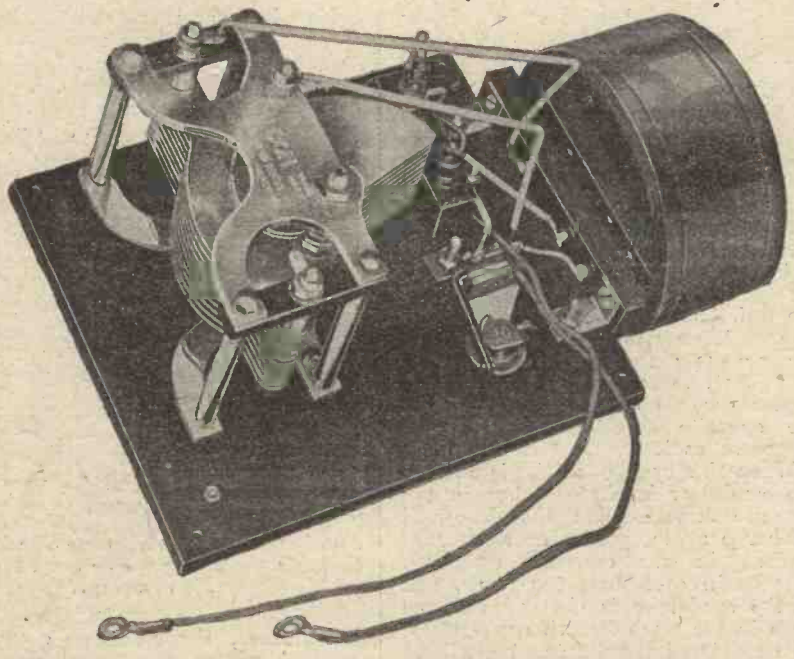
Now a buzzer wavemeter is designed to produce a similar effect in a nearly

How to Use a Wavemeter—*continued*

similar manner. In the first place we must arrange to charge the condenser of the circuit periodically and to allow it to discharge through the coils. The charge and discharge is arranged in a spark transmitter by means of a spark gap which automatically ensures that the condenser shall cease to be charged up, and shall discharge through the coil when the voltage reaches a certain limit. This arrangement is not convenient in a buzzer wavemeter, and a mechanical change over is arranged for. This is brought about by the medium of the buzzer itself, which is an instrument carrying a vibrating armature, somewhat similar to the mechanism of an ordinary electric bell.

The Buzzer

The buzzer consists of a coil of wire, an armature which is attracted thereby, and a contact pin. A diagram of the arrangement is shown in Fig. 2. When the current is switched on, it passes through the contact pin, through a contact strip carried on the magnetic armature of the buzzer, and then through the coil of the buzzer back to the battery. The magnetic effect of the coil attracts the armature



The construction of a buzzer wavemeter is not a complicated matter, since few components are required.

or moving portion of the buzzer, and pulls it away from the contact pin. The circuit is thus broken, and the attraction on the buzzer armature therefore ceases.

Frequency

The springiness of the armature then causes it to return to its original position where it again comes up against the contact pin so making circuit once more. The whole cycle is then repeated, so that the armature is continually pulled away from and allowed to return to the contact pin. In a buzzer the armature is made small and fairly stiff, the result being that it has a very high natural frequency, and will vibrate a large number of times per second. The actual frequency of vibration varies in different buzzers from between 200 and 1,000 cycles per second.

Instruments of this type can be purchased quite cheaply. Simple types of buzzer are usually provided with a fixed note, whereas the better and more reliable types are usually provided with an adjustment whereby the note of the buzzer can be altered by varying the tension on the armature. It does not follow that a buzzer having a variable note is necessarily more reliable, but the better-class buzzers are often provided with a variable note.

Points of Design

The design of a buzzer is a matter of some skill in order that a clear and steady note shall be obtained. Owing to the incessant making and breaking of the contact, platinum or gold-silver contacts have to be provided in order that a clean contact shall be ensured every time. Moreover, the form of the contact has a great deal to do with the steadiness of the note, much depending upon the freedom with which the armature itself is allowed to vibrate, and for this reason some form of spring contact is usually to be desired, rather than a definite stop which pulls the buzzer armature up with a jerk. These points, however, are rather outside the scope of the present discussion, but are inserted to indicate why such widely differing

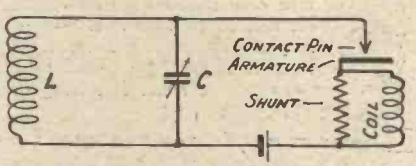


Fig. 3.—A circuit sometimes used in buzzer wavemeters.

prices rule for buzzers generally. It will usually be found that a good deal of exasperation and temper can be saved by purchasing a good instrument.

Circuit

Now an instrument such as this can be used to set up trains of waves in a similar manner to a spark transmitter by utilising a circuit, such as is shown in Fig. 3. Here it will be seen that the buzzer is connected across the variable condenser C. As long as the armature remains in contact with the contact pin, therefore, the voltage of the battery is applied across the condenser C (apart from a small drop in voltage on the buzzer winding). Current, however, flows through the buzzer and the coil L, and results in the armature being pulled away from the contact pin, so breaking the circuit.

Tuning

When this occurs, the condenser C discharges through the coil in oscillatory fashion, so producing a train of waves. Now, as we have seen, the armature of the buzzer is continually being attracted and pulled away from the contact pin several hundred times per second, and at each one of these we get a train of waves set up in the oscillatory circuit LC. Consequently, if we place this instrument near to a wireless receiver, we shall radiate small trains of wireless waves at the particular wavelength to which the circuit LC happens to be tuned.

Wavelength Checking

We can tune in the wireless receiver to this wavelength, and we shall hear a note similar to that of the buzzer. It will be found that this note can be tuned in exactly the same way as an ordinary wireless signal. If we alter the setting of

(*Continued on page* 251.)

HOW TO USE A WAVEMETER

—continued from page 248

the condenser, then we shall vary the wavelength of the wavemeter, and we shall have to tune our receiver to a different position in order to obtain the note of the buzzer once again.

It will be clear at once that this forms a very convenient method of ascertaining the wavelength of a receiver. We can have a standard coil and condenser, and we can calibrate them in conjunction with each other and the rest of the circuit, so that for each setting of the condenser we know exactly what the wavelength of the combination is.

If, then, we wish to tune our receiver to a given wavelength, it is only necessary to set the condenser of the wavemeter to a point corresponding to that wavelength, and at this point the instrument, when the buzzer is switched on, will radiate signals of that exact wavelength. We can then bring the receiver near to the instrument, and tune the receiver in, as previously described.

Another Use

Another use for the instrument is in finding the wavelength of a particular station which has already been tuned in on the receiver. In this case we operate the arrangement in the reverse direction, so to speak. We

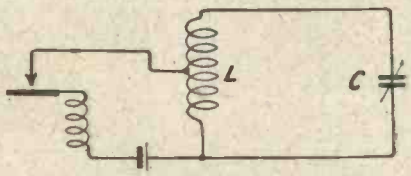


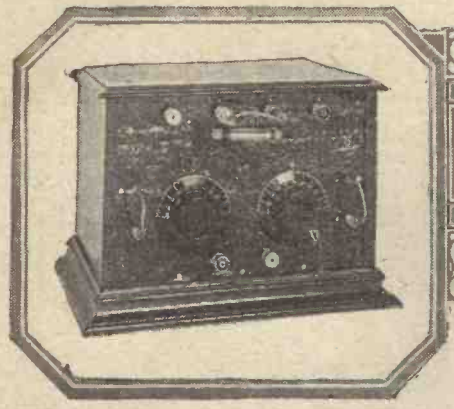
Fig. 4. — By connecting the buzzer across part of the coil only, sharper tuning is obtained.

leave the receiver tuned in, and vary the setting of the condenser C, holding the instrument near the receiver, until the buzzer note is heard. The particular point at which the buzzer signals are loudest is observed on the condenser, and the wavelength at this point read off. This is then the wavelength of the station to which the set is tuned.

Identifying Stations

It will be appreciated that an instrument of this nature is almost invaluable, particularly if it can be constructed in a cheap manner. With the new wavelengths which are at present being tried out, all one's old friends are lost, and it is necessary to find them all again. Conversely, there is a large number of stations which can now be received very well, but which can only be identified as a result of patient waiting,

(*Continued on page 278.*)



CHOOSE YOUR OWN CIRCUIT

A Multiple Circuit Crystal Set

By BRIAN ST. CLAIR

A set which, without undue complication, permits of the testing of a number of circuits, making it possible to discover the best possible arrangement for individual circumstances.

THE multiplicity of circuits which are open to investigation by the crystal user has done much to enhance the popularity of the crystal receiver, apart from any other considerations, such as cheapness, purity of signals, absence of renewals, battery costs, etc., and it is both interesting and instructive to try out several circuits in order to ascertain which particular one meets the needs of the moment. Questions of selectivity are of paramount importance in those situations where interference is experienced,

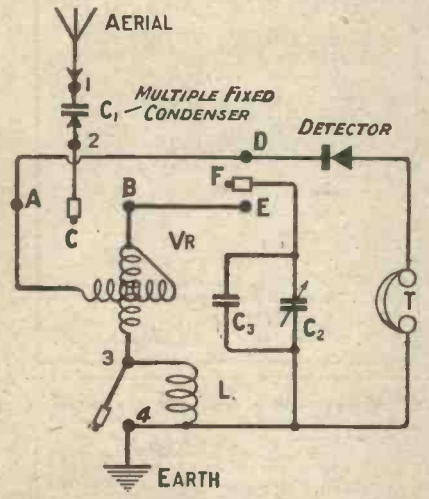


Fig. 1.—From this basic circuit of the set it will be apparent that many circuit variations are available.

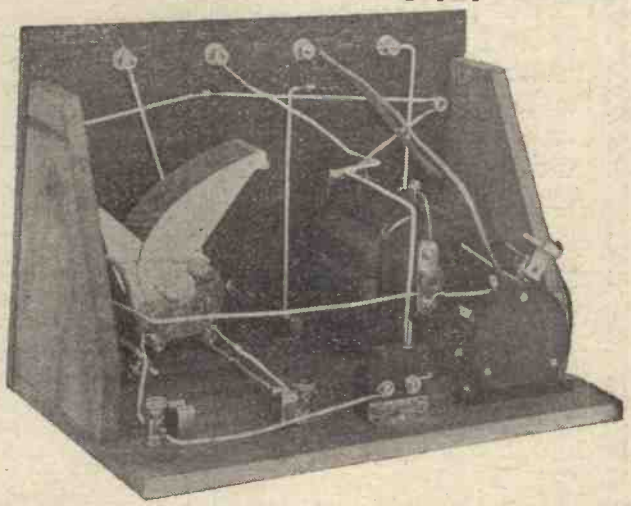
and the demands of the crystal user have not been neglected in this direction.

The crystal receiver described in this article has been designed with a view to providing a set which will enable many circuits to be tried, at least those which can be covered with the aid of a variometer, variable condenser, loading coil and multiple fixed condenser.

Possible Circuits

A short study of the theoretical diagram of Fig. 1 will enable the scheme adopted to become apparent. The aerial can be connected to either of terminals 1 or 2, the former connection bringing into circuit a multiple fixed condenser C_1, which gives a selection of fourteen different capacity values that can be placed in series with aerial. The best value should be determined by experiment, and will depend on the size and type of aerial in use at the time. Aerial terminal 2 is brought out to a flexible lead and plug C, which can be inserted into one of two sockets.

The socket marked A is joined to one side of the moving coil of the variometer, while B makes connection with the junction of the fixed and moving coils. The remaining side of the fixed coil passes to the earth terminal through a loading coil L_1, joined to terminals 3 and 4, which can be short-circuited by a link consisting of a flexible rubber-covered wire with two plugs.



The wooden sides to the baseboard take the place of metal angle brackets.

Wavelength Ranges

One side of the variable condenser is joined to another flexible lead, terminating in a plug F, so that it can be joined across the whole of the variometer (plug into D) or only across the fixed coil (plug into E). In addition, provision is made for inserting various fixed condensers (C_3) across C, in order to increase the range.

Reception of the local station or Daventry is possible with one of several circuits, the receiver being simple to operate, since the change over from one circuit to another is effected with ease.

If an exact duplicate of the set is desired, the accompanying list of components and materials employed should be referred to, but readers can bear in mind that substitutes may be made where desired. The Eelex terminals, plugs, and sockets are admirably adapted for the desired flexibility to enable the alteration of circuits to take place rapidly, but Clix wander plugs and sockets will also serve for the purpose.

Construction

The initial task to be undertaken in the construction of this receiver is the drilling of the panel, and for this purpose reference must be made to the drilling diagram of Fig. 3. The panel components can then be fixed in position, and a large proportion of the wiring undertaken before the baseboard—which in this particular case had wooden side brackets—is screwed to the panel. The wiring should then be completed according to the wiring instructions.

Easy Wiring

For the benefit of those constructors who do not feel at home with the soldering iron, it will be interesting to note that only at two points have I used solder—*i.e.*, at the junctions to the crystal detector screws.

Even this soldering can be avoided if longer screws are employed. The flexible wire passing through the bushed holes C and F in the panel

Choose Your Own Circuit—*continued*

should be just long enough to enable the terminating plugs to be inserted into sockets A or B and D or E respectively. The appropriate panel transfers can then be affixed to the panel in the usual manner, thus completing the construction of the receiver.

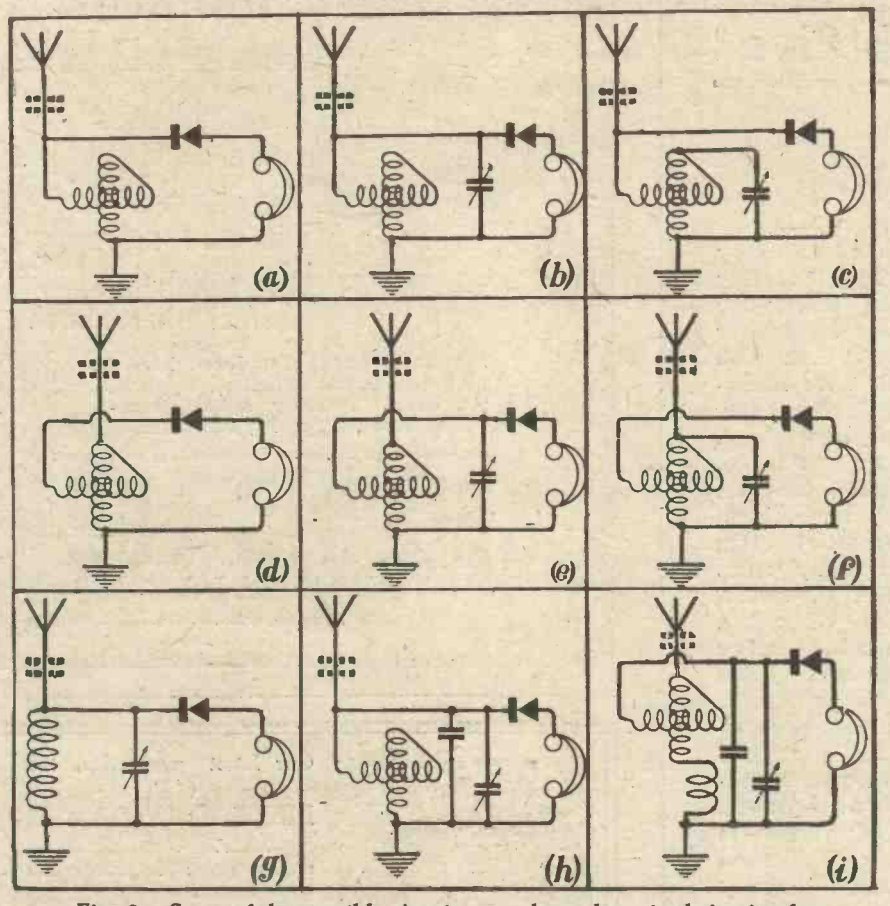


Fig. 2.—Some of the possible circuits are shown here in their simplest form. The lettered and numbered diagram of Fig. 1 may be used as a key to these circuits, together with the instructions in the text.

BUILD THIS SET WITH—

One "Trolite" panel (mahogany finish), 10 in. by 7 in. by ¼ in. (F. A. Hughes & Co., Ltd.)

One cabinet to suit, and baseboard 6 in. deep. (Pickett's Cabinet Works.)

One .0005 ultra low loss S.L.F. variable condenser. (Formo Co., Ltd.)

One variometer. (Claude Lyons.)

One multiple fixed condenser. (C. A. Vandervell & Co., Ltd.)

One baseboard mounting coil holder. (Burne-Jones & Co., Ltd.)

One crystal detector. (Watson Jones, Ltd.)

Two fixed condensers, .001 and .002, with one pair of clips. (L. McMichael, Ltd.)

Six T2 L.C. terminals, marked "Aerial" (2), "Earth," "'Phones" (2), and one with plain top. Two T2 S. terminals, six sockets and four T14 plugs. (J. J. Eastick and Sons.)

One spring clip. (Peto-Scott Co., Ltd.)

Radio Press panel transfers.

Glazite, rubber-covered flex and wood screws. Approximate cost .. .. £4.

We now come to the testing operations, and in order to see that the set is working satisfactorily, the easiest plan will be to arrange the circuit as a simple variometer receiver, as indicated at (a) in the composite diagram, Fig. 2, given on this page. This is done by plugging C into A, shorting 3 and 4, and leaving F disconnected. Connect the aerial to terminal No. 2 in the first place, and slowly rotate the variometer dial until signals are heard, and then adjust the crystal so that it works on a sensitive spot. Now try the effect of inserting the multiple fixed condenser C, in series with the aerial, by connecting the aerial to A, and adjusting the spring clip so that various capacity values are employed. Retune each time, and thus ascertain which value gives the best signal strength.

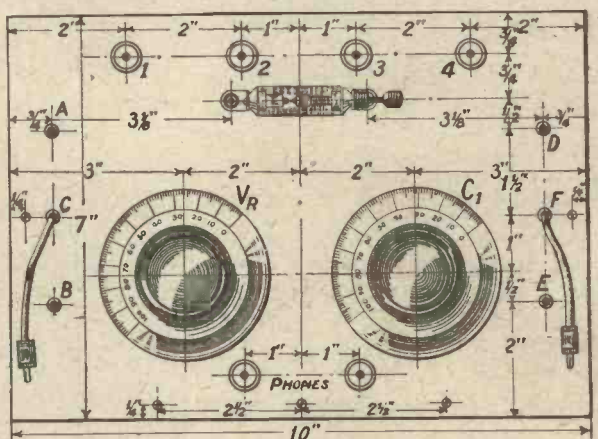


Fig. 3.—The dimensions for the symmetrical panel layout may be taken from this scale drawing. Blueprint No. C1077A.

Further Experiments

Another experiment which will no doubt give interesting results is to find the best combination of capacity and inductance which suits your own particular aerial. This should first be tried with diagram (b), the only alteration from the previous circuit being the addition of the variable condenser, C_2 in parallel with the variometer, effected by plugging F into D.

With the aerial initially joined to No. 2 terminal, tune in the local station with the minimum capacity and maximum inductance, and note the signal strength. Now increase the capacity slightly, and reduce the inductance correspondingly, and again note the signal strength. Repeat this for several readings, and then insert various values of C_1 in series with the aerial, changing the aerial connection to No. 1 terminal, and repeat the process. In this way you can ascertain the combination best suited to your aerial in order to give maximum signal strength.

The circuit of diagram (c) should also be tried by changing F from plug D to plug E.

The main feature desired by many constructors in a crystal receiver is a fair measure of selectivity. While an auto-coupled aerial arrangement does not generally give such a high degree of selectivity as a separate aerial winding, it has many points in its favour, and the difference is not very marked

Choose Your Own Circuit—*continued*

in a crystal set. The variometer lends itself quite well to an auto-coupled scheme, and the change is effected very simply in this receiver by plugging C into B and leaving F disconnected for the first trial. This gives us circuit (d), and it is seen that the aerial is joined to the junction of the fixed and moving coils of the variometer.

Results

In my own particular case, when tested on an aerial of average size and efficiency about 9½ miles north-west of London, that station came in at particularly good strength, while selectivity was best with C_1 = .0002 and C_2 about one-third of the way round on the dial. Tests for the best capacity and inductance balance should be made, the time spent in this manner being well justified by the results obtained, since it enables the maximum efficiency to be secured. The effect of altering F to E should also be noted.

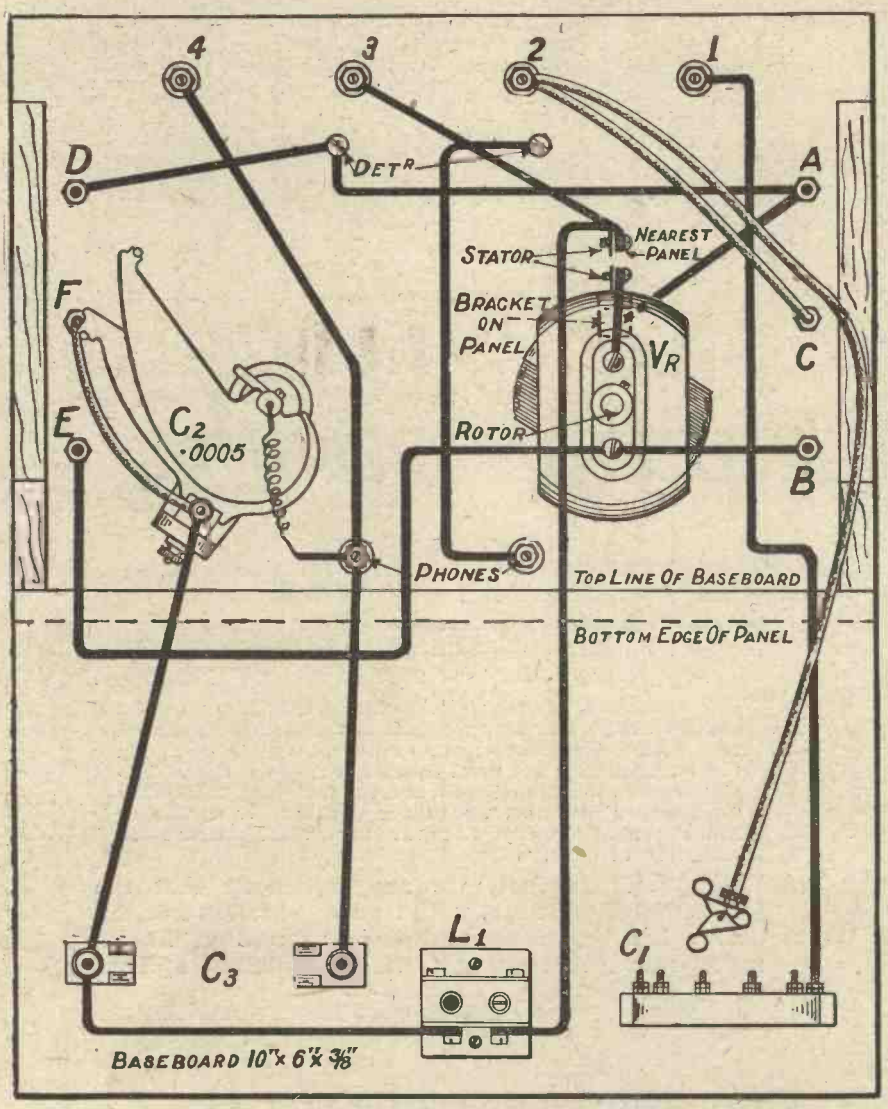


Fig. 4.—The wiring of the set is quite simple. The length of the flex leads carrying plugs should be adjusted so that connections can be easily made to the necessary sockets. Blueprint No. C 1077B.

Tests should be made both with and without the aerial condenser C_1, signal strength being noted. A big improvement in the selectivity will be brought about, however, if C_2 is added to the circuit by plugging F into D, which gives diagram (e). This is a very interesting and efficient arrangement, and is perhaps the best circuit for many purposes.

Comparing Coils

A comparison of these results with the ordinary plug-in coil and condenser arrangement can be tried with little trouble. Remove the shorting link between terminals 3 and 4 and arrange it across terminals 2 and 3. This short circuits the variometer. Plug C into A and F into D, and insert a No. 50 or 60 coil into position for L_1 (or, of course, the equivalent in lettered makes), and we have the arrangement (g). The local station can now be tuned in on C_2, while the effect of the series condenser C_1 can also be tried.

WIRING IN WORDS.

Join socket A to spindle of variometer, to one side of crystal detector and to socket D.
Join other side of crystal detector to one telephone terminal.
Join terminal 3 to one end of variometer, and continue to one side of L1 coil holder.
Join socket B to other end of variometer, and continue to socket E.
Join terminal 1 to terminal 000 of fixed condenser C1.
Join terminal 4 to remaining telephone terminal, and continue to moving vanes of variable condenser C2 and to one side of fixed condenser C3.
Join remaining side of C3 to remaining side of L1 coil holder and to fixed vanes of C2.
Join a flex lead to fixed vanes of C2, pass it out through socket F and attach a plug.
Join two flex leads to terminal 2. Attach a spring clip to one for connection with C1, pass the other out through socket C, and attach a plug.
Join together two plugs with a short length of flex.

For the reception of Daventry the last circuit can be used if desired by altering L_1 to a No. 150 or 200 plug-in coil. With the particular variometer used in this receiver it is possible to receive Daventry by resorting to circuit (h). Plug C into A, F into D, insert a .001 or .002 condenser in the clips for C_3 and short terminals 3 and 4. That station can then be tuned in on the variometer or the condenser C_2 as desired.

An Improvement

An arrangement which is to be preferred and which I found gave stronger and more selective signals is that shown at (i). Plug C into B and remove the short between terminals 3 and 4 and employ a No. 60 plug-in coil for L_1. Tuning can be effected on C_2 or the variometer, while the addition of a .0001 condenser in the C_3 clips is worth trying if such a size is handy.

Other Circuits

The circuits (g) and (i) will be found quite suitable for Daventry, and in the situation previously mentioned signals were quite good, the station being about 70 miles away. The experimenter will find that this receiver will enable him to obtain very interesting results, and the simplicity of the arrangement and the rapid change over from one circuit to another will, no doubt, recommend themselves to many readers.

Opesti~ Nipitia~Secomba

These strange words were broadcast into space the other week when Mars came within the chatting distance of 42 million miles. The chat, however, was all on our side, and several theories exist as to why our advances met with no response.

One enthusiast writes :—"Assuming that Mars enjoys the blessing of Radio, we take too much for granted that their instruments are as efficient as our own. In the transmitting set used down here by us ORMOND Condensers were employed, and the fact that ORMOND Condensers are not, up to the present, available in Mars would amply account for their failure to establish contact."

We agree. In fact, we are convinced that the ORMOND Condenser, with its slow-motion friction drive, ball bearings and easy mounting, has a ready market awaiting it in that distant sphere.

Illustrated above is our artist's idea of Mars and the Martians. Others, doubtless, have different conceptions. But however much at variance opinions on this point may be, no two opinions exist as far as ORMOND Condensers are concerned. In this all are unanimous in acclaiming ORMOND as consistently the best.

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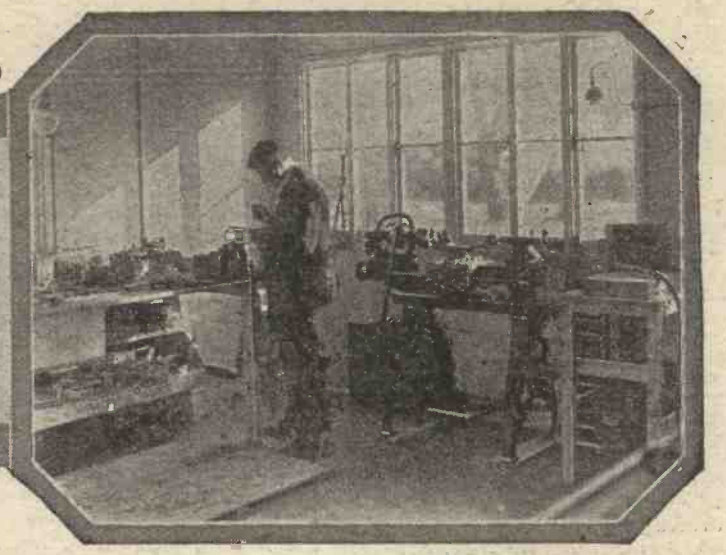
WORKSHOP HINTS FOR THE HOME CONSTRUCTOR



Home-made Cabinets—Easy French Polishing—Mahogany Panels and Jacks—Soldering Leads to Jacks—Tagging without Solder—Neat Wire Bending—Erinoid and Ivorine.

HOME-MADE CABINETS

A LARGE number of constructors now make their own cabinets for complete sets and for small pieces of apparatus such as wavemeters, valve testers and the like. The method of constructing cabinets from ply-wood, described recently in these notes, is a simple and inexpensive one, which produces a wonderfully good looking article. Those who like something more solid can now obtain from one firm, at any rate, parcels containing every piece of wood required for the construction of a cabinet, ready cut to size, squared up, and rough finished. These parcels are made up for various standard sizes, but anyone who wishes to make a cabinet of different dimensions can obtain all the necessary pieces of wood by sending exact particulars of his requirements with his order.

Simple Construction

This immensely simplifies the business of cabinet making, for cabinets of wonderfully good appearance can be made by simply screwing the ends, top, bottom and back together without a single dovetailed or halved-in joint. A plain, but exceedingly useful type of cabinet is seen in Fig. 1. As the inexperienced may easily make mistakes in measuring up when ordering supplies of wood, it may be as well to give a hint or two on this. The bottom, A, which should be of half-inch or three-quarter-inch wood, will be 1 inch longer than the sliding baseboard and ¼ inch wider. The end pieces, B,B, will be ½ inch thick and ½ inch higher than the panel; their length will be equal to the width of the bottom piece. The batten, C, will be 1½ or 2 inches wide, ½ inch thick, and of the same length as the baseboard. The back piece, D, may be of soft wood ½ inch thick. It will be of the same length as the bottom piece and half an inch higher than the end pieces (¾ inch higher, if the baseboard is ¾ inch thick). The lid, E, will be 1 inch longer than the bottom piece, to give an overhang of ½ inch at each end, and 1 inch wider than the bottom piece in order to allow it to cover the back and have an overhang of half an inch in the front.

If the wood is ordered ready cut and rough finished, a cabinet of this kind can be screwed together in a very short time, and provided that reasonable care is taken over the work the result is distinctly pleasing. The overhanging edges of the lid should be slightly rounded off either with a plane or with a rasp, being subsequently finished with sandpaper.

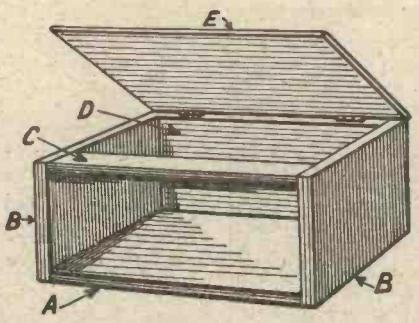


Fig. 1.—A plain but useful type of cabinet may be constructed in this manner.

EASY FRENCH POLISHING

NOTHING gives a cabinet a better appearance than french polishing. Ordinary french polish is, however, exceedingly difficult to use, and none but a practised hand can produce even passable results with it. The difficulty is this. Owing to its shellac basis the polish would become tacky as it was put on, and the surface would be spoilt by the smoothing pad unless a lubricant were used. Oil is employed for the purpose, but its use renders the polish cloudy. To remove this cloudiness a process known as "spiriting off" is necessary, which requires a great deal of practice for its successful performance. Fortunately for amateur cabinet makers a new type of french polish is now available, which is so simple to use that anyone can obtain a splendid finish with it; it requires neither oil nor a subsequent spiriting off.

How It Is Done

The process of applying it is as follows:—The wood is first of all sandpapered until it has a satiny smoothness. Mahogany, teak and other hard woods suitable for wireless cabinets are close grained, and do not require any filling up. A little of the polish is put on to a pad of cotton wool covered with a piece of old linen. This is applied to the wood with a circular motion, working in lines from one end to the other. Only a small area should be dealt with at a time, and the pad should be worked out quite dry. Any smears disappear of themselves as the polish dries, and a good surface results. When this process is completed, the work should be set aside for the polish to dry. As soon as it is quite hard, it should be rubbed down with a piece of the finest glass-paper, wiped off with a smooth cloth and repolished. In this way the veriest beginner can produce a beautiful high polish on his cabinets. I have made considerable use of this simplified french polish, which certainly gives a much better appearance than the oil finish with which I was previously content for home-made cabinets.

One brand of this polish is known as "Lightning" polish.

Workshop Hints—*continued*

MAHOGANY PANELS AND JACKS

THE use of mahogany panels is becoming increasingly popular, and they are perfectly satisfactory so long as the metal parts of all compo-

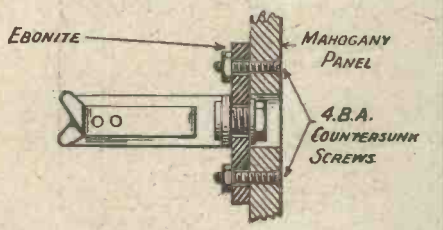
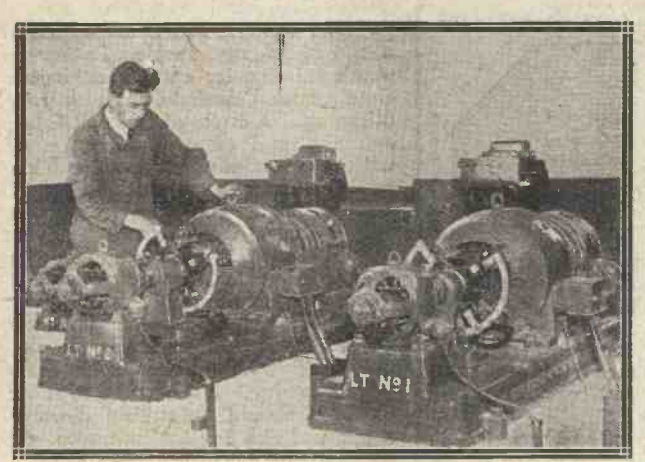


Fig. 2.—A hole of ample size should be drilled in the wooden panel before mounting the jack.

nents which come into contact with the wood are at the same potential. A complication, however, arises when jacks are used, for the body of a jack is in connection with high-tension positive. Further, when jacks are used in two low-frequency circuits and placed close together upon the panel, minute leakages may occur, quite sufficient, as I have found to my cost, to cause a considerable amount of noisiness. A very useful method of mounting jacks on mahogany panels is that shown in Fig. 2. For each jack an ebonite strip 1¼ inches wide and 1½ inches in length is used. In this is drilled a hole just large enough to take the neck of the jack, which is firmly clamped up in the ordinary way. Two 4B.A. clearance holes are also made as shown in the drawing. In the panel is made a hole whose diameter is such as to allow it to clear the nut and washer of the jack by about ⅛ inch all round. The front edge of this hole should be slightly chamfered off. Two holes for the fixing screws are drilled and countersunk in the panel, and the jack is fixed in position. If this method is employed, there need be no fear that noisiness will occur owing to defective insulation, for the insulation is as good as if the panel were of solid ebonite.



The generators in the Post Office Wireless Station at St. Albans used for supplying current to the valve filaments.

SOLDERING LEADS TO JACKS

ONE maker at any rate has produced a fan-tailed jack, but the majority are content to arrange the tags so that they lie parallel to one another and very close together. For this reason the task of soldering leads to jacks may be a rather troublesome one, particularly in the case of those like the double filament type, which have as many as six connections. The process is very much simplified if before soldering begins a pair of small flat-nosed pliers is applied to each tag in turn. In a 4-point jack the top tag may be given a biggish bend upwards and a slight twist to the right, the second a small bend upwards and a twist to the left, the third a slight bend downwards and a twist to the right, and the fourth a bigger bend downwards and a twist to the left. When tags are dealt with in this way, one has much more room to work in, and there is also considerably more space between the "live" points when soldering has been done.

Wiring-up

Always remember when you are wiring up jacks to make the most difficult connections first. Such is human nature that the temptation always is to deal first of all with the easiest ones, and to put off those that are very troublesome to the last. If this is done, one's difficulties are very much increased, for the available space will probably have become distinctly small. Many constructors have found, no doubt, that connections soldered to jacks have an annoying way of coming adrift after a month or two for no apparent reason. This is due largely to the fact that in some jacks the nickel surface of the metal used for the tags makes soldering difficult. It is a good tip always to give these tags a rub over with a file before soldering, and then to tin them well.

The Best Way

The tags of most jacks have little slots cut in them near the ends, though many constructors make no use of these. This is an unwise practice, for a much more secure job can be made by making full use of them. Before you solder a lead, bend its end into a little hook. Pass this over the end of the tag, pull it into the slot and then clamp it tightly by squeezing the wire hard with the largest pair of pliers that there is room for. When this is done, the connections are more or less self-supporting, even without soldering, and they are not nearly so likely to work loose under the effects of jarring or rough usage as are those made by simply embedding the straight end of the lead in a blob of solder.

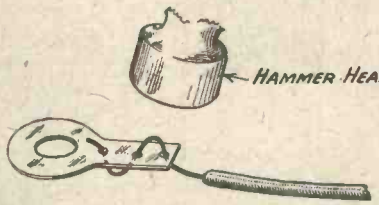


Fig. 3.—This type of tag is useful for stiff or flexible wire connections.

TAGGING WITHOUT SOLDER

THOUGH the practice of soldering every possible connection is not now looked upon with such favour as it was, owing to the liability of soldered joints to deteriorate, there are many who like to tag the ends of all leads that are fixed to terminals. Tagging in the ordinary way entails the use of solder with its attendant drawbacks. It is, however, possible to tag leads neatly and quite securely by means of the method shown in Fig. 3. In the tail of the tag three small holes are drilled of a diameter just large enough to pass the wire in use. This is threaded through as shown in the drawing, after which the tag and the wire are flattened out with a hammer. For dealing with flex leads a very useful form of tag is the sleeved variety, which are often to be bought very cheaply in gross lots from firms which deal in W.D. surplus goods. The strands, first tightly twisted together, are thrust into the sleeve, brought out of the hole at its far end and taken through the second hole provided. When flattening has been done with a hammer, the job is as firm and as secure as could be desired. (Fig. 4.)

WORKSHOP HINTS—*continued*

NEAT WIRE BENDING

I NEVER bother about tagging the ends of leads which are attached to terminals, but I like to make neat loops in them. Those who are particular about the appearance of the wiring of their sets will appreciate the improvement made by forming loops neatly, and not just bending them anyhow. Fairly good work can be done with a pair of round-nose pliers, but there is one objection to their use for this purpose. The "noses" are tapered, and it is thus difficult to make loops which are a good fit for terminals of various sizes.

A Useful Tool

Instead of pliers I use the little home-made tool shown in Fig. 5. This is made from a piece of stout sheet brass, one end of which is rounded off

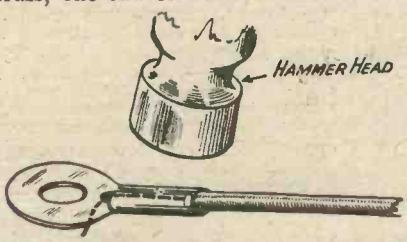


Fig. 4.—Another form of tag which can be satisfactorily attached to a flex lead without solder.

and bent over at right angles. The other end is pointed to form a tang, which is inserted into a tool handle, being wedged tightly, if necessary, by driving a couple of headless nails into the handle, one on either side of the broad part of the tang. Into the flat part bent over at right angles to the tang are screwed two pieces of studding placed fairly close together. I use three of these tools, provided respectively with 2, 4 and 6 B.A. studs. To make a loop, place the bared end of the lead between the studs—a little practice will show how much must be allowed to protrude—

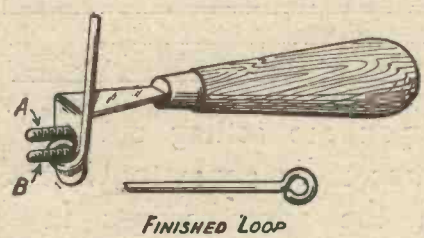


Fig. 5.—This easily-made tool enables the constructor to make neat loops in a moment.

and twist in an anti-clockwise direction, holding the wire so that it does not slip from the studs. The wire seen in the drawing on the tool has been bent in this way, which is the first part of the process. The next is to turn the tool in the opposite direction, that is, clockwise, which brings stud B against the standing part of the wire and enables a neck to be formed. The little inset drawing shows a finished loop made in this way. By using three different tools one can always make a loop that is a perfect fit for 2, 4 or 6 B.A. terminals. Besides looking particularly neat, loops of this kind make for secure connections, since as they are entirely closed there is much less chance of their slipping, and so causing a terminal to slacken.

* * *

ERINOID AND IVORINE

I DO not think that many constructors have realised the possibilities for wireless work of erinoid, ivorine and other similar materials. They have been employed to some extent for dials, but that is about as far as their use has gone. These materials can, as a matter of fact, be employed in a large number of other ways. Most of them are quite good insulators, their resistance being greater than that of mahogany or other hard woods. Since they can be obtained in a large variety of plain colours as well as in mottled forms, thin sheets of these materials can be used most effectively as veneers for panels of wireless sets.

A Suggestion for Panels

Many people do not care about using mahogany panels, since they like a colour contrast between the panel itself and the cabinet of the set. Why not then make the panel itself of hard wood and cover it with a sheet of erinoid $\frac{1}{16}$-in. thick in any colour that you may fancy? A novel and attractive effect can be produced by using a sheet of white material for the purpose. Such lettering as is needed, as well as dial indicator marks, can be made with Indian ink, and the resulting job is distinctly pleasing. There is not the least trouble about keeping the material clean, for it does not collect dust to the same extent as does ebonite, and it can be restored at any time to its original whiteness by being wiped over with a damp cloth. If you prefer a black panel, you can obtain the material in this hue; it is, in fact, manufactured in more than sixty colours, shades and blends.

And why stop at the panel? Recently I showed how cabinets could be constructed very simply from ply-wood. You can if you wish substitute for ply-wood erinoid or ivorine in any desired shade, for it it can be obtained in sheets from 2 mm. to 20 mm. in thickness. It takes, as we shall see in a moment, a delightful finish, and if it is used, cabinets of striking appearance can be made at very small

WORKSHOP HINTS—*concluded*

cost. Another use for this material is to be found in the naming of terminals. Small discs or squares can be cut out, upon which the nature of any particular terminal can be inscribed in Indian ink. If a 4B.A. clearance hole is drilled in these they can be placed between the terminals and the panel upon which they are mounted.

Easy to Work

All of these materials are very pleasant to work with. They can be cut with a hacksaw and drilled or tapped as easily as ebonite, more easily in fact, since owing to their slightly softer nature they show practically no tendency to split when they are drilled or to strip when tapping is being done. All of them will take a beautiful finish, and will repay any trouble that is spent upon them to produce it. They differ from ebonite, from the workshop point of view, in one important respect. When you are working ebonite it is not advisable to run drills at too high a speed; with any of the materials mentioned the speed can hardly be too high.

Finishing

Like ebonite, these materials are easily moulded to any desired shape by immersing them in hot water prior to operations. They are thus particularly suitable for making formers to carry the windings of rheostats and potentiometers. They are less hard upon tools than is ebonite, which will take the edge off drills or lathe cutters more rapidly than metal. To obtain a high finish begin by removing, with a medium grade of glass paper, any scratches that may have been made. This having been done, wrap a piece of finer glass paper round a flat piece of wood and work over the surface. Follow this with a piece of the finest glass cloth, and finish off by dressing with a mixture of beeswax and turpentine and applying plenty of elbow grease with a "selvyt" polishing cloth.

Fixing

These materials possess one great advantage over ebonite: pieces of them are quite easily stuck together with glue. Any good fish glue is quite suitable for the purpose. It should, however, be remembered that the glue takes some time to dry, which makes it advisable for the surfaces which are to be joined to be left under pressure until the joints are thoroughly set. All of these materials, if very thin sheets are used, show a slight tendency to warp. I have, therefore, found it best when employing them as veneers either for panels or for cabinets to fix them in position both by screws and by a layer of glue. If, however, reasonable care is exercised, they will be found most satisfactory in every way.

FURTHER NOTES on the "NIGHT HAWK"

By PERCY W. HARRIS, M.I.R.E.

Alternative Components—High-tension Supply—Trying for America.

SINCE writing the notes on the "Night Hawk," which were published in the November issue of this journal, I have had an opportunity of trying a number of alternative makes of components in this set, and have made several structural changes in order to include them.

Alternative Components

I can recommend any good make of variable condenser in this set, provided it does not occupy appreciably more space than is permissible. I have tried several makes of 250,000-ohm resistance, and found them equally satisfactory, and I have also tested Messrs. Peto-Scott's fieldless coils, and find them well up to standard. As to valves, a large number of makes have been tried with satisfactory results, although there is no question that in the first three stages valves designed for high-frequency work and resistance-capacity coupling give the best results. The neutralising position varies with different valves, but once it has been found for a particular valve, it remains in this setting for the duration of the life of the valve.

The high-tension supply needs to be adequate for a modern five-valve set, and the "Night Hawk" is no exception to this rule. For this reason I cannot recommend the very small-size high-tension batteries, and, if you have them, a high-tension accumulator will prove most economical in the long run. If you use dry batteries I would strongly recommend the large type specially designed for multi-valve sets.

The "Night Hawk" receiver, of which constructional details appeared in the October issue of "The Wireless Constructor."

America on the "Night Hawk"

If you are building the "Night Hawk" receiver and decide to try for America with it, here are a few hints that will help you.

(1) First of all, do not attempt to listen before midnight. It will be a sheer waste of time, save in a few favourable localities, such as Cheshire, where occasionally American stations have been heard before midnight.

(2) Remember that past experience has shown the most favourable time for reception from America is between 1 and 3 a.m. This corresponds with 8 p.m. to 10 p.m. in the New York zone, or 7 p.m. to 9 p.m. in the Chicago district. At that time it will be dark all the way across. It is rare for reception to be effected on the broadcast band from American stations when one or both stations is in daylight.

(3) Do not attempt to search all over the broadcast band on one evening. Conditions are very freaky, and if you concentrate on a small band, such as that round about 380 metres, you will have a reasonable chance of hearing WGY, which comes in very strongly when conditions are good. If you are fortunate enough to tune in a station, leave the set alone for a little time and listen. Without your touching the dial the signal strength will increase and decrease, sometimes slowly and sometimes rapidly. This will be due to natural conditions, and will not be anything to do with your set. Remember that in long-distance reception of this kind, patience will do far more than twiddling the dial.

SOME SOLUTIONS TO YOUR SUPERHET PUZZLES

By JOHN UNDERDOWN

A fault in a superheterodyne receiver, preventing it from functioning properly, is often difficult to locate, and much time may be wasted "on a wrong scent." If you have encountered any of the troubles mentioned here, you will find useful information given to enable you to set matters right.

IN a recent issue of this journal (October, 1926) I gave details of how various super-het. arrangements might be tried with a minimum amount of trouble. This article is intended to deal with a number of faults peculiar to super-het. circuits in order that, should difficulty be experienced, readers will have some idea of where to look for the faults.

Puzzling Symptoms

In a long and sometimes bitter experience with various super-heterodyne sets, I have found that minor faults in components have very far reaching effects and often appear to implicate any other component than the one actually responsible.

The first real difficulty which I met with was experienced with a set employing a separate oscillator arrangement, two intermediates, the usual first and second detectors and a transformer-coupled note magnifier, the main part of the circuit being indicated in Fig. 1.

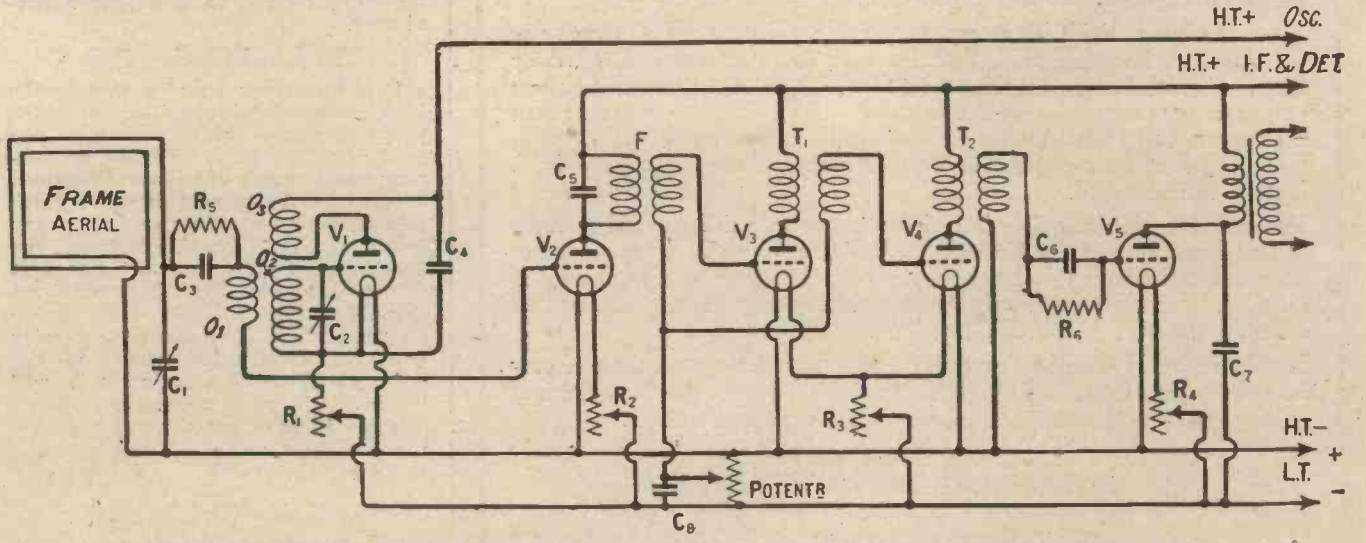


Fig. 1.—A straightforward superheterodyne arrangement, employing a separate oscillator valve.

Testing

Upon completion of the wiring a valve was inserted into each valve socket in turn and the filament in each case was controlled properly. All H.T. positive leads were then joined together and were tapped into a comparatively low voltage socket of the H.T. battery, and since the filaments did not increase in brilliancy it was assumed that all was correct, and normal H.T. voltages for the valves in use were applied.

The potentiometer controlling the intermediate-frequency amplifiers was set about midway, in which position this part of the receiver was stable, and tuning was carried out in the normal manner upon the frame aerial condenser C_1 and the oscillator condenser C_2. A general deadness was experienced, however, the usual clicks of the oscillator going out of the oscillating condition when in tune with the frame circuit being present, but at very poor strength. Similarly the long-wave side could be made to oscillate, and upon rotating the oscillator condenser, in conjunction with the frame tuning condenser, it was found that the usual heterodyne carrier whistles, usually denoting that a carrier wave is being received, were heard.

Almost Normal Behaviour

When the long-wave potentiometer was adjusted, after having tuned in to the silent point between the normal two heterodyne whistles, no telephony could be heard, but by very careful searching signals at crystal strength were obtained from the local station. The symptoms therefore were that the set was behaving exactly as a super-het. should do, excepting that all the usual phenomena were much weaker than should have been the case and only very weak telephony could be heard.

Substitution Tests

To eliminate the valves as being responsible for the difficulty, these were tried individually in a single-valve set, all appearing up to standard; fixed condensers and grid-leaks were replaced by others known to work effectively, and the potentiometer was checked for continuity, but no faults were located.

The Solution

Finally, in disgust, the wiring of the whole set was stripped down and

SOME SOLUTIONS TO YOUR SUPERHET PUZZLES—*continued*

the springs of the anti-vibratory valve holders, normally hidden when these components are screwed to the baseboard, were examined. All was in order here, but finally close examination of the metal valve sockets, which were embedded in the usual composition moulding, showed that the insulating material was, in the case of one valve holder, slightly overlapping the edge of the metal, so that the plate leg of one of the valves was not making contact.

Satisfactory Operation

Upon removing the overlapping insulating material from the valve holder in question and re-wiring the set, it was found to function in a very satisfactory manner, most of the main British stations being received at good loud-speaker strength, as were a large number of Continental transmissions also.

Introducing Reaction

To sharpen the tuning and give improved range, an excellent scheme to adopt is to utilise a split frame in the manner shown in Fig. 2. In many cases this is practically equivalent to adding an H.F. valve and has the merit of giving considerable improvement without necessitating the purchase of a further valve with consequent increase of filament and H.T. current. With arrangements of the Fig. 2 type, however, I have come into contact with a number of cases in which somewhat similar symptoms were experienced to those given previously.

The Local Station Only

It is sometimes found that only the local station is obtained, and that at poor strength, whilst whether the oscillator valve is alight or extinguished makes but little difference. Occasionally bringing this latter valve into operation prevents any telephony being heard. When this happens, the trouble is usually due to the first detector, V_2 in Fig. 2, oscillating. The first step to take then is to decrease the H.T. on the first detector down to a very low value, of the order of 20 or 30 volts, when it will be found, in most cases, that the set behaves in the normal way, provided the oscillator valve V_1 can be made to function correctly.

Feeble Oscillation

If only feeble oscillations are obtainable, the difficulty is often due to the employment of unsuitable coils for the grid and plate coils O_2 and O_3. These two coils should be similar in size and should not be coupled magnetically. When the coils used here are of very inefficient type the oscillator valve may oscillate only in a very feeble manner. Improvement can often be obtained by employing

Some Solutions to Your Superhet Puzzles—*continued*

a valve which oscillates more readily, such as certain of the resistance-coupling types, whilst an increase of the applied H.T. is sometimes helpful.

A Last Resource

As a last resource, when all else fails to prevent the first detector taking on the oscillator's function, the reaction arrangement should be discarded temporarily and the whole of the frame, still tuned by C_1, should be connected across the grid and filament of the first detector. Attention may then be confined to the oscillator, other coils and valves being tried until this part of the receiver behaves in a more healthy manner. Finally the split-frame scheme may be reintroduced, if necessary, with a smaller condenser in the C_3 position.

Reaction Effects Lacking

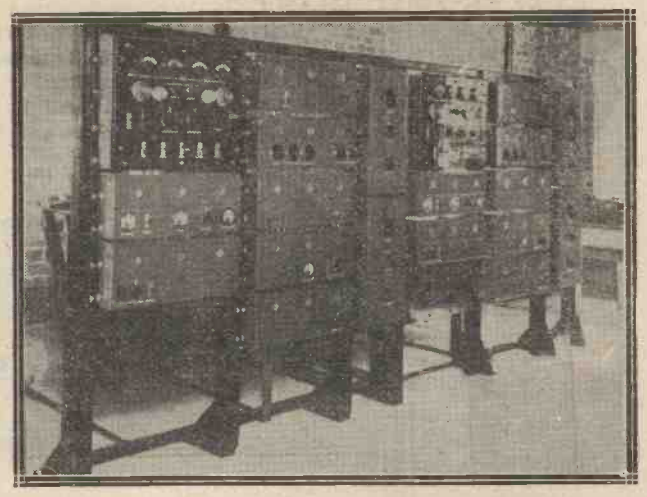
The converse of the previous trouble, namely, difficulty in obtaining reaction effects with a split-frame, is usually traceable to the first intermediate transformer or filter (F in Fig. 2). In order to sharpen up the tuning of the long-wave side, it is fairly common practice to employ a suitable fixed condenser, *e.g.*, C_7 shown dotted, across the primary of the transformer in the anode circuit of the first detector, this condenser often being incorporated within the transformer unit. This, of course, acts as a bypass and prevents the required choking effect from being obtained.

The Solution

Often a simple method of overcoming this trouble is to place the filter in the anode circuit of one of the intermediate-frequency amplifying valves, its place being taken by the transformer which would otherwise be employed there. Where, however, the self-capacity of the primary winding of the transformer in the filter position is high, an H.F. choke may have to be inserted at the point X.

Tuned Intermediates

When the primary and secondary windings of the filter and intermediate-frequency transformers are tuned by small condensers incorporated in these units, and upon endeavouring to balance the long side it is found that clicks are heard and signals disappear, a short in a tuning condenser should be suspected, and the kit should be returned to the makers for examination and report. Fortunately this fault is by no means a common one.



The receiver panel of the Marconi beam station which was completed recently. The receiver on the left is for signals from South Africa and that on the right for those from Canada.

Poor Selectivity

The selectivity of a superheterodyne set should be of a high order, and when this is poor the matching of the filter and intermediate transformers, for example F, T_1 and T_2 of Fig. 1, is often responsible. The first step to take in a case of this kind is to remove the fixed condenser across the primary winding of the filter transformer F, if this is possible, and to substitute a variable condenser of larger size than C_8. The variable condenser can then be adjusted to bring the filter into tune with the intermediate transformers T_1 and T_2, slight adjustment being made to the oscillator condenser with each adjustment of the former condenser. If when matters are balanced up here it is found that the long-wave side oscillates more readily and selectivity is improved, a suitable fixed condenser should replace C_8, or alternatively the variable one should be retained.

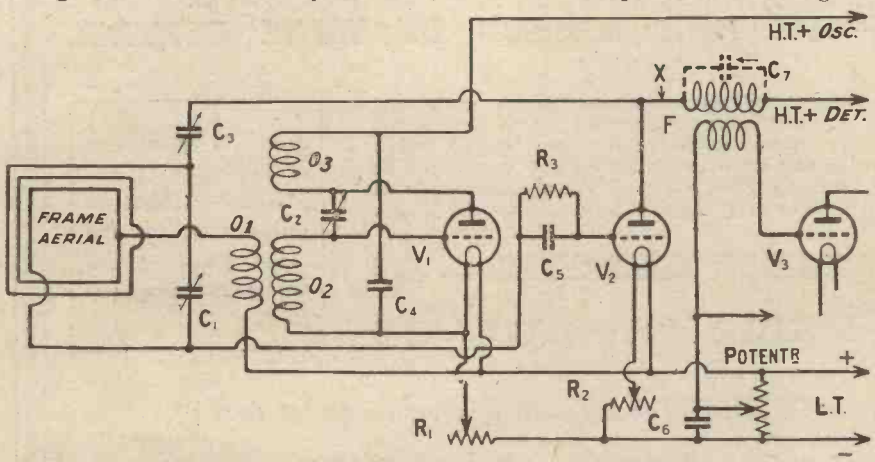


Fig. 2.—The use of a split frame aerial with a superheterodyne receiver will often produce a noticeably improved performance.

Valve Characteristics

It sometimes happens in practice that the valves employed in the intermediate-frequency positions vary widely in characteristics. The result of employing such valves may be to give rise to very weird symptoms, often seeming to implicate the oscillator more than any other part of the set. If suspected, the valves should be changed round in order that those most suitable for the intermediate-frequency amplifier positions may be used.

An individual valve may be responsible for one intermediate-frequency stage oscillating on its own, with the result that the potentiometer has to be taken practically over to full positive before the intermediate-frequency side is stable. This, of course, results in the intermediate-frequency stages being particularly insensitive when adjusted to function just below the oscillating condition.

A good indication as to which intermediate-frequency valve is responsible may be obtained if the long-wave side is just allowed to oscillate gently, the grids of the intermediate-frequency amplifiers being touched in turn. If only one valve is oscillating, a much louder plop will be obtained when its grid is touched with the finger than that given by the others.

IS IT WORTH WHILE?

By a Critical Listener

Distant reception and good quality: can they go hand in hand, or are they alternatives which cannot be obtained together? Decided views are expressed in this article, which raises many points of interest to a large number of listeners.

AS the popularity of broadcasting as a means of entertainment increases and the time is not too far distant when the radio receiver will be regarded as part of the ordinary house furniture, the listener is becoming more and more particular as to the quality of reproduction.

A great number of the general public hankers after the distant stations, hoping that these may be received with an absence of interference and distortion such as they are accustomed to when listening to the local station. Arguing along these ambitious lines, I ask the question—Is it worth while?

Multi-Valve Sets

In the first place, before one can hope to receive the majority of the distant stations at loud-speaker strength, it is necessary to possess a receiver which incorporates no small number of valves, and apart from the expense involved in the construction of such a set, it is rarely that one is able to listen to a distant station free from Morse interference, local oscillation, and the like. Certain multi-valve sets will admittedly do their jobs properly, but these usually incorporate special coils or screens or both, and it is not within the financial ability of all of us to incur the expense necessary in the building of such receivers.

Natural Reproduction

To the man of modest means the local station must serve as the main centre of amusement, therefore to receive this station with the greatest possible purity, rather than the conquering of distant reception, becomes the chief ambition. Further, since music is music the world over, what does it matter whether it comes from but a few miles away instead of hundreds?

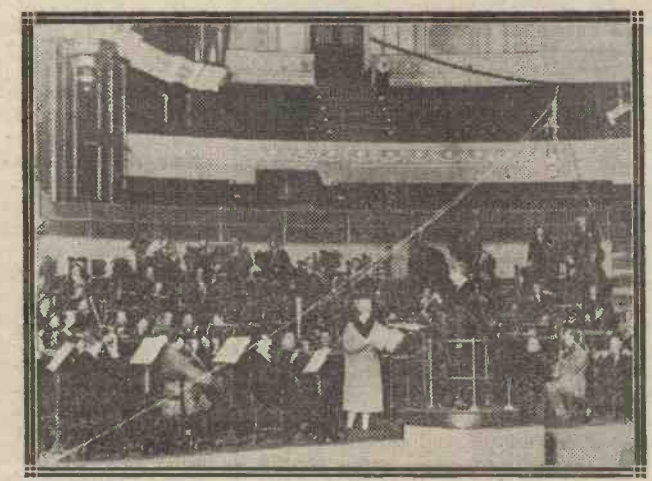
A weak argument to meet that of the "distance" listener, with his talk of fascination, his glory in conquering distance, and so on, but for all that an argument which to many of us is a perfectly sound one.

Some listeners say that even the local station is a poor show when it comes to comparing wireless with the real thing, but with that point of view I entirely disagree.

Unsuitable Apparatus

So long as the receiver is well made and the right circuit is used in conjunction with the right valves and loud-speaker, the results are distinctly pleasing and in no way unmusical. Unfortunately, in many cases the conditions just given are not complied with, and one often finds a listener using a valve in his set which is quite unsuitable for the circuit; in fact, only the other day a case was brought to light where a listener, thinking that he was doing right, was using a special resistance-capacity coupling valve in series with an L.F. transformer which was designed with a ratio suitable for use with one of the popular power valves. The result in this case was distinctly unpleasant and fully justified the condemnation it received.

"Since music is music the world over, what does it matter whether it comes from but a few miles away instead of hundreds?"



Amplifier Faults

The causes of poor reproduction are many and varied, particularly in the low-frequency portion of the circuit, and since the most common form of L.F. amplification is by means of transformers, some of these causes will be discussed in the hope that at least some of the sceptics as regards the possibility of purity in reproduction will be converted.

Choosing the Right Valve

In the majority of sets some form of general-purpose valve is used for the detector stage, and it should be remembered that since for the best results the impedance of the primary winding of the L.F. transformer should be suitable for the type of detector valve chosen, it is not any valve chosen indiscriminately that will give a reproduction which satisfies one's interpretation of purity. It is unfortunately not possible to give definite figures regarding the impedance of this winding, for practically every type of valve has a different impedance. One of a certain make of valve will quite likely have an impedance different from that of a similar type of valve of another make, but we can compromise to some extent by using a first stage transformer of reputable manufacture.

These components are suitable for use after a detector valve and the makers have in most cases based their designs upon the assumption that a valve of relatively high impedance will be used as a rectifier.

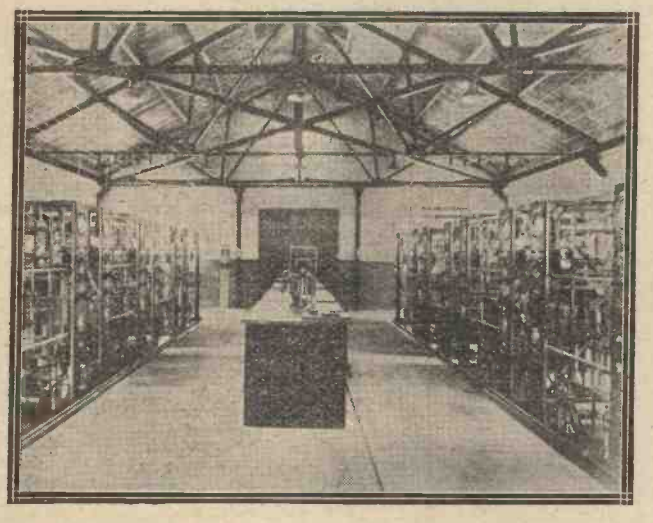
Provided that only one stage of transformer coupling is used, there should be little difficulty in obtain-

Is it Worth While?—*continued*

ing good quality, but where two stages are employed, more careful operation is necessary for the best results.

Inaudible Oscillation

Many home constructors are familiar with the fact that a newly-made amplifier sometimes howls until the connections to the primary winding of the second transformer are reversed, but few know that though no howl is heard the amplifier may still be oscillating—at a frequency above the audible range. In such a case distortion will, of course, be most marked, and after reversing connections to see whether that will effect a cure, the disposition of the two transformers in relation to each other should be varied, observing the results as regards purity.



A general view of the transmitting room at the Bodmin Beam Wireless Station, showing the control table in the centre.

Grid Bias

One of the biggest reasons for there being so many sceptics as to the purity which they say that wireless is unable to give, is the complete absence of understanding of grid bias. It is, of course, *essential* to use the correct grid bias as specified by the makers of the valve employed, or in cases where no printed directions are given, the characteristic curve should be examined. In this latter case the proper grid bias may be read off by dropping a vertical from a point halfway along the straight portion of the curve to the left of the ordinate; the point where the vertical cuts the negative grid volt scale indicates the correct grid bias value to use for that particular H.T. voltage, and in all cases this should be regarded as an indispensable condition.

Experiments

It is attention to such small details as these that makes the reception of the local station really worth while, and though it will be appreciated that it is not possible to deal with every point and every type of circuit which may affect good reception, it will, it is hoped, be recognised that almost as much experimental and pioneer work can be spent in making the most of the local station as can be devoted to receiving our Continental friends.

Possibly this latter hobby will bring results sooner, but nevertheless careful adjustments and the discriminating use of valves will quickly show that one is progressing along the right lines.

Local or Distant?

In conclusion, let it be said that whereas there will always be listeners who hanker after the foreign and other distant stations, there will at the same time always be listeners who desire to listen to the local station only. The arguments of these latter as to why they are content with bridging a relatively few miles, when it is possible to cover several hundreds, is largely built upon the fact that interference by shipping, heterodyning of the desired station, and so on render the transmission a hopeless noise of mush and Morse.

Another reason for the lack of enthusiasm in receiving distant stations is that when one has actually picked up the desired station, what is offered other than entertainment similar to that of the local station?

"Faust" transmitted by Hamburg is no more "Faust" if it comes from Hamburg than if it comes from Birmingham or Aberdeen; further, since a much more elaborate set is required to pick up these foreign stations at loud-speaker strength—is it worth while?

The "Wander Lust"

Many listeners known to the writer may be placed in the class of distance enthusiasts, and to spend an evening with them is, so far as radio is concerned, an evening spent in painful indulgence. You are asked if you would care to hear Radio-Toulouse, and upon expressing the obvious desire (obvious in that to give a negative answer would probably offend your host) Radio-Toulouse is tuned in. Some moments pass in listening, when the operator expresses the opinion that it is not quite so good as usual, and proceeds to readjust the set. During this operation he hits upon another station and is not content until this is tuned-in and identified. Satisfied upon this point, he decides that it is a good evening for receiving Radio-Milan, San Sebastian, Oslo, and many others, with the result that instead of listening to Radio-Toulouse as you were content to do, the evening has been spent in hearing snatches of music of doubtful origin and talks in foreign languages which you do not understand.

It is true that one has toured Europe in imagination, it is true that one has heard practically every language spoken in Europe, but since one's desire was to listen to music in an intelligent manner—is it worth while? This knob-twiddling in search of "distance" when one really wants music is much the same as giving a gun to an angler to catch salmon with—he may land his fish, but the amusement is gone.

A "FILLING" FOR OLD EBONITE PANELS

WHEN one is re-designing an old receiver and bringing it up to date, it nearly always happens that there are a certain number of holes in the panel which are not needed in the new design.

Chatterton's compound is often used to fill the unwanted holes, but this substance has a way of contracting and not properly filling the holes as it cools and sets. A softer substance is much easier to work, and the constructor will find that the wax of which "Dictaphone" cylinders are made is admirable for the purpose.

The easiest way of filling a hole is to lay the panel on a smooth board, place a lump of the wax in the hole, and apply to it the tip of a heated poker or old soldering iron. The wax should be melted down till it is rather above the level of the panel surface. A piece of rag is then wrapped round a small block of wood to form a pad, and when the wax has set the superfluous wax around the hole is rubbed down with the pad. The filling takes a polish, which matches well with the surface of a polished panel. A. V. D. H.

How to Make your own Screened Coils—*concluded from page 192*

One reader has made his screened coils by using aluminium hot-water bottles, which are just about the right diameter, cutting off the top in which the screwed stopper is placed, and using the remainder, which forms a very suitable screen.

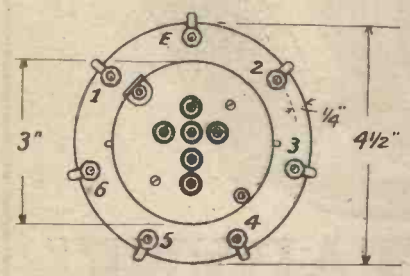


Fig. 5.—To conform to the standard arrangement the terminals should be marked as shown.

The Base

Having decided therefore on the screen itself, turn or file up a base of ebonite or wood of sufficient diameter to fit tightly inside the end of the tube. It is now necessary to cut out a piece of sheet copper of the same diameter as this base piece, and to drill in it six large clearing holes, so that it may be placed over the base, the holes being to allow the six sockets to be screwed into the base without "shorting" to the copper piece. This copper piece should then be screwed in position, so that it forms a base to the screen, the only holes being those at which the sockets are screwed in.

Terminals

The whole base, with the copper piece in place, should then be screwed on to another base which will carry the seven terminals required. Six of these terminals are required for connection to the six sockets, while the seventh terminal is taken to the screen itself in order to earth the component. The connections to the six pins are as shown in Fig. 4, and this is the standard connection adopted. It should be followed out if it is desired to use standard coils.

When the base has been mounted upon the terminal block, the screen should then be fitted over it, in order to ensure that it makes a good fit. If tube has been employed in making the cover, it will be necessary to cut out another disc of copper to fit over the end of the copper tube, and this should then be soldered in position to make a good electrical joint. If aluminium tube is used, then the top must be made a very good fit, and must be held in position with screws, as aluminium cannot readily be soldered.

Another Method

Another way of making the tube is to take a cardboard cylinder, which should be well shellaced or waxed, and to wind copper foil round the outside, the copper foil being lightly soldered in order to keep it in place. This construction is somewhat simpler than the other, but the presence of the cardboard near to the coil may introduce extra losses, which are undesirable. Paxolin or ebonite would be better.

Connection to Screen

It is finally necessary, having constructed the cover with its top and the base with the proper base piece, to have some means of making contact between the base piece and the remainder of the screen. In the particular model described, in which a copper tube was used, this has been provided for by a small strip of phosphor-bronze, which has been screwed to the base piece in a convenient position. This is so shaped that when the cover is placed over the base the end of this phosphor-bronze spring rubs on the inside of the tube, and so makes contact therewith.

Various other methods will suggest themselves, but some sort of device is essential. The actual earth terminal on the base is connected usually to the copper sheet on the base itself. It is necessary to ensure that the cover shall also be effectively connected to earth, and normally the only way in which this can be done is by ensuring that it makes a good and sound contact with the base.

Another method of achieving the results is to make the base of fairly thin copper sheet cut to a larger diameter than is actually necessary. It may then be slotted all round the circumference, and the protruding disc bent in order to make a form of cup, over which, or inside which as the case may be, the cover may be fitted. This is a form of construction, however, which requires very careful handling, and is liable to give trouble except in the hands of an expert.

A new view of the experimental wireless station at Kensington, Maryland. This is to be used by the U.S.A. Bureau of Standards for studying the problems of fading and atmospherics

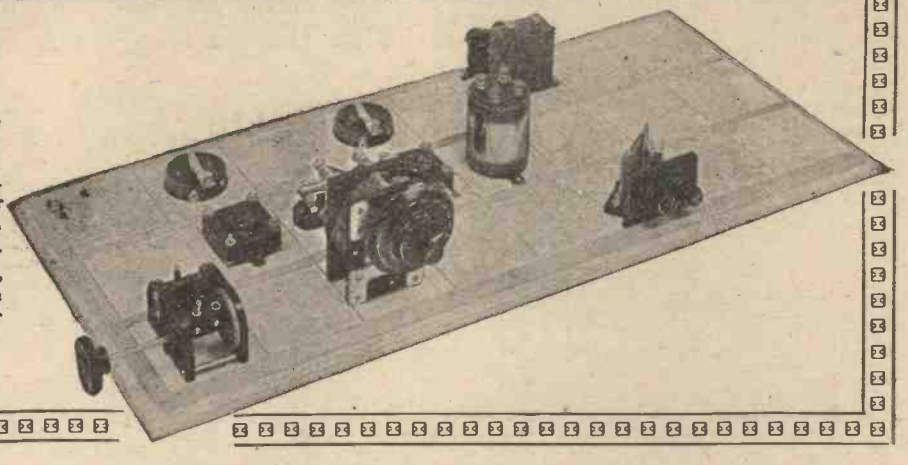
Important Points

It cannot be too strongly emphasised, however, first of all that the clearance must be as stated earlier in this article, ½ in. at least at the sides of the coil, and 1 in. at least from each end of the coil to the top and bottom of the screen respectively. Secondly, it is also essential that the screen itself shall be effectively connected to earth, as otherwise all sorts of peculiar and unpleasant results may follow.

AN EXPERIMENTER'S BASE-BOARD

By H. BRAMFORD

A "unit" method of arranging a set in experimental or even in permanent form, possessed of considerable flexibility and allowing ample freedom for the ingenuity of the experimenter in laying out components. Some suggestions for mounting components are given, and the accompanying photograph shows part of a possible layout for a two-valve set.



A PIECE of apparatus which should be most useful to the experimenter is a device whereby he can rig up any desired circuit with speed and ease and without the usual confusion and disorder. This article describes a unique type of base-board which may be used for this purpose, and which presents so neat an appearance in any stage of use that one might almost say that not only is it suitable to the experimenter himself, but also that it is a most desirable article for the average set maker. Practically speaking, it dispenses entirely with ebonite panels, which in itself is a most important feature from many points of view. The idea itself is worked out somewhat on the lines of a draught-board, which to some extent was the means of providing the suggestion in its crude state.

Practically everybody who makes a set at some time or other wishes to dismantle it for certain alterations or for some modern improvements. This particular base-board idea allows for this to be done at any time without the usual scrapping process having to be gone through.

Material

The special base-board is obtainable from Messrs. Peto Scott, Ltd., from whom those who desire an article of finished and pleasing appearance should procure it in either a plain or polished state. The base-board mentioned is an independent item, but those who desire it could easily have fitted to it a polished mahogany cover of sufficient depth inside to allow for the housing of the average type of component. Alternatively, the base-board and fittings may be home made in accordance with the details given in the diagram.

Components

As regards the actual components to be used in conjunction with this base-board, practically any type may be employed, but the principal idea is to choose such components as are most suitable for mounting upon wood bases, and that are also equipped, as far as possible, with terminals instead of only soldering tags. As practically all components are now obtainable with this fitting, it is not difficult to choose suitable ones. The base-board allows for 24 units in all, which should be quite sufficient for the average receiver up to, say, four valves. Those who wish to use more or fewer components may, however, do so, in which case the base-board is increased or reduced in size accordingly.

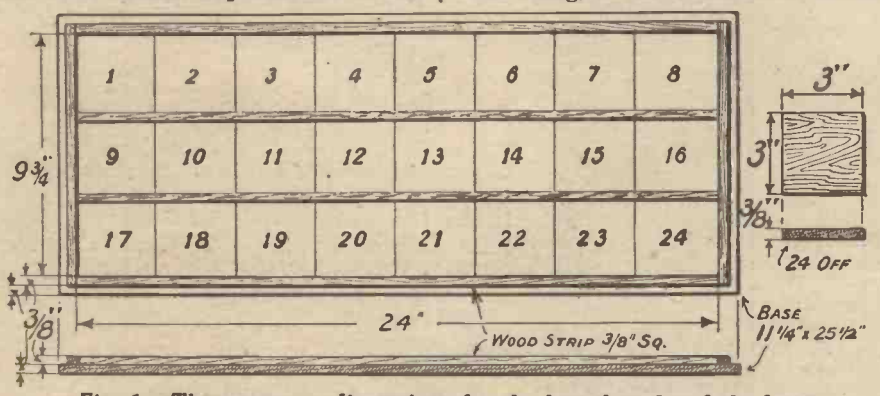


Fig. 1.—The necessary dimensions for the base-board and the loose wooden squares are given in this drawing.

Method of Use

Details are given in the diagram of the actual base-board, which consists of a piece of wood 11¼ ins. × 25½ ins. Strips are secured to this base, as shown, which are cut from ⅜-in. square wood. Two dozen mounting bases will next be required. The best way to make these is to procure a perfectly square piece of wood 24 ins. × 9 ins. and divide it into three one way and eight the other way. Square the wood thus divided with the aid of a steel square, and then proceed to cut off the 24 pieces. Each piece provides an independent base for the mounting of some component, or for the building of a unit. When the components chosen are mounted upon the pieces in this manner it will be seen that they may be placed in any desirable position upon the base-board and are held in position by each other, and also by the raised strips which form part of the base-board. It is a simple matter to transfer a piece from one position to another.

Laying Out a Set

We will suppose, therefore, that we have 24 components, one component mounted upon each of the pieces. These components, for the sake of argument, will consist of the necessary parts for the average type of four-valve receiver. First, we may place each part in the most desirable position for wiring-up purposes, not forgetting at the same time to consider the relative positions of each unit as regards efficient arrangement. Having placed the parts in the most suitable manner, they may be quickly wired up by means of a series of varying lengths of insulated flex, each piece having each of its extremities equipped with a spade terminal.

Wiring

If, as has been suggested above, the components chosen are all provided with terminals, this connecting-up process will not be difficult. Absolute safety is ensured if insulated flexible

AN EXPERIMENTER'S BASE-BOARD—*continued*

wire is used for this purpose, and the general appearance of a circuit so made will be quite equal to the appearance produced by the conventionally wired-up receiver. If alterations are to be made, little trouble is experienced in this direction, as one component may be taken out or another added, or the positions of various components altered. Some ingenuity is called for, however, in the design and arrangement of each particular component unit.

Special Units

One unit, (a) in Fig. 2, should obviously provide a means of connecting the aerial and earth leads. It is a good idea to arrange this unit so that the base piece is provided with three terminals. One terminal should connect to one side of a clip-in condenser, the other side of the clip-in condenser should connect to another terminal, and the remaining terminal should be independent for the earth connection. Thus we may employ constant aerial tuning.

H.T. Battery

The next necessary unit to consider is an H.T. battery unit (b). Here four terminals are mounted as shown upon an ebonite strip. Three smoothing condensers are connected from the H.T. negative terminal to one of the H.T. positive taps in each case.

Low-tension and Grid Bias

An L.T. and G.B. battery unit may be made as shown at (c). This unit is equipped with five terminals, arranged as shown. The switch provides a means of switching off the filaments of the valves.

Telephones

A 'phone or loud-speaker unit is shown at (d). Here the use of two terminals and a jack is employed in order that 'phones or loud-speaker may be used at will. A by-pass condenser of any desirable capacity may be clipped in.

Grid Condenser and Leak

A grid-leak unit (e) may be made as shown. A variable grid leak may be employed, or alternatively a fixed leak of any value may be clipped in. The clip-in fixed condenser provides again a means of adjusting the value of this component to suit any type of circuit.

Six-pin Base

The last unit shown (f) carries a six-socket base for use in conjunction with any coil of the six-pin type.

These few suggestions should enable the constructor to carry out his own ideas.

The device is of considerable use to those who wish to try out circuits for new ideas before actually incorporating them in a receiver. A photograph of the base-board is shown, giving some idea of the appearance of the device with certain components mounted on it ready for wiring up. Those components which have no holes for wood-screws are secured with bolts from beneath the squares into tapped holes.

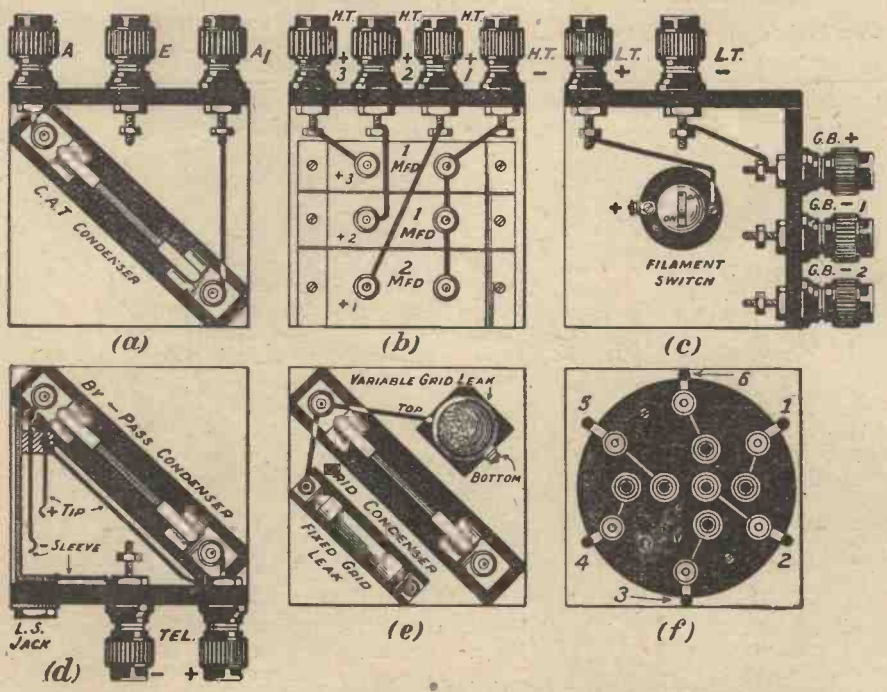


Fig. 2.—By careful arrangement of the components on the squares, the wiring of the set may be kept simple, with adequate spacing of the components.

GRID LEAK TROUBLES

WITH reference to the efficient working of a detector valve, probably the most important point of all is to make quite certain that your grid leak and condenser are not only of the correct value, but also of a reliable make, and constant. A grid condenser for a detector valve should hardly ever be larger than .0003; the writer has found a very marked difference in the operation of the set, even when several condensers of a cheap kind, all of which purported to be of this capacity, were tried. Make sure that the value really *is* that stamped on the condenser, by using reputable makes only.

Eliminating "Mush"

The grid leak is another difficult point. Very often that slight background in a set that sounds like faint interference from Northolt or Leafield is really due to the grid leak. In the writer's short-wave receiver several different makes of grid leaks were tried, and one was found that was obviously superior to the rest, the absence of "mush" when this particular one was connected in circuit being most conspicuous. Here, above all other things, is the necessity for absolute constancy.

Values

A grid leak that varies in value will cause an overlap to appear one day which vanishes again on the next, and will make the set oscillate furiously on one occasion and not at all on another. These are, of course, extreme cases, but a "self-variable" grid leak will be a constant source of trouble. Once again, keep to reliable makes, and trouble of this kind will not occur. Another objectionable effect, also caused by a defective grid leak, is a slight tendency of the set to burst into a "howl" just as it is brought up to the oscillation point. If this occurs, it will generally be found that the grid-leak value is too high.

L. H. T.

ADDRESS WANTED

WE are informed by Messrs. Dubilier Condenser Co. (1925), Ltd., that they have received an inquiry from a Mr. R. Anderson, of London, for details concerning their "Hiloten" Battery Eliminator. No address was given on the letter. If Mr. Anderson will forward his address to the above firm, they will be pleased to supply him with the required information.

READERS BUILD THE "NIGHT HAWK"

The "Night Hawk" receiver was described in our October, 1926, issue.

SIR,—I am writing to congratulate Mr. Percy W. Harris on his latest success, "The Night Hawk." I have constructed this set for a friend, and had only one night for testing, but in that one test I received twenty-eight stations on the loud-speaker, the best known being Hanover, Stoke-on-Trent, Bradford, Leeds, Barcelona, Nottingham, Hull, Cardiff, London, Manchester, Bournemouth, Hamburg, Newcastle, Munster, Radio Toulouse, Birmingham, and many others.

What I like the set best for is that though I have always had a job to get stations up north they fell in on this set.

Wishing THE WIRELESS CONSTRUCTOR every success.—I am, yours faithfully,

London, S.E.5. E. A. LONGDON.

SIR,—As per your request for remarks on the "Night Hawk," I have completed the set and am delighted with the result. London comes in at terrific strength and wonderful purity.

The other evening we listened to the concert from Hamburg, and it was all that could be desired, the amount of "mush" being negligible. Working from your chart I have tuned in most of the stations mentioned at various strengths, all on the loud-speaker.

The "Night Hawk" set constructed by Mr. A. Woodcraft.

I am working with Cossor .1 valves from a 2-volt accumulator. All three of my condenser dials match, which makes tuning very simple, and the reaction condenser brings in or cuts out a station or unwanted signals.

The set is rather prone to oscillate, and needs careful handling. The great snag I am up against is an incessant ringing in the loud-speaker, which is very objectionable. Is there any way of remedying this, as it entirely spoils anything but the band? If this can be overcome I think you have as near a perfect set as one could get and you are to be congratulated on designing it.—Yours faithfully,

E. MAJOR.

Carshalton, Surrey.

SIR,—I have now completed building the "Night Hawk" and find it very satisfactory indeed.

I can tune in about twenty stations, foreign and British, at good loud-speaker strength.

I am only using four valves, 2.H.F., detector, and 1.L.F., and I am using 140 volts H.T. This gives me ample volume. I am sending a photograph of the set.—Yours faithfully,

A. WOODCRAFT.

Norbury, S.W.16.

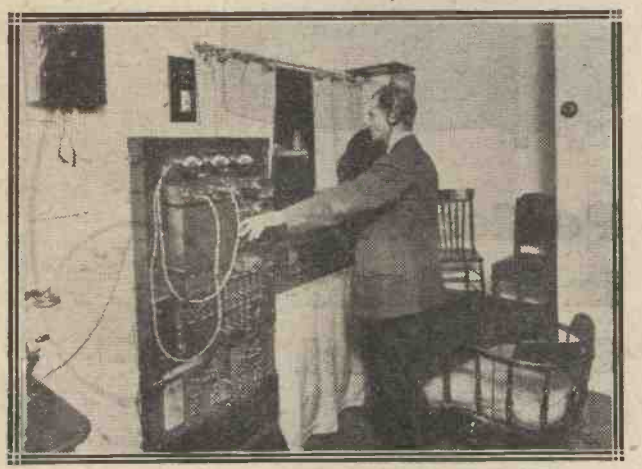
How to Use a Wavemeter—*continued from page 251*

for hours it may be, in order to receive some announcement from the station concerned. With a wavemeter the wavelength of the transmission may be determined, and this at once narrows down the choice of possible stations to a much smaller field.

A Better Circuit

This, however, does not give completely satisfactory results, and various devices are adopted in order to reduce the effect of the buzzer on the tuned circuit. One method of doing this is shown in Fig. 4. Here the buzzer is connected across only a small portion of the coil. The effect of switching on the battery causes a sudden pulse of current to flow through this portion of the coil, which is stepped-up by a transformer effect, and so charges the condenser. This results in a somewhat weaker signal strength, but at the same time the effect of the buzzer on the coil is very considerably reduced, and materially sharper tuning is the result.

Even this circuit, however, possesses certain disadvantages. It was in order to overcome these disadvantages that I undertook some experimental work extending over several months in order to find the best type of circuit. It was eventually found that by a special circuit the buzzer could be almost entirely isolated from the tuned circuit, and this gave a remarkable increase in the sharpness of tuning. Moreover, the arrangement in question only required the addition of a fixed condenser, so that it did not involve considerable expense.



The control-room operator at 3LO in Melbourne is able to watch the studio and to make the necessary adjustments for the items transmitted.

Sharp Tuning

In order to be of real use, however, it is necessary that the tuning on the wavemeter shall be crisp and sharp. This is a matter of careful design once again. The crude circuit shown in Fig. 3 is more or less hopeless for really sharp results. The effect of the buzzer connected across the tuned circuit is to introduce considerable damping, and makes the signals very flatly tuned. It was mentioned that the voltage of the battery was practically applied across the condenser C. In order to ensure that this is so, it is customary to shunt the coil of the buzzer itself with a resistance, so that a big pulse of current flows at the instant when the armature comes into contact with the contact pin, so ensuring that the condenser is charged to as high a value as possible.

An Improvement

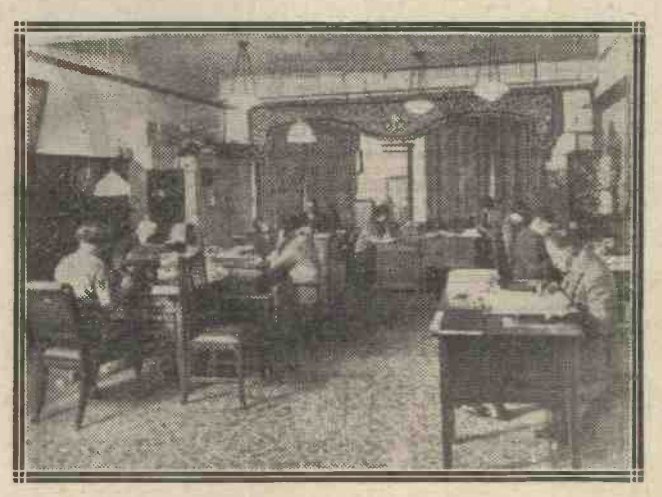
This at the same time increases the damping which is introduced into the circuit, and the tuning is apt to be somewhat flat. In operation, the exact tuning point may be facilitated by gradually removing the buzzer wavemeter further and further away from the receiver. As this is done the signal strength will be found to fall off rapidly, but at the same time the tuning will become narrowed down. So the band over which the buzzer can be heard on the wavemeter will be narrowed down very considerably, and it is possible by this means to obtain a reading with a fair degree of accuracy.

The Final Design

The actual method employed has been incorporated in the Radio Press Envelope No. 14, the "Razor-Sharp Wavemeter," which gives full details of the circuit, with constructional details showing how a simple wavemeter can be made up on these lines. As an example of the completeness with which the buzzer has been isolated from the rest of the receiver, it may be mentioned that the natural wavelength of the circuit LC by itself is not appreciably different from its wavelength when the buzzer circuit is connected across it. This is a state of affairs which cannot be achieved by any of the ordinary methods, and results in a very much more accurate instrument.

Calibration Difficulties Removed

The use of this special circuit also enables one of the biggest difficulties of a home-constructed wavemeter to be overcome. There are many ways in which a wavemeter may be made up quite simply and cheaply, yet at the same time there is always afterwards the difficulty of calibrating the coil and condenser in use, in order to know the wavelength of the combination for the particular settings of the condenser. With this particular circuit it has been found that, provided that the instrument is made up exactly in accordance with the specification, the calibration remains appreciably constant. It is therefore possible to pro-



Another glimpse of 3LO, the Australian broadcasting station at Melbourne, showing some of the "Uncles and Aunts" and other members of the station staff.

HOW TO USE A WAVEMETER

—concluded

vide a calibration chart in the actual envelope, so that when the instrument is made up it is already calibrated. Such a proceeding is naturally of considerable assistance to the amateur who wishes to possess a wavemeter for himself.

A Useful Accessory

As was stated at the beginning of this article, there is an increasing tendency to use these instruments. They take up very little accommodation, and repose in a corner quite unobstrusively. A dry battery serves to energise the buzzer, and will last for a considerable period. Yet there are those occasions when it is particularly desired to get some clue as to identity of a particular station, or perhaps it is desired to tune in the receiver to a particular wavelength, and in such cases the wavemeter proves an almost inestimable boon.

Tracing Faults

Those readers who make up numerous sets, often in skeleton form for their own amusement, will find a wavemeter particularly useful in testing out such receivers. This is particularly the case in multi-valve circuits, such as the "Elstree Six." By means of a wavemeter it is possible to test each circuit individually by holding the wavemeter near to that circuit, so greatly facilitating the tracing of any fault which may develop. At the same time, when dealing with a circuit which is somewhat tricky to operate until the settings of the condensers have been logged, the use of a wavemeter will save a considerable amount of trouble.

These are just a few of the uses to which a wavemeter may be put. There are numerous others also, and there are various tricks and dodges which the reader will find out for himself. There can be no doubt, however, that with the enormous number of stations now working a wavemeter is a most desirable asset.

LISTEN TO AMERICA DIRECT

—concluded from page 240

out of oscillation. Adjustment of the L.T. and H.T. voltages will assist in obtaining this condition. In some cases the use of a 5-megohm leak in place of the 4-megohm specified may effect an improvement in this direction.

Wavelength Range

It is impossible to state with any certainty what will be the exact wavelength range of any set constructed on this model, owing to the considerable effect exercised by detail changes in the construction. With the variable condenser specified it was possible to get down to about 30 metres with the 9- and 12-turn coils in series, and the earth clip at the ninth turn.

By moving the clips inwards from the two ends it was possible to go lower, but, probably owing to dead-end effects, better results were achieved by removing the 12-turn coil and using the 9-turn only. With this coil, and with the earth clip at the centre turn, a check on a wavemeter was obtained down to 25 metres, and it would oscillate readily at settings considerably lower. The smaller aerial coil was used for these lower wavelengths.

Generally speaking, the number of reaction turns may be the same as the grid turns for the lowest wavelengths, and slightly less as the wavelength is increased. Definite rules cannot be laid down, however, and test with the particular set constructed is the only reliable guide.

DAVENTRY COILS FOR THE 'SPANSPACE THREE'

THE coils for use in the "Spanspace Three" on the Daventry waveband are wound in an exactly similar manner to those for the ordinary broadcast band, the connections being exactly the same as those given in the November issue.

The windings, of course, are different in size, and are carried out with No. 40 s.s.c. wire on the same type of former. The first unit carries an aerial winding of 80 turns, and a centre-tapped secondary of 350 turns.

The second unit carries only a single winding, exactly as in the case of the shorter wave coil, with a tapping roughly one-third of the way from the end of the coil. The winding itself consists of 350 turns of the same wire, No. 40 s.s.c.

Questions & Answers

IMPORTANT NOTICE

IN consequence of the change in ownership of "THE WIRELESS CONSTRUCTOR," readers are requested to note that the service of Questions and Answers service is temporarily suspended.

A further announcement regarding this service will appear at an early date.

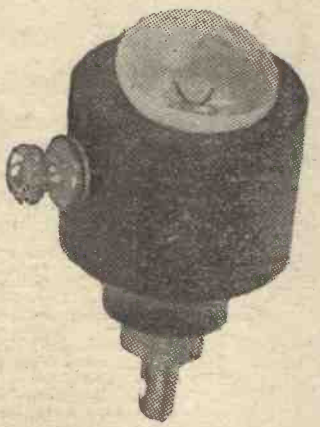
Attention is also drawn to the notice regarding the Free Blueprint service, which will be found on page 286.

For "The Wireless Constructor" at our Elstree Laboratories.

Safety Wander Plug

MESSRS. A. H. HUNT, LTD., have sent us one of their safety wander plugs for test. This wander plug consists of a small screw lamp holder which is provided with a plug fitting to enable it to be inserted in the usual high-tension battery. On the side is a small terminal under which the lead itself may be fixed. A small flash lamp screws into the holder and acts as a fuse, thus preventing the valve from burning out should a short take place.

When placed on test it was found that when this wander plug was



An ordinary flash lamp bulb screws into Messrs. A. H. Hunt's safety wander plug.

placed in series with the H.T. lead-in and the battery then shorted across a .06 valve, the safety lamp burnt out without the valve being damaged in any way.

This is a well-finished and useful accessory which commends itself to many amateurs as a simple means of protecting valves from being burnt out.

Safety Lead-in

MESSRS. PRESSLAND have sent us one of their safety lead-in tubes for test.

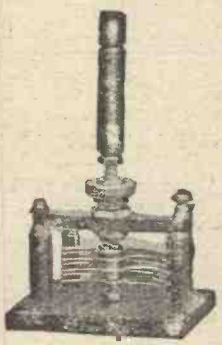
The aerial lead-in is attached to a heavy terminal, fixed at one end of a length of brass screwed rod. This rod passes through the centre of a brass ring to which an earth external to the building is connected. There is only a small gap between the screwed rod and this brass ring, so that in the event of a high static charge collecting on the aerial it is claimed that it will discharge straight to the earth across this gap rather than go through the set. The rest of the brass rod passes through an ebonite tube, and there is a stout terminal at the far end for connecting the lead-in to the set. The safety gap is totally enclosed so as to prevent leakage occurring owing to rain.

When placed on test it was found that the insulation resistance was infinity, while the capacity between the lead-in and the earth ring was found to be negligible. An insurance guarantee is supplied with each of these components, under which damage to personal property or third party will be paid up to £100.

Neutralising Condenser

MESSRS. Peto-Scott Co., Ltd., have sent us one of their new pattern of neutralising condensers for test.

In this component the spindle which carries the moving plates passes through a bush located in the centre of a bridge-piece of insulating material, which is carried at the top of two pillars of similar substance fixed



The Peto-Scott neutralising condenser, designed to have a low minimum capacity.

to the base. This forms the main bearing of the spindle, the bottom bearing being carried in a small metal bush screwed into the base. The fixed plates are placed well away from the moving plates, so as to obtain a low minimum, which is further provided for by the special curved shape of the opposing edges of the plates. The spindle is provided with a lock nut, so that the condenser may be locked after the correct setting is obtained. Terminals or soldering tags may be employed when making connections.

On test the component showed a minimum capacity of two micro-microfarads, the maximum being nineteen. This is quite satisfactory for all practical purposes, and can be considered as complying with the standard specification.

Panel Brackets

MESSRS. BURNE-JONES & CO., LTD., have sent us samples of their "Magnum" panel brackets for

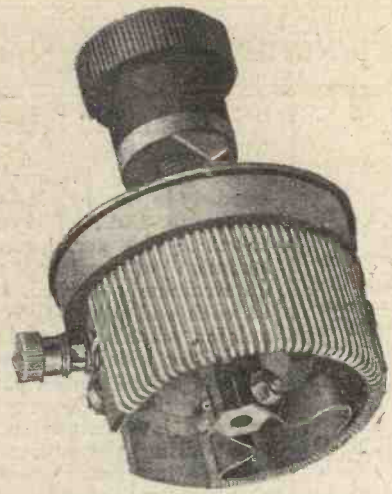
A panel bracket of the type submitted by Messrs. Burne-Jones & Co., Ltd.

test. These brackets, which appear to be constructed of cast aluminium, though light in weight, are solid and robust in construction, while both faces have been machined, so that when in use the panel will be held at true right angles to the baseboard.

Each arm of the brackets is provided with two holes for fixing purposes, and these accessories can specially be recommended in cases where heavy components are mounted on the panel.

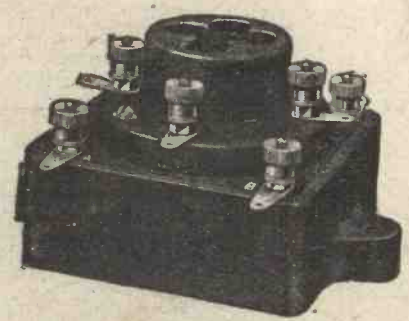
Filament Rheostat

WE have received samples of baseboard mounting filament rheostats from Messrs. Lissen, Ltd.



The "Cosmos" Rheostat.

The "Cosmos" Permacon.



The "Cosmos" Coupling Unit and spring valve holder.

Ask your dealer for these attractive folders on "Cosmos" Valves, Sets and Components.

Cosmos
RADIO COMPONENTS
ensure reliable sets.

Constructors who desire smooth working and efficient sets use "Cosmos" Precision Components.

The "Cosmos" Rheostat. The principal features of the "Cosmos" Filament Rheostat are its sturdy construction and reliable, smooth movement. The contact arm cannot easily be damaged, having its movement on the inner side of a porcelain bobbin which carries the windings.

Other pleasing features of this Precision Rheostat are the handsome knob and dial, ONE HOLE fixing, and the small space it occupies.

Made in four types, two of which are double wound for DULL or BRIGHT Valves and one a Potentiometer.

Description	Ohms	Current	Price
Single Wound	6.0	1.0 amp.	4s. 6d.
Double „	20	.4 „	5s. 0d.
„ „	34	.2 „	5s. 0d.
Potentiometer	300	—	6s. 0d.

The "Cosmos" Permacon is an ideal fixed condenser being light in weight, of guaranteed accurate capacity, and having the lowest possible losses.

The dielectric is mica, and each condenser is tested at 500 volts during inspection. Nickel-plated cases give them a particularly neat appearance.

.0001 mfd.	1/6	.001 mfd. ..	1/8
.0002 „	1/6	.002 „ ..	1/10
.0005 „	1/6	.005 „ ..	2/8
.0003 „ (with clips for grid leak)	1/8	.01 „ ..	3/9

The "Cosmos" Coupling Unit. Real purity of reproduction can only be obtained with resistance capacity coupling. The "Cosmos" coupling unit with a suitable valve is as effective as an ordinary transformer-coupled stage. It avoids all distortion and effects considerable economies in first and operating cost.

Designed primarily for use with the "Cosmos" S.P. Blue Spot Valves, it can be used successfully with any valve having an amplification factor of 30 or more.

Type "O," the Unit alone .. .. 8/6.
Type "V," the Unit incorporating spring valve holder (as illustrated) 10/6.
Suitable valves for use with this unit are "Cosmos" S.P. 18/B at 14/- and "Cosmos" S.P. 55 B at 18/6.

Metro-Vick Supplies Ltd.

(Proprietors: Metropolitan-Vickers Electrical Co., Ltd.)

METRO-VICK HOUSE,
155, CHARING CROSS ROAD, LONDON, W.C.2 R / P 54

Apparatus Tested—*continued*

These rheostats are similar in construction to their well-known panel mounting type in that the winding is carried on a strip of insulating material, which is bent round a moulded insulating former. Terminals or soldering tags are provided for making connections, while a special short spindle is employed so that the rheostat may be mounted flat on the baseboard. The resistance can be set to any required value within its limits, and, so long as an "on" and "off" switch is included in circuit, need not be altered again.

The rheostats received were of the bright emitter type, and when placed on test it was found that they all had a resistance of 7 ohms, which is the figure given by the makers. The maximum position gives less than one-tenth of an ohm, while the wire employed is of a heavy gauge, so that several amperes can be passed through this resistance without overheating.

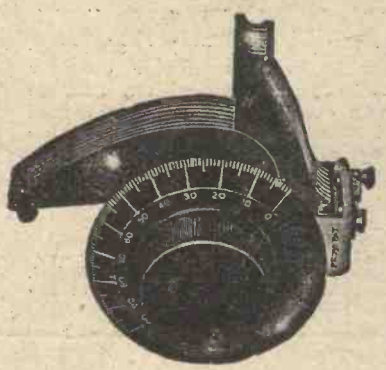
This component is robust in construction, and can be recommended for use.

Variable Condenser

WE have received a straight-line frequency variable condenser for test from Messrs. Formo, Ltd.

The construction of this component incorporates several novel features. Only a single bearing is employed, and this is of the cone type, arrangements being made for adjustments to take up wear. The stator plates are supported at one place only, the insulation being arranged so as to be out of the main field of the condenser.

As in most S.L.F. condensers, the vanes are somewhat long, and in order



The Formo S.L.F. variable condenser.

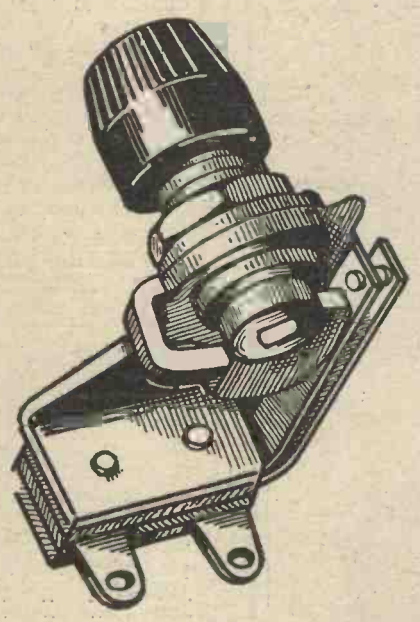
to eliminate any possibility of irregular spacing at the tip, small supports to both the rotor and stator vanes have been fitted. The component is of the one-hole fixing type, and is provided with a standard ¼ in. spindle for the dial. Connections may be made either by terminals or soldering tags, while, as an additional means for connecting to the rotor plates, a copper pigtail is provided.

The capacity of the condenser is rated at .0003 by the makers, and when placed on test its actual value was found to be .0003. Its minimum value was .00002, while at broadcast frequencies its losses were negligible.

The instrument is robustly constructed and well finished, and can be fully recommended.

Battery Switch

MESSRS. ROTHERMEL RADIO CORPORATION OF GREAT BRITAIN, LTD., have submitted to



The "Yaxley" battery switch.

us for test one of their "Yaxley" battery switches.

As the name implies, this component is intended for insertion in one of the battery leads for use as an "on-and-off" switch. A small lever actuates a cam made of insulating material, which presses against a spring contact as the knob is rotated, thus closing the circuit.

Connections may be made by means of two soldering tags, and a positive stop is provided for "on" and "off" positions, which are indicated by means of a small engraved plate placed in position on the panel under the fixing nut. The lever on the switch knob also serves to lock the knob on the spindle, and it is provided with a knurled end for easy withdrawal.

We can recommend this component as being a workmanlike job, and it provides a satisfactory means of making or breaking the low-tension circuit.

"Enhansa" Indoor Aerial

WE have tested a sample "Enhansa" indoor aerial forwarded to us by Messrs. Ward & Goldstone, Ltd., of Pendleton, Manchester. This aerial consists of three strands of silver-braided cable, approximately 4 yards long, carrying at each end a reel-type porcelain insulator, while at one end there is a terminal for making the necessary connection to the lead-in wire.

The aerial can be very easily hooked up, and is especially suitable for service during the summer months for use as a temporary outdoor aerial, and should prove exceptionally useful to motorists who take receiving sets with them.

Tested on a two-valve receiver at a distance of seven miles from 2LO, the aerial gave very good results considering its size, London being heard at good loud-speaker strength, whilst on a crystal set signals were received at fair telephone strength.

We can recommend this aerial under conditions where a long outside aerial is either impracticable or undesirable.

Duros High-Tension Unit

MESSRS. A.F.A. Accumulators LTD., have sent us for test one of their Duros high-tension units.

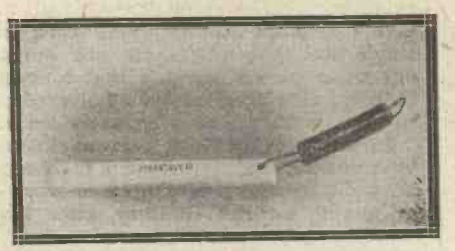
This unit is of monobloc construction, compact in size and light in weight. When discharged at a rate of 60 milliamperes its capacity is stated to be 1,800 milliampere hours.

One of the Duros high-tension units.

The plates are separated from each other by a strip moulded into the glass container, while the top of the cell is filled in with pitch, tappings being provided at every 2 volts. The vent plugs are held together on a common strip of indiarubber, this being an excellent idea, since the single vent plugs do not get lost.

Apparatus Tested—*continued*

Several of these units have been in use for some months as a 60-volt high-tension battery, and when originally charged their voltage was found to be in the neighbourhood of 66 volts. After two months' use the voltage still registers above 60, and the cells appear to be in excellent condition in every way; the battery is silent in action.



The "Hypower" insulator is fitted with a spring to keep the aerial taut.

The makers advise giving this cell a slight boosting charge every four to five weeks, but this has not been found necessary in the case of the unit under test.

Although we have not as yet been able to give this cell a very stringent test, the results so far obtained are very favourable, and we have no hesitation in recommending this high-tension unit.

"Hypower" Insulator

MESSRS. SPRING WASHERS, LTD., have sent us one of their "Hypower" Insulators for examination and test.

This insulator, which is of the rod type, is made of porcelain with a glazed surface, and is provided at one end with an aerial tensioning spring. Using this product for the aerial insulator so that the spring has a slight tension, the wire will remain taut under varying conditions.

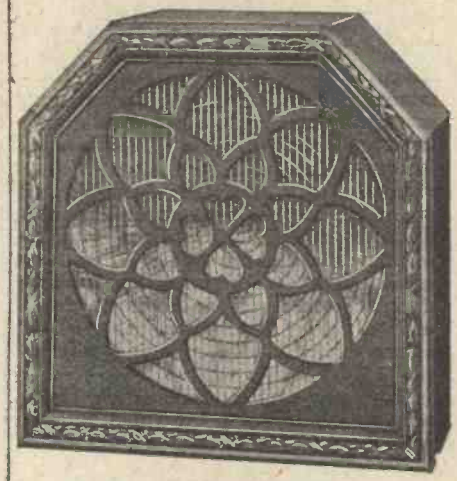
The insulation resistance was found to be infinity, while the capacity to earth introduced by its use is considerably lower than the average. It is stated that the breaking load of this insulator is 500 lb., a figure far in excess of the maximum load likely to be applied by the largest amateur aerial.

This is a useful fitting which can be recommended for aerial insulation, either for reception or transmission.

Celestion Loud-Speaker

WE have received one of their A3 models from Messrs. Celestion Radio Co.

This model is an advance upon the one originally produced by this firm. Instead of being contained in a square mahogany case, the two top corners have been bevelled off. We also understand that improvements to the mechanism have been made by the makers, so that the maximum load which can be taken by this instrument is far greater than in earlier models, while overloading would in no way affect the performance of this model.



The new model "Celestion" loud-speaker.

On test it was found that the reproduction given by this instrument was of exceptionally fine quality both on speech and music, the tones coming out

Apparatus Tested—*continued*

particularly well. The articulation is clear on speech, while musical items are well reproduced.

"C.W." Battery Container and Safety Wander Plug

WE have received samples of various components from Messrs. The J. E. B. Trading Co., including their "C.W." Battery Container, "C.W." Safety Wander plug, battery tester and inspection lamp combined, and some of their special battery links.

The battery container consists of two metal trays sliding one within the other, of suitable dimensions to take ordinary flash lamp cells. The container allows a high-tension battery of any desired size to be made from cells of this description, the whole battery being kept secure and tidy in the battery tray.

The component is finished in black japan enamel, and is provided with a metal knob at each end.

Battery Links

The battery links are special double-ended clips, by means of which the flat spring contacts on each flash lamp cell may be linked with succeeding and preceding cells. They provide a ready and handy means of doing this neatly and efficiently, while a hole drilled through the centre of the link enables wander plugs to be used in the conventional manner.

Safety Wander Plug

The safety wander plug consists of a small flash lamp holder provided

The "C.W." extensible battery container.

with a specially long wander plug for the centre contact, while a small swivelling brass arm makes contact with the outside part of the holder. When this is used in the negative lead of a high-tension battery, it is intended that the lamp should burn out in the event of the high-tension battery being inadvertently connected across the valves, thus preserving the latter from damage.

It is also intended for use as a battery tester, since the brightness of the lamp will give a rough indication of the condition of each flash lamp cell, while with leads connected to it from a suitable battery it may be used as an inspection lamp for examining the interior of a set.

When placed on test it was found that at 6 volts a current of .42 ampere was passed by this lamp without it being burnt out. Under working conditions, however, it was found to give ample protection, and even a single .06 type valve was not burnt out when placed across a high-tension battery with this safety wander plug in series with one of the battery leads.

In view of the high current taken by the filament of the lamp it is not advisable to use this plug as a means of testing an H.T. battery, since the

The "C.W." combined safety wander-plug and battery tester.

load is considerably higher than would be imposed upon the battery under normal working conditions.

HOW WIRELESS COMPONENTS ARE MADE

(*Concluded from page 190*)

Capping

When this is done those valves which stand the test are "capped." There are two parts to the cap of the valve, the shell and the insulator. The cap is pasted on to the base of the shell. The insulator is fixed into position into the shell and the four copper wires, which you remember were fixed to the foot of the valve, are threaded between the valve legs, which you will notice are usually slit for this purpose. The wire is cut off and soldered to the leg of the valve to which it applies, two of the leads going to the two filament legs, one to the anode leg and one to the grid leg. Then the shell of the valve is "pinched" by means of a hand machine on to the insulator and the cap is fixed by this means.

Final Tests

After cleaning and dusting—for the valve becomes very dirty going through so many hands in this way—a final test is made with instruments recording the emission, vacuum and general behaviour of the valve. It is marked and stamped on the glass with the various markings necessary to it and the valve is ready for issue for use by you on your receiving set. It has taken a long time to describe all this, yet the process of valve making, from beginning to end, though so complex, is rapidly carried through to ensure a maximum output within the minimum space of time necessary to efficiency.

The two larger photographs of valve manufacturing apparatus which accompany this article are reproduced by courtesy of the General Electric Co., illustrating the making of Osram valves at their works.

THE "DISTAFLEX TWO"

THE design of the screened coils used in Radio Press sets is the result of a careful combination of efficiency and compactness. After experiments at our Elstree Laboratories certain standards have been found necessary, and unless these are adhered to loss of efficiency may result.

The following makes of screened coils have been tested at Elstree and found to conform to the standard specification, being therefore suitable for the "Distaflex Two" and other Radio Press sets incorporating standard screened coils:—Bowyer Lowe, Collinson, Copex, Efesca, Lewcos, Magnum, Wright & Weaire.

FREE BLUEPRINTS

IMPORTANT NOTICE TO READERS

IN consequence of a change in the ownership of THE WIRELESS CONSTRUCTOR and MODERN WIRELESS, the free blueprint service has been discontinued as from 1st December, 1926.

A Revised Scheme for the supply of blueprints is in course of preparation, and announcements concerning it will appear in early issues of "POPULAR WIRELESS."

A NOTE ON TAPPING

WHEN drilling a hole for tapping remember to make it smaller than the finished size you want; if you do not, the tap will nearly "drop" through and no thread will result. An approximate idea of the size required can be gained by taking one and three-quarter times of the finished size, *i.e.*, three-sixteenths for a quarter tapped Whitworth. There are a number of different threads in use, including Whitworth, British Association, Gas, Metric, etc. These all have a different pitch, *i.e.*, the distance between the centre of one thread to the centre of the next. But the wireless worker need only trouble about the British Association or "B.A.," as it is called. This has a very fine thread which is most suitable for wireless work.

Taps

It is usual to employ three taps, although two will do at a pinch. These are first, second and plug or bottoming taps. Naturally one commences with the first tap; this is the one with the greatest taper and little or no thread at the end. This is followed by the second tap, namely, the one with a slight taper; and lastly, the plug tap.

Keep Straight

Great care should be taken when using the tap to keep it vertical, as a slanting hole will show up if the screw-head projects. If your hole happens to have run a little out of true in the drilling, careful tapping can correct it, but care will have to be taken if you do not wish to add a broken tap to a badly-drilled hole.

Keep a steady pressure on the tap wrench, and as soon as the tap tends to jam, remove it from the hole and clear away any material that may have stuck in the flukes; this jamming is usually preceded by a springiness or "give" in the tap—so take warning. Do not "lay" on your job when tapping or you will make the hole too big and possibly break the tap.

Finally, do not buy cheap taps or dies, since they are often made from cheap steel of doubtful quality and improperly hardened and tempered. Broken taps and spoiled work are likely to result from their use, so that they do not pay in the long run.

W. J. H.

AN OBSCURE VALVE FAULT

MISBEHAVIOUR on the part of a set using dull-emitter valves is often due to partial loss of emission of one or more of the valves.

The general symptoms of loss of emission are weak signals and failure to oscillate. A general "dead sensation" about the set is often attributable to this cause, and it is important that these symptoms be known, as results may often be temporarily improved by increasing the filament voltage applied to the valve. This, however, generally results in the complete destruction of the dull-emitting properties of the filament, and though the valve may be run for some time after as a bright-emitter, it will not last very long. When the behaviour of the set gives the slightest reason to suspect that the emission of the valve is defective, the *first* thing that should be tried is the substitution of another valve.

L. H. T.

ALL ROUND EUROPE WITH PLUG-IN COILS

—concluded from page 200

be made somewhere about the 400-metre mark, so that the balancing shall remain as accurate as possible both on the higher and lower wavelengths.

If the two coils L_4 and L_6 are badly matched, it will be found that the two halves of the gang condenser will have to be adjusted so that one is a large number of degrees in front of or behind the other. If this is the case, then different pairs of similarly-rated coils should be tried till a pair is found with which both condensers are nearly set the same. A variation of 5 or 6 degrees is approximately the maximum permissible divergence, though the set will work quite well with a larger difference than this. Under these circumstances, however, it is highly probable that weak transmissions will not be received at all.

Some Results

When I tried out the set on a short screened aerial about two miles from 2LO, in conjunction with a low-frequency amplifier, I was able to receive a number of stations on the loud-speaker with only one stage of L.F. at a strength equal to, if not greater than, that which I can obtain with a four-valve set, using only one stage of H.F. and two of L.F., thus definitely proving that the circuit used in this receiver is a highly efficient one.

It was found possible to tune in just on thirty stations in half an hour, and among the transmissions received I have picked out those which were heard at reasonable strength with only one stage of L.F., many of them, as stated, being at loud-speaker strength. Without any low frequency all these stations are heard at excellent strength in the 'phones, some of them, indeed, rather too loud for comfort. The dial readings refer only to the gang condenser, since the aerial condenser will vary according to circumstances. L_5 and L_6 were both Gambrell B, the makers supplying specially matched coils if desired.

Tuning was found to be delightfully simple, and, since the reaction control very seldom required touching, it was easy to go from station to station just on two dials. Selectivity was good, Bournemouth being received at two miles from 2LO with only slight interference.

INDEX TO ADVERTISERS.

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