The Wireless Constructor

6D MONTHLY

EDITED BY
PERCY W. HARRIS

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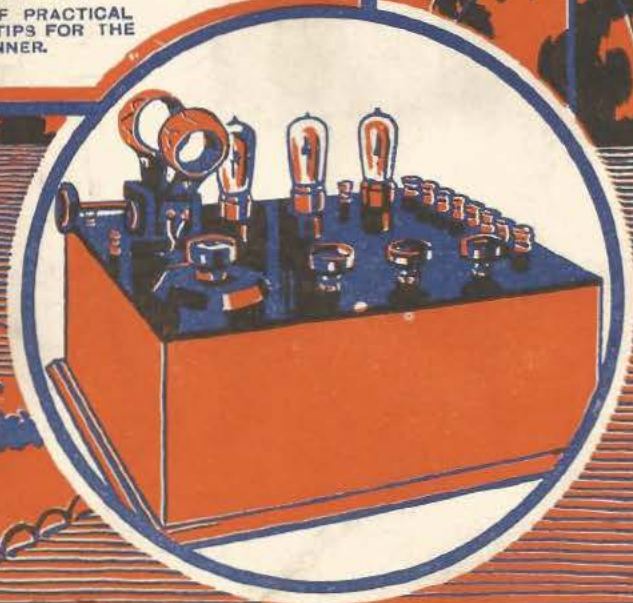
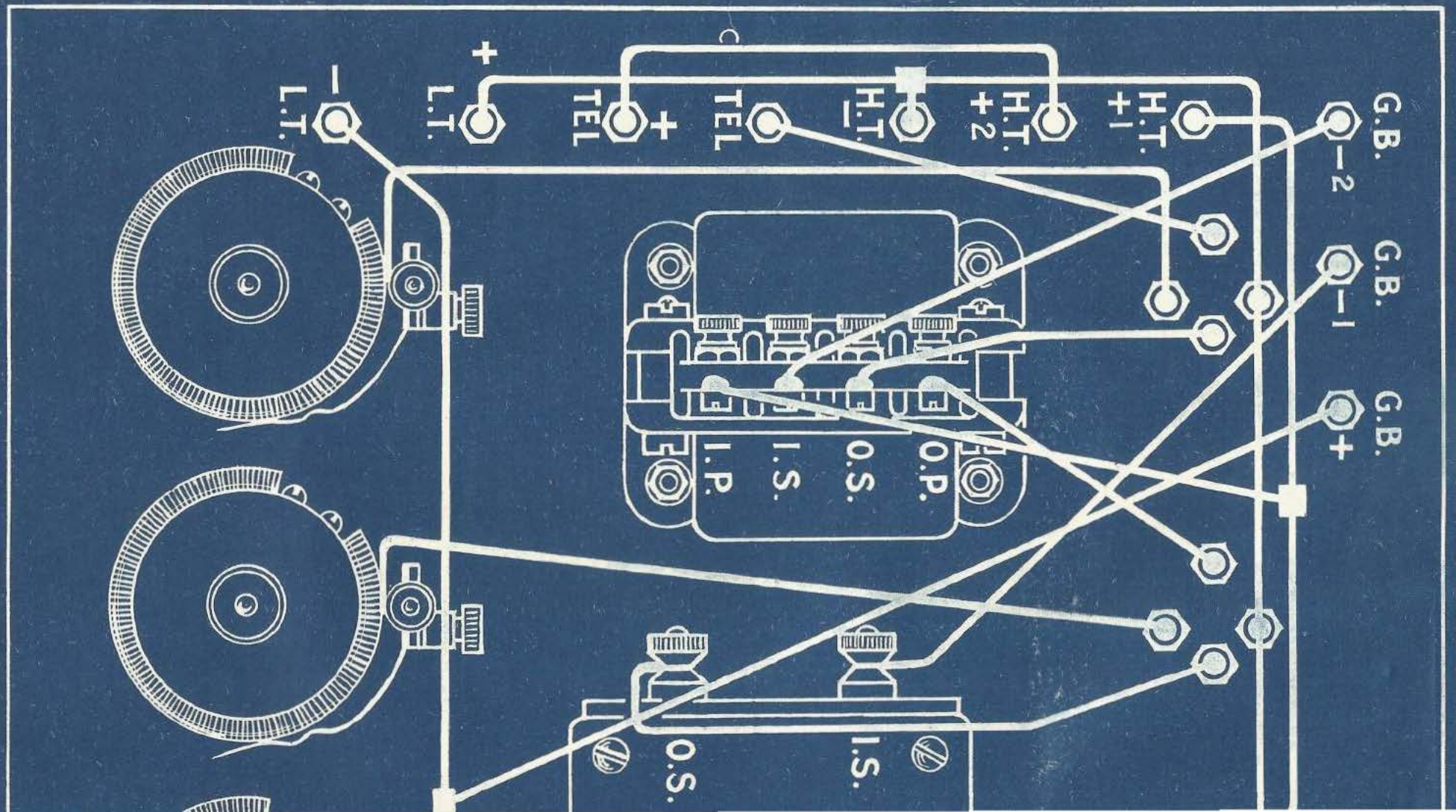
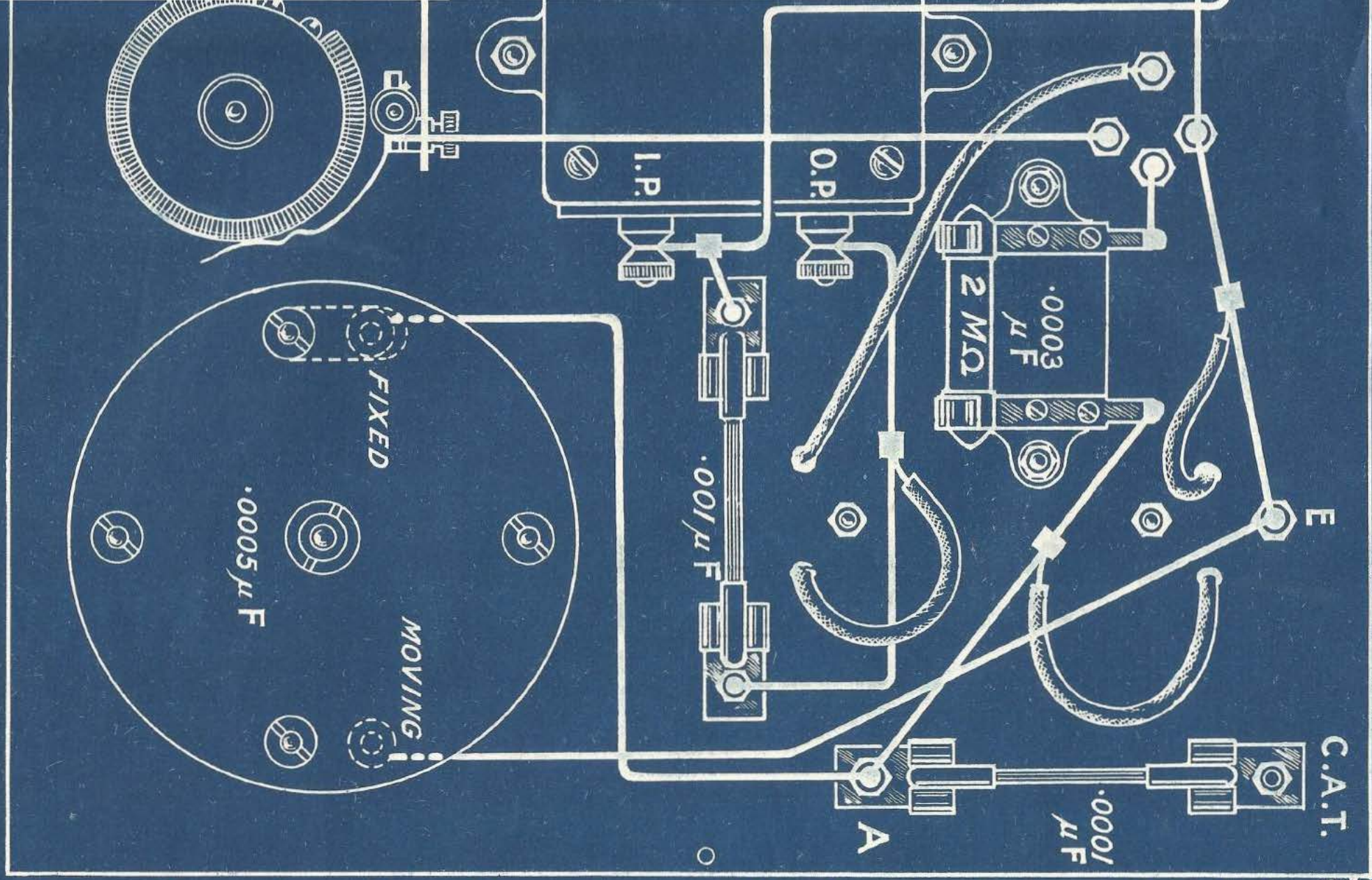
Vol. 1. No. 6. APRIL, 1925



1/6 BLUEPRINT FREE INSIDE

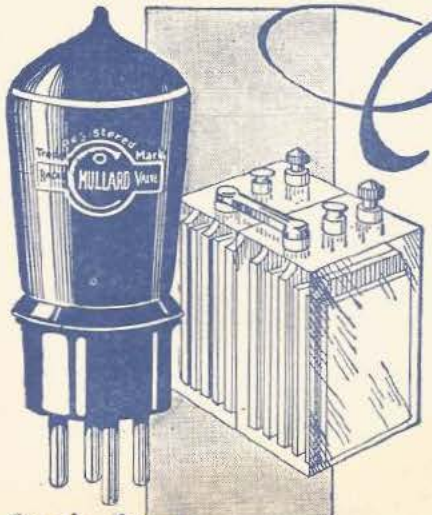
THE WIRELESS CONSTRUCTOR "POWERFUL 3-VALVE" RECEIVER.



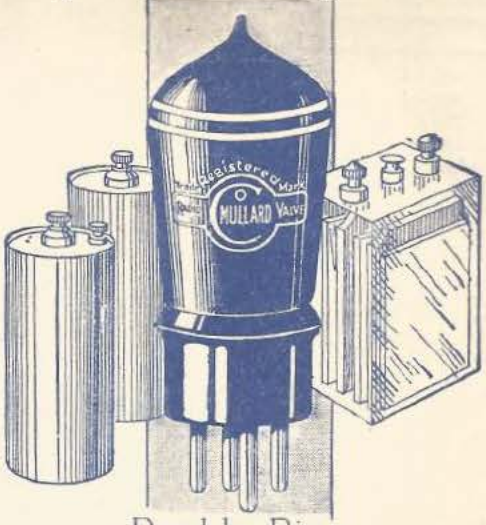


RADIO PRESS LTD., BUSH HOUSE, STRAND, W.C.2. Blue Print C.1011B Price 1/6.

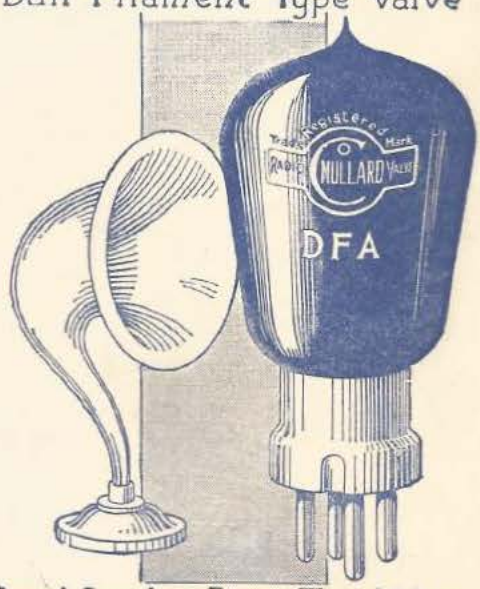
Comprehensive Range



Single Ring
Bright Filament Type Valve



Double Ring
Dull Filament Type Valve



Loud Speaker Power Type Valve

Here are Master Valves for perfect long-distance and pure tone reception.

You will find in these three groups a range of Master Valves that will produce the finest wireless reception from your set. Each type of Mullard Valve is the best that modern research can produce. Make your own choice.

BRIGHT FILAMENT VALVES

FOR 4-VOLT ACCUMULATORS.

Mullard H.F. Red Ring Valves for H.F. AMPLIFICATION and DETECTION - - - - - 11/- each

Mullard L.F. Green Ring Valves for L.F. AMPLIFICATION - - - - - - 11/- each

(Recommended for reflex or dual circuits.)
Leaflet M. 8 gives full information.

DULL FILAMENT VALVES

MULLARD H.F. DOUBLE RED RING VALVES FOR H.F. AMPLIFICATION.

Type D.3, for Accumulators - - - - - - 18/- each

Type D.06, for Dry Cells - - - - - - - 21/- each

MULLARD L.F. DOUBLE GREEN RING VALVES FOR L.F. AMPLIFICATION.

Type D.3, for Accumulators - - - - - - 18/- each

Type D.06, for Dry Cells - - - - - - - 21/- each

Leaflet V.R. 20 gives full information.

LOUD SPEAKER VALVES

Mullard D.F.A. 0, for 4-volt Accumulators - - 26/- each

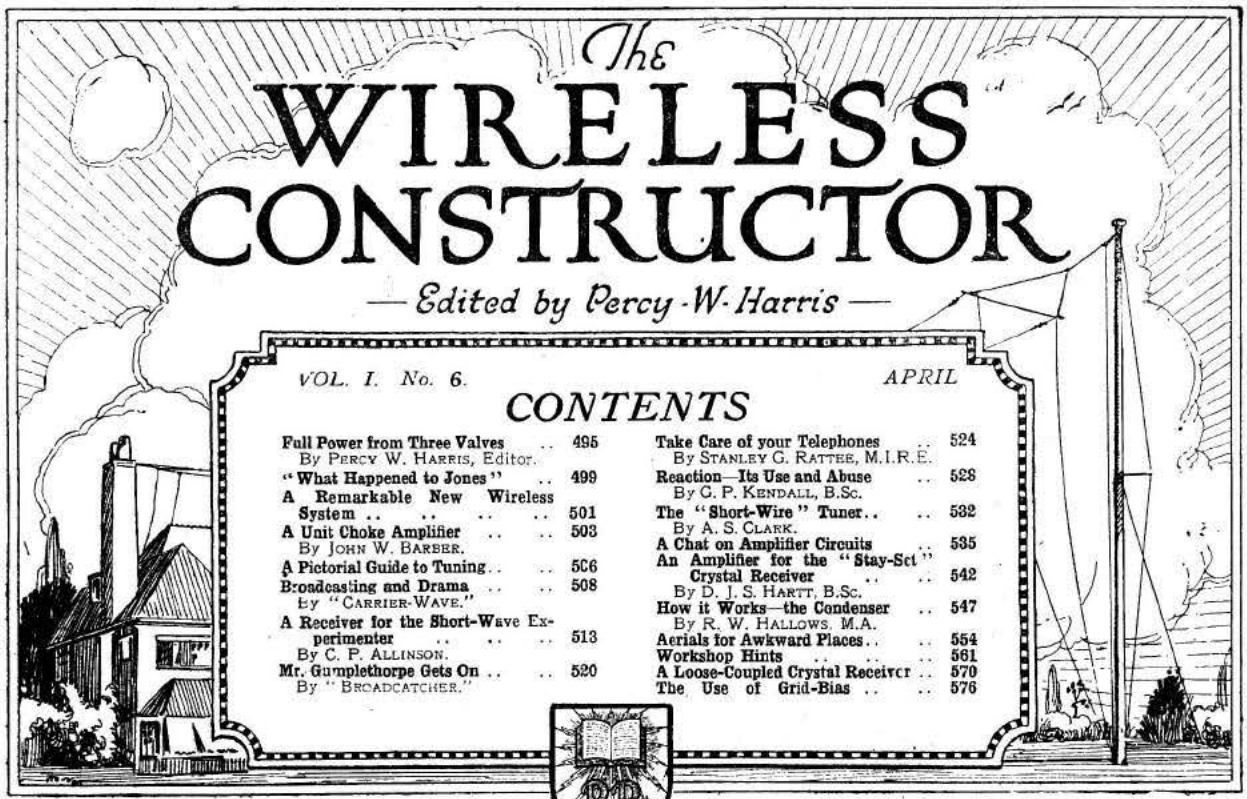
Mullard D.F.A. 1, for 6-volt Accumulators - - 30/- each

Leaflet V.A. 4 gives full information.

All these Valves bear the Hall Mark of

Mullard

THE · MASTER · VALVE



The WIRELESS CONSTRUCTOR

— Edited by Percy W. Harris —

VOL. I. No. 6. APRIL

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Full Power from Three Valves

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

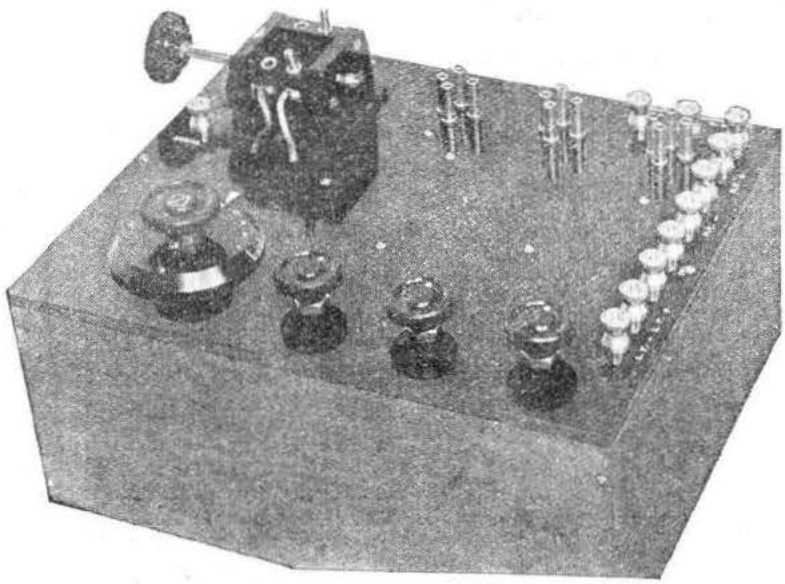
This simply made receiver is designed to give full volume from three valves, together with great simplicity in handling. Suitable component parts can be purchased from any radio dealer

A VALVE detector, followed by two stages of note magnification, is an excellent combination of valves for many purposes. If the note-magnifying valves are transformer coupled, and if good transformers are used, we shall get a high degree of magnification from each stage, and thus shall use our valves economically. For this reason the combination referred to is deservedly popular.

In the powerful three-valve set about to be described the circuit used is not new—in fact, it can be called quite old, so far as wireless counts. In putting the circuit into practical shape for this issue, I have found it possible to introduce one or two novelties in design which help to make the set more pleasing in appearance than many built with the same circuit. Needless refinements have been eliminated, but provision is made for separate grid-bias for each note-magnifying valve, and for additional high-tension on the last stage, so that, if the reader desires, he can use a power valve in the correct manner. What you, personally, can receive with this set depends largely upon your aerial, your local conditions and your skill in handling. Even if you have never handled a set before, you will be able on an average outdoor aerial, after half an hour's practice, to tune in your local station on the loud-speaker, provided it is not more than 40 or 50 miles away.

Simplicity and ease of control are important features of this receiver.

If you are used to handling valve detectors using reaction, you will be able to hear (in the telephones) several, if not all, of the other broadcasting stations, with perhaps two or three of them on the loud-speaker. Personally, I have received America on this set by listening on a good night, but this must not be taken to indicate that I recommend the set for regular long-distance reception. It is really designed for the man who wants to obtain the nearest station at good loud-speaker volume with the greatest simplicity in handling.



With coils and valves removed, this photograph gives a clear idea of the layout.

The Lay-out

In designing such a set we have the choice of several styles. We may adopt what is generally termed the "American" method, placing most of the components on a baseboard behind and the controlling knobs on a vertical panel, the valves being enclosed within the cabinet. This style has the advantage of a pleasing appearance, but is more difficult for the beginner to wire up. Secondly, we have the "English" method of mounting the various components on a single panel with valves outside. With good design, a pleasing appearance may still be obtained and, in addition, the wiring is much clearer to illustrate, and much simpler for the beginner. For this reason the latter style has been chosen for the present instrument.

If you examine the photographs you will see on the left of the panel a two-coil holder by which the coupling between the reaction and the aerial coils can be varied. At the back of the instrument are placed three valve sockets, whilst along the front can be seen the knobs of the three filament resistances which control the brightness of the valve filaments. Suitable terminals are disposed on the right and left, with facility for using the now popular "constant aerial tuning" as well as the more conventional parallel tuning.

Behind the panel you will see the variable condenser, grid-leak and condenser, two intervalve transformers, the constant-aerial-tuning condenser (interchangeable, between clips), and an interchangeable condenser across the primary of the first intervalve transformer. The filament resistances adopted are the type that have interchangeable bobbins, so that if at any time you should wish to change from bright to dull emitters, or *vice versa*, it is only necessary to unscrew a knob on each holder, withdraw the interchangeable bobbin, and replace it by one suitable for the new valves to be used. In this way we can change from bright emitters to the ·06 type of dull emitter without any alterations of wiring.

Components

The components needed to make this set are very easily obtained. Whilst any good makes will do throughout, the makers of the actual parts used are named, so that any readers who wish to duplicate the set in every detail may do so.

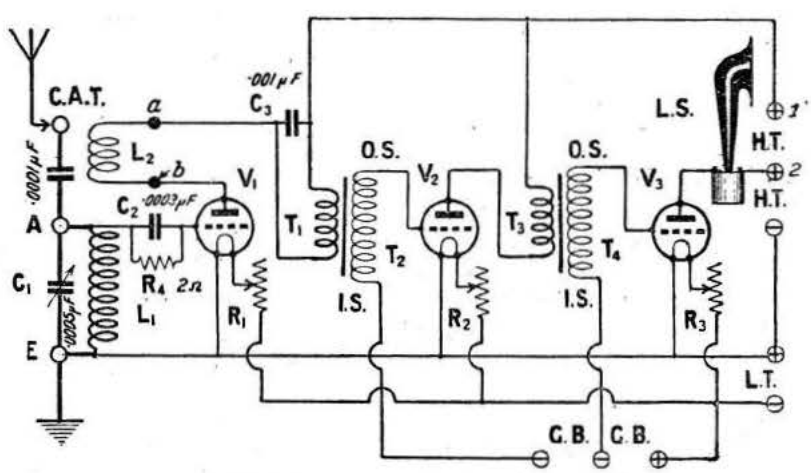
One 12 by 10 by ¼ in. panel. This must be of a first-class insulating substance, free from surface leakage. There are many makes of guaranteed ebonite quite suitable for the purpose, and 12 by 10 in. panels, ready cut, are sold by large numbers of dealers. I have actually used a panel, not of ebonite, but made from a substance called Trolite.

One suitable box at least 5 in. deep.

Thirteen terminals.

One variable condenser, square law, ·0005 microfarad. I have used the Peto-Scott, and can also recommend from personal experience square law condensers made by Sterling, Bowyer-Lowe and Jackson Bros. There are other makes of square law condensers I have not tried which might prove suitable here.

One first-stage intervalve transformer.



The theoretical circuit diagram.

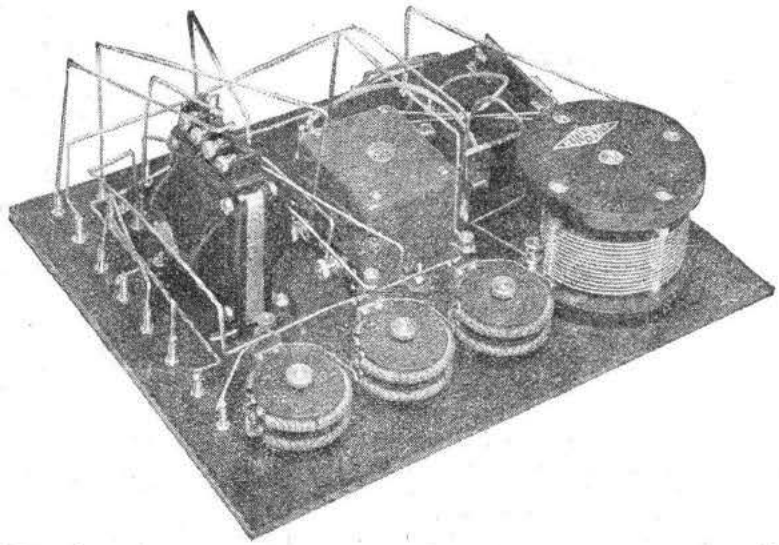
One second-stage intervalve transformer. Many good makes will do here. I have used for the first stage a Gambrell, and the second a second-stage Igranic. This combination works well, and there is no tendency whatever to howl—a valuable feature.

Three filament resistances (I have used Polar bobbin interchangeable resistances). If you use these, purchase them with bobbins to suit the valves you are to use. It will only be necessary to specify whether they are for bright emitters or for a particular type of dull emitter, and the makers will supply the correct bobbin.

One grid condenser and leak, ·0003 microfarads and 2 megohms (Dubilier). There are several other suitable makes.

One clip-in condenser with clips, ·0001 microfarad (McMichael MH pattern).

One clip-in condenser with clips, ·001 microfarad (McMichael MH pattern).



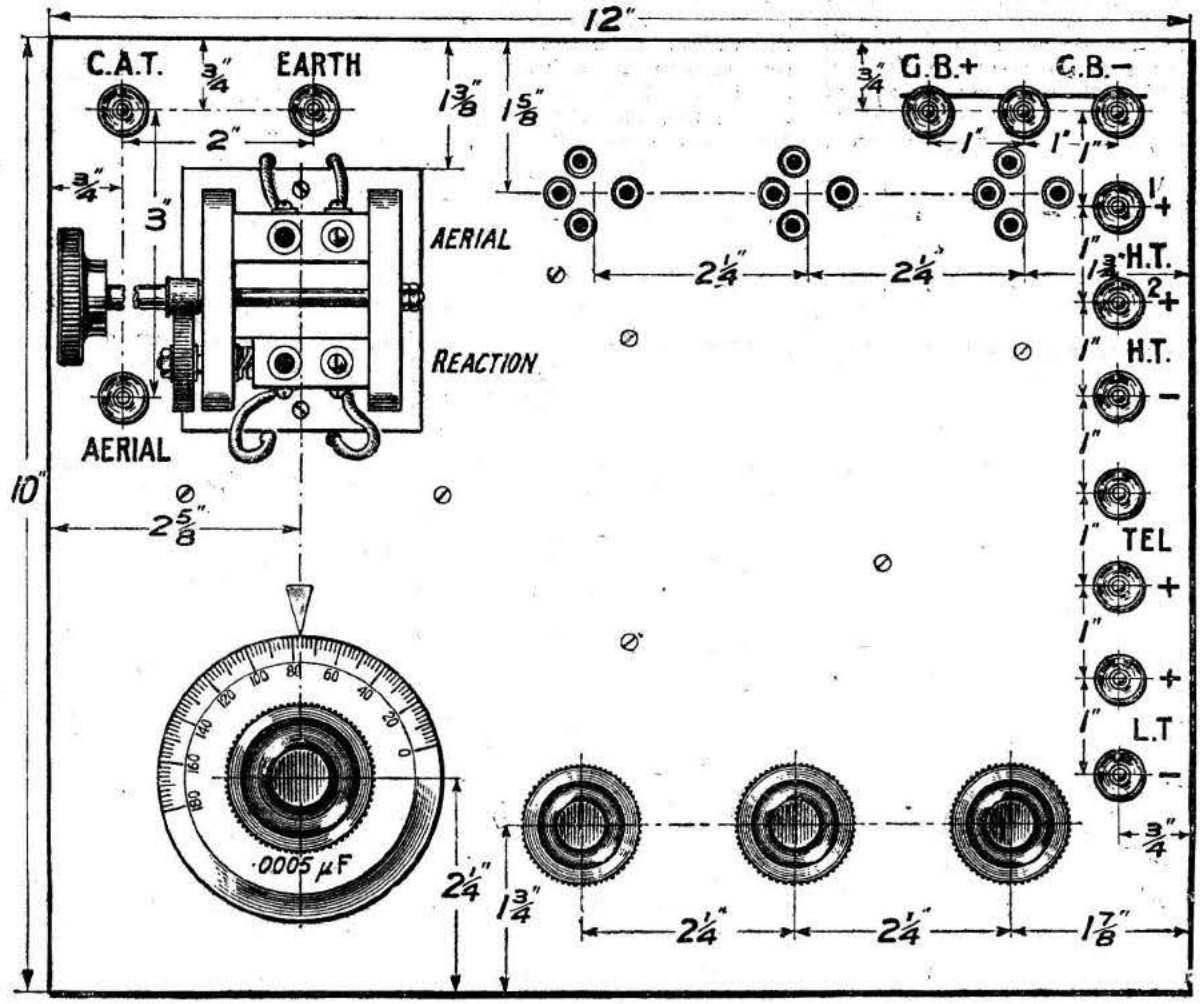
This view shows how the transformers and rheostats are mounted.

One two-coil holder. The particular pattern shown is Peto-Scott manufacture.

Three sets of valve sockets.

No. 16 square wire for wiring up.

A few B.A. countersunk head



Drilling diagram of the panel, showing terminal markings. Blueprint No. C1011A.

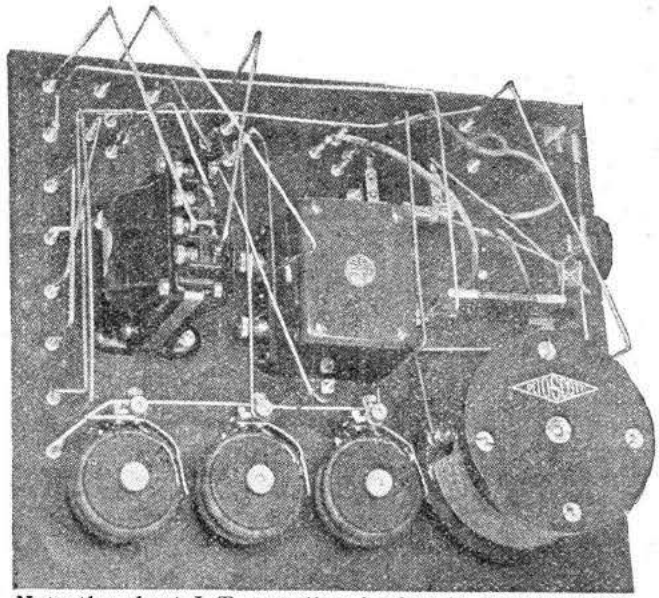
metal screws with nuts for holding component parts to panel.

One set of Radio Press panel transfers.

Constructional Work

Having obtained your panel, collect together your other components and lay them out on the panel, remembering always that in this lay-out you are working from the *back* of panel, and therefore the order of parts will be reversed in relation to the front view. If you use the actual components indicated in the present set, you will, of course, be able to lay them out very accurately from the free blue print, but if you have used different makes it may be necessary to adjust the position of a few parts so as to work them into the space. In doing this, be careful to adhere as closely as possible to the original design, for the actual disposition of wiring is of great importance in any set.

Terminal positions and such-like can, of course, be marked out directly from the blue print. In any case, do not attempt to drill the panel until you have obtained *all* the parts, so as to make sure of their relative positions. Drilling should be carried out with care, and in the case of such components as terminals, these should be kept on a straight line to avoid an untidy appearance in the finished receiver. Notice that in addition to the holes for the securing of screws of the two-coil holder, four additional holes are drilled in the panel to allow flexible leads to pass through. These flexible leads are connected to the screws of the coil sockets by passing the wires underneath washers and screwing up tightly. The other ends are soldered to suitable points on the fixed wires, as shown.

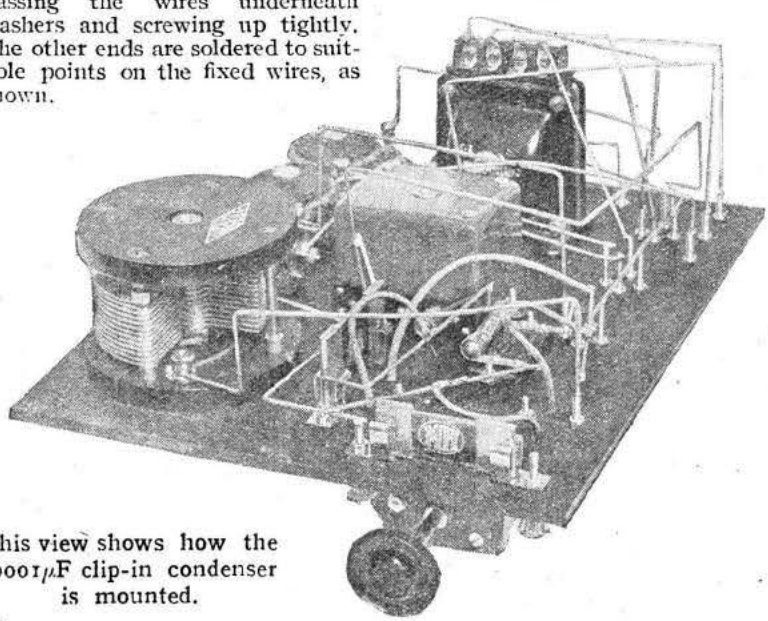


Note the short L.T. negative busbar to the rheostats.

Points in Wiring

Special points to note in wiring up are that the moving plates of the variable condenser should be connected to the earth terminal to avoid hand capacity effects. Notice, too, that the clips of the McMichael condenser are held beneath the lock nuts of the terminals "C.A.T." and "A" respectively. On some aerials you may find it advantageous to change the value of ·0001 to, say, ·0002 μF, but in general ·0001 will be found quite suitable. The O.S. terminal of each transformer should go to the grid of its respective valve, and the I.S. to the negative terminal of the grid-bias. The I.P. and O.P. connections do not matter so much, but if you use the transformers indicated in the photograph, I advise you to adhere to the connections given. In other transformers it may be advantageous to reverse the I.P. and O.P. connections on one, or both, of the transformers. In any case, if, when the set is completed, it is found to howl (this may happen with some cheap transformers), reversing the I.P. and O.P. connections of one or both of the transformers should be tried to see whether this effects a cure. In most cases it will.

Notice, too, that a wire comes from the negative L.T. terminal to all three of the filament resistances, the other connections of which are taken to the filament legs of the valves.



This view shows how the ·0001μF clip-in condenser is mounted.

Testing Out

When the set is wired up, carefully set the filament resistances to the "off" position and connect up the accumulator. Be careful that your connections are on the right terminals. For the moment do not connect any other wires, and then, having placed three valves in the sockets, turn on each filament resistance a little, to see whether the valves light. If they do, and proper control of filament brightness is obtained by rotating the knobs, leave the low-tension accumulator connected and connect up the high-tension battery, the aerial, the earth and the telephones or loud speaker. A loud speaker, if used, should be 2,000

(*Continued on p.* 552.)

WHAT HAPPENED TO JONES

Golfers once had the monopoly in our local trains; now the Wireless Men are strong competitors!

Remarkable New Wireless System

EXCLUSIVE FIRST DESCRIPTION For "THE WIRELESS CONSTRUCTOR"

This article describes a highly interesting system by which it is possible to don a pair of headphones which have no cords attached to them and to walk about the room while listening, unimpeded by dragging cords. The apparatus has been personally tested by the Editor, and certainly gives remarkable results

LISTENING to broadcasting by means of telephone receivers or a loud-speaker seems in these days such a simple matter that one is tempted to take "listening-in" for granted much in the same way as we make a journey by train or do any other of the hundred and one things which seem part of everyday existence. In general the main question is usually one of initial expense, that is, whether we are to be limited to the simple crystal set with "headphones"—possibly an extra pair or two to avoid the accusation of ultra-selfishness—or a valve and loud speaker outfit with which the family and one's friends can be enjoyably entertained—enjoyably, that is, if the receiver and loud speaker are capable of giving faithful reproduction of the music, etc., transmitted by the broadcasting station.

A New Way

In certain circumstances, however, the provision of facilities for "listening-in" raises a problem greater than, and often far removed from, the question of cost. For example, the manager of the Royal Hotel, Somecity, is fully cognisant of the delights of broadcasting but is also mindful of the dissension and annoyance which it might occasion, some guests wanting nothing better than to listen to LO2, others wanting "anything on earth but to listen to such stuff," or wishing to read without having LO2's entertainment superimposed upon the excitements of wondering what the next murder will be like or the prospect of the hero succumbing, in the next chapter, to the wiles of green-eyed Anthea. Still more difficult would be the atmosphere created at the club—especially if Brown and Jones, or Smith and Robinson, or any others of the old school happened to be about seeking food for argument; in such circumstances the lot of the valiant member who suggested the importation of a loud-speaker outfit would be anything but pleasant. To think of overcoming the difficulty by installing a receiver to which several sets of "headphones" are connected is to overlook the inconvenience aspect of the question—the objection to sitting tethered to an instrument or to a point in some particular part of a room. What is required then to overcome such objections? Of the two known reproduction methods, neither the loud-speaker nor the telephones connected to the receiver meet our requirements; that is obvious. We need to be able to listen, in whatever part of a room we may elect to sit, without being tethered and without occasioning annoyance to others who may be present, or we may desire some of our guests to be able to hear the broadcasting without requiring silence on the part of others who find greater pleasure in conversation.

The commercial form of the Hale-Lyle receiver.

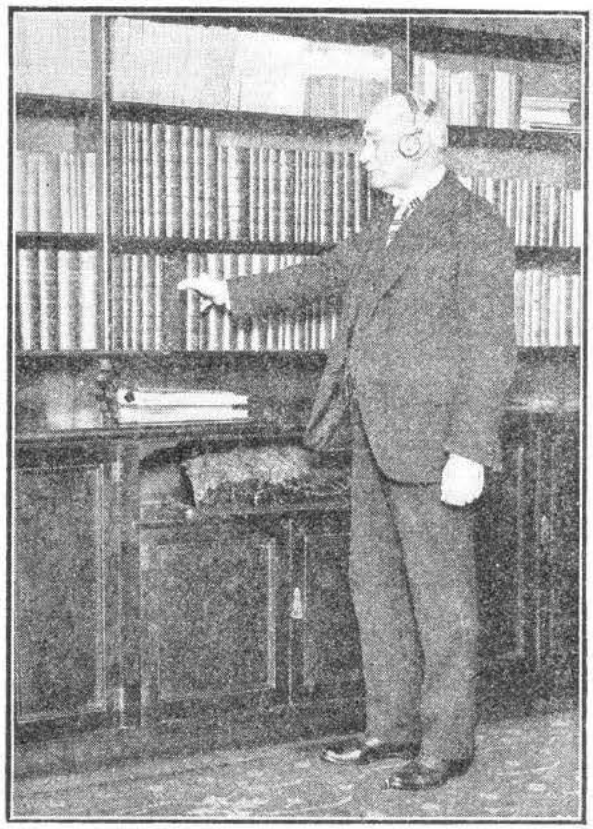
The Hale-Lyle system provides the easy way out of our difficulties—we can listen by means of telephone receivers worn in the ordinary way, or a single telephone receiver with a handle fitment will suffice if the headphones cannot be used conveniently—the case of Marcel waves *v.* radio waves, of course!

An Explanation

How is it done—what is the Hale-Lyle system? Primarily, it is a method of radio reception by causing the telephones to be operated by and in accordance with variation in the magnitude of an electrostatic field which is created in the rooms or places where reception is desired.

To do this, receiving apparatus is employed embodying an amplifier capable of so strengthening and converting the received signal energy as to apply high potentials to distributing grids or networks located in areas where reception is to be provided for. The electrostatic field will induce charges of considerable magnitude in any insulated conductive bodies within the field, and the potential difference between any two such bodies will be capable of creating telephonic currents if they are electrically connected through the coils of a telephone receiver. The encased headband of the telephones and the surface of the body of the person using them would comprise two bodies of different capacity to earth. A metallic earcap joined to one end of the telephone coils serves to make connection to the body of the user, and all the coils are connected in series between the headbands on the one hand and the body of the wearer, through the metallic earcap, on the other hand. Within one earpiece is a condenser connected in a shunt path to the telephone windings between the conducting bodies, which offers small impedance to currents of high audio-frequency, but offers

a high impedance to currents of lower frequencies, so that the currents of the higher audio-frequencies have a relatively easy passage through the condenser, and their effect upon the telephone instrument is consideraby reduced, whilst the lower frequency currents are obliged to pass through the windings. In this way, a more uniform response over a large range of frequencies is obtained, and any tendency to distortion, due to the comparatively low impedance of the resultant capacity of the conductive bodies to induced potentials of the higher audio-frequencies is eliminated. In the amplifier shown in the diagram, provision is also made for varying the degree of amplification in order that the same type of amplifier may be used under various conditions and give consistently satisfactory results. The degree of amplification required, for instance, if the receiving apparatus is to be used at a considerable distance from a broadcasting station would be higher than in the case of reception at a comparatively short distance. In order that the necessary variation may be obtained without affecting the working characteristics of the valves, and thereby causing distortion, a special form of amplification control has been developed.



Sir James Allen, High Commissioner for New Zealand, with his headphones in the library. Notice the convenience of the cordless phones.

The headphones are quite conventional in appearance. One earpiece is covered with a special metal cap.

This consists of a pair of choke coils, which are connected in series and through which the anode current of one of the valves of the amplifier is passed. The point of connection of the two coils is joined to the grid of the following valve through the usual grid condenser. Instead of the ordinary fixed iron core, a movable core is used, which can be made to occupy the central space within either of the coils or any intermediate position. A large difference of audio-frequency potential will be set up across whichever of the coils encloses the iron core, whilst the other coil will virtually short-circuit the audio-frequency potentials. By the adjustment of the position of the core relative to the coils the necessary gradual adjustment of the degree of amplification can be obtained.

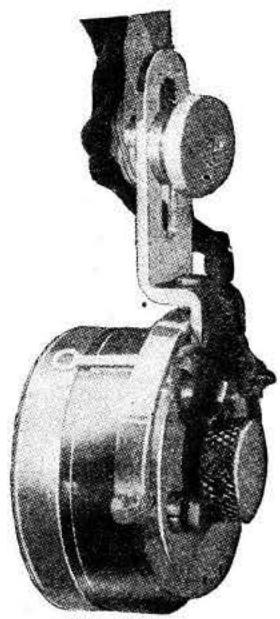
The Output

The secondary winding of the high-tension output transformer of the amplifier has taps taken out to studs of a rotary switch for varying the ratio of the turns of the primary and secondary windings the points at which the distributing grids are connected to the secondary winding depending upon the area of the grids in use. The latter consist of fine-gauge wire in the form of a network between rubber or stout paper sheets cemented together or fastened to the flooring or under-felt and placed beneath the carpets in areas to be served. They may also be accommodated in other ways according to the particular circumstances, as, for example, in trains where they may be conveniently placed beneath the seats.

For my lady's vanity-bag, a special telephone receiver in the form of a fan has been produced, the fan taking the place of the headband as the conductive body. This kind of "radio fan" makes reception of broadcasting delightfully easy and convenient.

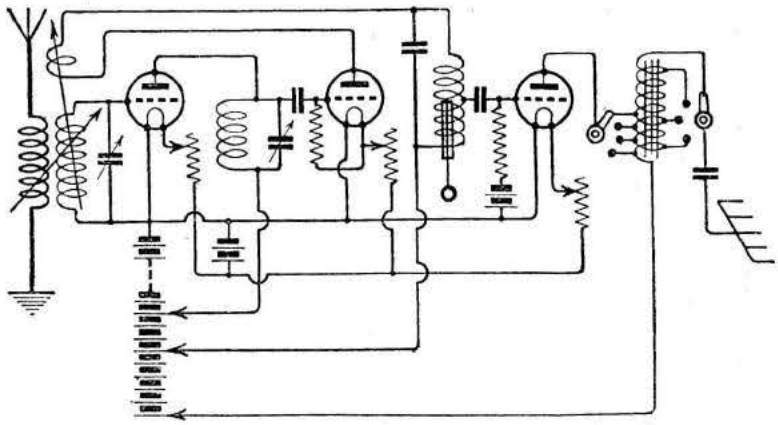
An Interesting Demonstration

In the course of the Radio Engineering Company's experiments, the apparatus was installed at the residence of Mr. C. H. C. McIlwraith, Gidleigh Park, Devonshire, which is situated in a valley and screened by heavily wooded hills between which the Teign speeds its way—"truly a place of wondrous charm," but, from a radio standpoint, so "blind" that a four-valve set of a well-known



A "close-up" of the headphone cap which is an integral part of the system.

make could only induce a loud-speaker to whisper faintly. That the Cardiff and Bournemouth programmes were well received under such conditions by means of telephones operated by variations in the magnitude of an electrostatic field was sufficiently convincing,



A circuit diagram, showing how the grids on the floor are connected to the output side of the instrument.

and, during tests carried out at Mr. McIlwraith's house at St. Albans, the effectiveness of the induced charges was well indicated by the operation of a loud-speaker standing on a copper plate to which one terminal was joined, the other terminal being connected to a log rack standing on the stone hearth, which served as the other conductive body. The signal strength was equal to that obtained when the loud-speaker was directly connected to a four-valve receiver. A growing plant was also used with equally striking results, and even the collective capacity of a nail in the wall, a drawer handle, or other small metal object has been found to be sufficient for the operation of the system.

This method of remote reception has proved to be a most interesting field for experiment—as well as a source of no little mystification—and promises to widen considerably the scope of the broadcasting services.

A YOUNG CONSTRUCTOR'S RESULTS

SIR,—I follow with great interest both THE WIRELESS CONSTRUCTOR and *Modern Wireless*, both of them excellent papers, and I have constructed many of the sets described, including the "Transatlantic Four" and the "Anglo-American Six," the results of which I give in this letter. I wrote not long ago giving my results with the "Transatlantic Four," but since then I have had excellent results, receiving WGY, WBZ, KDKA (long wave), and WTAM, on any occasion that I have tried, WGY at good loud-speaker strength.

The "Anglo-American Six," which I completed about a fortnight ago, gives good results on the wavelengths from about 370 upwards, as I have no lower wavelength H.F. transformers, and my present ones are not neutrodyne units, consisting of two matched Bowyer-Lowe (300-600) and one McMichael (300-600). I have received WGY with wonderful clarity of tone and very good signal strength on four valves.

I came to the conclusion that this receiver would work much better if reaction were used, and this I tried, with greatly improved results. Of course, I did not allow my set to oscillate during broadcast hours, but the selectivity of the receiver was greatly improved.

I am 16 years of age, and have had nearly three years' radio experience, beginning with a crystal and working up to large valve sets.

I think your three journals are the best published, and I am very interested in the articles appearing in *Wireless Weekly*, "Making a Start in Transmission."

Wishing you the best of luck with THE WIRELESS CONSTRUCTOR.

I remain, Yours truly,
KENNETH A. CHIPPINDALE.

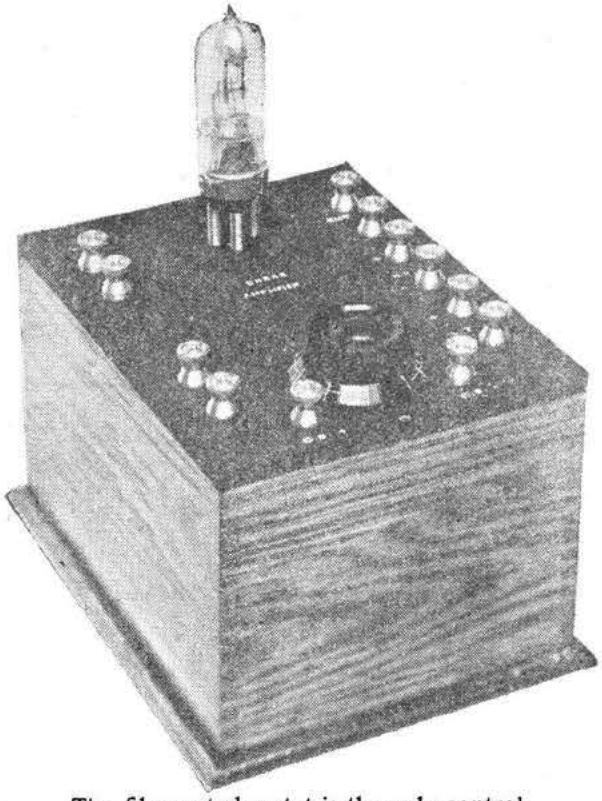
[The introduction of separate reaction is unnecessary if correct adjustment of the neutrodyne condensers is carried out. The neutrodyne "verniers" introduce any reaction required.—ED., W.C.]

Mother teaches the children to listen-in!

A Unit Choke Amplifier

By JOHN W. BARBER

A useful amplifying unit made up on a little used principle. Simplicity and great purity are the essential features of this unit, which may be duplicated



The filament rheostat is the only control.

WHEN a discussion arises among those of the cult over some problem in low-frequency amplification, one invariably finds the interest centred either in the resistance-capacity method or the iron-core transformer, and it is a fact that these two methods, either separately or in combination, are the most popular at the present time. The principle of iron-core choke coupling is one which has received little or no attention, especially as regards broadcast receivers, and we would do well to consider this principle and its application to the ever-present problem of obtaining good volume with reasonably pure reproduction. I say "reasonably" advisedly, because purity of reproduction is a quality which appears to vary enormously with the ideas of the person observing. Reproduction which I personally call bad has been brought to my notice as "first class" by people who have at least had some musical training, and I must confess it is beyond me to account for the variation in the standard of quality desired to be reached before the observer calls it "pure." In a transformer-coupled amplifier, the currents in the primary winding induce currents in the secondary winding, and the voltage variations produced are applied to the grid of the low-frequency amplifying valve. In a resistance amplifier the varying potentials across the resistance in the anode circuit of the detector valve are applied to the grid of the low-frequency amplifier through a "stopping" condenser, a grid-leak being employed which is connected to the negative of the filament-heating battery, or to the negative of a grid-biasing battery.

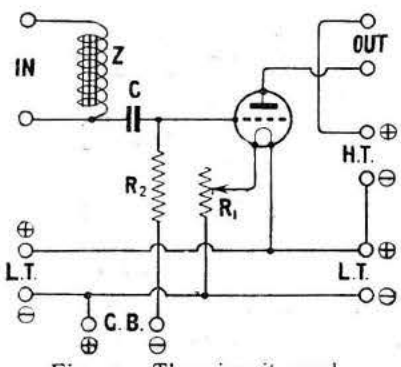
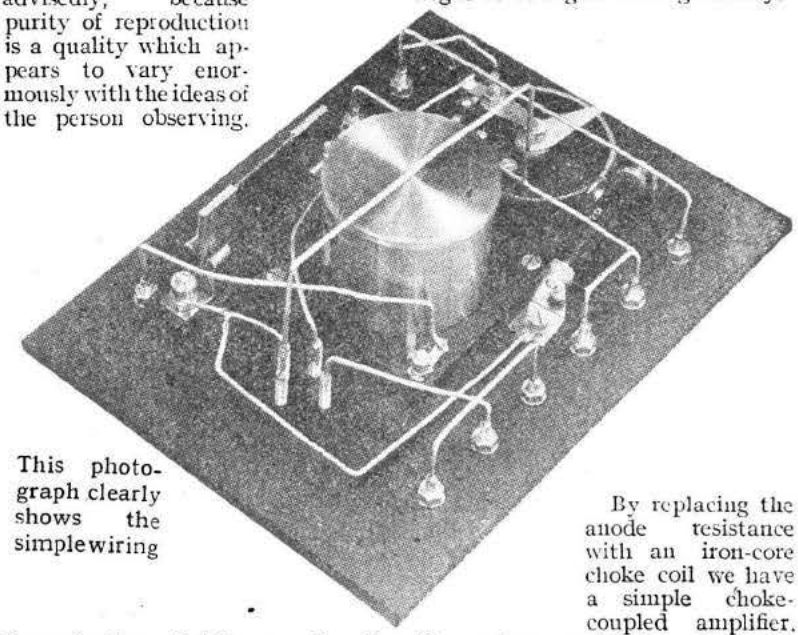


Fig. 1.—The circuit used.



This photograph clearly shows the simple wiring

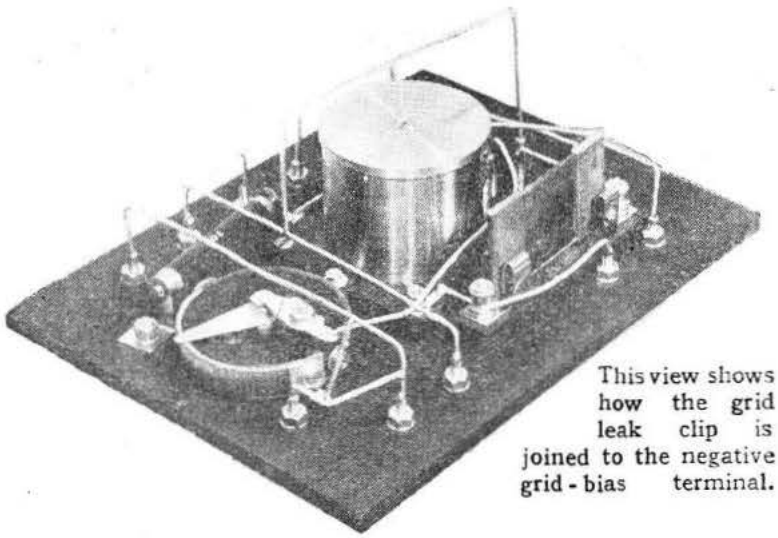
By replacing the anode resistance with an iron-core choke coil we have a simple choke-coupled amplifier. The voltage variations across the detector valve cause a varying voltage to be set up across the choke coil, and these variations are impressed upon the grid of the low-frequency amplifying valve. The choke coil must have a "resistance" to currents of audible frequency which is very high indeed; that is to say, the inductance of the choke must be high.

An iron core is therefore used, and the winding of the choke coil is put on over this iron core. For those who understand the calculation part of wireless, it may be said that the impedance of the choke (*i.e.*, its "resistance" to speech currents), which may be calculated from the formula $Z=2\pi fL$ where Z=impedance, f=frequency, L=inductance in henries, must be very high, and if we take 500 as the frequency (an average figure) and, say, 50 henries as the inductance of the choke, it is an easy matter to work out Z, which in this case comes out at 157,000 ohms.

The Choke

I have spent a considerable amount of time experimenting with various types of choke, including the secondary winding of all sorts of transformers, and have found that the best results are obtained with a choke coil made for me by the makers of the "Success" transformer. These chokes are now on the market, and may be obtained at a very reasonable figure. For the man who can obtain it, the secondary winding of a "Ford" induction coil makes a good substitute.

In designing the amplifier unit seen in the photographs, simplicity was taken as being the first essential, while it was decided to make the unit up in such a form that it should be easily duplicated, thereby enabling two such units to be placed side by side and connected up easily.



This view shows how the grid leak clip is joined to the negative grid-bias terminal.

The Circuit

Look now at the circuit diagram. On the left will be seen two terminals marked "in." These must be joined to the telephone terminals of a valve receiver in a manner to be described later. The condenser C may have any value from ·006μF up to about ·25μF, while any value of resistance about 1 megohm will be suitable for the grid leak R_2. I use ·007μF and 2 megohms, and am perfectly satisfied. It will be seen that there are two pairs of L.T. terminals. These are to permit of the battery being joined to those on the right, while those on the left are connected to the corresponding terminals on the existing receiver.

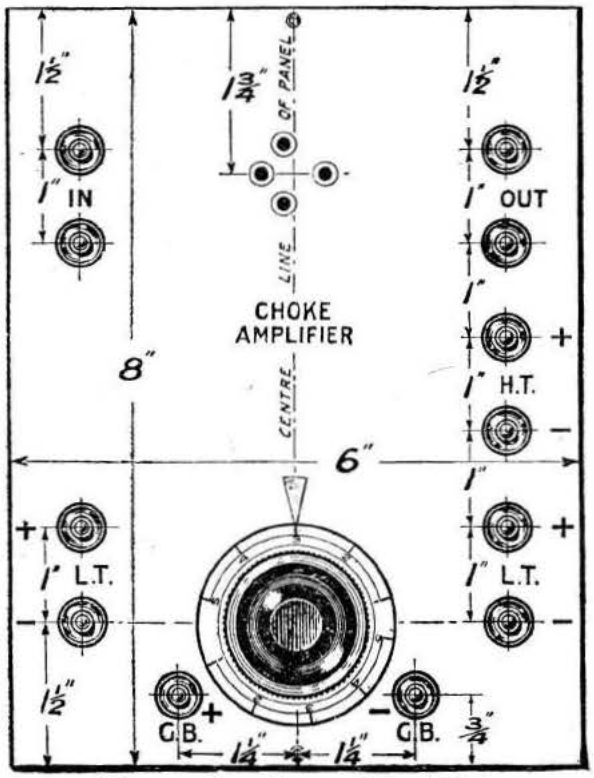


Fig. 2.—How the panel is drilled.

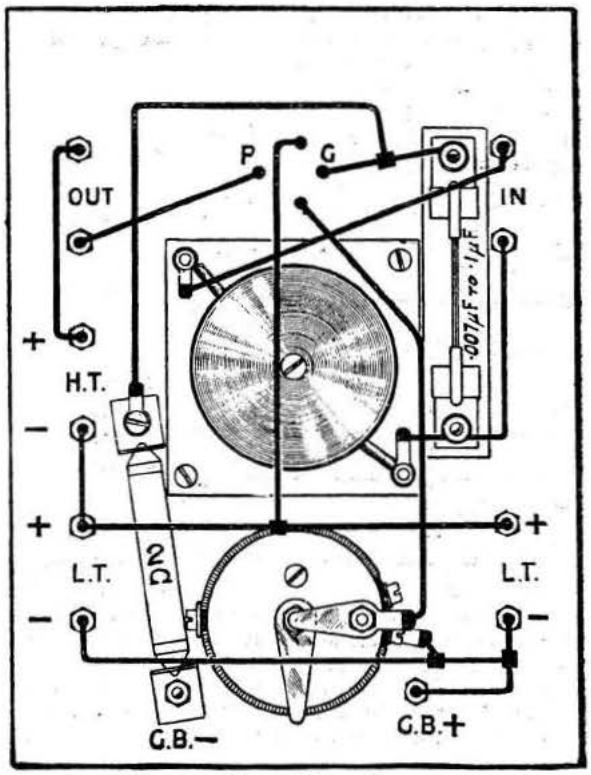


Fig. 3.—The wiring diagram.

Both of these drawings are exactly half size.

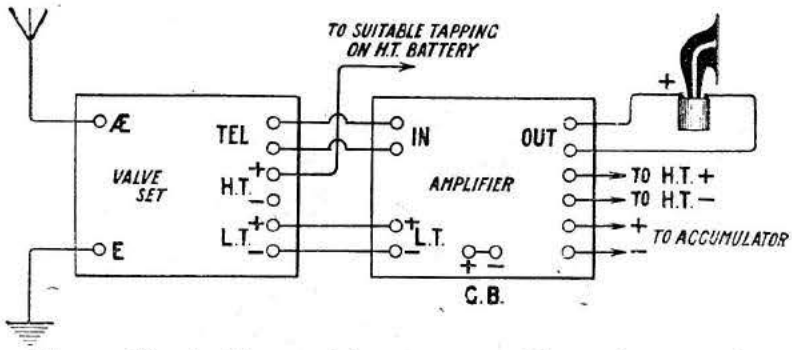


Fig. 4.—Showing how to join up one amplifier unit to a valve set which is already in use.

Components Necessary

There are really quite few parts needed, and a list is given, together with names of manufacturers. Any good make of part may be substituted for those mentioned, but I do not advise you to "try your luck" with other makes of choke, for reasons already given :—

One ebonite panel, 8 in. by 6 in. by ¼ in. (Britannia Rubber Co.).

Suitable box (Carrington Manufacturing Co.).

Four valve sockets, or one complete holder.

One filament resistance (McMichael dual type).

One choke coil (Success).

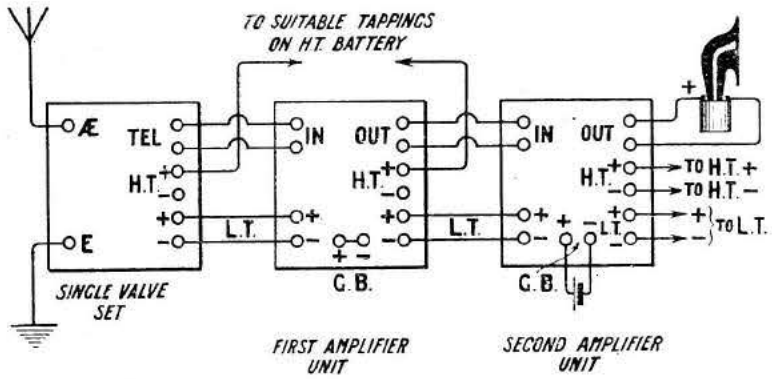
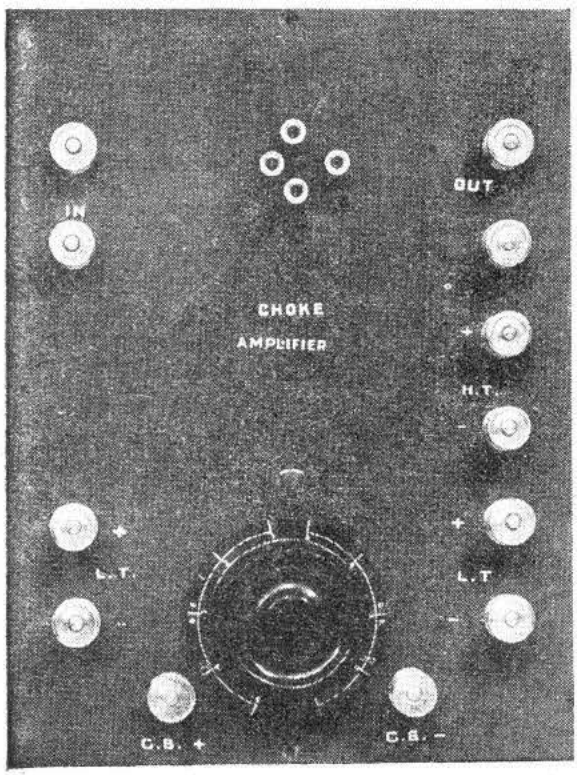


Fig. 5.—How to join up two units to a set which does not already embody low-frequency amplification.



A close-up view of the panel, showing the simple construction.

One ·007 μF clip-in condenser and base (McMichael).

One 2 megohm grid leak with clips (McMichael).

Twelve terminals, W.O. type.

One "Decko" dial indicator.

One set Radio Press Panel Transfers.

Screws for fixing choke, condenser, etc.

Suitable wire for connections.

How to Drill your Panel

The layout of this amplifier unit is so simple that it is quite an easy matter to make it up in an afternoon, and the drawings given help to make the work easier. The layout of the panel and necessary holes are seen in Fig. 2, and the ebonite, bought ready cut to size, should be marked out in accordance with this drawing. *Don't* use a pencil. If you are tempted in this direction, leave all your pencils in a place as far removed from the workshop as possible, and keep your scriber handy.

Blind Holes

You may notice that on the front of the panel there do not appear any screw-heads, such as are necessary for securing the choke, grid-leak clips, and condenser base to the panel. This is because I delight in drilling and tapping "blind" holes. You won't upset the unit, however, by drilling clearance holes and securing the components with screws which pass right through the panel. The same remark regarding tapping applies to the valve sockets. If you don't use a complete valve-holder, the only satisfactory way to mark out the positions for the separate sockets is by using one of the excellent templates, such as the Morris or the Aermonic (to mention only two), which are now obtainable quite cheaply. Having mounted up the parts, you can proceed with the wiring, and the diagram given will help you here. Don't try to "improve" the design; It has been worked out with considerable care.

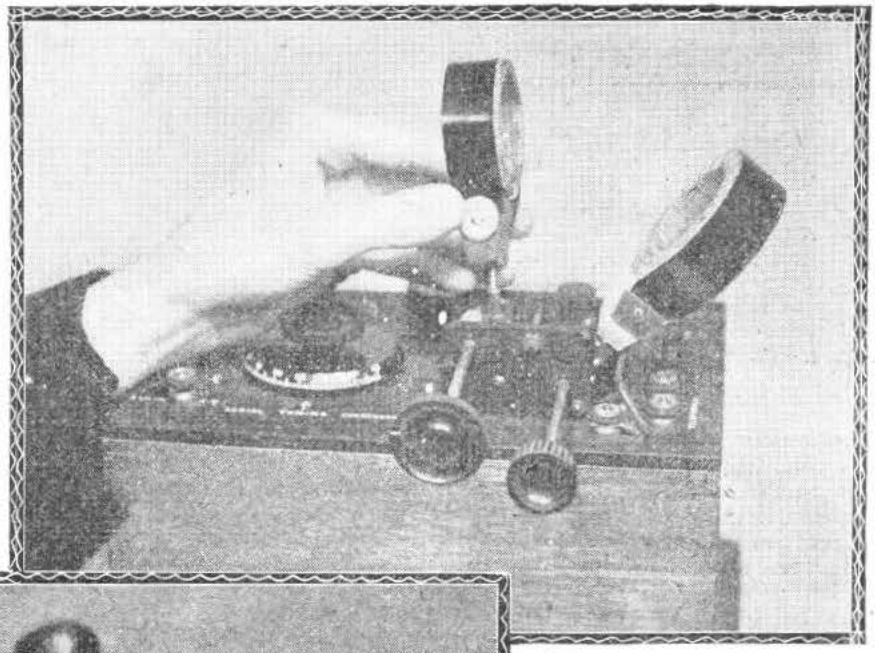
How to Use the Unit

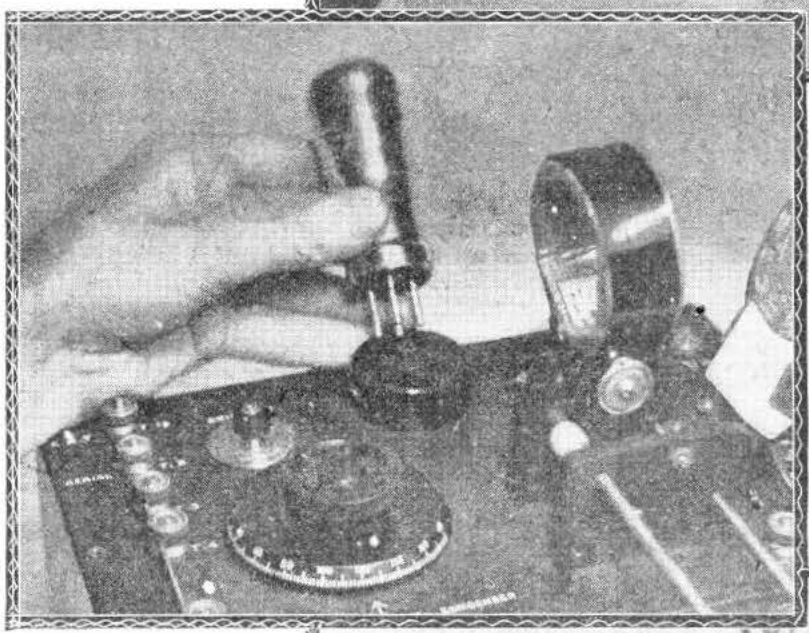
When you have finished making the unit, connect it up to your valve set (which, by the way, should not already contain more

(*Continued on p.* 539.)

A PICTORIAL GUIDE TO TUNING

Some useful hints for the beginner

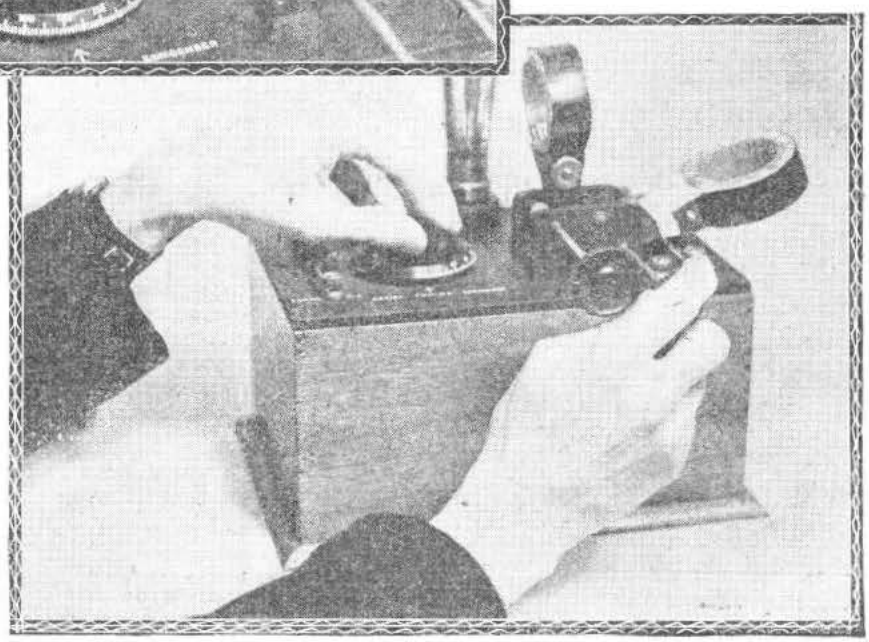


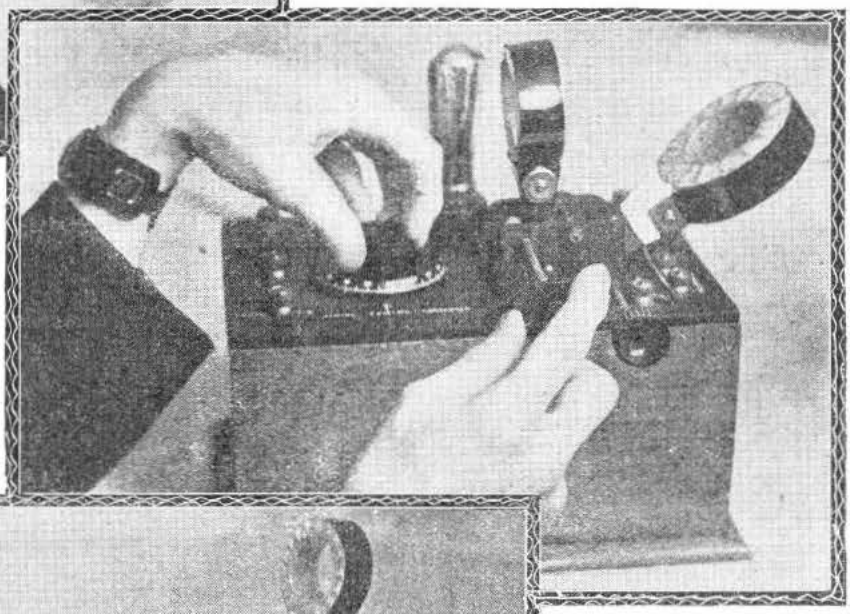


ALTHOUGH the process of tuning a set can be described in relatively few words, nothing is better than a practical demonstration, and next to this a series of photographs. The accompanying pictures show a simple single valve set being handled by a member of Radio Press technical staff so as to get the best results in tuning.

In the set shown, the left-hand socket carries the aerial coil, and the moving socket the reaction coil. It so happens that in the particular coil-holder used there is a vernier adjustment for what is normally the fixed socket, but this can be ignored at the beginning. Many coil-holders have not such an adjustment.

First of all, then, we must place suitable coils in the aerial and the reaction sockets. For a single valve set the reaction coil should be about one size larger than the aerial coil, this latter being chosen to suit the wavelength it is desired to receive. Owing to differences in conditions, the coil will give different wavelength adjustments on different





the round portion should not be gripped and squeezed. It is better to act as shown by placing the finger and thumb on the socket rather than on the coil itself.

The next step is to place a suitable valve in its holder, taking care that the unequally-placed pins are not forced into the wrong sockets in so doing. In a previous issue was shown how to place a valve in its socket (November issue, page 57).

Now, before turning on the current, open out the reaction setting by turning the knob of the coil-holder until the moving coil is as far away as possible from the aerial coil (third photograph). Now, with the coil in this position, rotate the variable condenser slowly backwards and forwards until the station it is desired to hear is heard at best strength. If you are some distance from a broadcasting station you may not at first hear the station in this way, in which case you should follow the procedure shown in the fourth illustration, in which the reaction coil is brought a little nearer to the aerial coil by means of the knob shown. The tuning should then be repeated, but if by any chance, in rotating the condenser, you hear a howl which varies its note as you turn, it is a sign that the set is oscillating, and you should open out the reaction coil until this effect is eliminated.

aerials, but generally we may say that any wavelength within the range of 300 to 500 metres can be received on either a 25, 35, or a 50, or its equivalent in those makes which do not give numerical definitions.

Notice particularly that care is required in placing the coil in its socket, and

The last photograph, whilst it looks innocent enough, illustrates how disaster may come upon the beginner, for here we see just what happens when he starts to dismantle his set to look at the wiring. The moral is, of course, when taking your valve from a set to lay it somewhere where you are perfectly sure it will not be knocked or pushed off the table!

Mr. R. E. Jeffrey, the Dramatic Director at the London Station.

Broadcasting and Drama

By "CARRIER-WAVE"

Miss Cathleen Nesbitt, one of the Pioneers of Broadcast Drama.

MOST people will admit that the two essentials for ideal wireless reception are—a first-class set and a healthy imagination. Given the above factors, we shut our eyes, and see Pavlova dancing to the ballet music at Covent Garden, watch the gaily clad dancers at the Savoy Hotel, and follow all the mediæval heroes and heroines of our favourite operas; and until television is made possible, we are fain to be content.

Illusion

But when it comes to drama, the B.B.C., like unto the Fairy Godmother of old, waves her wand, or shall we say, perhaps, shakes her aerial, and declares that to the bread of imagination she will add the sweetening influence of illusion. In consequence, when we descend metaphorically into the coal mine of "Danger," we hear the rushing of the waters that swamp us, the creaking of the descending lifts to our rescue, while for other plays we have heard the motor that never fails to reach us in the nick of time, the runaway horse, or the vivid storm that coincides so frequently with the weather report.

The First Play to be Broadcast

The only question that arises after we have turned up the lights,

At first a barrister, Mr. Nigel Playfair has contributed largely to broadcast drama.

and mopped our moist brows, fevered as we carefully explain by the heat of the room, and not the shrieks of the tortured heroine, is, how is it done? And that is the problem which the B.B.C. and its clever band of assistants has endeavoured to solve.

As a matter of fact, the play-broadcast is one of the very oldest of all the items on the programme; indeed, it may be said to be the first programme ever broadcast, for in 1922, when Captain Eckersley obtained permission for the Radio Society of Great Britain to establish a small broadcasting station for experimental purposes at Writtle, near Chelmsford, he himself established the installed by broadcasting excerpts from "Cyrano de Bergerac."

Opera

When the B.B.C. came into existence, and 2LO, in the shape of a 100-watt set, was installed in the cinema theatre of Marconi House, Strand, a tremendous experiment was made with the first attempt to broadcast opera from Covent Garden, where a season was being held by the British National Opera Co., and a very successful experiment it proved. From that time onward both plays and opera have become a very vital part of every programme, and one of the earliest attempts when 2LO was transferred to Savoy Hill was to arrange Shakespeare's "Midsummer Night's Dream," and on July 25, 1923, in addition to the various members of the Staff, Mr. Rex Palmer, Arthur Burroughs, and others—the well-known theatrical stars, Ernest Milton, Cathleen Nesbitt (who arranged the whole production), Nigel Play-

Mr. William Macready, the well-known Shakespearean actor, is the Dramatic Director at Birmingham.

Mr. R. T. Fleming, a successful actor, at the Manchester Station.

Mr. Victor Smythe, the Director of Plays at Manchester.

A chat about broadcast plays and those who have made them successful

Miss Dorothy Franklin, who is well known to Manchester listeners.

fair, Ivan Berlyn, amongst them, gave wonderful assistance. At that time it was thought sufficient to give us just the actual lines and the music of Mendelssohn, and it is a far step to the performance of "The Tempest," given just recently under the direction of the Dramatic Director, Mr. R. E. Jeffrey. A star cast, including Ernest Milton and Moyna MacGill, was again utilised, but he also had the assistance of a trained band of "sound-makers."

So that all we had to do was to close our eyes, and we had Prospero's island, with its storms, its waves, and the stress and strain of weather we have been experiencing ourselves, indeed, we almost expected him to tell us that his "further outlook" was also "unsettled." The sounds, however, which so faithfully represented it were in reality very simple devices. A rotating wheel, covered with bands of canvas, revolving at varying speeds made the wind, and a large shallow drum, filled with buckshot, when tilted in the hands of the expert, reproduced the waves breaking on the shore and their backwash again. Thin sheets of metal gave us the thunder, literally, as "Alice in Wonderland" would have said, "rolling round in heaps."

Other plays, of course, require other devices, and, where the loud splashing of water is necessary, use is made of a lead tank of real water which, although only about eight feet long and five wide, is quite sufficient to give most terrifying sounds for shipwreck scenes.

Sound Effects

A railway train travelling at high speed is imitated by a pair of ordinary roller skates pressing against a rotating drum, a clatter of hoofs with two pieces of board, pails of broken glass, and hollow pipes with rattling chains are all utilised to give the effect of distant sounds. A vigorously squeezed paper-basket gives an excellent imitation of rickshaws, and these in the hands of experts, and made strictly to the "beat" of the conductor, who has carefully rehearsed every movement, give us the thrills necessary.

Producing a play at 2LO. This photograph shows some of the "sound effects" being produced. Mr. Nigel Playfair is on the extreme right.

Mr. R. E. Jeffrey

Mr. R. E. Jeffrey has indeed brought these "effects" to a very high pitch of art at 2LO, to which station he was transferred as Dramatic Director from Aberdeen, to the keen dismay of listeners in that area. Few producers have had wider or more varied experience, for he has long been one of the foremost figures in the Scottish and London entertainment world. As author of books, as actor—he has played the part of "Raffles" alone some four hundred times—and as producer, when at the Aldwych Theatre he presented in 1920 "Macbeth," with Mrs. Pat. Campbell, in conjunction with Gilbert Porteous, "La Tosca," with Ethel Irving, and with Viola Tree, "The Unknown," as well as one of his own plays, "The Dragon," it is evident that Mr. Jeffrey is particularly the right man in the right place.

Miss Cathleen Nesbitt

Of the earlier pioneers of wireless drama, Miss Cathleen Nesbitt, the well-known actress, stands out, perhaps, most prominently, for she

arranged so many of the Shakespearean plays for wireless purposes. "A Midsummer Night's Dream," "Romeo and Juliet," and "The

Mr. D. E. Ormerod, Assistant Producer at the Manchester Station.

Merchant of Venice" were arranged for 2LO by her, and she herself played Titania, Juliet and Portia. On the actual stage she has played all over the world, and was with the first repertoire company, "The Irish Players." To her immense repertoire she has now added her part in "Spring Cleaning" at the St. Martin's Theatre.

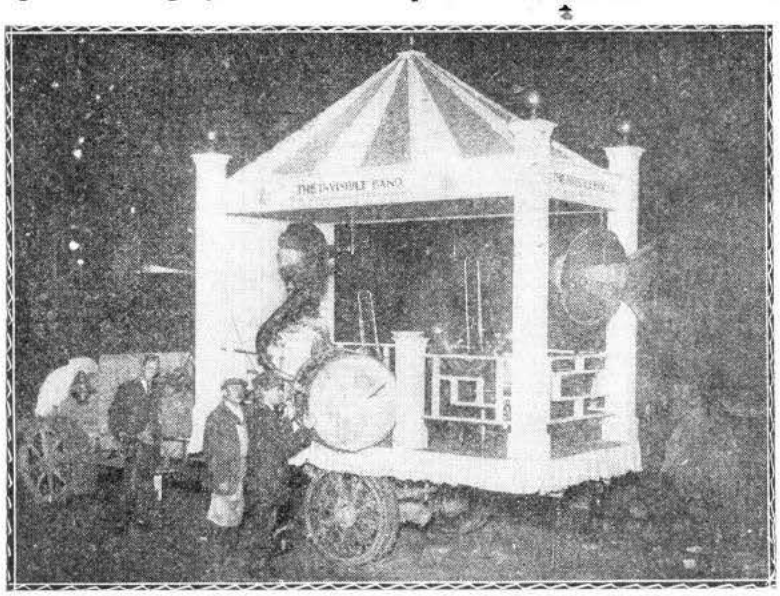
Mr. Nigel Playfair

Mr. Nigel Playfair, who gave us those three Grand Guignol plays last year, was at first a barrister, but turned to the stage, after gaining some experience with the Oxford Union Dramatic Society, the Old Stagers and the Windsor Strollers, all famous amateur societies. He admits that he made his first appearance professionally at the Garrick Theatre in 1902 in the capacity of "noise without," but fame has come since, and amongst his numerous successes may be mentioned the plays "His House in Order" and "The Knight of the Burning Pestle," in which he played the part of Ralph, his favourite part. For broadcasting purposes he superintended the whole production.

In the Provinces

Drama, however, has played an even bigger part in the provinces than at 2 LO. Manchester and Birmingham have been especially energetic in this direction.

At Manchester, Mr. Victor Smythe has been the producer of all the Station plays, amongst them being "Captain Swift," "A Butterfly on the Wheel," "The Witness for the Defence," with countless others, and for these he gathered round him a select little company of stock players, which included Dorothy Franklin, as leading lady, a young actress especially gifted for emotional parts. It is said there that if she plays a rôle that demands her crying, she cries hard, and when one remembers that there is no one in the studio, one can realise that she is really lost in her part. Mr. D. E. Ormerod joined the 2ZY players in the very early days, and played in "A Midsummer Night's Dream," and all the other powerful dramas. He has been also assistant producer to Mr. Smythe.



The B.B.C. car which provided music during the Lord Mayor's procession in 1923.

Another clever 2 ZY actor is Mr. R. T. Fleming, and has been successful not only at "dude" parts, but "heavy" as well, as was instanced by his outstanding performance

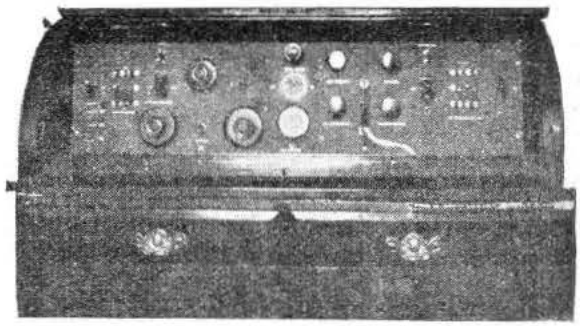
Miss Edna Godfrey Turner, the wife of Mr. W. Macready, has contributed largely toward the success of broadcast plays.

of the dual roles of Stephen Ballantyne and Dick Hazlewood in "The Witness for the Defence."

Birmingham

5IT has been exceptionally lucky in having the assistance of the best known Shakespearean actor William Macready (and who is now Dramatic Director at Birmingham), and his charming wife, known professionally as Miss Edna Godfrey Turner.

Their legitimate stage work is too well known to need detailed comment, but on their broadcasting work it is impossible to dwell too strongly. They have had the strongest companies to assist them, and every possible "sound method" at their command. They were the first to broadcast a play by Hall Caine ("The Christian"), and the famous "Under Two Flags," of Ouida, and surely no more difficult play could be imagined for wireless purposes. Yet the "sound effects" were all obtained, the sand storm of that last ride of Cigarette being perhaps one of the best. Other plays include "The School for Scandal," "She Stoops to Conquer," "David Garrick," "Othello," "Caste," "Tale of Two Cities," "Moths," and a whole host of farces. When it is remembered that these two artists have a Shakespearean repertoire of over 300 scenes, which are given without the aid of the book, it is little wonder that they have been welcomed at all Stations, and they can fill an entire evening without touching Shakespeare at all. They have indeed made broadcast drama the triumph it is.



The handsome receiving set operated by the author.

Some Notes on Crystal Reception

By V. PETTY

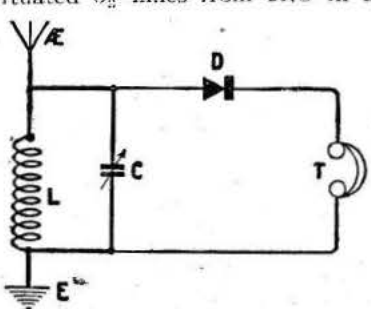
The simplest crystal circuit, if carefully designed, can be made to give really excellent results, as these notes show

RECENTLY the humble crystal has come into the limelight again, and there have been developed many circuits which give excellent signals.

The writer has been experimenting with crystals for some time past, and a plain crystal circuit has been included in the four-valve set, a photograph of which is reproduced herewith. A diagram of the circuit used is shown below, and, as will be seen, nothing out of the ordinary is incorporated. The coil is of the solenoid type wound with 18 D.C.C. on a 4-in. ebonite former, and contains 31 turns. No shellac varnish or other binding medium was used. The tuning is effected by means of a ·001μF. variable condenser. The number of turns for the coil was determined by experiment to give the maximum signal strength (R.9) from 2LO, using 5 degrees of condenser. There are no tappings taken, but provision is made for a loading coil on the aerial side.

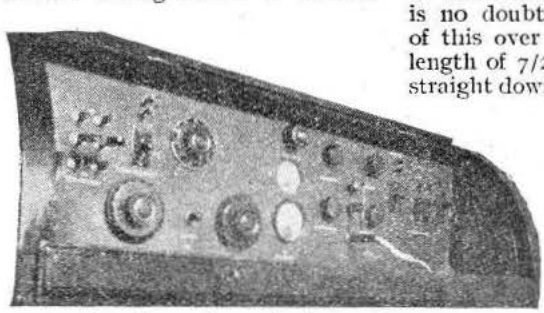
Some Results

Now as to the results. I am situated 6½ miles from 2LO in a



The circuit used is perfectly straightforward.

S.S.E. direction, and the neighbourhood is badly screened, owing to the proximity of the Crystal Palace and a large number of tall trees. However, in spite of these adverse conditions, Radio-Paris comes in on the crystal set regularly, and is loud enough to be enjoyable, provided everything is fairly quiet. Glasgow is also received fairly regularly after the local station has "signed off," when they relay dance music from Gleneagles, which is about twice a week. That is about 400 miles away. Aberdeen was heard quite plainly on September 9, 1924, the concert ending about 8 minutes



Another view of the valve set.

after 2LO had finished. Other B.B.C. stations have been heard during the Children's Hours, but were not identified, as they do not give the call signs on these occasions.

Madrid

The climax was reached, however, when, on September 9, at about 11.35 p.m. Madrid was tuned in, 800 miles away. I confirmed this by switching over to the valve circuit. This station, by the way, comes in very loud on a single valve. When I say I heard it on a crystal, I do not mean to say that it was loud enough to enjoy, but at times was loud enough to hear and distinguish the words spoken, and tunes could be recognised. I repeated this performance on eight consecutive evenings, so you see that the possibility of it being a freak result is "washed out."

Now for the reasons why these results are possible, or, at least, the only reasons that I can think of. First of all, the aerial. This is supported between two masts. One is about 35 ft. high and the other is a 16-ft. pole on the roof, making it 60 ft. from the ground. The aerial is made up of three lengths of 7/22 each 85 ft. long, but they are not supported on spreaders. They are twisted together, so as to form a single length which consists of 21 strands of No. 22 wire. There is no doubt as to the advantage of this over the more usual single length of 7/22. The lead-in comes straight down from the end, through the window frame and on to the set, being about 13 ft. long (the lead-in, of course, not the set).

The method employed in twisting the wires might prove interesting. The three lengths were measured off and fixed to the mast at the end of the garden, about 4 ft. from the ground. The other ends were taken together and fixed into the chucks of a twist drill, and by turning this the obvious thing happened. The wires were bound round in about eight places to keep them from untwisting. A word of warning here would not be out of place. Great care must be taken to secure both ends of the wires properly during the twisting business, as should they come unanchored whilst under tension, they might cause considerable bodily harm to anyone who happened to be in the way, as they would fly about in all directions with plenty of force. Another important item to consider in crystal reception is the telephones. Personally I use a pair of foreign light-weights. The only

objection to these is obvious, but I cannot find anything else to compare with them at the price. I know one can obtain goods of British manufacture as good as or even better than the above, but my pocket is not long enough. The detector is not a matter of vital importance, and I use the ordinary open type that costs about 9d. I find it easier to manipulate than the expensive micrometer adjustment affairs, and quite as stable. The crystal itself is a ninepenny piece of well-known make and has been in commission now for some months. Any fine-pointed whisker will work wonders with a good piece of crystal.

Reception of 2LO on a Crystal

The only comments necessary on reception from 2LO are that the crystal set alone works the loud-speaker at comfortable strength for a small quiet room.

In conclusion, I would like to point out that this is not a campaign against any of the "stunt" circuits which have been published recently. I have not tried any of them, so cannot offer any opinions. Rather, it is intended to illustrate what can be done with a plain straight circuit and a good aerial.

I know quite well that many readers will think some of the results impossible, especially the 800-mile business. I expect I should. But to back my statements I am quite willing to give a demonstration by appointment (one at a time, please).

Where Wireless is a Boon

By SYDNEY WILDMAN

FAR away, off the north-east coast of Scotland, there lies a small group of islands known as the Orkney Islands.

Many of the islands are inhabited, but there are some which are so desolate and so wind-swept that, save for a few sheep which graze on the scanty pastures, and are visited now and again by shepherds, they are totally deserted. Countless sea-birds make some of the smaller islands their home, and their shrill cries can be heard above the roar of the seas against the forbidding coasts.

Kirkwall and Stromness are the only two towns of note on these islands. Kirkwall is the chief town, and is situated on the Bay of Kirkwall.

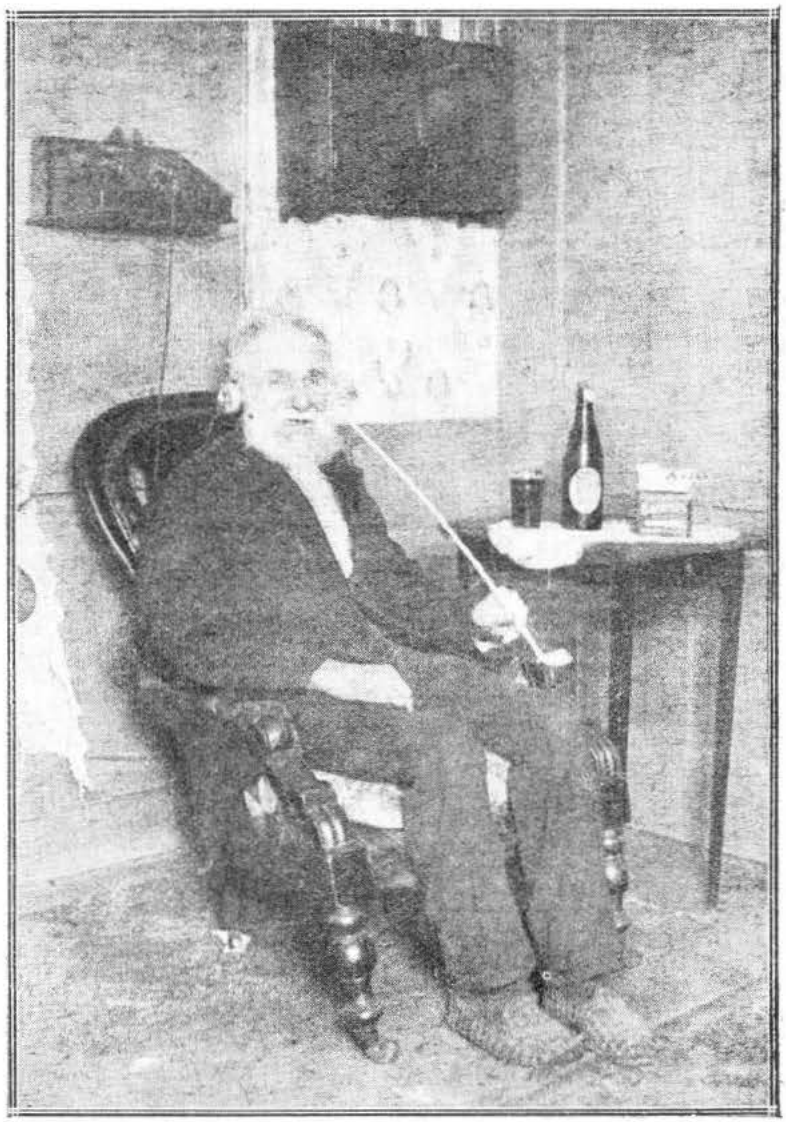
The history of the islands goes back to the days of the fierce Vikings and Norsemen, and many a fight has taken place around the rock-bound coasts of Orkney.

Lonely Islanders

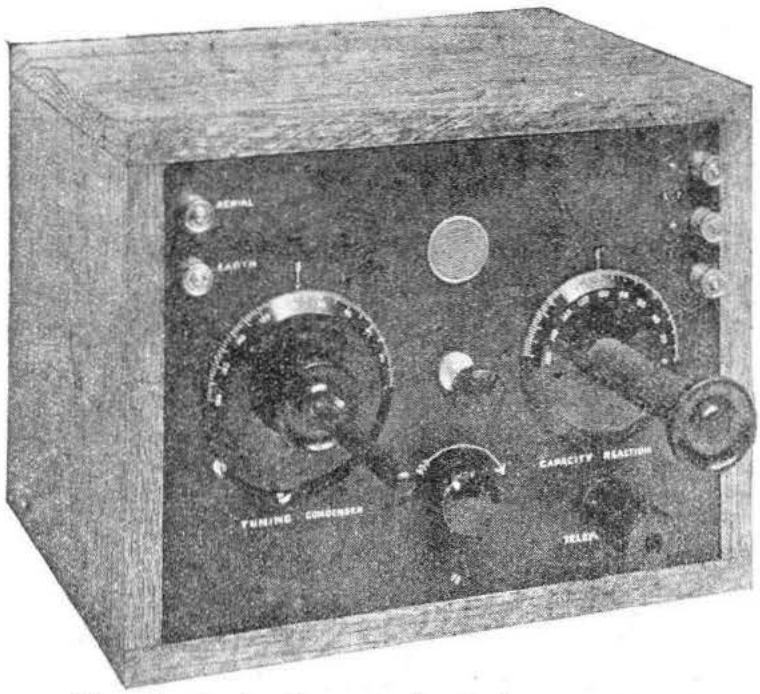
A stretch of water known as the Pentland Firth separates the islands from the mainland, and it is across the Firth that the supplies, mails and newspapers have to be brought to the islanders. Very often the sea is so rough that no boat can cross, with the result that the Orkneys, save for telegraphic communication, are cut off for days at a time.

Before the introduction of broadcasting, these islanders led a very drab existence and had to rely on their own resources for amusement. Now, all is changed. Every evening, those of the inhabitants who have wireless sets tune in to Glasgow, Aberdeen, or even London, and listen to the latest news, and dance to the strains of the Savoy bands, playing five hundred miles away.

People who live in the great cities and towns of Great Britain, and who are used to theatres and cinemas and all the bright things of life, have no idea what a boon broadcasting is to the few inhabitants of the Orkney Islands and other isolated spots off our coasts.



A retired Navy man, Mr. J. Rothwell, heard with interest the recent "Songs of the Sea" programme from 2LO.



The extension handles are a necessity for accurate tuning.

FOR THE SHORT-WAVE EXPERIMENTER

A Receiver for Wave-lengths between 40 and 210 metres

By

C. P. ALLINSON

THE design of a short-wave set is one that allows for a wide scope as regards the choice of circuit, there being various forms of Reinartz that enjoy great popularity as well as the straightforward magnetic reaction receiver.

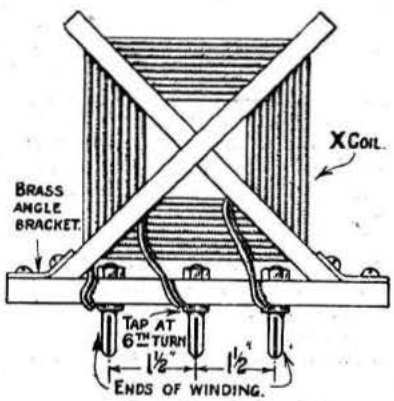
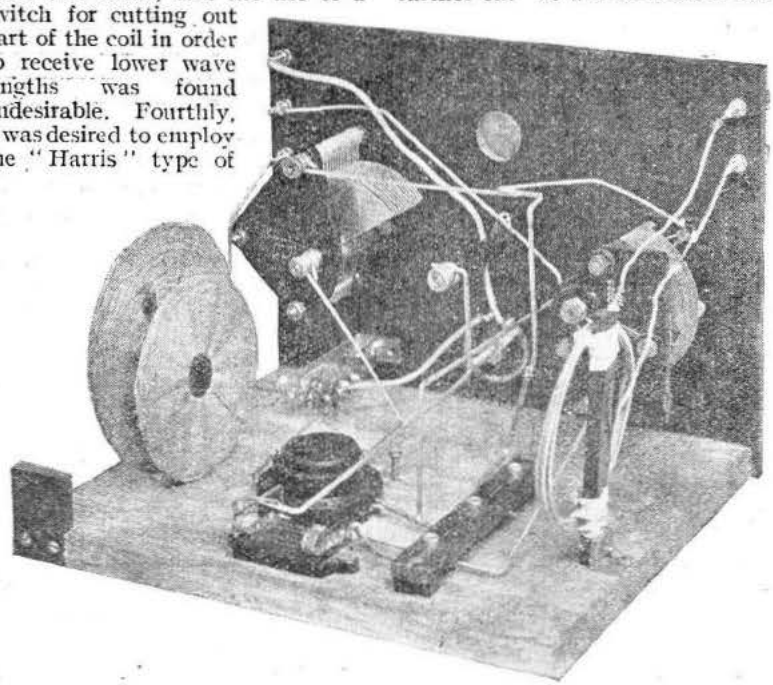


Fig. 1.—Details of the interchangeable tuning coil.

The question was complicated in the writer's case owing to several conditions with which it was intended that the receiver should comply. First of all, a loose-coupled circuit was a *sine qua non*, as a very bad earth hum is experienced when using direct or auto-coupled circuits. Secondly, it was found that magnetic reaction in most cases caused an enormous alteration in tuning with even the slightest variation in coupling between the reaction coil and the secondary, and though this has not been entirely overcome in the receiver about to be described, it is kept within easily controllable limits. Thirdly, it was desired to make the tuning coil or coils interchangeable, so as to cover a far wider band than is possible with a single coil. The use of a tapped coil was decided against in view of possible dead end losses, and the use of a switch for cutting out part of the coil in order to receive lower wave lengths was found undesirable. Fourthly, it was desired to employ the "Harris" type of X coil, which has been found so efficient on short-wave work.

The Circuit

The circuit finally evolved was that shown in Fig. 5, and will be seen to be a modified Hartley circuit. The aerial coil L_1 consists of four turns of 18-gauge d.c.c. copper wire coupled loosely to the secondary coil L_2, which consists of 20 turns of the same wire made up as described further on. It will be noticed that



The set removed from the cabinet. The basket coils form the choke coil in the plate circuit.

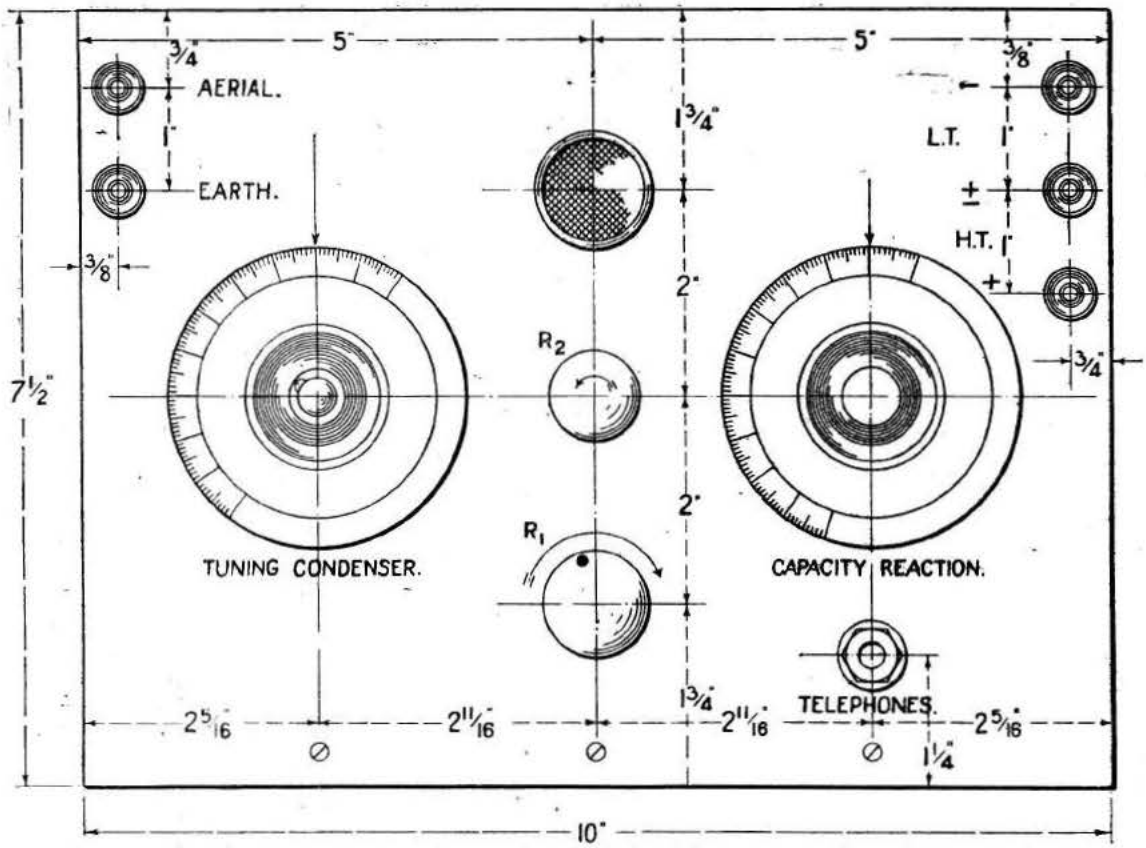


Fig. 2.—Showing how the upright panel is drilled. All necessary dimensions are given.

the filament tap is not in the centre of this coil, as is usual in the Hartley circuit, but much nearer the plate end of the coil. This was found necessary, as otherwise reaction was fierce and uncontrollable. The actual number of turns used was arrived at after considerable experiment, as also in the other coils which were used to cover other wavelengths.

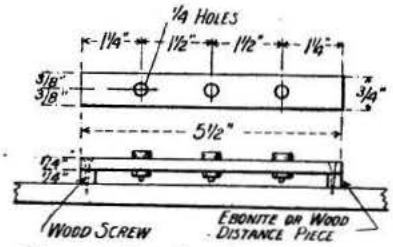


Fig. 3.—Details of the ebonite strip which acts as a coil holder.

A word of explanation as regards these may not be amiss. The 20-turn coil was found to cover the wave band between 75 and 210 metres. This was necessary in order to receive the 200-metre transmissions from amateurs. The 65-metre transmissions from KDKA, however, required another coil; this was, therefore, wound with only 10 turns, and brings in

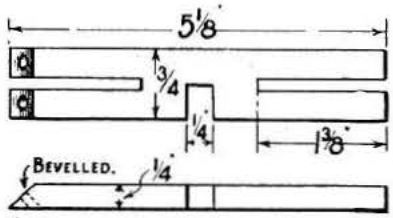


Fig. 4.—The ebonite strips used for the X coils.

the above station at about 80 deg. on the tuning condenser, the minimum wavelength receivable being in the region of 40 metres. It was found possible to get the set to oscillate with a coil L_2 of only five turns, though this, of course, required a rather higher plate voltage than that usually used. Both these last coils needed the filament tap to be in the centre of the coil. Next, it was decided to see if reception on the broadcast band could be obtained with any degree of efficiency, and therefore an 80-turn coil was made up with several tappings toward the plate end of the winding, the correct point for the filament tap being finally found at 8 turns. This was found to give excellent results on London (2LO); other B.B.C. stations were also easily received, but

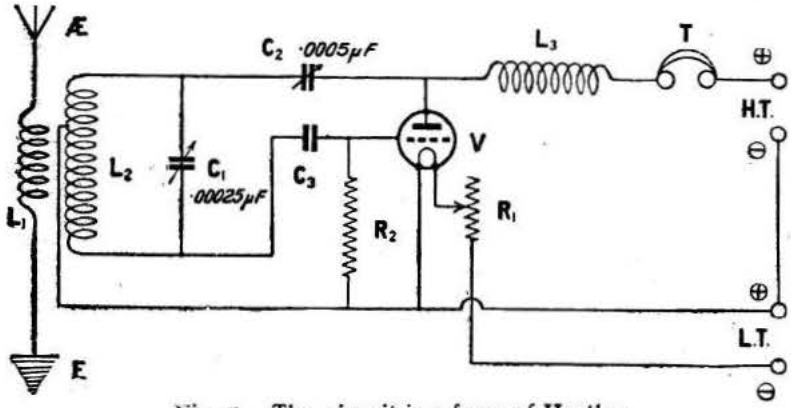


Fig. 5.—The circuit is a form of Hartley.

not so efficiently as on a receiver specially designed for this wave band. In any case the set was available as an emergency stand-by for 2LO's transmissions;

Reaction

With the 80-turn coil it was found that on the higher readings of the tuning condenser C_1 the reaction condenser C_2 must not be reduced to zero, otherwise a bad low-frequency howl resulted, that left one's ears singing for some considerable period.

Reaction is obtained by a variable condenser C_2, as shown in the theoretical diagram. A choke coil, which consists of two basket coils placed in series, is connected in series with the phones in the H.T. positive lead. The value of the condenser C_2 is ·0005μF, of which only about 80 deg. is required normally (which is quite a low value of capacity, as the condenser is of the square law type), the full capacity only being required on the very small or very big coils. On the medium short wavelengths it was found possible to leave this condenser set for searching, and only touch it when bringing in a very weak transmission. An extension handle was required both on this as well as the tuning condenser, as the receiver is not entirely free from hand capacity effects, though these are not serious, except on the ultra-short waves.

Extension Handles

These handles are visible in the photograph of the complete set which will be seen to present a businesslike appearance. As the unit was intended to stand by another cabinet containing an amplifier, a moulded base and top were avoided, so that the two cabinets would stand flush side by side. The panel lay-out is neat and simple, and is shown to scale in Fig. 2, with all the necessary dimensions. A filament jack has been used, so that the insertion of the telephone or amplifier plug switches the valve on, and the receiver can be left switched off without fear of the valve being turned on accidentally.

The following components are required to build this receiver, and though the maker's name has been given in each case, for the convenience of those who wish exactly to duplicate the receiver as described, it is not necessary to use just these makes as long as parts of good quality are used. This proviso as to quality is specially important if it is desired to obtain the utmost efficiency on the short waves, and in particular it applies to the ebonite and variable condensers used. You will need :—

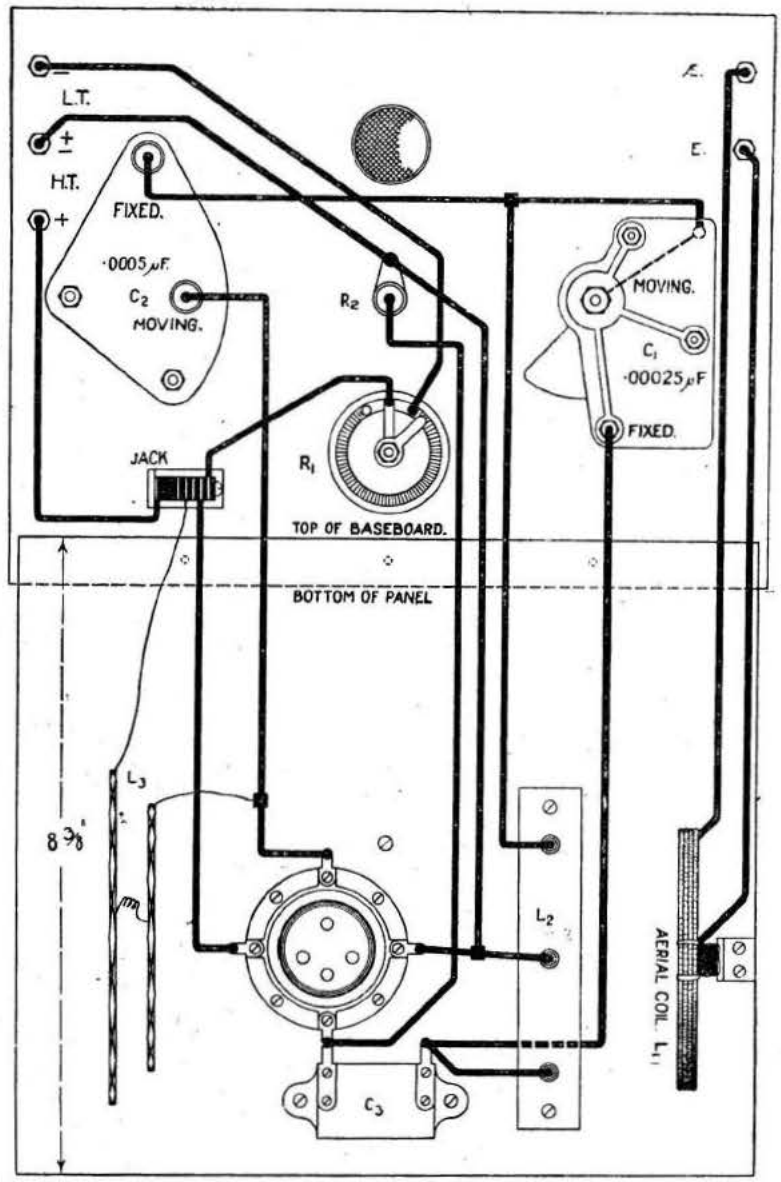


Fig. 6.—Wiring is very simple.

One ebonite panel, 7½ in. × 10 × ¼ in. This size was at hand and, if desired, a 7 in. panel, which is a standard size, may be used (Will Day matted).

One cabinet for same, 8½ in. deep.

One 0·00025μF. variable condenser with integral vernier (Sterling).

One 0·0005μF. variable condenser, square law type (Jackson Bros).

One Bretwood variable grid leak.

One filament resistance (K. Raymond). If it is intended to use dull emitter valves a rheostat suitable for use with these should be obtained.

One "Anti-phonic" valve holder (Burndept). If another make is employed it should be of the anti-capacity type.

One 0·0003μF. fixed condenser (Dubilier).

One filament jack (G.R.C.).

One valve window.

Two basket coils about 100 turns each. Those used were two of different sizes that were on hand.

One piece ebonite rod for extension handles 3½ in. × ⅜ in.

One piece ebonite rod 3½ in. × 1 in. for other extension handle.

Four strips of ebonite 5½ in. × ¾ in. × ¼ in. for making the X coils and coil mountings.

One strip of ebonite 4½ in. × ¾ in. × ¼ in. for coil sockets.

Three Gibson sockets. These are obtainable to take valve pins.

Nine valve pins.

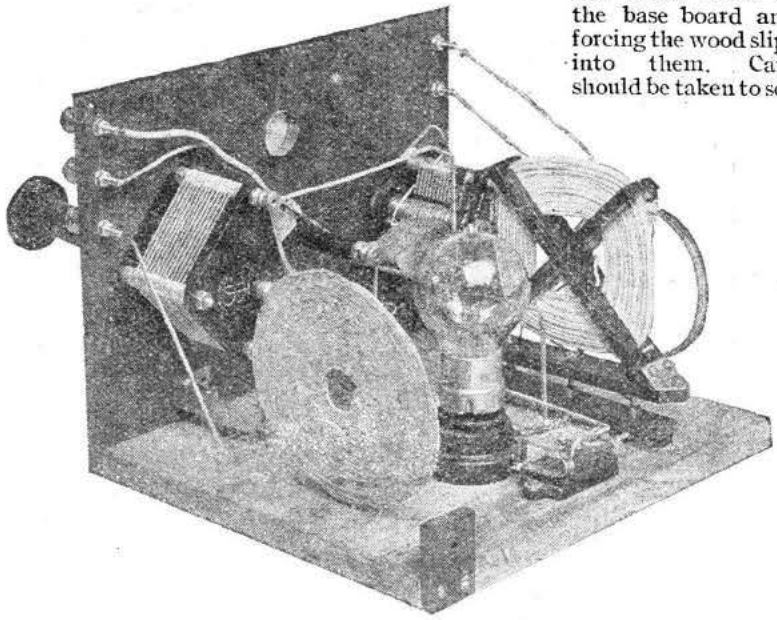
Five nickel terminals (Burne-Jones).

Square tinned copper wire for connections, a small brass strip for mounting the coils and a strip of ebonite for the primary.

Radio Press Panel Transfers.

Though this may appear a rather long list of components, the actual cost of this receiver will be found to be very reasonable, and the results obtainable will be found well worth the outlay.

If guaranteed ebonite has been obtained, the panel may be marked out and drilled right away, otherwise first prepare the panel by removing the shiny surface with No. 0 sandpaper, rubbing in one direction only. Both sides of the panel should be treated in this manner. Next apply transfers if you wish to use them and attach the components to the panel. The $\frac{3}{8}$ in. ebonite rod is used for the extension handle for the vernier control of the tuning condenser, and has a clearance hole drilled up one end suited to the spindle of this control. A hole is drilled in the side with a 6 B.A. tapping drill, tapped 6 B.A. and a small screw inserted to lock the extension handle on the vernier spindle.



A view showing the tuning coil in position.

The Second Handle

The other piece of ebonite, which is 1 in. thick, may be turned taper at one end if a lathe is available, and a 2 B.A. tapping hole drilled in the small end. This is tapped out 2 B.A. and screwed on to the spindle of the reaction condenser. The other end can be knurled, and gives a firm grip.

The various components that go on the base board should next be fixed and the panel fixed to this by means of three $\frac{1}{2}$ in. $\times$ 3 in. wood screws. The "coil-holder" with the three sockets should be made next, and a dimensioned drawing of this will be found in Fig. 3, and needs no further instructions. Before fixing this to the base board, however, three short pieces of wire should be fixed under the nuts of the sockets in order to make connections to them. The primary coil can now be wound. This consists of four turns of 18 gauge d.c.c. wire wound on a 3 in. former, slipped off and tied together and fixed to a strip of ebonite about $4\frac{1}{2}$ in. long with string. This is mounted to the base by means of an angle bracket as shown in Fig. 9. The two basket coils are mounted by inserting a slip of wood into one of the spaces between the turns of wire, drilling two small holes in the base board and forcing the wood slips into them. Care should be taken to see that the windings are in the same direction, in which case the inside end of one will be connected to the outside of the other.

The set may now be wired up according to the wiring diagram shown in Fig. 6. This is a perfectly straightforward matter, the leads being few and well spaced. Only remains now to construct the necessary tuning coils. The construction of the formers for these is quite simple, fully dimensioned drawings of the ebonite strips being given in Fig. 4. The slots to take the wire may be cut with a hack saw, two blades being used side by side to make the slot wide enough to take the 18 gauge wire. The 200 to 80-metre coil is 20 turns of 18 gauge d.c.c. wire, with a tap at the 6th turn from the beginning of the winding. This is made by twisting a loop in the wire about 3 in. long, the winding then being completed.

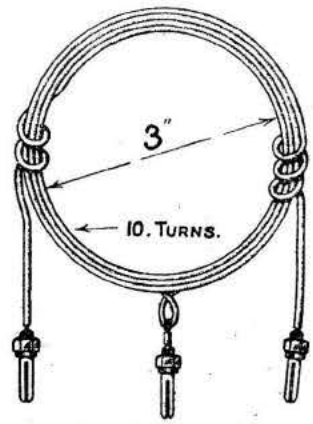


Fig. 7.—Showing the appearance of the completed 10-turn coil.

The two ends of the winding and the loop are fastened under the nuts of the valve pins which are secured to the mounting strip $1\frac{1}{2}$ in. apart in the order shown in Fig. 1, the coil being fixed to the mounting by means of two brass strips, bent as in the same figure. The B.B.C. wave coil is made in a similar manner, 80 turns of 24 wire being wound on and a tap taken at 8 turns from the commencement. The smallest coil consists of 10 turns of the 18 gauge wire 3 in. in diameter with the tap taken at the centre, and is made self-supporting by twisting the ends of the winding round the coil, and the valve pins attached straight to the wire. It will be found that the wire is quite stiff enough to support the coil without any former or ebonite

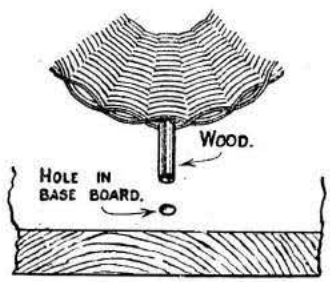


Fig. 8.—Showing how the basket coils in the plate lead are mounted.

mounting. When plugging in the two larger coils they should be inserted so that the valve pin attached to inner end of the winding

LISSENIUM

In comes a melody—

From farther away it comes to you, as you turn the LISSENSTAT knob, and clearer, stronger, until you have reception at its best. The powerful penetration of your receiver depends upon LISSENSTAT control as part of its equipment. With no other filament control can you duplicate its performance. Its critical command over electron emission improves the reception of distant telephony in a marked manner.

Sold in three models:

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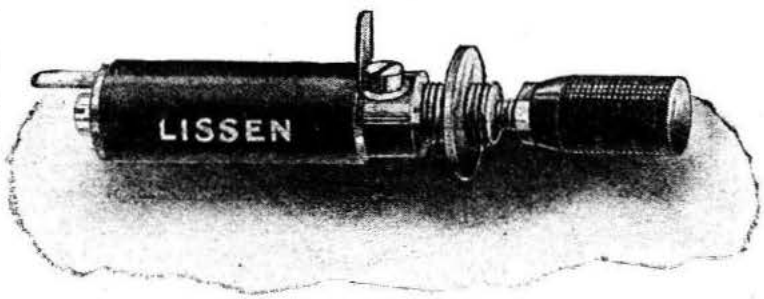
To those who think LISSENSTAT control is the same thing as an ordinary rheostat—let them try the difference.



Varying Grid Leak Value—

The grid leak value required for weak or distant stations is different to that needed on loud or nearby transmissions. For instance, to receive American telephony, the grid leak could even be as high as 10 or 12 megohms. The LISSEN Variable Grid Leak is the only one with which it is possible to obtain this high value, as well as the low minimum of ¼ megohm. Not only has it got a wide range, but it is constant and accurate, and gives absolute control over grid potential under all receiving conditions. It is a necessary fitment in every sensitive receiver. Range ¼ to 15 megohms.

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A LISSEN Variable Grid Leak across the secondary of the last transformer or across the loud speaker itself will smooth out any loud speaker distortion.

LISSEN Matched Neutralizing Transformers

The LISSEN MATCHED NEUTRALIZING TRANSFORMERS described by Mr. W. H. R. TINGEY in "Wireless Weekly" are now ready for delivery. The first range ready is the "A" range, which covers the Broadcasting band. The transformers should be ordered in a set of three, the separate coils making up the set being known as A1, A2, and A3. The letter identifies the wavelength range ("A" for the Broadcasting band), and the number the position in which the transformer is used in the receiver. Price, per coil, **£1**; set of three **£3**. Other ranges will soon be ready.

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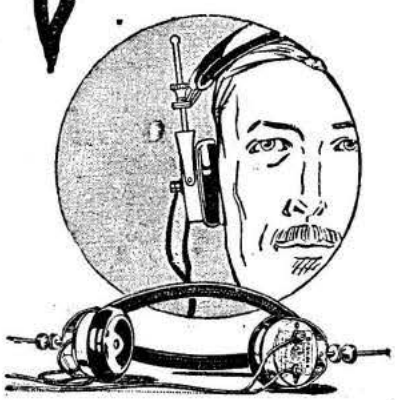

Brandes' Superior *Matched Tone* Headphones are admirably versatile. It's hard to imagine them fitting snugly to the tenderest curly head and yet fulfilling their duty on the head of the expert who sits down to long hours of serious experiment. So comfortable and with a rugged strength of construction to protect their delicate adjustment, they are excellent for family use. Primarily designed for long-range telephony from expert technical knowledge their *Matched Tone* feature brings in the most distant signals with purity and strength. The experimenter finds that they bring the best results in trans-Atlantic and trans-Continental reception. One gentleman writes from Walton-on-Thames: "I received Australia on Brandes', and consider they are the most sensitive 'phones I have used. I am much pleased with their general performance." *Ask your Dealer for Brandes.*

.....every one of these advertisements will show an added advantage in the construction of Brandes Headphones.

Look at the illustration above. See how snugly the 'phones fit the head. A gentle pressure on the crown, a firm clasp to the ears, and the rest of the headband is held well away from the hair. This means long-wearing comfort and the shutting out of extraneous sounds. Strength and firm beauty of lines typifies their finished construction.

Table-Talker 42/-

The Table-Talker is another Brandes quality product at moderate price. Its full round tones are wonderfully clear and pleasing. The horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound balance. Gracefully simple of line, it is finished a shade of neutral brown and is twenty-one inches high.

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Superior "Matched Tone" Headphones

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is inserted into the socket nearest to the panel.

Testing

The set can now be tested out. Connect the L.T. leads to their respective terminals and see that the valve lights up correctly when the telephone plug is inserted into the jack. Next, attach aerial and earth leads, plug in the desired coil, place the tuning condenser at about 20 deg. and the reaction condenser at the same value, j in up the H.T. battery and insert the telephones. A suitable value of H.T. will be about 60 to 80 volts with a general-purpose bright emitter. On increasing the value of the reaction condenser the set should go smoothly into oscillation; if, however, it goes over with a "plock," the value of the grid leak should be altered till reaction is smoothly controllable. When receiving B.B.C. transmissions the set should not be allowed to oscillate, of course, for reasons that must now be familiar to most of our readers, and it will be found quite a simple matter to adjust the two condensers together, keeping the set just off the oscillation point.

On the shorter wave bands a great deal of interesting reception can be obtained even by the amateur who has no knowledge of Morse. Harmonics from the local broadcast station can be picked up and form a convenient means of calibrating the receiver; several foreign stations are to be found transmitting telephony in the neighbourhood of 100 metres, amateurs working telephony are to be heard after broadcasting hours, and last, but not least, on the smallest coil KDKA will be found

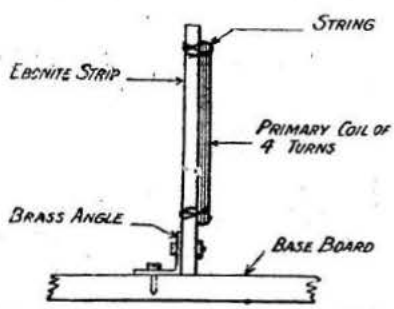


Fig. 9.—**How the primary coil is mounted.**

at good strength under normal conditions at 11.30 p.m. on about 65 metres.

Short Waves

In searching on the short wavelengths the tuning condenser should be turned very slowly and the reaction condenser adjusted so that the set is only just oscillating; otherwise carrier waves will be passed over. The use of the vernier adjustment on the tuning condenser will be found almost a necessity, and, as this is employed

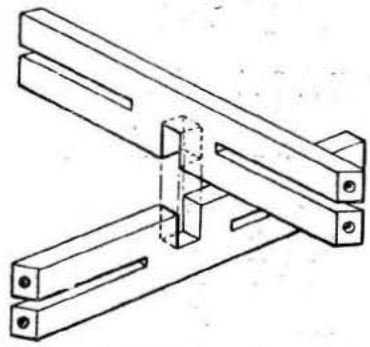


Fig. 10.—**How the strips of the X coil are mounted.**

for making the final adjustments, the extension handle will be found most useful.

American Stations

With this receiver the writer has picked up as many as a dozen American amateurs between 10 and 11 p.m.; some have also been received as early as 9 p.m. under favourable conditions. These are usually found on the 80 metre wave band, and sometimes, with three or four coming through at once, it is rather difficult to separate them as they all appear to come in at about the same strength.

As the set described has been the result of some months of experimental work, the author would be glad to hear of readers' results, in view of the great variation in local conditions that obtain.

Notes on Operation

To conclude, here are a few words of warning with regard to short-wave work. Keep dust out of the variable condensers, otherwise they will become noisy and make searching a scratchy business. Keep contacts clean; a small amount of dirt makes a big difference at these high frequencies. Keep the set and, above all, the coils dry. In damp weather it may be found necessary to dry the coils out over a fire or stove before the set will work successfully. Always use the same valve, as there is then no need to readjust values of H.T., L.T., grid-bias, etc. Further, any calibration curve you make is more likely to remain constant. Remember that tuning is somewhat critical, and do not be disappointed if you fail to receive KDKA the first time you try.

The Seven Circuit Crystal Receiver

SIR,—After having my set in use for the last two or three weeks, I feel I should write to you, saying how pleased I have been at having made the crystal set illustrated in No. 2 of THE WIRELESS CONSTRUCTOR.

Everything was built at home—the condenser was built, the ebonite drilled, and even the mahogany box dovetailed, glued and French polished.

Being some 23 miles from 2LO, and not having an aerial I was obliged to make a coil for Chelmsford. This was done on the honeycomb method, a former was made out of a piece of curtain pole, and 46 nails driven therein. As the nails were different sizes, and burred up the wood of the pole, the coil did not slide off so easily as might have been. With the aid of a reel or two of white cotton it was drawn into some kind of shape.

We tried some wire in the loft, and heard Chelmsford, and also got a very fair reception off the rain gutter, even when the rain was pouring down. However, we possessed a clothes line of that Government insulated steel wire which sagged to within 4 ft. of the ground, so we ran that in through a chink and the reception is loud and clear.

Thinking you might like a suggestion or two, might I say that undoubtedly an article is wanted on indoor aerials—how to put one up in 20 ft. by 5 ft., and so on, so as to secure proper electrical balance or symmetry, or whatever it is called.—Yours faithfully,

J. H. GREVILLE.

Brentwood.

Editorial Note: A series of articles on "Aerials For Awkward Places" is now appearing, and will doubtless fill the need expressed by our correspondent.

SPECIAL NOTICE

Query Department

Owing to the enormous increase in correspondence as a result of the publication of this journal, the above department is temporarily unable to deal with further queries, although every effort is being made to provide :: further facilities and new staff ::

Gets On

By "BROADCATCHER"

WHEN an out-and-out cast iron, dyed in the wool hater of wireless becomes converted he generally turns into the most violent type of radiomaniac in a remarkably short time. What happens, I imagine, is that the germ responsible for radiomania gets tired of biting people who succumb without a struggle to its attacks. "This," it says to itself, "is too easy. I am getting bored by these people who simply put up no show at all, but fall victims at once. Give me something with some kick in it." And then the germ discovers somebody like our friend Mr. Edward Gumplethorpe. With a shout of glee it goes for him tooth and nail. I believe that I am right in saying that germs are actually unprovided with either fangs or talons, still you see what I mean. Its

Danced off the platform.

first onslaught is repulsed. It retires with what to a microbe is the equivalent to a thick ear. But he recoils only in order to leap better. Its next onslaught is far more furious, and if it is driven off it goes round and whacks up lots of its little pals to come and help. In the end the fortress is captured, and having effected an entry the germs simply make hay of everything, and the victim has a terrible time of it.

When the Boys went Away

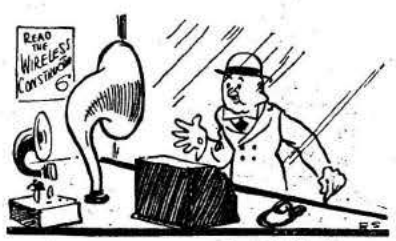
Mr. Gumplethorpe's case followed these lines precisely, and when he caught radiomania he got it, in the words of Shakespeare, where Anne Boleyn got the axe.

Somehow he felt that he must curb his wild desires so long as the boys were at home, but since young Ben was to accompany Horace to the select seminary for young gentlemen when the new term began, he knew that he had not long to wait until the coast should be clear. The great day came at last. Mr. Gumplethorpe took the lads to London, conveyed them across in a taxi, and saw them off on the last stage of their journey. Cruel though it must sound, I must confess that even though there were now two pairs of eyes streaming with tears above four cheeks bulging with toffee drops, Mr. Gumplethorpe was far from sad. In fact, when the train began to pull out of the station he stopped waving his handkerchief as soon as he decently could, and positively danced off the platform whistling "It Ain't Gonna Rain No Mo'."

Where he Went

Hailing a taxi he was whirled off, still whistling, to a wireless shop. Mr. Gumplethorpe passed the day in a perfect orgy of wireless. He invested first of all in vast quantities of literature—"Twelve Messed Up Wireless Sets," by Mr. Hercy Parris; "Tuning Coils But Never Mind Them," by G. P. Bendall; "Wireless Sets as Home Destructors," by Mr. E. Headbath; and "Ten Thousand Wireless Answers Questioned," by Messrs. Bendall and Headbath. These, with "Soldering Simplified, or Wireless Made Greasy," by an author who has had the sense to remain anonymous, completed his literary outfit.

Mr. Gumplethorpe was not the kind of man to purchase a ready-made set. No real enthusiast does this. Would you buy your clothes ready made? No, a thousand times no. Then why purchase a reach-me-down receiving set? It may be objected that if any enthusiastic amateur of the sterner sex endeavoured to make his own clothes the results might be rather painful, and therefore the analogy is not a good one. Anyhow, I have seen a good many home-made wireless sets that were pretty queer misfits. But I digress, though the fault is yours, not mine. Did I hear you say I beg your pardon? Granted as soon as asked. Let us now proceed without further ado. Mr. Gumplethorpe was not such a fool as to think of beginning with an umpteen valve Super Heterodyne. He had quite made up his mind to begin at the beginning. For this reason his mind ran entirely upon catswhiskers and crystal cups, and things of that kind. He had resolved that later on he would read "From Valve to Crystal, or Out of the Frying Pan into the Fire," by Mr. Headbath, but for the moment his foot was set upon the lowest rung of the ladder, and he was determined to climb slowly and surely. So many fellows dash at the ladder bald headed, only to find that there are two or three rungs missing which they do not see; they come to understand



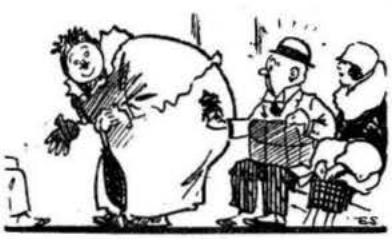
Flattened his nose against the window.

what Mr. Jorrocks meant when he said, "A fall's a hawful thing."

Somebody's Fall

I once knew a man who sent in to the test department a seventeen-valve super-putrodyne, remarking, brightly, in his covering letter that it was his first attempt at wireless construction. He added that there must be some little thing wrong with it because it would not work. There was not very much amiss. He had merely placed the high-tension battery condenser in series with the L.T.— lead, tuned his anodes with rheostats instead of variable condensers, provided for the regulation of filament voltage by means of variable condensers, connected the grids of his valves to the O.P. side of the transformers

and the plates to the gridleaks, forgotten all about an aerial-tuning inductance, and connected the telephones across the positive and negative terminals of the accumulator. That was all, but these little things just sufficed to make all the difference between perfect efficiency and comparatively poor results. You see what I mean? Again, dear reader, I digress, but we will hark back once more to our theme. Anyhow, you cannot complain that I am not giving you some exceedingly sound advice. What I mean is this. I knew a man once—— [Yes, yes, but will you please get on with Mr. Gumplethorpe's adventures?—ED. Oh, *very* well; but are you not rather hasty? I knew a man once—— That will do. Get ON.—ED.] That is the sort of conversation, reader, that takes the heart out of a man. I go and give the Editor a leg-up by bringing in a mention of his "Twelve Messed Up Wireless



Spoiled by a twenty-seven stone passenger.

Sets," and that kind of thing is all the return I get. It is a hard life, this writing business. I knew—— [I don't care whether you knew six men. What we want to hear about is Mr. Gumplethorpe's adventures. For the last time, GET ON.—ED.]

All right! Editors are—but, no, I will refrain. Mr. Edward Gumplethorpe spent a very large part of the day in flattening his rather retroussé nose against the windows of dozens of wireless shops. Several of them he entered. He asked questions much worse than those usually put forward by the beginner. Scores of wireless salesmen went mad and were removed to Colney Hatch on that terrible day.

Disaster

He reached home at length, having pawned his watch in order to pay his bus fare since all his money had been expended, with seven pairs of telephones and six variable condensers. These also were seven when he started on his journey, but one of them he left upon the seat beside him, and the strain put upon it by the descent of a twenty-seven stone passenger into the vacant place having buckled its spindle into a plausible imitation of the backbone of a dyspeptic eel, Mr. Gumplethorpe presented it to the conductor, with a little courtly bow and an expression of the hope that he would find it useful. He did a little later, when a barking dog followed the bus. There were also coils, and wires and crystals, and whiskers and fixed condensers, and earth pins, and spreaders, and pulleys, and guide ropes, and other odd bits and pieces in abundance. "If," said Mr. Gumplethorpe, to himself, "the thing is worth doing at all, it is worth doing thoroughly."

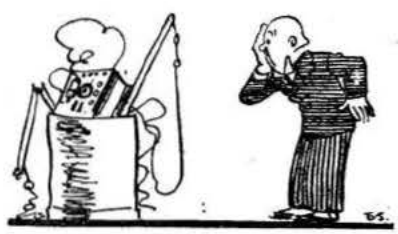
His First Set

Mr. Gumplethorpe proceeded after dinner that evening to assemble his first crystal set. He was a little handicapped by his inability to follow the cryptic symbols of wiring diagrams. Who could blame the man if he mistook a series of in-and-out curves for the representation of the catswhisker, and the thing looking like an arrow piercing two beef steaks at one blow for the crystal cup? The circuit which he evolved that night was certainly original, though it looked more like a barbed-wire entanglement after being shelled by 5.9's than anything else. Luckily for Mr. Gumplethorpe, he possessed an expert friend, to whose home he repaired, notwithstanding the lateness of the hour, in order to get all the advice he could for nothing. What he said can only be expressed by dashes, asterisks, daggers and things of that sort, for when a man lets himself go to a bosom friend on the subject of his first attempt at a wireless set, what he says is not to be printed in the more usual alphabetical symbols. The friend calmed him down and assured him that all beginners suffered some tribulations and promised to come round on the following evening to set matters right.

He duly turned up, saying, as he entered, "Good evening, Gumplethorpe. I have come round to put that crystal set of yours right." "Crystal set!" cried Mr. Gumplethorpe, "crystal set! Oh, that was yesterday. I have given up crystals now and I am just making my first single-valver."

Troubles

And that, dear reader, is a true and faithful account of the first two days in which Mr. Gumplethorpe let himself go as a wireless man. On the third he came down to earth, renouncing the valve in favour of the crystal. On the fourth, when dawn was gilding the skies, he flung all his components into the dustbin, rescuing them carefully after breakfast when he had had time to think matters over. On the fifth, whilst he was trying to think of some plausible reason for summoning Ben and Horace back from school to help, he suddenly stumbled upon something that would work. He had undoubtedly got 2LO, but there was something lacking about the strength. It must be the coil. Mr. Gumplethorpe wound two more, but whilst he was out of the room for a moment in order to find some string with which to secure their ends, the kitten got at them. Undeterred, he telephoned to the nearest wireless shop for a dozen. Experiment showed him that it was not the coil. In that case it must be the con-



Flung them into the dustbin.

denser. He tried all that he possessed, and several of which he became subsequently possessed, though he could not afford them. It was not the condenser. It must be the catswhisker. He tried thin ones and curly ones, and blunt ones and pointed ones, and brass ones and copper ones, and gold ones and tin ones. It was not the catswhisker. It must be the crystal. He tried Blowmetite and Blatherskite, and Dynamite and Gelignite, and coke. It was not the crystal. He suspected the earth plate. He dug it up. He purchased a new one of enormous size and buried it practically in the bowels of the earth. It was not the earth plate; but it was, though Mr. Gumplethorpe did not discover the fact for some little time, that he had forgotten to connect it to the appropriate terminal of his set.

And there we must leave Mr. Gumplethorpe still struggling to obtain perfection with his crystal set. He has since taken to valves and of his tussles with them I shall have more to tell you next time.

Take Care of Your Telephones !

By STANLEY G. RATTEE, M.I.R.E.,
Staff Editor

An article of interest to all who listen

PROBABLY the most sensitive accessory of any wireless set, exclusive of valves, is the telephone headpiece, yet in many cases this is the most abused. In fact, it may be said that many listeners upon purchasing a pair of telephones do much to affect the sensitiveness of these instruments right from the very commencement by the common practice of removing the earcaps in order that they may see "how they work."

Firstly, it is quite conceivable that the unscrewing of the ebonite earcap by inexperienced hands may bend the thin diaphragm which it holds in position; secondly, the correct position of the earcap may not be found when the latter is replaced; and thirdly, the washer which is usually inside the earcap may not be put back in the right place.

Connecting to the Receiver

Perhaps one of the most common faults made by listeners is the manner in which they connect their telephones to the receiver. In common with several other small details in radio there is a right and a wrong way of connecting telephones, the right way resulting in increased efficiency, with long life, and the wrong way terminating in the spoiling of the instruments. In view of these remarks, it is rather remarkable that manufacturers of telephones do not in every case draw the purchaser's attention to this fact.

Important Features

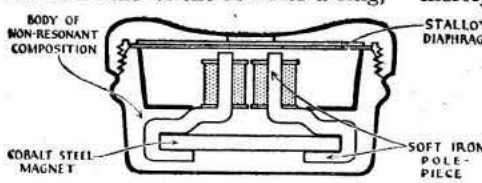
The most important features in any telephone receiver are the magnets, the coil windings and the diaphragm, and, assuming that we do not probe the diaphragm with a pencil or that the coils do not get burnt out, there remains only one factor to be considered in regard to the useful life of the instrument, namely, the permanent magnet.

Makers of telephones have devoted considerable research work to the finding of a suitable steel with which to make telephone magnets, and it may be understood that every good make of telephone is built with a magnet which has undergone a very exhaustive test, embracing chemical, mechanical and magnetic qualities.

In view of this careful selection on the part of manufacturers, it behoves the users of telephones to refrain from neutralising the good work, if it is their ambition to get the best results.

The Permanent Magnets

The permanent magnets contained within a pair of telephones are as a rule in the form of a ring,



Showing the interior construction of a telephone earpiece.

or else built up from ring laminations, and carry soft iron pole pieces on which the coils are wound. When assembling the telephones extreme care is taken to ensure that the coils are so connected that when a current flows through the receiver in the correct direction the magnetism of the permanent magnet is reinforced.

The diaphragm of the telephone is always under the "pull" of the magnet, and has therefore a tendency to sag in the direction of the pull; now, when this pull is increased or relaxed, the diaphragm is attracted or released accordingly.

Assuming now that the telephones are connected the right way on a receiver, the flow of current produced by the received signal will assist the "permanent pull" and we shall be getting the maximum effect from the diaphragm in that operating under these most favourable conditions it will respond to most feeble currents flowing through the coils. If the telephones were connected the wrong way round, then, in the case of a valve set where the telephones are in the anode circuit, the "permanent pull" would be weakened and current changes in the coil windings resulting from received signals would still further reduce it, lowering, therefore, the general efficiency.

Reduction in Magnetism

Were this the only disadvantage, then a wrong connection would merely affect results, and not the instruments, but, unfortunately, if the telephones are left wrongly connected in a valve set for a sufficiently long time, the opposing currents will gradually reduce the strength of the magnets, and the telephones will be ruined.

In the good makes of telephones provision is made for this possible condition of things by marking the earpieces positive and negative, and also by binding in red one of the two ends of the telephone leads which is connected to the set. When connecting headphones to a valve receiver, every care should be made to see that the positive of the phones is connected to the positive phone terminal of the set, whilst in the case of a crystal set the connections should be tried both ways, choosing very weak signals with which to make the tests.

A Simple Test

It may be found that with some makes of telephones that their polarity is not indicated, in which case the following simple test may be made. Take a silver coin and another of copper and place them

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1. Circuit diagrams for 3 and 5 valves.
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3. Instructions for Operation.
4. Complete schedule of all material required.

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"The set goes very well indeed . . . I may say we got Havana, Cuba, the other morning, which none of the sets in this town have got yet."

C. J. H., Thurso.

"I must say I am delighted with mine. Nightly I tour the Continent."

Bush, Bradford.

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side by side with their edges touching, and drop a spot of vinegar where the two join. With this done, place the phones upon the head and touch the coins, one with each end of the phone lead. By doing this a faint click will be heard, upon which reverse the leads and touch the coins again; do this several times until one is able to decide which way gives the loudest result, whereupon that lead which is touching the silver coin is that which should be connected to the positive terminal of the set. It may suggest itself to the reader at this point that this test may be made with a small dry battery, but since the click would be so loud with either connection, the use of such a battery for this purpose is not advocated.

Connecting Phones to a Valve Set

When connecting the telephones to a valve receiver, they should be connected as already stated, positive to positive, and in those cases where readers do not know which of the telephone terminals of the set is the positive, one of the telephone tags should be connected to the L.T. positive and the telephone terminals touched each in turn with the remaining telephone tag; that terminal which gives the loudest click is the positive terminal.

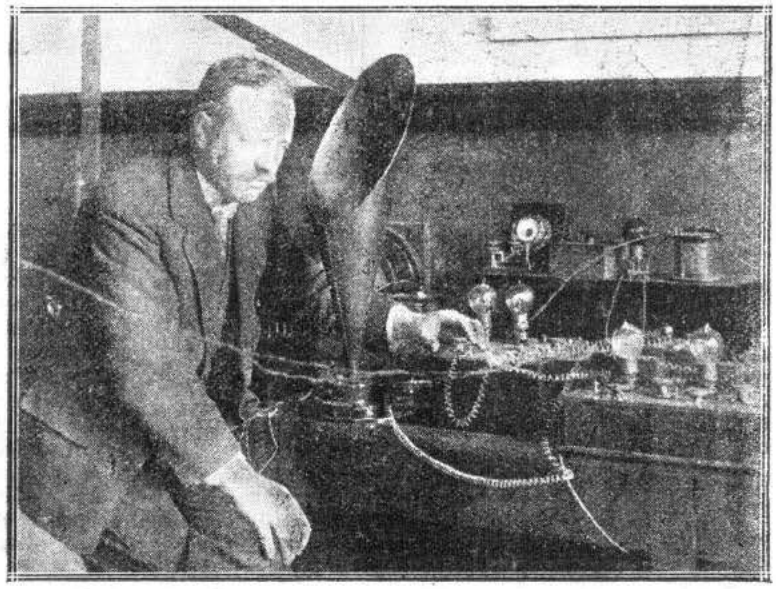
Don't Drop Them!

Apart from wrongly connecting their telephones, many listeners damage these sensitive accessories by dropping or jarring them and, which is equally bad, allowing the two phones to bang together when removing them from the head. There is perhaps nothing which reduces the efficiency of a pair of telephones so much as the careless banging about which some instruments are called upon to endure.

Faulty Cords

Exclusive of loss of efficiency in the true sense of the word, it sometimes happens that telephones either fail to work at all, or else give intermittent results. In many cases such a condition of things may be easily remedied, for the symptoms usually indicate a faulty telephone cord, and the following simple test should be tried. Place the tags of the telephones across the terminals of a small dry cell, and note whether or not a loud click is heard at the time of contact and disconnection; if this results in nothing audible then it may be assumed that it is necessary to carry the test one stage further; if, on the other hand, a loud click results, then the phones are not at fault, and we must look elsewhere for the trouble.

The next procedure in the event of the battery test failing to give results is to replace the telephone leads with one of home-made manufacture and try once more, when, if there are still no clicks, then the fault is in one of the ear pieces, or both. To test these it is necessary to short-circuit one of them and to again try the battery test; if no sound is heard, then the short-circuiting wire should be transferred to the other phone, and the test again made. Should there still be no sound, then one may find consolation in the knowledge that both phones are at fault and must be returned to the makers for repair, or else a new pair must be purchased.



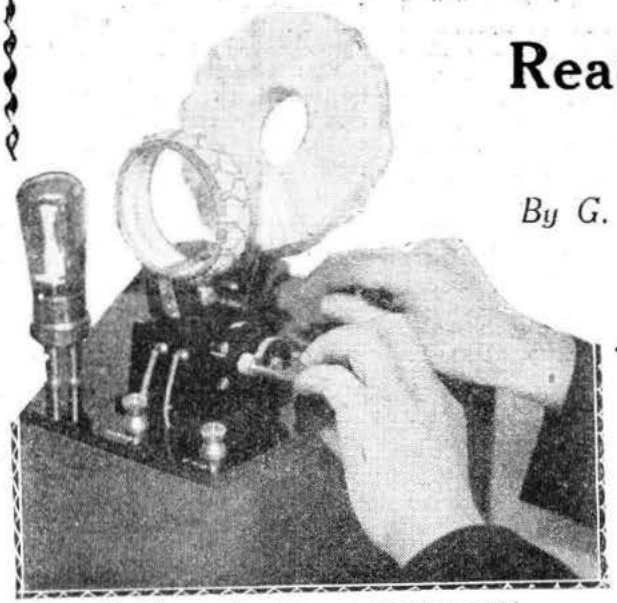
Some of the Wireless apparatus at Scotland Yard, where Major Vitty, seen above, is in charge of the Wireless Department.

With Mallet Aforethought!

Reaction: Its Use and Abuse

By G. P. KENDALL, B.Sc., Staff Editor

Some practical notes on a subject of vital importance to all users of the Aether



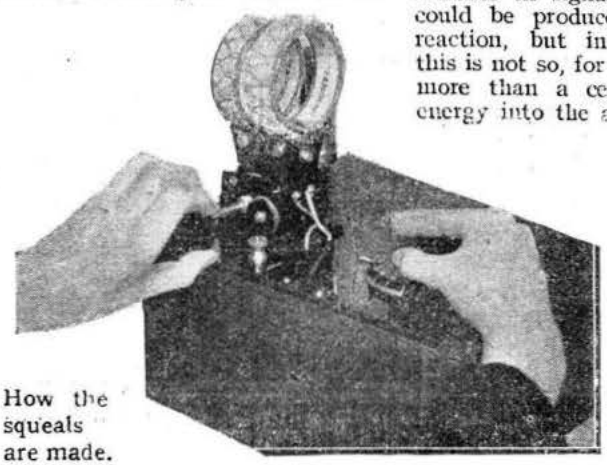
Don't use too large a reaction coil!

REACTION—what a world of hard feelings that word does conjure up in the minds of all who have had just a few weeks of experience of wireless, and who have known what it is to suffer in our own "use" of reaction by the "abuse" of it by others!

A Paradox

It seems strange that one of the most valuable properties of the wireless valve, namely, its power to produce reaction effects, should at the present time constitute a most grave menace to the success of broadcasting and the amateur constructors' movement. I use the words "grave menace" advisedly, because to any reflecting person the outlook is most alarming when it is remembered that in the past six months the evil practice of "reception by oscillation" has increased enormously and there appears to be no reason why a similar increase should not take place in the next six months. The state of affairs is already so bad that in many districts the reception of the more distant stations, especially the Continental ones, is becoming almost impossible at certain hours, as is the case in my own locality. Here one can receive Madrid at very full loud-speaker strength with a four-valve set so long as London is working, using a wavetrap to eliminate interference by the local station, but as soon as 2L.O closes down it seems that all the local oscillators swing up their reaction coils and proceed to search for Madrid, and all that one can hear from that moment is a chorus for thousands of voices of the howl or squeal variety, and in the midst of it very faint and much distorted telephony. It is no exaggeration to say that in my case, so long as 2L.O is not working, it is well-nigh impossible to receive *any* of the more distant stations, because they are simply buried in an overwhelming volume of local "carrier waves."

The trouble is not mainly due, I believe, to people who make a practice of searching for distant stations with their receiving set oscillating and stopping it from doing so when they actually pick up a station, but, rather, the result of the use of receiving sets continuously in an oscillating condition, the operator's idea of tuning in a station being merely to set his receiver to the silent point of the carrier wave and listen to the much-distorted and burbling results so obtained. Now, people who adopt this method of reception can never obtain proper results, since it is practically inevitable that the telephony they hear will be badly distorted and quite unfit to be described as music. It would therefore seem that what is required is not denunciation, but, rather, education in the proper use of reaction.



How the squeals are made.

Let us, first, see what is meant by the correct use of reaction and clearly understand the object at which we are aiming when manipulating the reaction coil.

Purpose of Reaction

The principal object in using reaction is, of course, to increase signal strength, and this is brought about by the fact that the use of a reaction coil enables us to feed back energy from the plate circuit of one of the valves into the aerial circuit, or, at any rate, into the grid circuit of a valve, to increase the strength of the incoming oscillations. A further great benefit conferred by the proper use of reaction is a very considerable increase in sharpness of tuning or selectivity, so that interference is reduced. Exactly how all this happens does not concern us here, since I do not wish to deal with the theory of the question, but purely with the actual practice concerned in getting good results without making oneself a public nuisance.

It would seem at first sight as though there were no limit to the increase in signal strength which could be produced by means of reaction, but in actual practice this is not so, for if one feeds back more than a certain amount of energy into the aerial one reaches a condition at which the set breaks into self-oscillation, and beyond that point it is of no advantage to go. On the contrary, as soon as the set begins to oscillate, any telephony which is being

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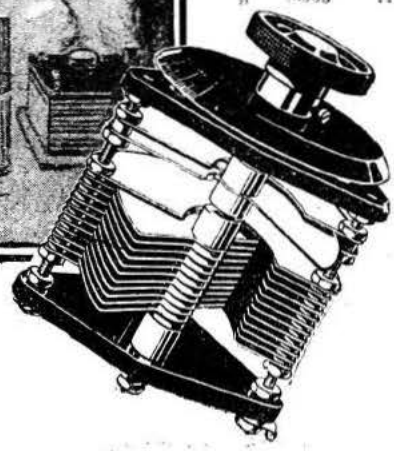

Every Set will be more efficient when "Low Loss" is understood

HAVE you ever wondered why it is that two wireless sets apparently alike in design, layout and wiring may be totally dissimilar in performance? One will yield signals of surprising musical quality over a wide range; the other will in every sense be disappointing.

The "Low Loss" principle affords the answer.

In every receiver, and every component, there are places where a dissipation of electrical energy occurs. Dirty condenser washers will cause this loss of power, so will faulty joints; poor quality ebonite is not a perfect insulator; through it energy is wasted. Thus and thus, in a hundred ways, tiny leakages of power accumulate and in the aggregate seriously affect the quality of the final reception.

These minute leakages are called "Losses."

It has not been sufficiently realised that it is the business of every manufacturer of wireless parts to so design and assemble his products that their construction reduces these losses to a minimum, for "Low Loss" components mean highly responsive sets.

Whenever you have reason to be dissatisfied with the quality of reception afforded by a set you make, be suspicious of losses.

SEND FOR THIS BOOK.
It contains 36 pages of useful information about all Bowyer-Lowe Tested Components, with blank pages for your own notes. It is FREE on application. Enclose 1½d. stamp for postage.

Locate the components which cause them, rebuild your set with parts you can trust, and the tremendous improvement will convert you to the "Low Loss" idea.

But it is better to be sure than sorry. Every single component made by Bowyer-Lowe is a "Low Loss" component, designed by experts and built by engineers in such fashion that its losses are reduced to a minimum.

This fact accounts for the extreme responsiveness of Bowyer-Lowe Square Law Condensers, which give ease of calibration with increased selectivity and wavelength range; it accounts for the high efficiency of every instrument and part we make.

Buy Bowyer-Lowe Parts for all your sets and secure maximum signal quality through low losses.

Bowyer-Lowe Tested Components
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MATCHED H.F. TRANSFORMERS.
Every one guaranteed to match perfectly every other in its range. All ranges 150 to 3,000 metres and up, also special Neutrodyne Unit. Price each 7/-

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Through low losses gives greatly increased efficiency, especially on short wavelengths. Fixed without metal nuts and screws. As used by Mr. P. W. Harris. Price 1/2

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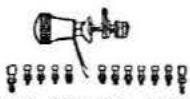

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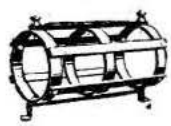

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For making short wave coils with minimum dielectric losses. Former is 3⅜" in diameter, 6 inches long, with terminals and soldering lugs each end and bracket for fixing. Constructed of Grade "A" Ebonite and Lacquered Brass. 5/-

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Heavily nickel plated, with rounded bezel, back plate, gauze and all nuts and bolts. A handsome finish to any set. Price each 9d.

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O.K. FLETCHER AD.

received becomes more or less distorted, any variation in tuning produces howls and whistles from the "heterodyning" of the carrier wave, and one is then radiating.

We shall therefore obtain the loudest signals without distortion if we learn to adjust our set so as to use as much reaction as possible *without* actually producing self-oscillation. This means, in practice, that we must aim at bringing the moving coil as close to the other coil as possible without actually falling over the edge into self-oscillation. This is undoubtedly one of the finer points of operating a receiver, requiring a certain amount of skill and practice; but a beginner is strongly urged to select some fairly strong station which he can pick up easily and to practise upon this the adjustment of his reaction until he can do it with certainty and celerity.

Tuning Variations

It will be found that varying the position of the reaction coil alters to some extent the tuning of the receiver itself, so that when one has brought the reaction coil up nearer to the aerial coil one may have to turn the aerial condenser slightly in one direction or the other, to hear the signals once more at full strength. This is soon learned and the novice should school himself in the habit of turning the reaction coil away from the aerial coil the very instant that he hears the first signs of self-oscillation, endeavouring to visualise, as he does so, the expressions upon the faces of all those of his wireless neighbours who may be suffering from his momentary transgression.

Signs of Self-oscillation

We have been assuming so far that the reader was familiar with the signs of self-oscillation, so that he could make certain of stopping any oscillation which took place very quickly, but a brief explanation should perhaps be given to show how such self-oscillation may be recognised. Upon the majority of sets when the self-oscillation commences, there is a slight click or "pop" in the headphones, after which a faint continuous rustle is heard, which is mostly due to the presence of a continuous stream of small atmospherics, which passed unnoticed when the set was not in the oscillating condition. Further, if one is actually listening to a telephony station at the time, the speech becomes distorted and is mixed up with howling and whistling noises when the variable condenser is turned. This latter is probably one of the surest signs, and it can be taken as a general rule that if shrieks and howls are heard whose pitch can be varied by turning any of the variable condensers in the set it is a sure sign that the receiver itself is oscillating.

Smooth Adjustment

Having satisfied oneself by experiment that we can recognise the symptoms of self-oscillation with reasonable certainty, we may next proceed to consider how we may make the set as controllable as possible, so that it will not oscillate when we do not intend it to do so. The ideal state of affairs is, in the case of a set employing reaction, that the high and low-tension supply to the valves, the size of reaction coil, &c., are so adjusted that when one brings up the reaction coil the set passes very gradually into self-oscillation, without a very loud click, and further that when one withdraws the reaction coil, self-oscillation shall cease in a similar quiet manner at the same point as that at which it commenced. This desirable state of affairs is usually brought about quite easily by paying careful attention to the adjustment of the detector valve, particularly its high-tension supply. If the set becomes very "floppy," giving a loud pop when it passes into oscillation, and continues to oscillate for some time after the reaction coil has been withdrawn beyond the point at which the oscillation commenced, it probably means either that an unsuitable grid leak is being used, that the high-tension supply to the rectifier is too high, or that the filament supply for this valve has been turned down too low. Care must be given to all these points to get the set into the proper easily-adjusted condition, otherwise it will be continually flopping into self-oscillation when one is trying to adjust for a distant station.

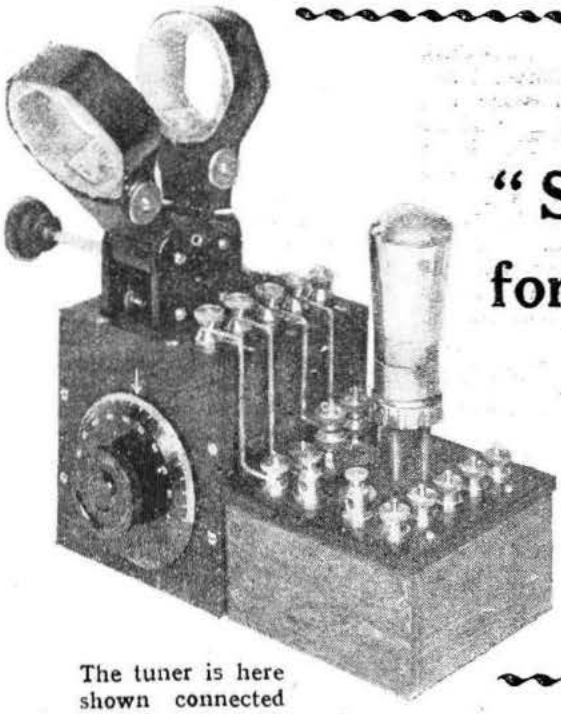
The French Ambassador to America has already fallen a victim to the radio fever.

The Coil

Having made the correct adjustments upon the valves to produce a fine control of reaction, we may next turn our attention to the question of the reaction coil to be used. Much trouble may result from the use of an unsuitable size of coil, and it would be advisable to try several sizes, since the correct one may vary somewhat with individual conditions. A fairly definite rule can be laid down, however, that the size of the coil should be such as to make the set oscillate when the reaction coil is some little distance from the coil upon which it is reacting, so that the tuning adjustments may not be very much upset by movements of the coil. The actual size of coil which will be required will depend upon the type of receiving set with which it is to be used, particularly as regards the number of high-frequency valves, but in general where only one high-frequency valve is incorporated a number 50 or its equivalent will be quite adequate for the broadcast band, while a set employing no high-frequency amplification may perhaps require a No. 75.

Using a Potentiometer

So far we have considered only sets in which reaction coil is used, but it should not be assumed that sets which do not possess such a coil cannot oscillate and cause interference, since this is by no means so. Sets employing two or more high-frequency valves are commonly controlled by means of a potentiometer, a reaction coil being optional. In such sets the adjustment of the potentiometer should be regarded as equivalent to the movement of the reaction coil, and all the precautions which I have already described must be taken, if one wishes to behave as a well-regulated citizen of the aether.



The tuner is here shown connected to the valve panel.

The "Short-Wire" Tuner for all Wavelengths

By A. S. CLARK

A compact and remarkably efficient tuner primarily intended for use in conjunction with the very popular little valve panel which appeared in the January issue

THE tuner about to be described is designed for use with the "Short-Wire Valve Panel" described in the January issue of THE WIRELESS CONSTRUCTOR. As the photograph of the two units joined together shows, the top panel of the tuner is the same size as the valve panel (*i.e.*, 4 in. by 4 in.), and although the depth is 2 in. more, it looks very well as a completed set.

A Complete Unit

It is a complete unit in itself, and therefore can be used in conjunction with any set which needs an external tuner. It will prove very efficient, due to its short wiring; this being only an inch or two longer than that used in the valve panel. The adjustment of the two variable controls is very easy, due to their convenient positions. It is possible by means of the small switch and terminal A_2 to change from parallel to series tuning.

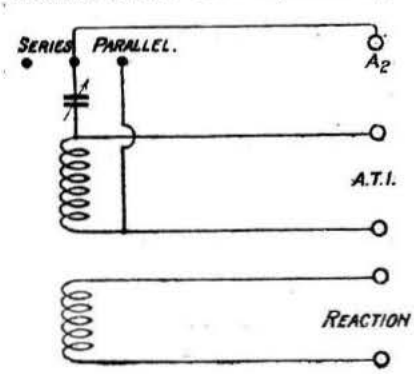


Fig. 1.—A theoretical diagram of the connections.

The Components

The tuner will be found simple and cheap to construct, and the components required are given in the following list. Of course, any good components of makes other than those specified may be used with equal results, providing they are of such a size that they may be fitted in. The space is very limited, and therefore this point should be considered before the components are purchased.

One two-way coil holder (Duco Vernier, Brown Bros.).

One ·0005 μF. variable condenser (Jackson Bros. Square-Law).

One miniature single-pole two-way switch.

Five nickel-plated terminals (Burne-Jones).

Two 4 in. by 4 in. by ¼ in. ebonite panels (Peter Curtis).

One packet of Radio Press Panel Transfers.

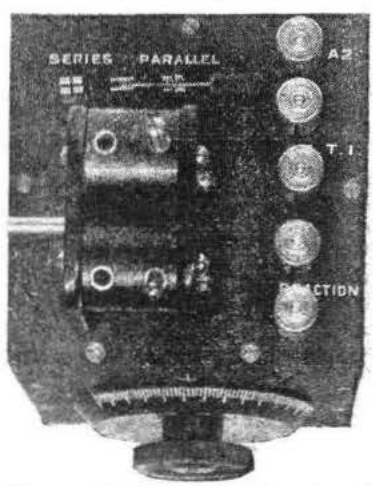
One piece of wood, 4 in. by 12 in. by ¾ in.

Length of square wire, 13 wood screws, and two 5 or 6 B.A. 1 in. brass screws.

Construction

The construction is commenced by marking out the two panels in accordance with the drilling diagram in Fig. 2. The two front holes in the top panel are for joining the two panels together, and they should be clearance holes for the particular screws used. The parts on the top panel may now be fixed in position, and as it is best to join the edges of the two panels while screwed to the containing box, the construction of this will be given next.

The 4 in. by 12 in. piece of wood must be cut into three pieces of the following sizes: 4 in. by 3⅞ in., 4 in. by 3⅞ in., 4 in. by 3½ in. These pieces of wood are joined together to form a three-sided containing box with no bottom. The 4 in. by 3½ in. piece is to form

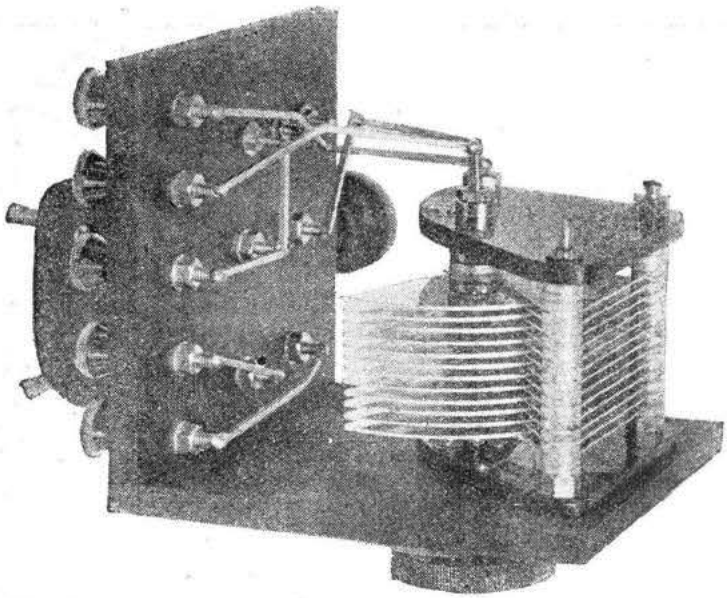


The switch may be seen to the back of the top panel in this photograph.

the back. Now screw the front and top panel on to the box, which may be smoothed down with sandpaper and varnished. Two holes are now tapped for the joining screws, and these screwed home. If the constructor has no taps, holes a little too small to allow the screws to enter can be drilled, and the screws forced into them. Now remove the two panels from the box, and fix the condenser in place.

Wiring

The wiring up can now be carried out. This must be done in accordance with the wiring diagram of Fig. 3. Care should be taken that the wiring clears the moving condenser plates. Now replace the panels, and after fixing panel transfers in accordance with those shown on the photograph of the top panel we are in a position to connect up the panel and try it out. Connection to the valve panel is made by means of pieces of square section wire as shown in the first photograph; the terminals marked A.T.I. and Reaction are joined to the terminals opposite them on the valve panel. It may be found necessary to have the reaction terminals connected the other way round to that shown in the photograph, in which case the connecting wires should be of flex.



This photograph should be referred to when wiring the tuner.

Using the Tuner

If parallel tuning is required the aerial is taken to the original aerial terminal, and the switch put in the parallel position, whilst if it is desired to use series tuning, the aerial is connected to the terminal A_2 and the switch is placed in the series position.

When tuning the set to 2LO the reaction coil should be placed right away from the aerial coil, and brought up afterwards in order to increase the strength. When searching for distant stations the coils must only be just close enough together to bring the set to the point just before oscillation.

When using special types of coils with the "Short Wire" valve panel, the condenser of this tuner may be utilised by putting the switch in the parallel position and using the terminals marked A.T.I. as the condenser connections.

In actual use this tuner gave very easy control when receiving in conjunction with the valve panel, distant stations being brought in with great ease without letting the set go right into oscillation. The author will be greatly pleased to receive accounts of the results which readers obtain with this tuner when used either in conjunction with the valve panel or another set.

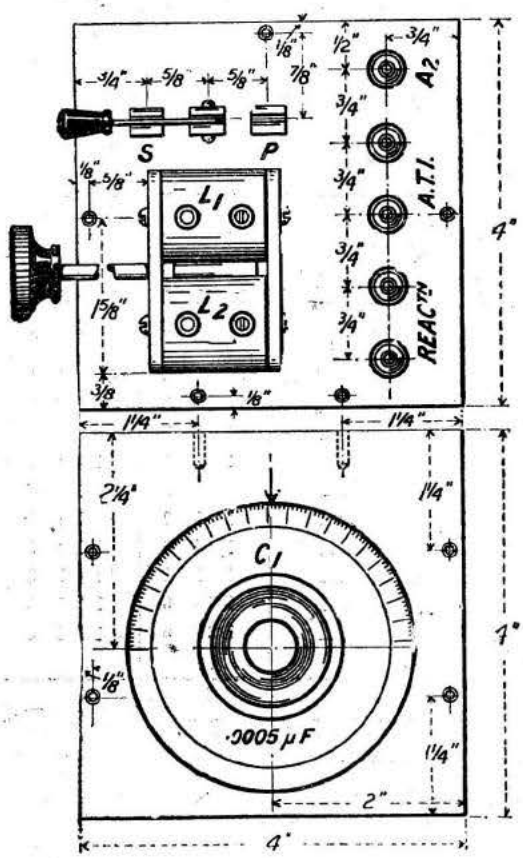


Fig. 2.—This diagram gives the necessary dimensions for drilling the panels.

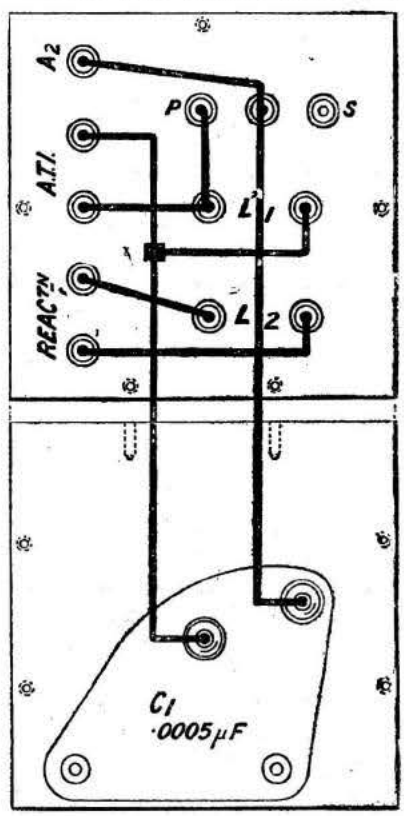


Fig. 3.—The various connections which have to be made are easily carried out from the above diagram.

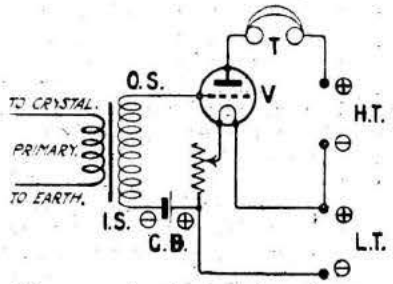


Fig. 1.—A single-valve transformer-coupled amplifier.

A Chat on Low-Frequency Amplifier Circuits

By AN "OLD STAGER"

THE most simple and probably the most popular low-frequency amplifier circuit is that using transformer coupling. Now the two great advantages of transformer coupling are, first, its great simplicity, and, second, its high amplification per valve. Fig. 1 shows the method of connecting a single-stage L.F. amplifier to an existing crystal receiver. The transformer primary should merely be connected to the existing telephone terminals, and it is usual in the majority of transformers for the outside secondary (O.S.) terminal to be taken to the grid of the amplifier valve. The other secondary terminal on the transformer, *i.e.*, in this case the I.S. connection, should go to the negative terminal of a small dry cell, termed the grid battery, the positive terminal of which should be connected to the L.T. minus. If an ordinary bright-emitter valve is used in conjunction with a 6 volt accumulator, the drop in volts across the filament rheostat will give sufficient grid bias for H.T. voltages of about 60, which is a suitable anode voltage for a circuit of this description, and the grid cell will not be necessary. In this case the I.S. connection from the transformer should be taken direct to the lower end of the filament resistance. If, however, dull-emitter valves of the 2 volt type are used in conjunction with a 2 volt accumulator, or valves of the ·06 type with two dry cells in series, then a small grid cell of 1·5 volts is certainly necessary. The use of grid bias improves quality and cuts down the plate current, thereby lengthening the life of the H.T. battery. The remaining connections will be easily followed from the diagram.

Capabilities

The Fig. 1 circuit is capable of giving strong signals in several pairs of telephones at a distance of about 15 miles from a main broadcasting station, but where signals are really weak in the first instance, transformer coupling is not very efficient and in most cases will give a disappointing increase in strength.

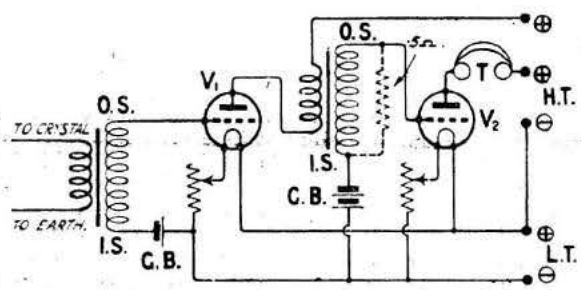


Fig. 2.—A two-stage transformer-coupled amplifier.

Two Stages

Fig. 2 shows a two-stage transformer-coupled amplifier suitable for use with a crystal set. In this circuit two separate positive tappings to the H.T. battery are provided, for this results in greater efficiency. The voltage applied to the plate of the last valve should be greater than that in the case of the first. Suitable H.T. values are, for V_1, say 60 volts, and for V_2 about 90-100 volts, with a negative grid bias of about 1·5 volts in the first case, and about 3 volts (two dry cells connected in series) in the case of V_2. The remarks regarding the drop in volts across the filament rheostat given above apply in all cases throughout this article and should be taken into consideration when calculating the total negative bias and, of course, without knowing the type of valve to be used, it is impossible to give definite instructions as to the necessary grid bias to apply in every case. The enthusiast should always follow out the valve manufacturers' instructions. This circuit should be capable of operating a small loud-speaker up to a distance of about 10 miles from a main B.B.C. station.

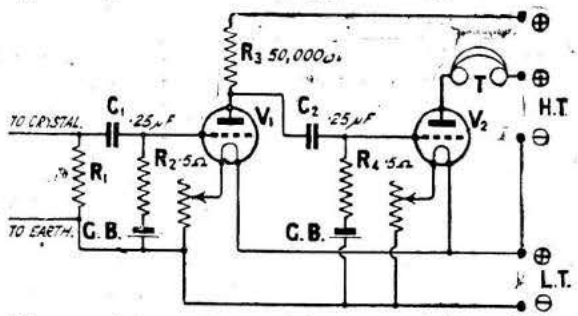


Fig. 3.—A two-stage resistance-coupled amplifier.

Improving Quality

If the constructor is willing to sacrifice a little volume, quality may often be improved by shunting the secondary winding of the last transformer with a resistance of about ·5 megohm, as shown dotted in the diagram. The listener who is desirous of obtaining faithful reproduction will find that the construction of a

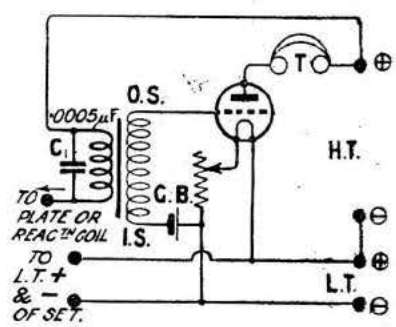


Fig. 4.—A transformer used after a detector valve.

resistance-coupled amplifier will meet these requirements. Resistance-capacity amplification, unfortunately, does not give the same amplification per stage as transformer coupling, but nevertheless a well-designed resistance amplifier will certainly give remarkable purity and is well worth making. Fig 3 shows a two-stage resistance amplifier suitable for attachment to an existing crystal receiver.

Some Rules

If the advantages of resistance coupling are to be obtained, then it is necessary that certain definite rules should be obeyed. The grids of both valves must be made negative by the application of

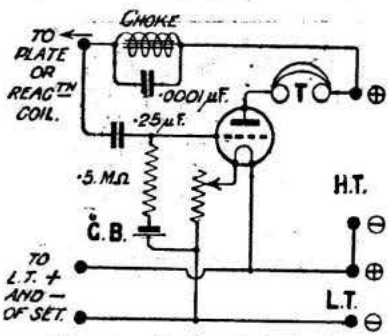


Fig. 5.—Choke Coupling.

the proper grid bias, the H.T. voltage should be greater than in the case of transformer coupling owing to the drop in volts across the anode resistance, and the anode resistance itself should be of good quality. The resistance R_1 is not critical, but should be kept low for good results and may be between 100,000 and 250,000 ohms. R_2 and R_4 should be about ·5 megohm, and R_3 may be 50,000 ohms in cases where ordinary general-purpose valves are used. The values of the coupling condensers C_1 and C_2 are not critical, but ·25μF is a good value. For best results separate positive H.T. tappings should be used and the H.T. voltage applied to V_1 should be in the neighbourhood of 120 volts on account of the anode resistance R_3; 1·5 volts grid bias should suffice in the case of the ordinary "R"-type valve. In the case of V_2 the plate voltage may be lower as there is no anode resistance in series, and 80-100 volts will be found sufficient with a negative bias of about 3 volts. For other types of valve the maker's advice should be followed.

After a Valve

We now have to consider the case where a low-frequency amplifier follows a valve detector. The rules which apply to the above circuits apply in general where a valve is used as a detector in the place of a crystal. Where reaction is used, however, it is essential that a small fixed condenser C_1, as shown in Fig. 4, should be shunted across the primary winding of the L.F. transformer.

By-Pass Condenser

This condenser is necessary to by-pass the high-frequency component of the anode current, and should be kept as small as possible consistent with efficient operation. A good average value is ·0005-·001μF. In Fig. 5 is shown a circuit utilising reactance-capacity, or choke coupling. This method will not give such high amplification as the transformer coupled method, but from the point of view of signal strength is slightly better than resistance-capacity coupling. It is particularly useful in cases where the listener is in possession of a transformer with a defective primary winding as the secondaries of most transformers make fairly good chokes, and, moreover, excellent quality may be obtained. Where reaction is used the winding should be shunted with a small condenser of about ·0001μF. This value is not critical, but for good results it should be kept low, and the above value will generally be found quite satisfactory. The values of the grid condenser and leak may be as shown in the diagram, and a suitable plate voltage is from 60-72 volts for ordinary general purpose valves. Lastly we have in Fig. 6 a single-stage resistance amplifier suitable for use with a valve detector. Separate H.T. tappings are shown on account of

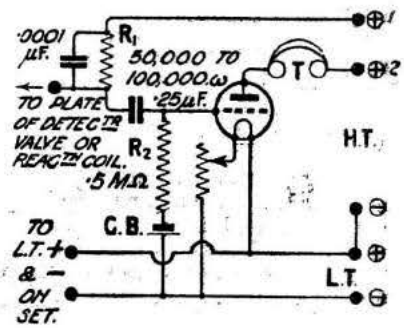
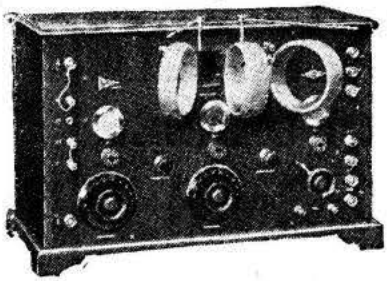


Fig. 6.—Resistance coupling after a valve.

the anode resistance R_1 in series with the plate of the detector valve. As in the case of choke coupling, where reaction is used the anode resistance should be shunted with a small fixed condenser of about ·0001μF, and the plate voltage should be adjusted to compensate for the drop across the resistance R_1. A suitable value of H.T. for the amplifier valve itself is about 60-90 volts, with a negative bias of 1·5-3 volts.

Just like a man!



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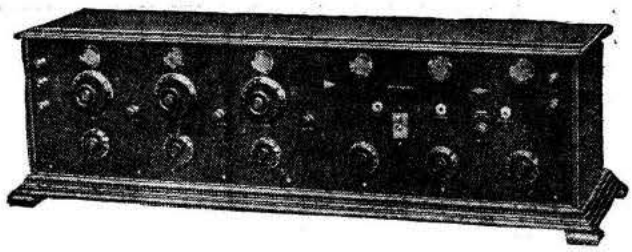


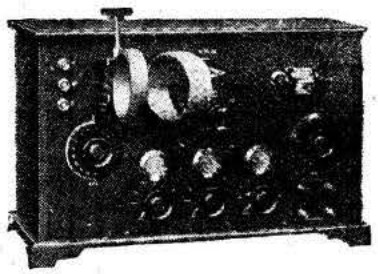
THE ANGLO-AMERICAN SIX.
"The Wireless Constructor" latest Set embodying three stages of neutrodyned high frequency. Gives practically the power of a super-heterodyne with a great saving in valves. A few feet of wire around the picture moulding of a room is all that is necessary to operate this Set.

Amateur-built Receivers that any Expert would be proud to own.

If you can use a pair of pliers to cut a length of wire—if you can screw a transformer to a ready-drilled panel—if you can follow a simple wiring diagram, then you can build any of the splendid Sets illustrated on this page. From the 2-valve Resistoflex to the 6-valve Anglo-American designed by Mr. Percy Harris for "The Wireless Constructor," they represent all that is best and most original in British Radio design to-day.

Every one of these Pilot Receivers carries our full guarantee that if made according to our working instructions they will work perfectly. Indeed, we go further than that—we have instituted a special Service Department to ferret out faults for you at a nominal cost should the Set not work when you have made it up.

Choose the best Set you can afford from the chart herewith—if you have some of the parts already, we shall be pleased to supply you with the balance. If you have all the parts already, we shall be equally pleased to supply you with only the panel or the cabinet. If you cannot make up your mind which Set you will build, write for a copy of our 32-page Pilot Chart (post free 3d.), containing upwards of 30 illustrations of Pilot Receivers with the fullest details.



THE PURIFLEX SET.
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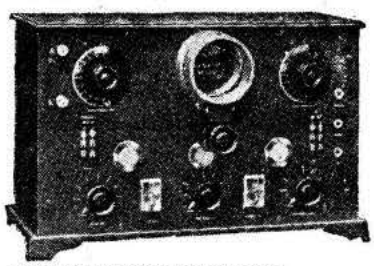
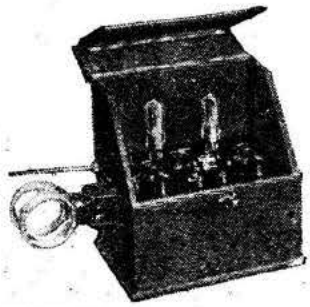


THE ALL CONCERT-DE-LUXE.
A most handsome Receiver with all fittings supplied nickel-plated. Simple switches enable note magnifier valve being cut out if not required. Has a telephone range of 800 to 1,000 miles under normal conditions. All battery connections at rear, and plugs and jacks for telephones and loud-speaker fitted to panel.

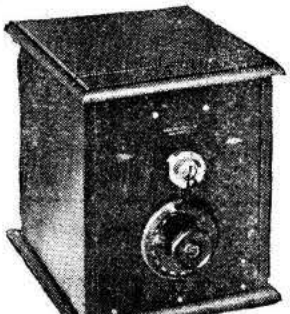
This abridged Chart will aid you in your choice

Name of Receiver.	No. of Valves	Price of panel drilled & engraved	Kit of Components.	Oak Cabinet with baseboard.
		£ s. d.	£ s. d.	£ s. d.
All Concert de luxe	3	15 6	4 15 6	17 0
S.T. 100	2	7 0	4 14 0	1 10 0
Puriflex	3	15 6	4 2 0	17 0
All-Britain ..	3	15 6	4 16 1	17 0
4-Valve Family ..	4	17 0	5 16 8	17 0
Transatlantic V...	5	18 6	5 8 5	17 0
Anglo-American 6	6	1 8 6	9 9 9	3 1 6
Transatlantic 4 ..	4	16 6	6 13 6	1 7 6
3-Valve Neutrodyne (Valve panel)	3	12 0	4 8 8	1 13 6
3-Valve Neutrodyne (Tuner panel)	—	11 6	4 2 3	(to take both panels)
T.A.T. 4-Valve Set	4	1 0 6	5 15 6	1 0 0
Harris Wavemeter	—	4 6	1 6 0	12 6
3-Valve Dual ..	3	17 0	5 5 0	15 6
Simplicity R'ceiv'r	3	12 0	3 16 0	10 6
7 Valve T.A.T. Receiver	7	1 17 6	7 18 0	1 12 6

¶SPECIAL NOTE: Where all components and panel are purchased together, a Marconi Royalty of 12s. 6d. per valve-holder must be paid.



THE S.T. 100.
The world's Standard 2-valve Reflex which gives probably the loudest signals it is possible to obtain with two valves. Tens of thousands of S.T. 100 Receivers have been built in America, although the circuit was first evolved by Mr. John Scott-Taggart (Editor of "Modern Wireless"). This Set is contained in a handsome oak double drop front, and possesses a most attractive appearance.



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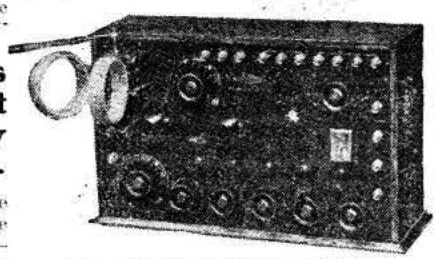
Every Wireless enthusiast needs a wavemeter. It tells him the wavelength of the station he is receiving. On the other hand, should he want to receive a station working on a known wavelength, he can easily tune his Set to that wavelength by means of the wavemeter. Price complete with battery and Silvertown buzzer fully calibrated ready for use. In mahogany or oak cabinet £3 15 0.

To get the full list of parts necessary for 30 different Receivers, send 3d. to-day for the Pilot's Chart——

If the 7 different Sets shown here are not suitable for you, send 3d. at once for a copy of our 32-page Booklet giving illustrations of 30 different Receivers—ranging from simple Crystal to elaborate multi-valve Sets. A full detailed list of every component required for each Receiver. An invaluable little Booklet for the Home Constructor. In addition, we also issue a 48-page fully illustrated catalogue (the most complete in the trade) of Wireless Components, post free 3d.; and also Peto-Scott's Wireless Book, post free 1s. 5d., containing more than 30 Circuit diagrams.



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P.S. 2205

A Unit Choke Amplifier

(*Concluded from page 505*)

than one stage of low-frequency amplification) as shown in Fig. 4. You must first of all ascertain two things. Firstly, which telephone terminal goes to the plate of the last valve, and, secondly, whether the H.T. — is joined to the L.T.+ in the set. This latter must be the case.

The telephone terminal of your set which is internally joined to the plate of the valve (perhaps through a reaction coil) must be joined to the *tower* of the two "input" terminals on the amplifier, the other telephone and "input" terminals being joined together. The H.T.+ terminal on the set is taken to a tapping on the high-tension battery corresponding to the voltage recommended by the makers of the valve used. The other connections are made clear in the drawing.

Coming now to the right-hand row of terminals on the amplifier, the top of the two "out" terminals is joined to the positive terminal of the 'phones or loud-speaker (usually marked in red). H.T.+ goes to a suitable tapping on the battery; HT— goes to the negative of the H.T. battery, while the L.T.+ and — terminals are joined to the accumulator.

Now turn on the filaments of the valves and tune your set in the ordinary way. Do not turn up the filament any brighter than is necessary to get the best results. For a single-stage amplifier, using normal H.T. voltage, the two grid-bias terminals may be joined together by a piece of wire.

Using Two Stages

Two stages may be used by joining up two units, as seen in Fig. 5, the output of the first unit being directly joined to the input of the second. Both the H.T. negative terminals, on the set and first unit, may be left free, and a lead taken to HT— from the terminal on the last unit.

A small cell may be joined across the grid-bias terminals on the second unit if necessary, but the first unit should not require biasing if normal voltages are used.

Crystal Sets

If you are a crystal set owner, and desire to add valves, I advise you to make up one unit without the choke, connecting the telephone terminal of your crystal set which goes to the crystal directly to the grid of the valve, and the other telephone terminal to L.T— on the left-hand side of the unit. A second stage may be added, using the choke this time, as seen in Fig. 5.

Results

One stage, after a single valve with reaction, and at six miles from 2LO, are the conditions in which a preliminary test was made. Purity was remarkable, being what Capt. Eckersley refers to as "pure music coming from a background of silence." Everyone who has heard the reproduction from this arrangement on a standard C.A.V. loud-speaker has remarked upon its excellence. The volume is not quite up to a good transformer, but is better than many, with considerable increase in faithfulness of reproduction.

When you have made it up, write and tell me what you think of it, but don't use "any old choke" and then blame the design.

The pirate bold!

HULLO EVERYBODY!!

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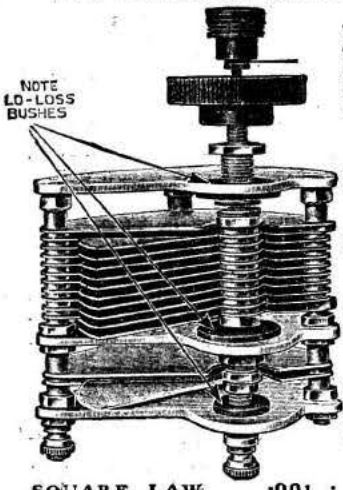

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An Amplifier for the "Stay-Set" Crystal Receiver

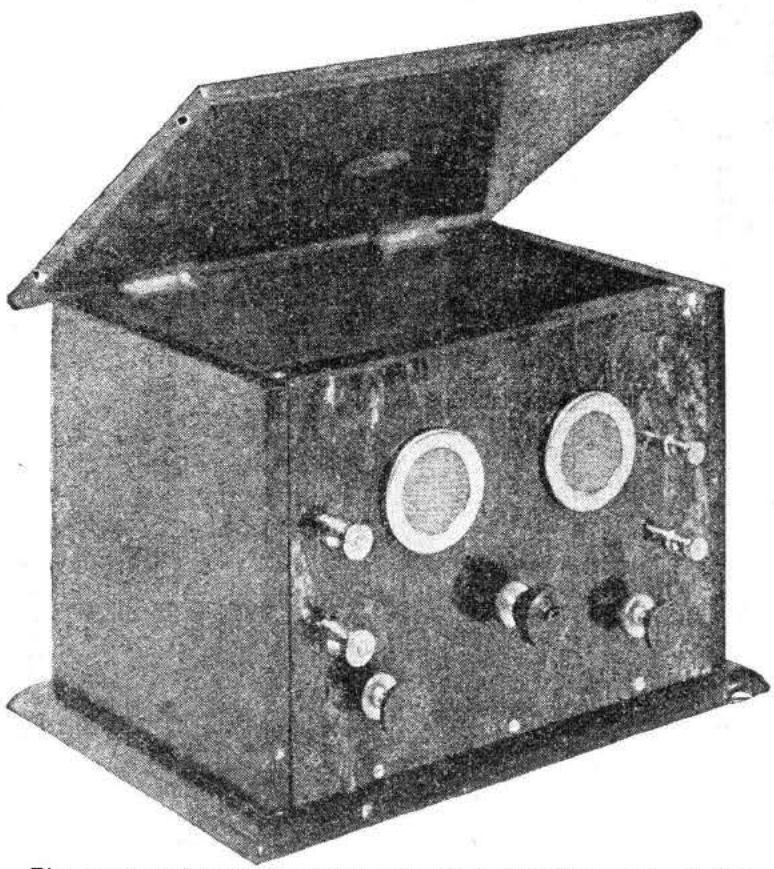
By D. J. S. HARTT, B.Sc.

FOR those who obtain good signals on a crystal set from their local broadcasting station, and are desirous of making an addition to their set to enable them to operate a loud-speaker, a two-valve low-frequency amplifier embodying a stage of transformer coupled amplification, followed by a resistance-coupled stage, will give ample volume and good reproduction.

The amplifier seen in the photographs is of this type, and is uniform with the "Stay-set" crystal receiver described by the author last month. The instrument may, of course, be used with any type of crystal set, but one in which is used a crystal detector that will stay adjusted is to be recommended.

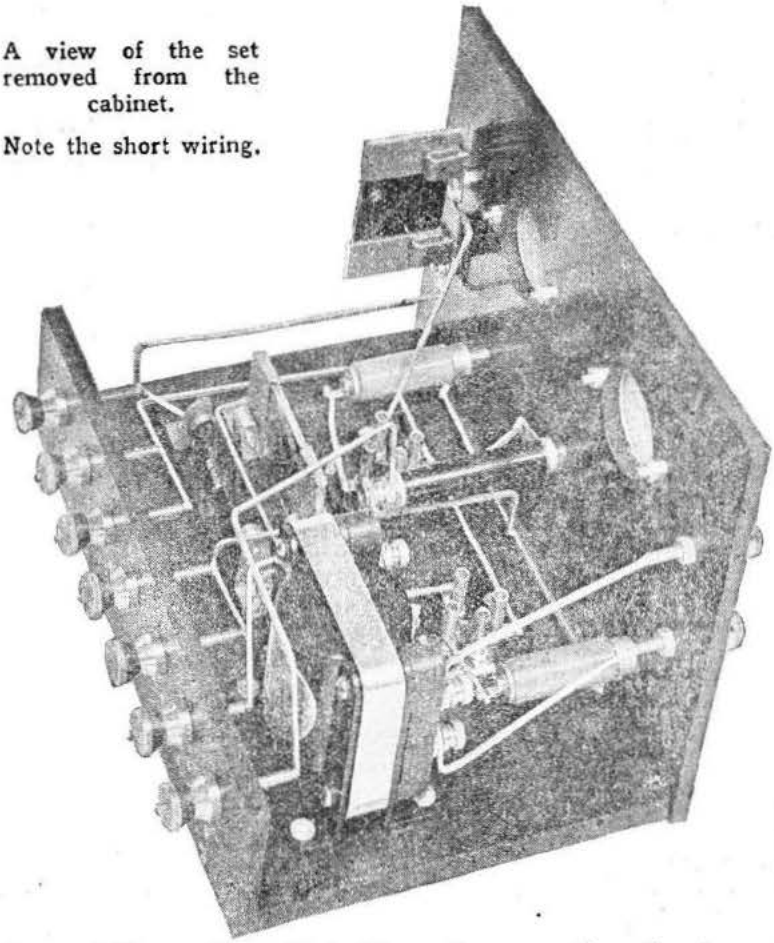
The Arrangement Used

The arrangement adopted consists of a vertical panel attached to a loose baseboard which carries a terminal strip at the back. The whole slides into the cabinet which, in the actual unit, is provided with a hinged lid, the lower part of the back of the cabinet being cut away to accommodate the terminal strip. When the amplifier is in use the valves are within the cabinet, and all battery connections are made from the rear. This arrangement makes possible a simple panel layout. The terminals seen on the left of the panel are connected to the telephone terminals of the crystal set, while those on the right are for the loud-speaker, the positive lead (usually marked +, or distinguished by some red or other coloured marking on the braid) of which is connected to the lower terminal. The control knobs for the rheostats are seen on the lower part of the panel, while that in the centre controls a variable grid leak.



The neat appearance of the amplifier matches that of the crystal set it is designed to follow.

From the circuit diagram it will be seen that only one H.T.+ terminal is provided, and that three terminals for grid-bias battery connections are used. The order of the terminals on the terminal strip is the same, reading from left to right when looking at the back of the instrument, as is shown on the circuit diagram, reading downwards from H.T.+. The value of the anode resistance R_4 may be 60,000 ohms if an ordinary general purpose valve is used as the first valve. If a valve of the D.E.5B type is used, however, this value may with advantage be increased to 100,000 ohms or more. The coupling condenser C_1 has a value of ·01μF, while the value of the condenser C_2 across the loud-speaker will vary according to the type of loud-speaker used, the limits being around ·001 to ·01μF, a ·004μF being an average value. The clip-in type of condenser is used, so that different values may be substituted if required. You will notice that no fixed condenser is shunted across the primary winding T_1 of the transformer, and in many cases there will be no condenser across the telephone terminals of your crystal set. In practice the use of a condenser in this position is justified only if results are thereby improved, but



A view of the set removed from the cabinet.

Note the short wiring.

in general it may be omitted with no apparent difference in the results.

Now with regard to the materials required, here is a list of those actually used. If in any case another make of component is selected, the layout may have to be slightly altered, if the size and shape are very different.

1 Ebonite panel, 8 in. by 6 in. by ¼ in. (Peter Curtis, mahogany finish).

1 Strip of ebonite, 8 in. by 2 in. by ¼ in.

1 Ditto, 4¼ in. by 1½ in. by ¼ in.

2 Valve windows (Aermonic, nickel-plated).

1 Variable grid leak (Bretwood).

2 Filament resistances (Lissenstat Minor).

2 Valve holders (Burne-Jones, for baseboard mounting).

1 Low-frequency transformer (Royal, Rothermel, Ltd.).

1 Anode resistance, 60,000 ohms, with clips (McMichael).

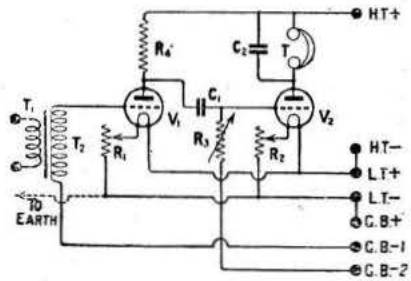
1 ·01 μF fixed condenser, with clips and an extra set of clips (McMichael).

9 W.O. type terminals and 2 phone-type terminals, nickel-plated.

Square section tinned copper wire, and one packet R.P. panel transfers.

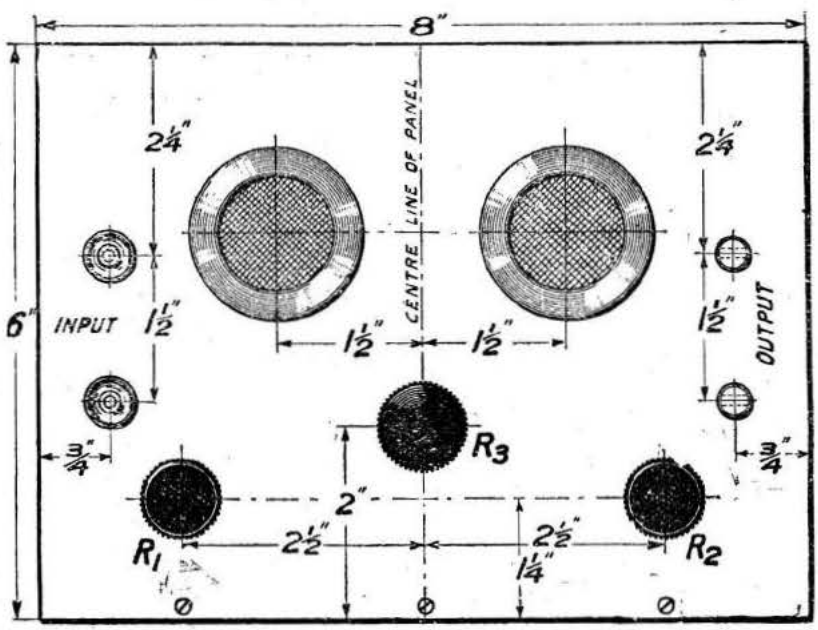
In addition, a suitable cabinet will be required; that shown in the photographs was made by the Carrington Mfg. Co.

The first step in the construction is to mark out the panel on the



The circuit arrangement.

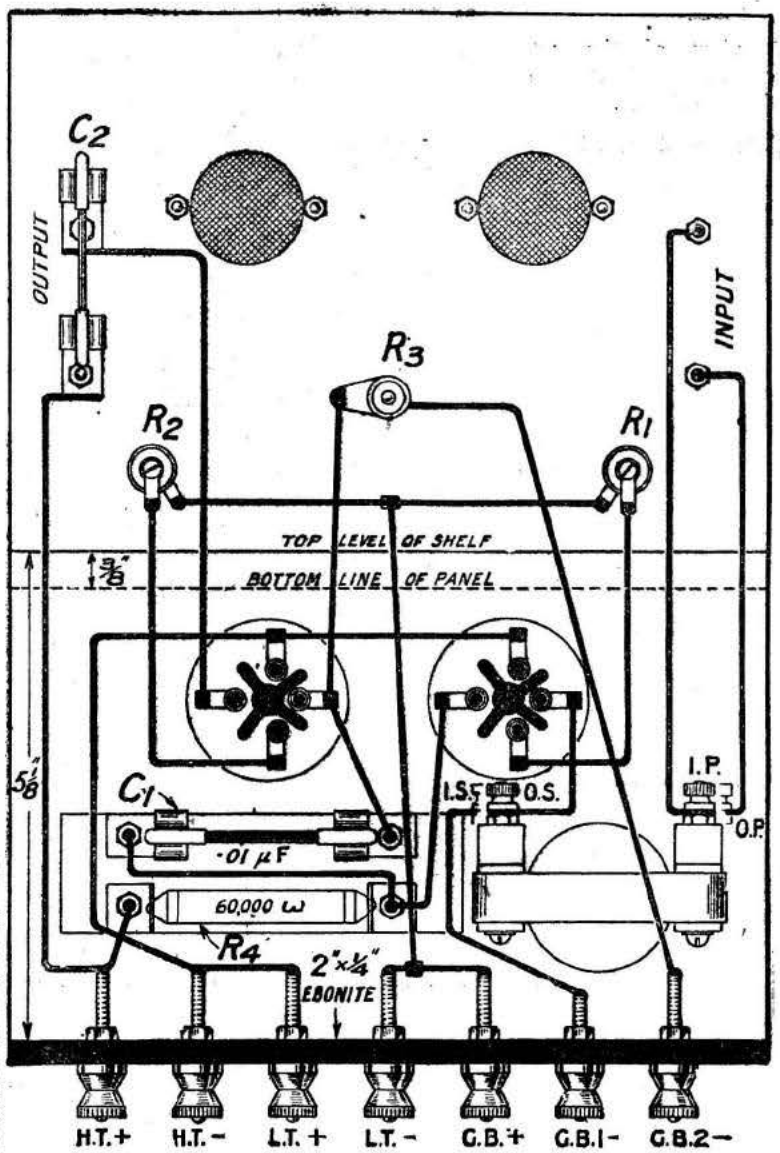
back and drill the necessary holes according to the drilling diagram. The large holes for the valve windows may be made with the aid of an ordinary fret-saw or an expanding bit, if this is available. Next mark out and drill the terminal strip, and then prepare the smaller ebonite strip for mounting the clips to hold the anode resistance and the coupling condenser; ¼-in. countersunk head 2B.A. screws are used for this purpose, and the holes are well countersunk on the underneath side. Holes are provided at the ends of this smaller strip for screwing to the baseboard. If desired, the anode resistance and the coupling condenser may be purchased already mounted on ebonite strips, in which case the 4¼-in. by 1¼-in. by ¼-in. strip of ebonite will not be required.



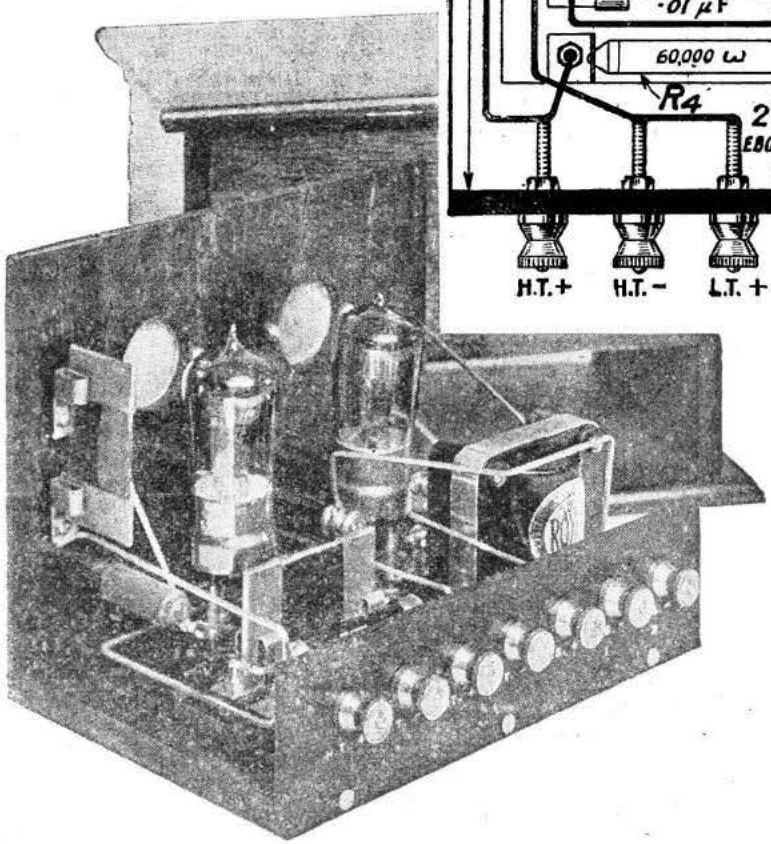
This half-size drawing shows how the panel is to be drilled.

At this stage mount the components on the panel, fix the terminals on the terminal strip, and screw down the transformer, valve holders, and anode resistance and coupling condenser unit to the baseboard. The disposition of these latter components may be gathered from the wiring diagram and the photographs. The clips for the condenser across the output are attached to the shanks of the terminals by a second nut screwed down tightly, the shanks being cut off level with the tops of these nuts.

The wiring is a simple matter if carried out as follows, all connections being carefully soldered :— First, screw the terminal strip to the back of the baseboard; then make the connections IS of transformer to terminal GB—1, filament to filament to H.T —to L.T.+, OS to grid of first valve, plate of first valve to anode resistance to coupling condenser, other side of coupling condenser to grid of second valve to grid leak. These connections may be followed from the wiring diagram. Next make the connection between those soldering lugs on the filament resistances which are nearest the panel; the



This drawing shows the wiring of the amplifier.



Another view of the set removed from the cabinet, showing how the latter is cut away to receive the terminal strip.

latter is then screwed to the baseboard by three countersunk screws, and the remainder of the connection made, finally checking the whole of the wiring against the diagram.

For a preliminary test on the amplifier join the three grid-bias terminals by a wire and connect up the accumulator. Ascertain that the valves light up correctly, then connect the two terminals on the left of the panel to the telephone terminals of your crystal set, which has previously been adjusted to give the best results on the local station. A wire is then taken from the L.T.— terminal to the earth terminal of the crystal set, and the H.T. battery and loud-speaker connected.

(*Continued on page* 551).

How It Works

THE CONDENSER

By R. W. HALLOWS, M.A., Staff Editor

IN the wireless set we use condensers for three main purposes. The variable condenser in conjunction with an inductance coil gives us a circuit which can be tuned to a band of wavelengths depending upon the size of the coil and the capacity of the condenser. A fixed condenser may be employed as a by pass for oscillating currents to whose passage it offers very little hindrance if its capacity is large enough. A condenser of this kind is used across

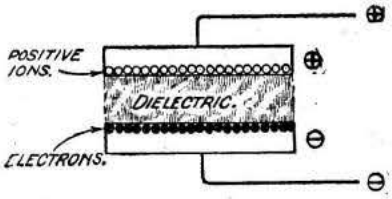


Fig. 1.—What happens in a charged condenser.

the telephones, intervalve transformer, or in shunt with the high-tension battery. The condenser may also be used as a barrier to direct current. Current of this kind is unable to pass through a condenser. The grid condenser serves both as a barrier to direct current from the high-tension battery in a tuned anode circuit and as a by-pass for oscillating impulses.

Metal Plates

A condenser consists of two metal plates separated by some non-conducting material which is called the dielectric. The best of all dielectrics is air for the capacity obtained when it is used is not

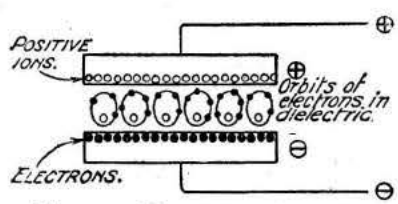


Fig. 2.—The state of strain.

liable to any great variations, losses through leakage are very small indeed, and if by any chance the dielectric is punctured by sparking between the plates, it repairs itself instantly. Mica has a higher dielectric constant than air. That is to say, if you have two sets of plates of equal size, the first with a mica dielectric and the second with an air dielectric, the distance between the plates being the same in both cases, the first condenser will have a capacity of about eight times that of the other. Other dielectrics sometimes used are ebonite, which gives rather more than twice the capacity of an air dielectric of the same thickness, glass, which averages about six times the capacity of air, and waxed paper, whose dielectric constant is rather more than double that of air. None of these is so constant or so efficient as air. A liquid dielectric in the form of mineral oil is sometimes used. The dielectric coefficient of some oils is a little more than double that of air.

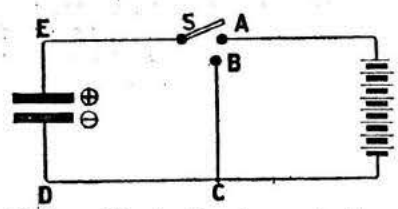


Fig. 3.—Illustrating how a battery can be used to charge a condenser.

Fig. 1 shows what happens in a charged condenser. On the positive plate there is an excess of positive ions, or of atoms which are deficient of one electron. These crowd on to the surface of the plate that is opposite the negative plate. On the negative plate there is an excess of electrons, which again crowd to the surface. Positive ions and electrons attract each other with a force that is many millions of times stronger than gravity. The dielectric is a substance which contains practically no detachable electrons; it is therefore impossible for current to pass through it unless the pressure is so enormous that it breaks down. What happens is that the orbits of the electrons in the dielectric become strained, as shown in Fig. 2. The positive nucleus of each atom is pulled by the attraction of the atoms towards the negative plate, whilst the electrons of the atom are drawn by the pull of

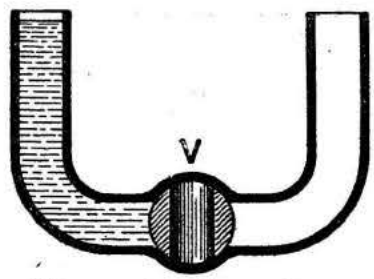


Fig. 4.—A water analogy.

the positive ions towards the positive plate. The more we charge up the condenser, the greater will the strain on the orbits be, and if we go on charging it indefinitely a point will be reached at which the dielectric can no longer stand the strain and breaks down. When this happens electrons in the dielectric are wrenched out of their orbits and make for the positive plate. They are replaced by electrons from the negative plate, and the result is that a current flows through the punctured dielectric. To break down an air dielectric one millimetre in thickness a voltage of 4,300 is required. Mica of the

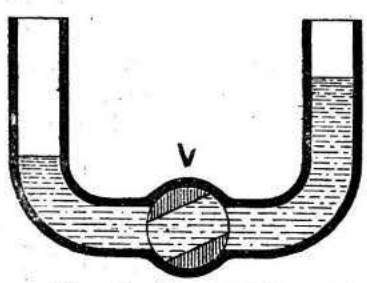


Fig. 5.—Overrunning.

same thickness will stand a pressure of 60,000 volts before giving way.

Holding the Charge

If the charge is not great enough to break down the dielectric the condenser will store up the energy put into it for a long time. A good

condenser will remain charged for many hours, or even days, but the charge will gradually leak away. Suppose now that we wire up a circuit such as that shown in Fig. 3. If we place the switch arm S on the contact point A the battery will charge up the condenser. This having been done, we will throw the switch over until the arm rests upon the contact point B. The condenser can now discharge itself through the circuit B, C, D, E. That is to say, electrons on the negative plate will rush round the circuit to combine with the positive atoms on the upper plate so as to neutralise them. Actually the discharge of a condenser is not quite

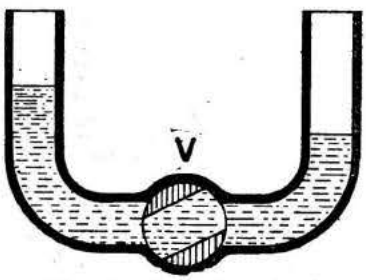


Fig. 6.—A back swing.

so simple as this. To understand it fully we may take an analogy from water. Fig. 4 shows a U-shaped glass tube provided with a valve V between the two arms.

A Hydraulic Analogy

If we fill the left-hand arm nearly to the top with water, leaving the right-hand arm empty, the tube is in precisely the same state as a charged condenser. The pressure of the water is acting upon the valve, which plays just the same part as the dielectric of the condenser. The water tries to pass into the right-hand arm, so that it may adjust itself to an equal height in both arms. Energy is stored up in the arrangement by means of the valve. Suppose now

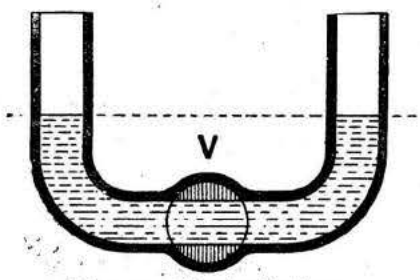


Fig. 7.—Neutralisation.

that we open the valve suddenly, what will happen? The water will rush with such force through it that after a moment the position will be very much what is shown in Fig. 5. The right-hand arm now has water whose level is higher than that in the left. The strain is now in the opposite direction, and the water swings back again, not going so far this time, until it reaches the position shown in

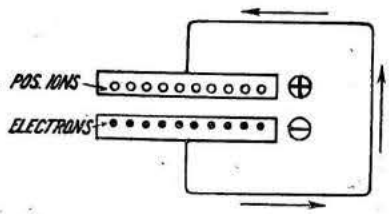


Fig. 8.—A numerical analogy.

Fig. 6. And so it continues to swing to and fro until, finally, it comes to rest in the position shown in Fig. 7, the level in both arms being the same. The condenser during discharge overdoes things in precisely the same way. This is shown diagrammatically in succeeding figures.

Surplus Electrons

Let us imagine that we start with ten surplus positive ions on the upper plate and ten surplus electrons on the lower—actually of course the numbers will be millions of times greater, but smaller figures will serve very well to illustrate what happens. Directly the switch in Fig. 3 is thrown over to contact B, the state of affairs is as shown in Fig. 8. Electrons rush round the circuit to neutralise

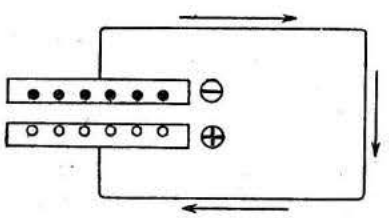


Fig. 9.—The second stage.

the positive ions. So great is the rush that far more than ten leave the plate, and at the end of a brief instant the position is that there are, let us say, five surplus positive atoms on the lower. There is now another dash of electrons in the opposite direction, as shown in Fig. 9. During this things are again slightly overdone, and the result is to leave, say, three surplus positive ions on the top plate and three extra electrons on the lower, as in Fig. 10. And so the discharge goes on by swings in alternate directions until, finally, the electrons have just balanced the positive ions and there is now no pressure at all between the plates.

The Spring

It may occur to you that you have seen a very similar phenomenon in mechanical things. You have noticed, for example, how a spring comes to rest when it has been extended and released. Fig. 11 shows what happens in such a case. At A we have a coil spring fixed at its upper end and under no strain. At B the spring has been pulled down until it is about double its original length. At C the spring has been released, and has shot back to something much shorter than it was originally. At D it has recoiled, and is now rather longer than it was at first, though not so long as it was at B. The spring continues to extend and

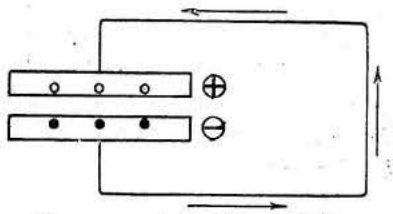


Fig. 10.—A further swing.

contract for some time before it finally comes to rest.

A Good Comparison

This analogy is a very good one, for a condenser is electrically just what a spring is mechanically. A spring either compressed or extended is storing up energy which will be given back when it is released. In the same way a charged condenser stores up energy, giving it back when a path is

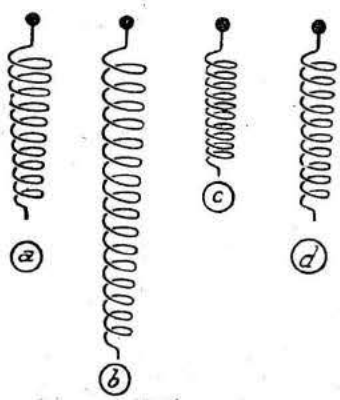


Fig. 11.—The spring analogy.

provided for it to discharge through.

Inductance

And we can carry the analogy much further if we fix in our

minds that inductance is the electrical equivalent of weight. This we will explain more fully in a future issue; it will suffice now just to bear the fact in mind.

Now let us take a very homely illustration. In your young days you enjoyed, no doubt, the fascinating though forbidden pastime of bouncing upon a spring mattress, or, if you have never done that, you have seen at a music-hall the comic antics of a clown who leaps on to what looks like an enormous bed and bounces until he is almost out of sight. Now, the more stiff the mattress the more rapid are the bounds. That is to say, the more you increase the tension the greater is the frequency. In a condenser this is increased by reducing the capacity. Hence when we turn a variable condenser, say, from 25 degrees to 50, we lessen the springiness and so effect a *decrease* in the frequency, or an *increase* in the wavelength. This is how tuning is done in the wireless set. Fig. 12 shows diagrammatically the way in which the variable condenser works. At A we have two plates directly opposite one another so that each presents the largest possible amount of surface area to the other. In this case the capacity is at its maximum. At B the plates have been moved so that each now presents to the other only one half of its total area. The capacity between the two plates is now halved. At C the two plates are entirely out of mesh, no portion of one being opposite any portion of the other.

No Real Zero

The capacity is now theoretically zero, though actually in a variable condenser it is impossible to reach anything like this value at the minimum setting. In a badly designed condenser the minimum capacity when the moving plates are completely out of mesh with the fixed may be as high as 10 per cent. of the maximum. Well-designed instruments may have a minimum capacity less than 1 per cent. of that obtained when the two sets of plates are fully meshed.

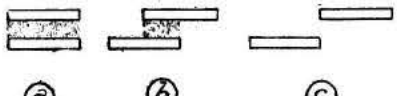


Fig. 12.—Effect of overlapping plates.

An Amplifier for the "Stay-Set" Crystal Receiver

(*Concluded from page 544*)

Adjust the rheostats to give the best results, then remove the wire connecting the grid-bias terminals and connect up a small grid battery tapped in 1½-volt steps. Keep the positive wander-plug fixed, and determine the best positions for each of the others. The variable grid leak should be adjusted near its minimum setting, that is, screwed fairly well in.

With regard to the valves used, quite good results may be obtained with ordinary general-purpose bright or dull emitter valves and about 100 volts H.T., but a better arrangement is to use for the first valve one of the D.E.5B type and a small power valve as the last, with an H.T. voltage within the limits given by the makers.

When this amplifier is connected to the crystal set referred to previously, a loud-speaker is worked with good volume and pleasing quality, the distance from 2LO being about 8 miles, and a good outdoor aerial being used.

Full Power from Three Valves

(*Concluded from page 498*)

or 4,000 ohms and should be connected to the terminals marked "Tel." If the aerial is connected to the C.A.T. terminal a No. 50 coil or a 75 will be found to cover the whole broadcast band easily. If the aerial is connected to A, thus cutting out the constant aerial tuning condenser, a 25 or 35 will be needed for the lower band of wavelength, and a 35 or 50 for the upper. For Chelmsford and Radiola a No. 150 should be used. The reaction coil can generally be made one size larger than the particular aerial tuning coil used at the moment, save when constant aerial tuning is used, when, as the set oscillates much more freely, a smaller reaction coil will be required.

Keep the Reaction Coil Away

A few minutes' manipulation of the variable condenser will show you how this part of the apparatus works. It should be mentioned that preliminary tuning should be carried out with the reaction coil placed as nearly as possible at right angles to the aerial tuning coil. When satisfactory results are obtained, the reaction coil can be gradually brought towards the fixed aerial coil, to see whether an increase of signal strength is effected in this way. If so, well and good; if not, reverse the connections to this coil.

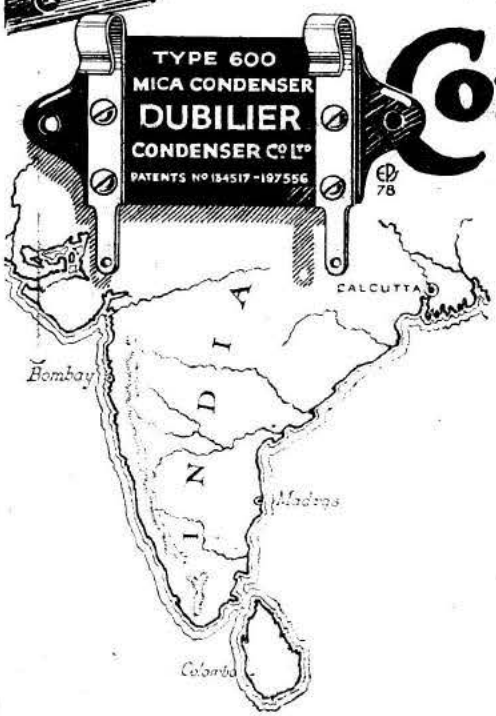
Control of Reaction

On another page you will find an article by Mr. G. P. Kendall on "Reaction—Its Use and Abuse," which will show you how to get the best from reaction control, and on other pages you will find some hints on tuning in a set. Both of these articles should be perused by the beginner before beginning work on this powerful set.

Results

As stated in the beginning of this article, excellent results have been obtained from the local station and from others in the British Isles. Birmingham and London were full loud-speaker strength at Wimbledon using an average aerial, and with careful adjustment American telephony has been brought in on favourable nights. Reports on results with this set will be particularly welcomed, as it is believed to be one which will suit a wide range of readers.

A consignment of Indian Ruby Mica for Dubilier condensers arriving at the London Docks.



Concerning Mica

The "Dielectric" in all Dubilier fixed Condensers is of the best Ruby Mica, specially imported from the quarries of India.

It has long been recognised that there are numerous reasons both mechanical and electrical, which account for the superiority of Mica over other dielectric materials employed in Fixed Condensers of small capacity.

Perhaps the best known of these are high insulation resistance and high dielectric strength which enable an exceedingly thin sheet of Mica to withstand very high voltages.

The Mica sheets in Dubilier Condensers measure only a few thousandths of an inch in thickness, yet each one of them before it can qualify for a place in a condenser has to withstand an alternating current pressure test of 5,000 Volts.

A Condenser made up of such sheets will resist, for example, the continued application of the full voltage from a High Tension Battery, whereas a condenser with an inferior dielectric may develop a short circuit—a fault which may possibly ruin a succession of H.T. Batteries before it is located.

Apart from insulation resistance, however, there are still very powerful arguments in favour of the Mica Condenser. The use of Mica enables Condensers losses (due to hysteresis, leakage, etc.), to be reduced to a minimum, especially as mica has a high "specific inductive capacity" so that the volume of the dielectric in a condenser in which losses can occur is reduced to a minimum.

From the above it will be seen that for every receiving circuit the best condenser is a Mica Condenser; and you will be assured of obtaining the best Mica Condenser if you

Specify Dubilier.

DUBILIER
CONDENSER CO. LTD

Advt. of the Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.
Telephone: Chiswick 2241-2-3.

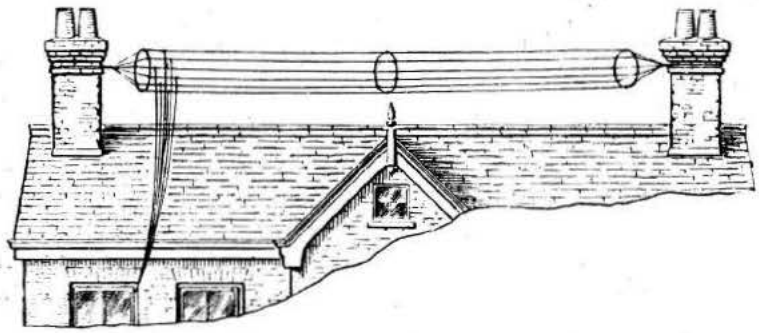


Fig. 1.—Showing how an outside aerial may be erected on the roof where space is limited.

AERIALS FOR AWKWARD PLACES

(2) Where the Garden is Small or Absent

By REDAX

MANY a man would like to fit a wireless receiving set in his house, but is deterred from so doing by the imagined impossibility of erecting a satisfactory aerial. Actually, there are very few cases where an aerial cannot be erected, even when the would-be wireless enthusiast lives in a flat or a house without a garden. Take, for example, the case of a man who lives in a house in a crowded district where gardens are the exception rather than the rule. If he has access to the roof, then an aerial similar to that shown in Fig. 1 can be erected, the lead-in being taken to the room where the apparatus is in use in the manner indicated.

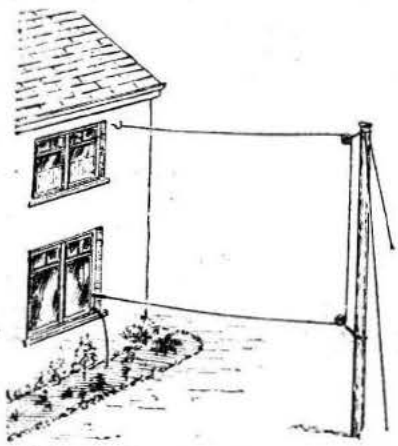


Fig. 2.—A poor arrangement.

If it is not possible to erect an aerial on the roof between chimneys, then frequently, particularly if the broadcasting station is not far away, a good aerial can be obtained as shown in Fig. 3, where an insulated wire is taken on hooks from the window of the room in which the apparatus is situated as far along the house front, or back, as is practicable.

In very short gardens where expense is not the first consideration, a mast of more than the usual height can be erected with excellent results. Masts up to 50 ft. in height can be obtained at reasonable prices, and a number of firms will undertake to erect the mast and aerial complete for a small additional sum.

Fig. 2 shows a scheme which has been proposed, but is not recommended, as it proves, on test, to be very inefficient. It consists in taking a wire from the room to the lower portion of a mast, from that to the top, and back to a hook on the house. Probably very much better results would be obtained by taking the aerial lead from the window to the insulator on a hook above, and then to the top of a mast, in the more conventional manner.

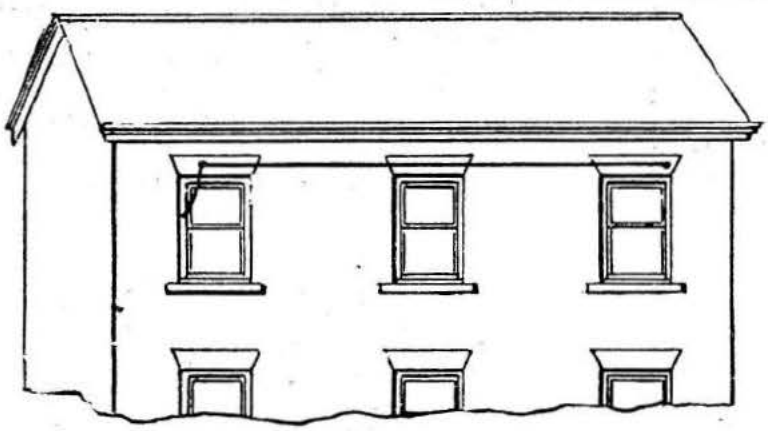


Fig. 3.—An insulated wire may be taken along the side of the house with good effect.

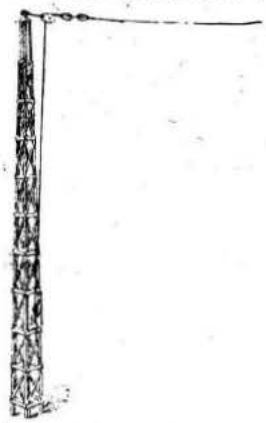


Fig. 4.—For the short garden a tall mast will help to compensate for lack of length.

Fig. 6 shows another arrangement, equally inefficient, and probably originating in the idea that so long as one erects a long wire its actual disposition does not much matter. Actually, in the illustration of Fig. 6, better results would be obtained with only half the amount of wire used. The remedy, of course, is to take the down lead from the upper portion, and cut out the wire running from the mast to the lower hook on the house.

Excellent results are obtainable from indoor aerials, particularly when the receiving set is fitted with one or more stages of high-

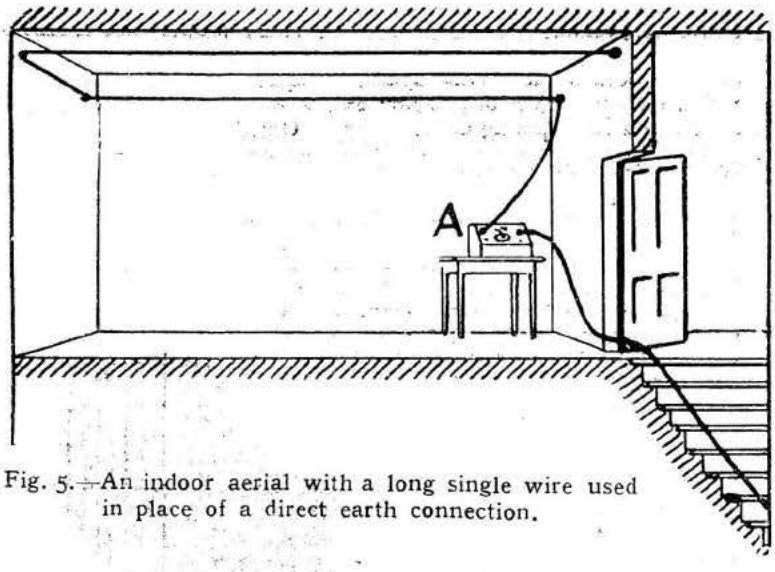


Fig. 5.—An indoor aerial with a long single wire used in place of a direct earth connection.

frequency amplification preceding the detector.

Fig. 5 shows a popular arrangement, the aerial being taken round three sides of a room, the earth wire being merely a single piece of insulated wire taken from the earth terminal down the side of the stairs for 20 or 30 ft. This arrangement often works just as well as if a direct earth were made upon a waterpipe or to a buried plate in the garden, and should be tried when it is difficult to obtain access to a waterpipe or other suitable grounded object.

Within three or four miles of a broadcasting station (and thousands of potential listeners are so situated), good results on three or four pairs of telephones are obtainable even with a crystal set with such an indoor aerial. In those cases where it is possible, an improvement can be effected by taking the aerial lead, not to a wire round the room, but to a similarly arranged wire round the loft, or along a landing above. In this case the aim should be to have the horizontal portion of the aerial as high as possible above the instruments. If you have time, you are advised to try experiments with the indoor aerial and to see which position in the house gives the best results, as it has been found that the electric-light wiring in the house, and also the disposition of gas piping and other metal work sometimes aids and sometimes hinders the reception with indoor aerials. In a few exceptional cases

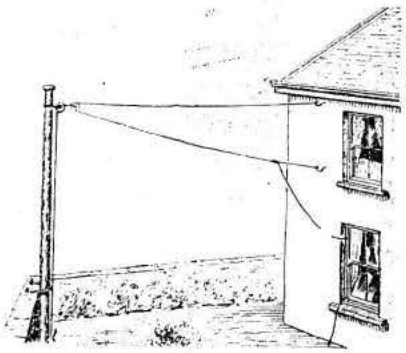


Fig. 6.—Another inefficient arrangement.

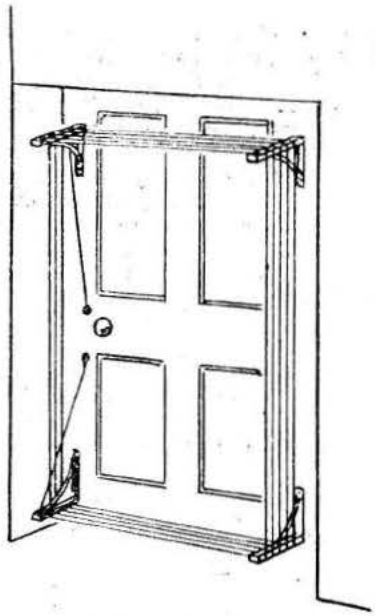


Fig 7.—This frame aerial is directional in its effect. The direction of best reception is found by swinging the door on its hinges.

results on indoor aerials have proved to be as good as on a fair-sized outdoor aerial, but as a rule we can say that indoor aerials are not so effective as those erected outside the house, provided these latter are supported 20 or 30 ft. above the ground.

In this article we have purposely omitted details of frame aerials, which will be subject of a separate article in a forthcoming issue.

The "Short Wire" Valve Panel

SIR,—As a reader of THE WIRELESS CONSTRUCTOR, I feel I must write and thank you for the publication of the Short Wire Valve Panel which appeared in the Christmas number.

I have made this panel, and am really surprised at the results I get with it, using a Wecovalve and tuning with two coils, and a .0005 variable condenser in parallel.

The volume is indeed excellent, and quality exceptionally good. In addition, I have found tuning distant stations ridiculously easy, and I can get any night several other stations in this country beyond 2LO, also I can get Madrid easily and French and German stations, and all with good volume.

I have tried quite a number of one and two-valve sets, but I am retaining this one permanently.

I am adding a L.F. valve on to this set, and anticipate good loud-speaker results.

Once again thanking you,

Yours faithfully,

WM. C. CASSE.

Oxted, Surrey.

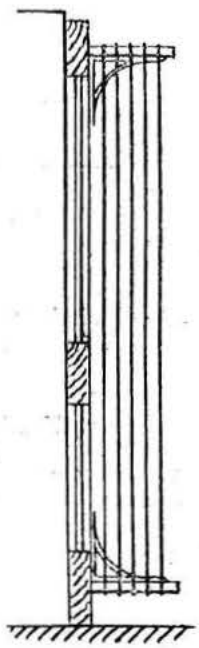


Fig. 8. An edgewise view of the frame aerial.

THE ANGLO-AMERICAN SIX.

SIR,—I am writing to give you a report on the "Anglo-American" six-valve set which I have constructed according to your description in THE WIRELESS CONSTRUCTOR. It is by far the best of several sets made in the past from Radio Press circuits.

I am using McMichael square-law condensers; "Polar" verniers as stabilising condensers; "Burndept" dual rheostats; Marconiphone "Ideal" 4-1 transformer, &c.

The set is extraordinarily simple to handle for a long-range set, and the purity of reproduction on distant stations is superior to any other I have heard. All B.B.C. main stations, of course, come in at great volume on two Amplion loud-speakers, and Continental stations seem to roar in "all over the dials." As the set has only been in operation a few evenings yet, I have still to get into touch with the U.S.A.

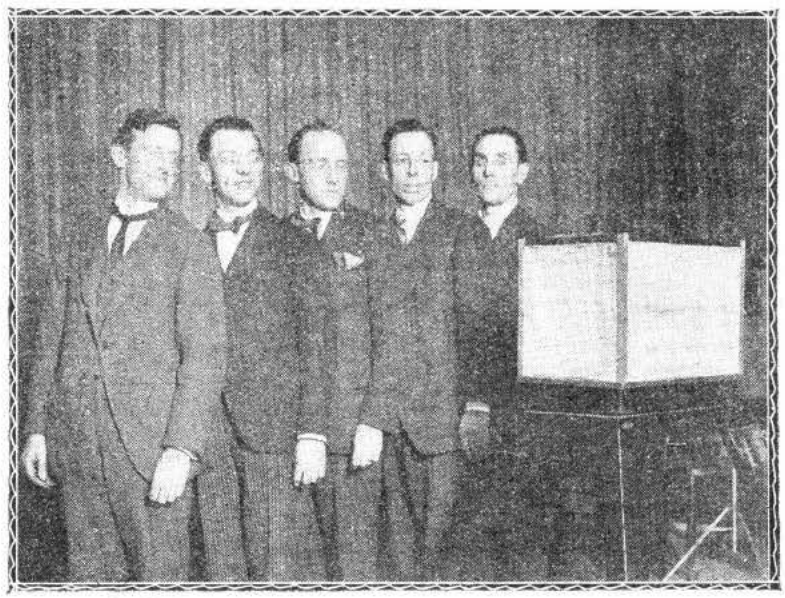
It seems highly desirable to use only parts of the highest quality in this set. I have replaced several components by others of better quality, with marked improvement. The valves used are B.T.H. B.5's for H.F. and Det., with another B.5 as first L.F. and a B.6 last. This combination certainly works excellently, and uses a negligible amount of filament current. Perhaps the best results as regards purity are obtained by using a valve of low impedance before the Marconiphone L.F. transformer as Det., and followed by a D.E.5.B. for the resistance-capacity coupled stage, with an L.S.5 last of all. H.T. used is 30 volts for the H.F., 15-18 volts Det.; and L.F. according to the particular valves in use at the time. The correct H.T. voltage and grid bias is important if undistorted reproduction is desired, using the valves and transformer named. I could not get the last stage to work well with 100,000 ohms resistance, but the substituting of a Dubilier 80,000 ohms made all the difference.

One of the most attractive things about the "Anglo-American Six" is its appearance. The polished mahogany cabinet, lustrous black dials, knobs and panel, coupled with the nickelled fittings, make it an ornament for any home.

I am looking forward to spending many pleasant evenings, thanks to you and the Radio Press, with the finest straight six-valve yet designed.

Yours faithfully,
R. H. MILLINGTON.

Manchester.



The well-known "Roosters" Concert Party at 2L.O.

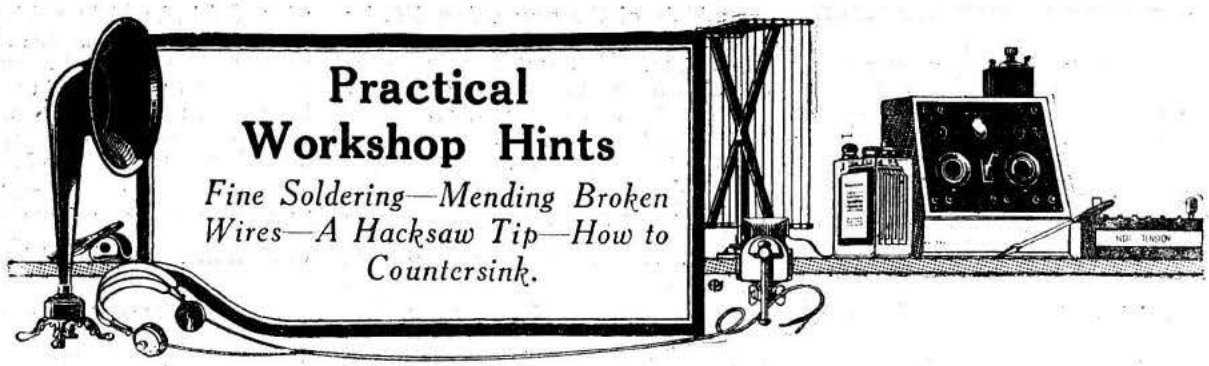
THE SINGLE-VALVE REFLEX RECEIVER.

SIR,—I have made up the one-valve reflex as described in the February issue of THE WIRELESS CONSTRUCTOR. I am astounded at the results. I can get almost any main B.B.C. Station any night at good phone strength. London, Birmingham, Newcastle, Glasgow, Belfast, and Bournemouth come in very strongly. Aberdeen I can always get with careful tuning, but never very loud, although loud enough to follow the programme. I also get a host of Continental stations, Breslau, Rome, and Madrid. Chelmsford comes in on the loud speaker, loud enough to hear every word comfortably at the far end of the room, 17 ft. away. London also I have had on the loud speaker. Almost as loud as Chelmsford. The only difference I made to the set was to fit two Sterling condensers, with verniers, and I used an R.I. transformer. I am not carried away by enthusiasm, as I am the possessor of one of the latest model . . . . 4-valve receivers. I merely make these little sets for amusement. I have made several, but this one easily surpasses the others as far as receiving distant stations goes.

Yours faithfully,
ROBT. HAMILTON.

Ashford, Kent.

I forgot to mention my aerial is L shape, 100 ft. long, 45 ft. high, unscreened. Earth, three bare copper wires, 6 gauge, 6 ft. apart, exactly under aerial, and extending its full length. Buried in ground 6 in. deep.



Practical Workshop Hints

Fine Soldering—Mending Broken Wires—A Hacksaw Tip—How to Countersink.

Fine Soldering

THOUGH the majority of wireless soldering jobs are pretty straightforward, one occasionally comes across a rather finicky piece of work which is not easy to deal with. The kind of job I mean is that which has to be undertaken when a break occurs at one end of the fine windings of a potentiometer or of a dull emitter rheostat. Another piece of soldering which calls for a little skill and patience is the refixing of a low-frequency transformer lead which has come adrift from its terminal or tag. For this kind of work the small iron which can be purchased for a shilling or so at most tool shops is very handy, provided that it is made of pure copper. Beware always of buying cheap soldering irons, for if you get hold of one

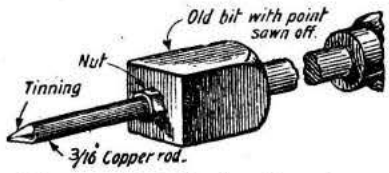


Fig. 1.—A soldering iron for fine work.

with a bit made of copper containing impurities, you will find it very difficult to make solder take properly. The small iron has, however, one great disadvantage, which is that it grows cool so rapidly. If I am using these irons for fine work I arrange a little stand made of bent wire which will support the soldering iron, so that its bit is in the flame of a spirit lamp placed on the table. It is quite a good idea to use a pair of irons, for then a hot iron is always available, since while one is in use the other is being heated by the lamp. Really, though, it is more satisfactory to use something with more "body" for heat retaining purposes, and here is a tip which will be found very useful. With a hacksaw cut off the point of an old bit of respectable size. Then in the

middle of the square face left by the removal of the tip drill and tap a $\frac{3}{16}$ in. hole about $\frac{1}{2}$ in. in depth. Obtain a 3 in. length of pure copper rod $\frac{3}{16}$ in. in diameter, screw one end for about $\frac{7}{8}$ in., and file the other to a point. Run a nut on to the threaded end. Screw the rod home into the face of the bit, and then lock in place with the nut. If you cannot do the drilling and the tapping jobs in your own workshop you can get them done very cheaply at any cycle shop or garage. When the pointed end of the rod has been properly tinned you have a soldering iron which will enable you to do very fine jobs, but which at the same time will retain its heat well, owing to the fact that the point is set in a comparatively large mass of copper. The iron is made still handier if the large bit is filed down into a kind of pear-shape with the small end towards the pointed rod.

Resoldering Broken Wires

The actual business of resoldering a fine wire which has come adrift, or of repairing a break in, for example, the windings of a potentiometer is less difficult than it looks. If the end has simply come adrift from its tag you will probably find that you have to sacrifice one or two turns in order to give you sufficient length of wire to get hold of. This will not make the least difference to the performance of the potentiometer, for it will only reduce its resistance by a very small amount indeed. Get the wire

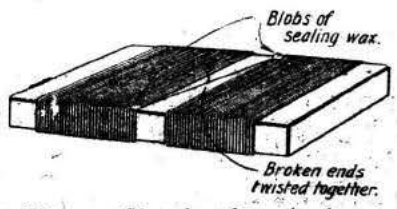


Fig. 2.—Showing how broken wires may be joined.

as tight as you can on the former, and hold the windings in place with the thumb and forefinger of the left hand. Get rid of the insulation at the end of the wire by holding a match flame an inch or so below it, and scraping it away when charred. Do not bring the wire actually into the flame, or it will become very brittle if it does not actually burn up. Now wind the bared end two or three times round the tag, apply a little flux, and solder quickly with a very hot iron. If the iron is hot enough the solder will run on instantly, but should it be on the cool side it may take you some time to make it stick properly, and the job when finished will be neither neat nor secure. When a break occurs in the middle of the windings, as it sometimes does, a few turns will have to be removed. Care must be taken to see that the joint is not made in the path of the sliding contact, or there will be a jump whenever the potentiometer is adjusted, and another break is almost certain to occur in a short time. Tighten up

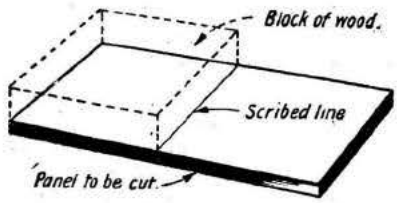


Fig. 3.—How to use a guide block for cutting ebonite.

the windings, and secure both ends with a little blob of sealing wax, which again must not be placed on the path of the slider. Twist the broken ends together as shown in Fig. 2, apply a little flux, and solder quickly as before. In the drawing the gap left in the windings as the result of the repair is very much exaggerated. Actually, with a little care one can mend broken windings, so that there is practically no gap at all in the path of the slider. When soldering has been done the twisted ends of the wires should be snipped off quite short.

A Hacksaw Tip

For cutting up ebonite there is nothing to beat the jeweller's or dentist's hacksaw, or a fretsaw fitted with blades specially made for dealing with tough work. It may, however, be found that if blades are fixed in the frame in the ordinary way, that is, so that they cut during the *thrust* part of the stroke, they have a tendency to buckle and break owing to the toughness of ebonite. When using these fine blades I find it better to adopt the Chinaman's method of sawing and to insert them in the holder so that they cut not on the thrust, but on the *draw*. Somehow it seems much easier to work with a fine blade set in this way, and, if you try it out, you will find that you do not have breakages nearly so often as when the blades are inserted in the normal manner.

Cutting a Straight Edge

Some people maintain that it is very difficult to go straight when cutting a longish edge with a small blade such as the fretsaw. Personally, I think that it is much easier to do so with this kind of

tool than with the ordinary hacksaw. The way in which I generally cut out panels is as follows. The line of the cut is, first of all, deeply marked with the point of a scriber. It is of no use to use a pencil for the purpose or to make the merest scratch with a scriber, for, if you do so, you will find that your line is constantly being obscured by ebonite dust as you work. The panel is then placed in the vice, between whose jaws and its surfaces pieces of wood are inserted to prevent disfigurement of the ebonite. The panel must be so placed that the scribed line is quite vertical. The saw is then started very carefully and cutting proceeds quite quickly. If one stands close to the work, with one's right eye directly over the scribed line, it is surprisingly easy to cut the edge so true that it requires very little trimming subsequently.

Displacement Effects

I find it best to close the left eye, for then there is no possibility that any displacement effect will occur, and hand and eye work so well together that the blade shows no tendency to leave the line. Those who find that in spite of all their endeavours they cannot keep straight with either hacksaw or fretsaw will do well to use another method of cutting out panels. This is to employ a stiff-backed or tenon saw. When this is done it is best to make use of a guide block, as shown in Fig. 3. This is a piece of wood which is laid upon the panel so that one of its edges, which must, of course, be perfectly straight, lies along the scribed line. The block is either clamped or held in place with the left hand and it prevents the saw from getting out of alignment. With a tenon saw edges can be made dead straight, but this method of cutting out ebonite is rather tedious, for it takes much longer than when a hacksaw or fretsaw is used.

Countersinking Made Easy

A job which many amateur constructors find difficult is to countersink neatly the heads of those screws which appear on the surfaces of their panels. Nothing looks neater than a panel with screw heads quite flush with the surface, and few things look worse than one in which some screws project a little, whilst others are too low. If you are the fortunate possessor of a bench drill, accurate countersinking is not very difficult with either hand or automatic feed. With the former experiment first of all on a piece of scrap ebonite, and discover the exact number of turns of both crank and feed wheel which are needed to produce a hollow of the correct depth. Make the same number of turns at each hole dealt with on the panel, and the results will be all that they should be. With the automatic feed it is necessary only to count the number of turns made with the crank, for the machine does the rest by itself. With the hand or breast drill, however, matters are rather more

Mr. T. A. Studley, of Harrow, who has received many American amateur stations on a single valve set.

complicated, for even if you count the turns given to the crank most carefully it is not easy to make sure that you are always applying exactly the same pressure. Six turns may therefore produce a hollow which is slightly shallower or deeper in one case than it is in another. Fig. 4 shows a very useful little fitting for the countersink which when used in one of these drills enables you to turn out first-class work with absolute certainty. It consists of a collar made of hard wood, through which is drilled a hole, into which the body of the countersink fits tightly. If the countersink is of the standard pattern with a ¼ in. shank, the diameter of its body will be ⅜ in. As most amateurs use only one size of screw, No. 4 B.A., for mounting components on their panels, a single guide collar will suffice for all jobs. The depth of the collar will depend upon the exact length of the body of the countersink, and must be found by experiment. To do this proceed as follows:—In a piece of scrap ebonite drill a 4 B.A. clearance hole and countersink it to exactly the right depth, so that the screw lies perfectly flush. Remove the countersink from the chuck of the drill, place its point in the hollow made and measure the distance from the surface of the ebonite to the shoulder of the countersink. Make the guide block just a little longer than the distance measured. Next drill several 4 B.A. clearance holes in an odd piece of ebonite. Replace the countersink in the drill, put the collar on to it, and run it in

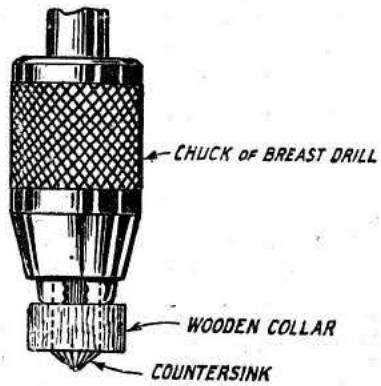


Fig. 4.—A countersink guide.

the first of the clearance holes until it is brought up by the collar. Try a screw in this hole and notice how much too high it is. Then place the lower end of the collar on a sheet of glass paper and rub it down a little. Test again by countersinking a hole and continue the rubbing down process until you obtain the exact length required. Though it takes some time to describe the process is not really a very long one, and the collar, once made, besides lasting indefinitely, will be found a valuable saver of time and trouble. When using a guide collar, do your countersinking *before* you give the panel its final surface. By doing this you ensure that any marks made by the collar on the ebonite are removed during the finishing process.

The Editor at 2LO

A short "wireless" talk broadcast from the London station on Thursday, February 12th

WE are all so used to talking about the art of radio as "wireless" that we are apt to forget the importance of the wire we have to use, and, as many of the troubles which face the wireless enthusiast are connected with wire, it occurred to me that a short chat on some difficulties with "wireless wires"—if I may use the term—would be helpful to listeners.

The other day I was asked by a friend why it was that whenever the wind was blowing he heard all kinds of strange crackles in his telephones, while signals went up and down in strength and sometimes failed completely. A brief examination showed that in erecting his aerial he had not used one continuous piece of wire, but two or three odd pieces joined together. Instead of making firm, sound, soldered joints, he had simply twisted the bare strands together, and, while this served excellently when the wire was new, dirt and corrosion had worked their way into the joints, so that whenever the wire was bent by the wind there were imperfect contacts between the parts. Both the fading and the crackling noises were due simply to inefficient joints, and I would advise you all to make quite sure that you have good, sound aerial joints before blaming the B.B.C. or the weather.

Don't Blame the 'Phones

Another friend grumbled to me that the telephones now sold were of very poor quality, and, although he had invested in at least half a dozen pairs of leading makes, they had all broken down in a few weeks. Wireless material is turned out in such quantities to-day that occasionally, even with the best makes, a faulty pair of 'phones may get through, although in my own experience this is an extremely rare occurrence. I knew that the chances of faulty pairs of each of the makes he mentioned getting into his hands was so remote as to be negligible, and there must be some other cause. I found when I went home with him that he was in the habit of laying his 'phones down anywhere, and while I was in the house they were twice knocked on to the floor. Now, the wire used to wind telephones is extremely fine—one might say the human hair is coarse compared with it. In spite of its fineness it is quite strong enough to carry the current normally passed through it, but it will not stand the strain imposed upon it by a sudden jar such as might be caused by dropping from the table to the floor. If the truth were told, it would probably be found that my friend's telephones were all spoiled by being dropped on the floor, and he seemed quite surprised when I pointed out to him that care was necessary in this way.

Transformer Breakdowns

We often hear of low-frequency transformers burning out. Actually a burn-out in the sense of the wire fusing through too heavy a current is an extremely rare occurrence, and in most cases where we are told a burn-out has occurred it would be much better to refer to it as a breakdown. When we suddenly start or break a current in the windings of an inter-valve transformer, quite an appreciable strain is set up by the magnetism in the core, and if the thin iron laminations are at all loose, the change in magnetism may cause contraction and expansion of the core. I have heard of a number of transformers breaking down through the user making far too many changes of high-tension voltage. When you are deciding the high-tension voltage to use with your receiver, make the adjustments very carefully and avoid at all costs taking your wander-plug and plugging it indiscriminately in all kinds of voltages. Constantly stopping and starting the current in this way sets up quite unnecessary strains and should be avoided where possible.

Other wires which will give trouble if they are not properly used are the flexible wires in the telephone cords. Do not allow these to get twisted into knots. A little care will prevent this and your telephone cords will last much longer.

Another wire of vital importance to your crystal set is the cat-whisker. Some of the very first crystal receivers had, not a single

wire for contact, but a small bunch of wires, and in these small bunches of wire some acute observer noticed the resemblance to a cat's whiskers. Although a small bunch of wires is still sometimes used, the general form of contact is a small springy wire which has not the remotest resemblance to a whisker of a cat or any other animal. The name still persists, however, and will be a long time in dying.

Perhaps you have not thought of wires in connection with your valves, but the most delicate wire of all is the slender filament from which the electrons are shot off when the valve is heated. Some people seem very unfortunate with their valves and wonder why they burn out so quickly. Of course, I trust you all know that you must not connect the high-tension battery to the low-tension terminals, even for the fun of seeing what happens, although a surprising number of people manage to do this in some way or another. It is less generally known that the life of a valve is very considerably shortened if the filaments are burnt too brightly. If you are using a bright-emitter valve rated by the manufacturers at 4 volts on the filament, and you are using a 6 volt accumulator, you will need to turn the knob of the average filament resistance only just "on" to get the best adjustment. If you turn the knob full on, you will be placing a full 6 volts on the filament and the life of the valve will be much shortened. Not only will you shorten the life of the valve, but you will not get any better work from it. It is a safe rule to burn your valves only just as brightly as will give you the signals you require. Dull-emitter valves want much more care, for, although their filaments may not burn out through being burnt too brightly, they will lose that peculiar emitting property upon which the work depends.

This funny collection of instruments is used at the London station to produce the noises which give such a natural effect in the broadcast plays.

DOES IT PUZZLE YOU?

THREE INTERESTING QUERIES ANSWERED

What Constitutes a Good Earth—A Crystal Question—Working a Loud-speaker

In the absence of a convenient main water pipe, what alternative earth connection can be used?

(1) An old galvanised iron bath or bucket, perforated with holes, should be buried two or three feet beneath the surface of the soil, underneath the aerial and as close to the "leading-in" point as possible. A stout copper wire should be soldered to the upper edge of the bath or bucket, which should be almost filled with cinders or preferably broken coke. Three or four bucketfuls of water should then be poured in and the earth shovelled back. (2) A corrugated, galvanised iron sheet (as large as is available), should have a stout copper wire soldered to one corner, the plate being buried on its edge until the upper edge is 6 in. or 8 in. below the surface of the ground. The hole in which it is placed should be about half filled with cinders or broken coke, water should be poured in and the earth replaced and stamped down. (3) If sufficient space is available, 2 (or more) long lengths of bare copper wire, not necessarily new, may be buried some 3 in. to 8 in. beneath the surface of the ground, underneath and in line with the aerial wires. The two wires should be brought together where they emerge from the ground (as near to the leading-in point as possible), and may be joined together to form the earth lead.

Why is it that in a simple Crystal Set the current passes through the high resistance of the crystal and 'phones, instead of through the low resistance tuning coil?

It must be remembered that although the tuning coil may have a low ohmic resistance, yet it offers a considerable impedance to currents of the frequency to which the circuit is tuned, and hence such currents produce appreciable differences of potential across its ends, which cause currents to flow in the detector circuit.

How many Valves must be used to work a Loud-speaker properly?

Naturally, the number varies with the efficiency of the receiving aerial and its distance from the broadcasting station. The following figures assume an average sized outdoor aerial, and should give a *general* idea of the required amount of amplification:—

Up to 10 miles, Crystal and two low-frequency valves.

10—40 miles, H.F., detector with reaction, and L.F.

40—100 miles, H.F., detector with reaction, and two L.F.

Above distances of perhaps 100 miles the four-valve combination will still serve, but an additional H.F. valve will be advantageous in many cases.

These are the minimum numbers of valves for *consistent* reception, without much skill in manipulation, or the use of a reflex circuit.

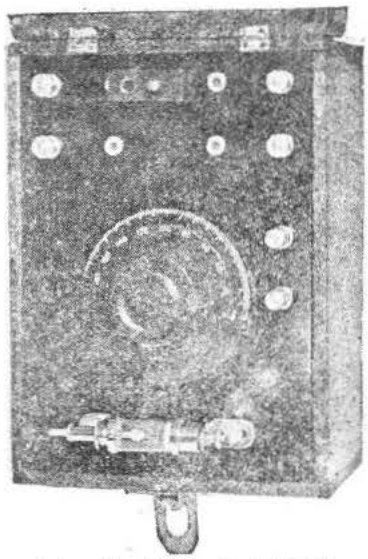
Radio Press News

A New Constructional Book

THE readers of THE WIRELESS CONSTRUCTOR will by now be familiar with the sterling value of the set designs produced by Mr. Stanley G. Rattee, M.I.R.E., Staff Editor, and many can speak from personal experience of the good results which they give. Much interest, therefore, attaches to the latest Radio Press publication, "Six Simple Sets" (Series No. 21, price 1s. 6d., or 1s. 8d. post free), which consists of a collection in a convenient book form of some of this author's most popular designs, some of which have appeared in *Wireless Weekly*, while others are entirely new. None have been published in this journal. The book contains a wide variety of extremely carefully selected designs, every one of which can be depended upon as a thoroughly practical and well-tested instrument. In Chapter I, for example, will be found the fullest possible details for constructing a very simple, cheaply made crystal set of high efficiency, which is suitable both for the ordinary broadcast band of 300-500 metres and also for the reception of the high power long wave station. There follows in the next chapter a description of a single valve receiver of a highly effective and straightforward kind, both easy to make and simple to operate, and built entirely with ready-made components. The contents of the book are progressively arranged, passing through a two and three valve design to a quite ambitious four-valve broadcast receiver which forms the last chapter. Simple every set certainly is, but no one should be deterred from obtaining the book by the feeling that probably they have been so simplified as to be lacking in the efficiency which everyone demands in his receiver. On the contrary, the simplicity is that which results from skilful design, in the leaving out of non-essentials, the arrangement of the parts, and so forth, of each instrument in such a way that it becomes as easy as possible to handle, thus permitting even the beginner to obtain the best possible results from the set.

The four-valve set, which forms the subject of the last chapter, is one of the new designs, and possesses several distinctive features, notably a very convenient system of switching which permits any combination of valves to be used, varying from one to the full four. The switching is so arranged that the losses usually attendant upon such a system are so minimised that no one need have any hesitation in building the receiver, since truly excellent results were given by the original.

Although the book will prove very valuable to the type of reader who already possesses a certain amount of experience, and merely wishes to select one particular design from the many given, it is perhaps likely to serve best the ends of the complete novice, who might very profitably start by building himself the crystal receiver in the first chapter, and then gradually progress through the book as his experience widens, with the minimum of expense, since a design is included for a two-valve low-frequency amplifier which, although intended primarily as a power amplifier, can be regarded equally well as a perfectly standard low-frequency magnifier for addition to any of the smaller sets.



The simplicity is evident.

A Simple Loose-Coupled Crystal Receiver

By H. BRAMFORD

This article describes how to make a simple loose-coupled crystal receiver, which may be adapted in several ways

THIS receiver has been designed for simplicity of construction and at the same time to give the utmost efficiency as regards results. A loose coupled tuning device which is constructed on simple and rather unique lines is embodied on the set. This component is of the plug-in type which enables the operator to employ direct or loose coupling at will

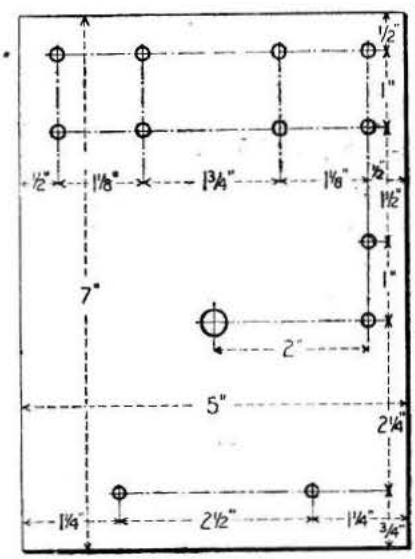


Fig. 1. How to drill your panel.

and to make quick change in the positions of the coils, and the reversing of the leads.

Material Required

One ebonite panel, measuring 7 in. × 5 in. × $\frac{3}{16}$ in.
One variable condenser ·0005 μF.
One micro detector (Service).
Four small pillar terminals.
Two telephone terminals.
Four Clix sockets.
Four Clix plugs with bushes.
Three coil plugs (K. Raymond).
One small 4 B.A. bushed knob.
Wood for the box.
One set of basket coils (Ledion).

Panel Drilling

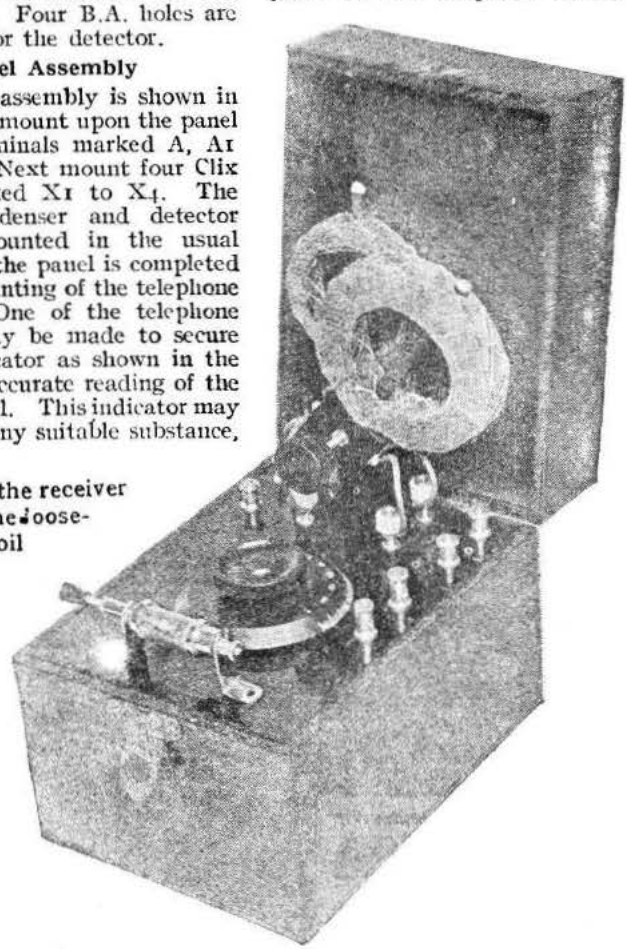
The panel, which measures 7 in. × 5 in., is drilled as shown in Fig. 1, the necessary dimensions being given. The hole to receive the single hole mounting condenser is drilled to clear the bush of same, the usual size being $\frac{3}{8}$ in. Terminal holes are drilled to clear 4 B.A. terminal screws. Four holes are drilled to $\frac{3}{16}$ in. diameter for the Clix sockets. Four B.A. holes are also drilled for the detector.

Panel Assembly

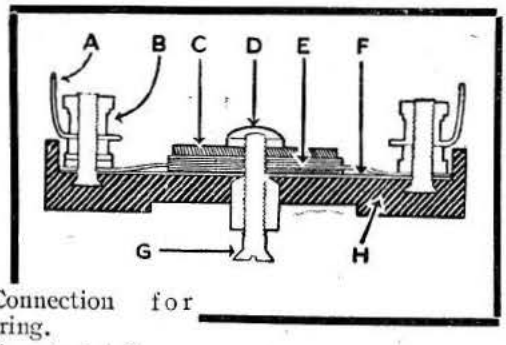
The panel assembly is shown in Fig. 2. First mount upon the panel the four terminals marked A, A1 F, and F1. Next mount four Clix sockets marked X1 to X4. The variable condenser and detector are then mounted in the usual manner and the panel is completed with the mounting of the telephone terminals. One of the telephone terminals may be made to secure a small indicator as shown in the diagram for accurate reading of the condenser dial. This indicator may be made of any suitable substance, white celluloid being preferable. A coil plug is assembled to the panel between Clix sockets X1 and X2, to act as an adapter for the plug-in two-way coil holder.

Connections

The back-of-panel connections are clearly shown in Fig. 4. Terminal A is connected to socket X1 and terminal E to X2. Socket X3 is connected to terminal A1, passing from this point to the fixed vanes of the variable condenser, and on again to one side of the detector. Socket X4 is connected to terminal E1, passing from this point to one telephone terminal,



A view of the receiver showing the loose-coupling coil holder.



A. Connection for Soldering.
B. Terminal Connection.
C. Clamping Plate, giving minimum air space and constant capacity.
D. Guarantee Seal after each condenser has been tested for short circuit, disconnection, leakage, capacity, etc.
E. High grade Ruby Mica Dielectric.
F. 98 per cent. Pure Copper Plates.
G. One-hole Fitting suitable for Panels $\frac{1}{8}$ in. to $\frac{1}{4}$ in.
H. Case made of a special high Insulating Composition.

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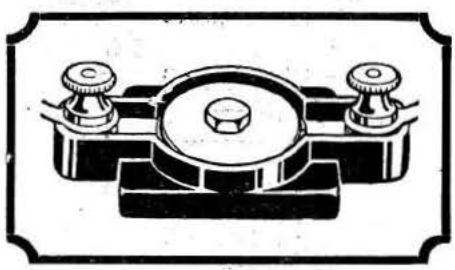

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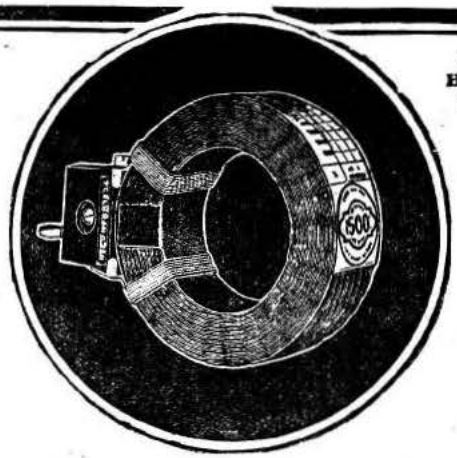

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50	38	133	252	395	498	693	5/2
60	39	157	298	464	585	814	5/4
75	38	170	326	511	644	895	5/6
100	24	220	504	815	1036	1445	7/-
150	25	333	738	1190	1520	2110	7/10
200	23	420	976	1580	2015	2820	8/8
250	24	538	1215	1960	2490	3480	9/-
300	20	608	1470	2400	3010	4280	9/5
400	16	810	2175	3585	4580	6430	10/3
500	18	956	2470	4050	5170	7240	10/6
600	18	1140	2905	4770	6100	8800	11/-
750	19	1450	3720	5950	7650	10640	11/10
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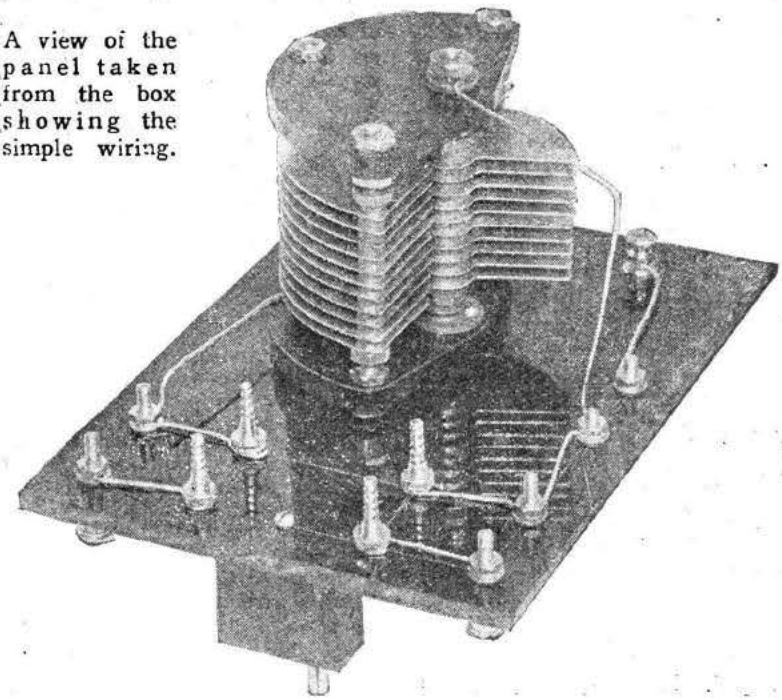

A view of the panel taken from the box showing the simple wiring.

and on again to the moving vane of the variable condenser. Connections are then completed by passing a wire from the other telephone terminal to the remaining side of the detector.

Loose-Coupled Coil Holder

Details of the loose-coupled coil holder are shown in Fig. 5. This

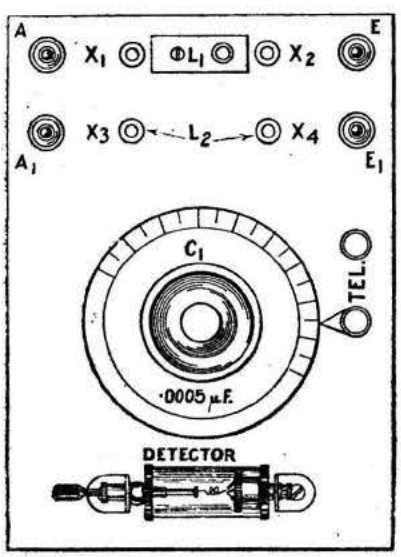

Fig. 2. This shows how the parts are mounted on the panel.

component has been made up entirely from two coil plugs, one small ebonite knob bushed 2 B.A., some round ebonite rod about $\frac{3}{16}$ in. diameter, nuts and washers, &c. First drill a hole through the centre of one of the coil plugs to clear 4 B.A. rod. Drill a further hole in the coil plug on the under side centrally to make a tight fit for the ebonite rod coil support. Treat the other coil plug in a similar manner, but in this case cut off the projecting pin with a hacksaw. Each of the coil plugs is then equipped with two lengths of ebonite rod. The two plugs are assembled by passing a short length of 4 B.A. rod through the coil plug, from which the pin has been removed, and securing by means of nuts each side as shown, leaving a projecting length of rod for the ebonite knob. Over the other end of the 4 B.A. rod pass a spacer washer, spring washer, and washer, then slip over the other coil plug, then a further spring washer followed by a nut and lock nut.

Flexible Leads

Four short lengths of insulated flexible wire are equipped with a Clix plug and bush, which are then secured to the four plug screws as shown. The coils, which should be of the basket type, extra air-spaced for low capacity effects, slip over the ebonite coil supports, the beginnings and endings of the windings being secured to the coil plug screws also. Having constructed the two-way coil holder, the coil holder which is provided with a pin is inserted into the coil socket on the panel. When this is done it will be seen that by rotating the ebonite knob one coil remains stationary, while the other moves radially.

Box

The box is made as shown in Fig. 7. $\frac{1}{4}$ in. thick wood has been used throughout, cutting sizes are as follows: two pieces $7 \times 3\frac{1}{2}$ in., two pieces $5\frac{1}{2} \times 3\frac{1}{2}$ in., two pieces $7\frac{1}{2} \times 5\frac{1}{2}$ in., two pieces 2×7 in., and two pieces $2 \times 5\frac{1}{2}$ in. Choice of wood and finishing is left to the taste of the constructor.

The lid is provided with two hinges and a snap lock, such as is used on attaché cases.

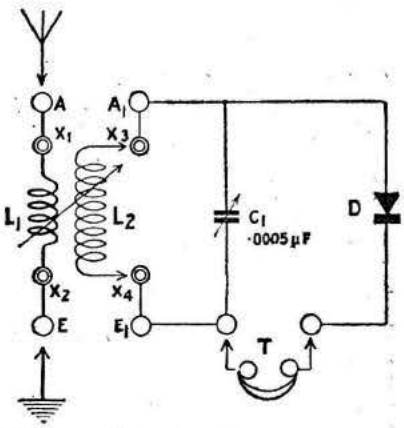

Fig. 3. The Circuit arrangement.

Circuit

The circuit is shown in Fig. 3. Where loose coupling is desired, connect the aerial to terminal A and the earth to terminal E. Plug the leads from the stationary coil L1 into sockets X1 and X2, and the moving coil L2 into sockets X3 and X4. Tuning is effected by means of the condenser C1, and also by means of the moving coil. Where direct coupling is desired,

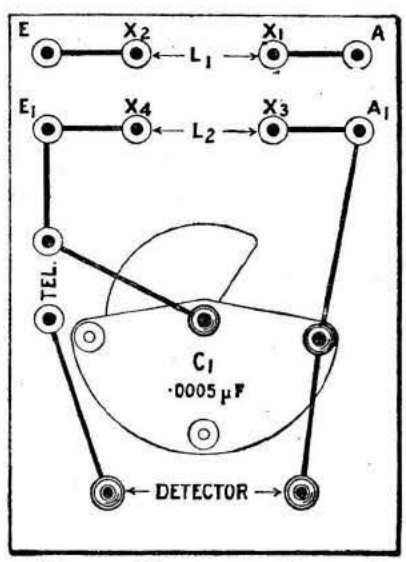

Fig. 4. Nine connections only are required.

the aerial is attached to terminal A1 and earth to E1. Either of the coils L1 or L2 being plugged into sockets X3 and X4. With the

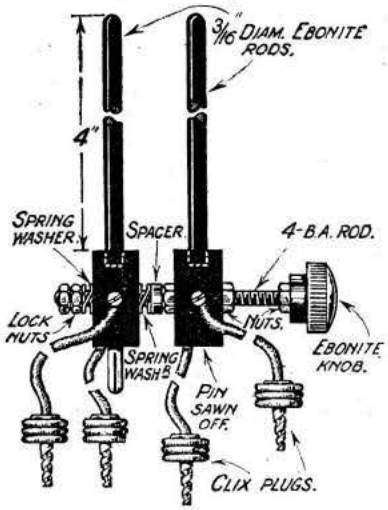

Fig. 5. Details of the coil-holder.

loose-coupled arrangement, terminals E and E1 may be joined together, thus earthing the lower end of the secondary coil L2. This may be found an advantage, and should certainly be tried.

To obtain a variometer tuning effect, connect the aerial to terminal A1, plug in one side of L2 to socket X3, and the other side of L2 into socket X1. Plug one side of L1 into X1, and the other side into X4. Earth to E1.

Some Results

This receiver was tested on a small indoor aerial, and results obtained therefrom were quite good. Signals were also good using the loose-coupled arrangement, the aerial coil having about 25 turns and the secondary coil about 50

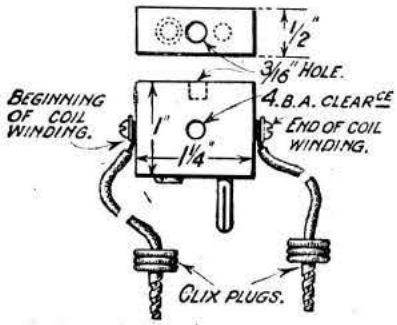

Fig. 6. How the coil-plugs are drilled.

turns. Similar satisfactory results were obtained by using direct coupling. Tuning with the condenser C1 was quite sharp.

In the hands of another member of the staff, the set was tested on an indoor, one-room aerial, loud signals being received from 2LO at a distance of about 10 miles. Loose coupling was employed,

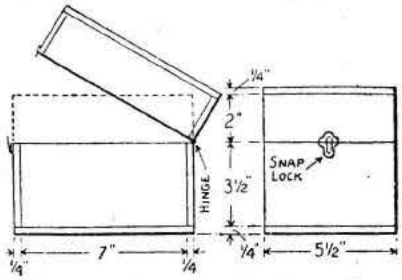

Fig. 7. How the box is made.

using a 30-turn coil in the aerial and 70 in the secondary circuit.

Chelmsford

Using a good outdoor aerial, 5 miles from 2LO, Chelmsford was heard at good signal strength, employing direct coupling by means of a 200 coil.

2LO was heard with considerable volume, using 40 in the aerial and 75 in the secondary circuit.

Using a 75 coil with the direct-coupled circuit, 2LO was received without an earth connection at good strength in the telephones.

Fixed or Experimental?

A question all must answer

MANY amateurs have a little difficulty in deciding how to arrange their apparatus. Those who have a complete set in one cabinet, and who are not always changing their circuits and using new gadgets, will have no difficulty in finding a place where their sets may be permanently connected up. But in regard to the real experimenter, is he to fix all his sets and apparatus up on a bench or table permanently and screw all his switches down, so that everything has a fixed place and can be used but not rearranged? Or shall he keep everything in a cupboard and reserve a clear table to connect up just what he needs for his experiments at the moment?

The best thing he can do is to make a compromise between the two, and have a small table on which is connected up a set which is kept permanently arranged so that it may be switched on at any time for reception from different stations, and a larger table which shall be kept more or less clear for trying out bench "hook-ups," and new sets, or for trying out new gadgets and ideas. Needless to say, the actual workshop part of his station should be kept quite separate from his completed apparatus. Although the hints given above are very simple, and do not look of much importance, they will make the work of the experimenter much easier and keep his station much neater if carried out.

A. S. C.

The B.B.C. have started a Rugger team. They are seen above after a game. Sixth from the left is Mr. Dan Godfrey, Jnr., a leading light in the team.

Coils for Trap Circuits

By R. A.

Undoubtedly the best results from trap circuits recently described by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., can only be obtained when low-loss Coils are employed. Owing to their special design and construction the most suitable Coils to use are "EFFICIENCY INDUCTANCE COILS," manufactured by Gambrells (Fig. 1).

Below are shewn the various Gambrell Coils which should be used for B.B.C. Stations, Chelmsford and Radiola.

	Aperiodic Aerial.	Anode	Trap.	Reaction.
B.B.C. Stations	a	C	C	A
Chelmsford & Radiola	D	F	G	E

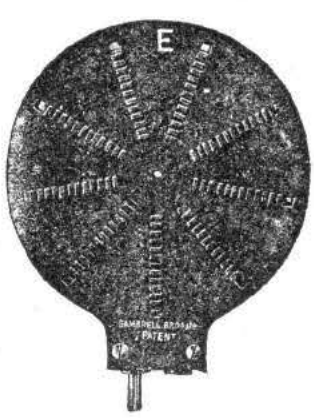

Fig. 1.—The Gambrell Coil.

Fig. 2.—The Gambrell Coil for Trap Circuits.

It is a simple matter to adapt any receiver utilising a 3-Coilholder for Trap working by plugging in Standard Coils such as above, but modifying the connections in accordance with the diagrams given in Mr. Scott-Taggart's article in the February issue of *Modern Wireless*, pages 12 to 16.

Special Coils have been designed in order that receivers utilising only a 2-Coilholder may be adapted for Trap working as simply as those with a 3-Coilholder. These Coils are special aperiodic Aerial Coils which will be called "aT" for B.B.C. wavelengths, and "DT" for Chelmsford and Radiola, and are fitted with two terminals instead of the usual plug and socket and a centre pin for clamping them to the Trap Circuit Coil, thus providing a very simple method of adapting existing receivers using Gambrell Coils to these Trap circuits.

Complete Aperiodic Aerial Coils with terminals and fixing studs (Fig. 2) :—

aT ... 6s. 6d. DT ... 8s. 9d.

How to Add Grid-Bias to Your Note Magnifiers

An interesting article which shows how to get the best out of an existing receiver

IN last month's issue of THE WIRELESS CONSTRUCTOR there was described, on page 397, an easy method whereby an extra H.T. voltage may be added to the note-magnifying valves of a commercially or home-made receiver fitted without the facilities for using a power valve and using the same circuit there will be found below a simple method whereby grid-bias may be added.

Firstly, it may be found that upon adding the extra H.T. voltage as suggested in the manner described in last month's issue, the quality of the music and speech has suffered somewhat, results having become nasal and trumpet-like. The reason for this distortion lies in the fact that by adding the extra H.T. voltage we have not only increased the volume of the results, but have so arranged things that the last valve is not operating in a proper manner, or, to put it more technically, is not operating upon the most advantageous point of its characteristic curve.

Introducing the Grid Battery

Now to so arrange that we may effectively utilise the extra H.T. voltage with the increased volume which it permits, we must insert between the L.T. negative terminal of our receiver and that terminal of the L.F. transformer previously connected to the L.T. negative busbar a small battery

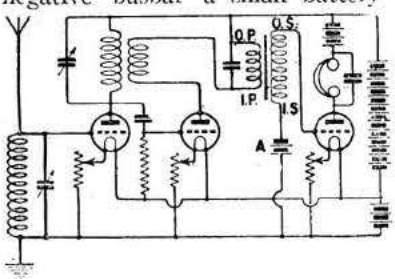

Fig. 1.—The extra battery A provides grid-bias.

commonly called a "grid" battery. In Fig. 1 is shown the same circuit as illustrated last month, but in this case the extra battery between the L.T. negative and transformer is shown at A.

The alteration whereby a receiver may be made to comply with these conditions is a little more difficult than was the case when adding the extra H.T. battery, in that the connections which have to be made affect the internal wiring of the receiver.

The First Operation

The first operation is to remove the panel from the containing box, when upon examination of the under side the connections as shown in Fig. 2 will be seen. The second operation is to remove the wire which connects the L.T. negative to the transformer secondary, and by some means or other to connect a lead from the grid battery positive to the L.T. negative, and from the grid battery negative to the terminal of the secondary of the

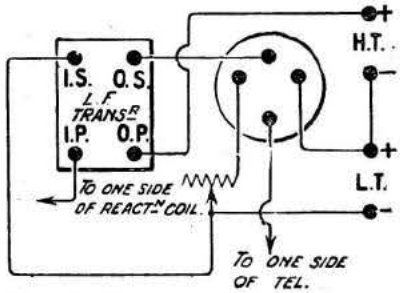

Fig. 2.—These connections are as found in the set.

transformer, but since we do not yet know what voltage will be required a little more thought upon the subject is called for. The most satisfactory manner in which to add grid-bias to an existing set is to find upon the panel at some convenient place sufficient room to permit the fitting of two extra terminals, to which may be connected *externally* a grid battery of suitable voltage according to results.

Assuming that these two terminals have been fitted, and usually there is at least *one* place where they may be added, the connections on the under side of the panel are as shown in Fig. 3, X and Y representing the extra terminals. When the wiring has been completed it should be noted which terminal goes to the L.T. negative (Y in Fig. 3), and the terminal should be marked "plus" on the *upper* side of the panel; similarly the other terminal (X) may be marked negative or "minus." With this work completed we may replace the panel upon the box, make all external connections as before and proceed in the following manner to rid the set of the distortion resulting from the use of the extra H.T. battery.

To the two terminals just fitted to the set connect two short lengths of flexible wire, each with wander plugs attached, one red, one black, the lead with the red plug going to the positive terminal, and the lead with the black plug going to the negative.

Procure from practically any wireless dealer a grid battery of 9 volts, fitted with tappings similar to those seen on H.T. batteries, and insert the red plug previously referred to into the positive of the battery and the black plug into, say, the 3-volt tapping.

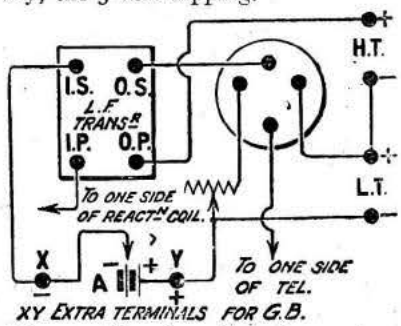

Fig. 3.—Showing how the extra terminals are to be joined in circuit.

Upon starting up the set to give the loudest results, it will be found that much of the distortion which was previously noticed will have disappeared, or else will do so upon changing the position of the black plug to other tappings of the grid battery.

When the Battery Wears Out

Should the grid battery at any time become exhausted through deterioration or accidental short-circuiting, then, until a new battery is procured the two terminals across which it would normally be connected should be joined together by means of a piece of wire.

S.G.R.

Test Department

The popularity of this department has necessitated greatly increased staff, and while it is not intended that the department should pay for itself, this fact together with the high cost of the necessary standard testing instruments compels us reluctantly to increase the cost of testing to 5/- per valve in a "straight" receiver, 10/- being charged for a "dual" valve. In addition, we cannot undertake to test any set in which a departure from Radio Press : : design has been made : :

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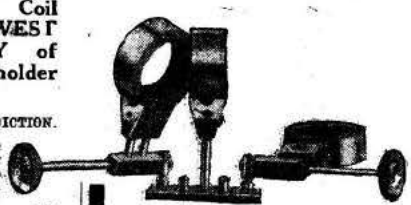

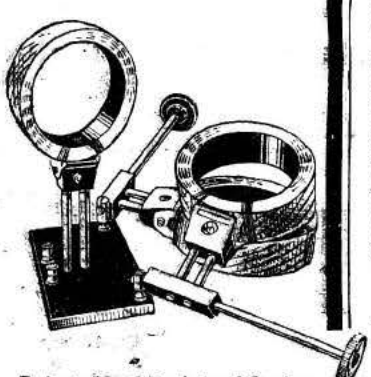

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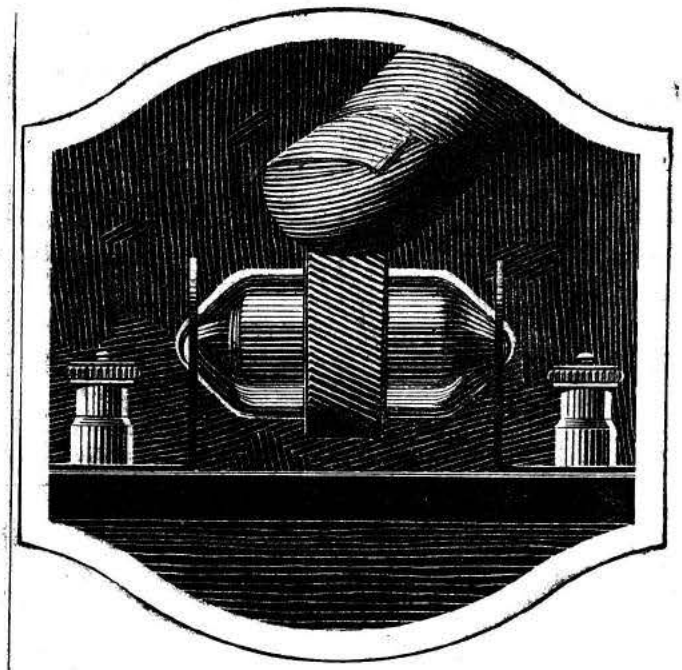

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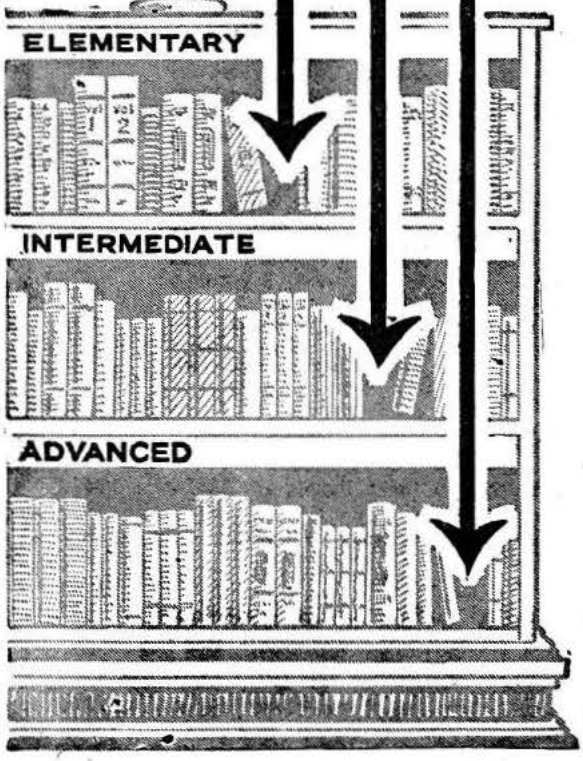

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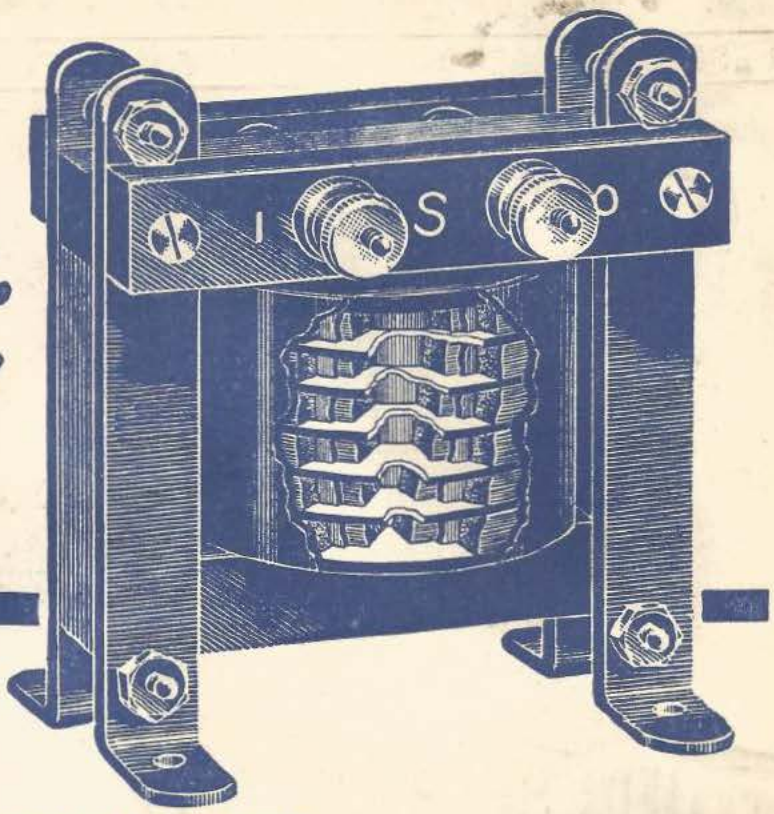

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