The Wireless Constructor

6D MONTHLY

Edited by PERCY W. HARRIS, M.I.R.E.

Vol. II JUNE, 1926 No. 8

Special Features:

Selectivity with a Single Valve
By John W. Barber

A 3-Valve Safety Set
A Non-Radiating Receiver for Indoor Aerials
By Percy W. Harris, M.I.R.E.

DX with Two Valves
By Stanley G. Rattee, M.I.R.E.

Reducing Interference
How to Construct a Loosely-Coupled Crystal Set
By John Underdown

How to Make a Folding Frame Aerial
By Philip H. Wood, B.Sc., F.P.S.L.

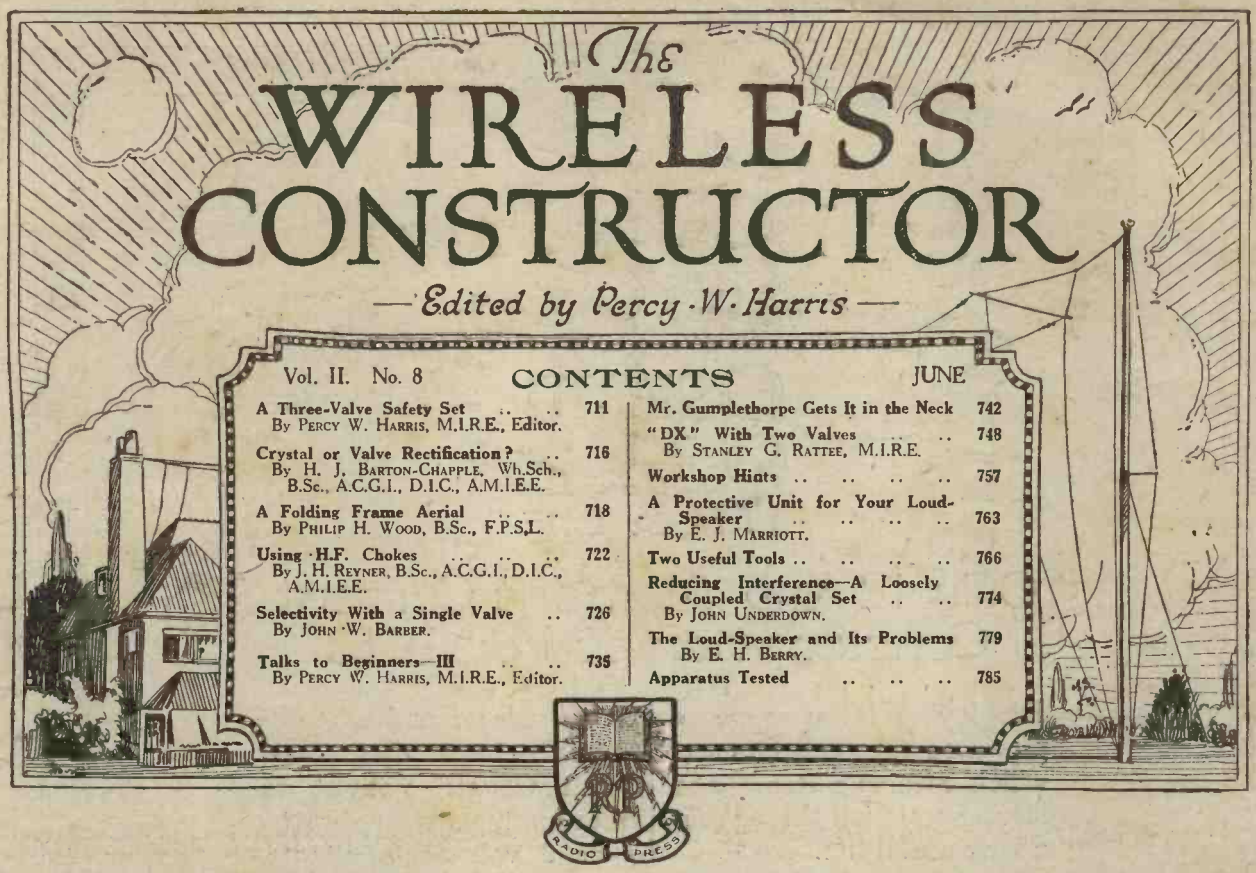
A Protective Unit for Your Loud-Speaker
By E. J. Marriott

Soldered Joints—Faults in Valves—Your Tuning Controls—H.F. Chokes, etc.

A 3-VALVE SAFETY SET

BY

Percy W. Harris, M.I.R.E.



The WIRELESS CONSTRUCTOR

—Edited by Percy W. Harris—

Vol. II. No. 8 CONTENTS JUNE

Published by Radio Press, Ltd., Bush House, Strand, W.C.2. 'Phone: City 9911.

A THREE-VALVE SAFETY SET

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

This thoroughly practical and efficient set, the operation of which can be learnt in five minutes, will meet the needs of numerous readers. Once adjusted, it cannot be made to "howl," however clumsily handled.

IN many of the New York "apartment houses" (the American name for blocks of flats) you will now see a notice prohibiting the use of radiating receivers. Any tenant found using a set capable of howling promptly receives notice to quit. As a result, one hears of apartment houses containing fifty or sixty different radio receivers, all operating loud-speakers, yet not interfering in the slightest degree with one another or with the reception in surrounding buildings.

Indeed, so active is the campaign against oscillating receivers, that howling has been, to all intents and purposes, abolished and good long distance reception made possible.

An Aerial Round the Room

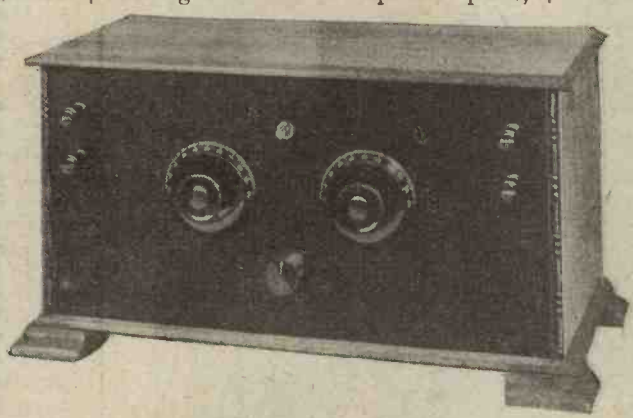
In London and other great cities there are thousands of people living in either flats or houses where no outside aerial is accessible.

Particularly in flats, the conscientious listener is anxious not to cause any interference with his neighbours' reception, and such listeners have not in the past been particularly well served in the way of designs to suit their immediate needs. The receiver I am describing this month has been specially designed to give good and pure loud-speaker reproduction from the nearest station, using as an aerial twenty or thirty feet of insulated wire run round the picture rail of the room in which the set is used.

In view of the trouble caused by the use of oscillating receivers, this particular instrument has been designed so that, once it has received its preliminary adjustments, it cannot be made to radiate however the tuning controls are manipulated, yet its sensitivity is of a high order, and when used with an outside aerial the set is capable of receiving a number of stations other than that which is nearest to the listener.

Two Tuning Controls

The simplicity of control will be evident from the first glance at the photograph showing the finished instrument. There are but two tuning dials, one knob for filament adjustment and an "on and off" switch, so that once the local station adjustment has been found, the set is as easy to switch on and off as the conventional electric light. Although a modern neutralised circuit is used to obtain efficiency, special care has been taken to avoid the necessity of purchasing a number of expensive parts,



The completed receiver.

and it will be found that with one or two exceptions the components used are those which a large number of experimenters have already in hand.

Dispensing with Battery Terminals

Notice, too, that with the exception of the aerial and earth connections, which go to the front of the panel, and the two convenient terminals for the telephones or loud-speaker, all leads are taken through the back of the cabinet in an unobtrusive fashion. In view of this fact, it has not been thought necessary to provide any terminals at the rear, as the necessary battery leads can be joined directly to their connecting points, without the intervention of terminals.

Although primarily designed for the reception of waves on the bands between 300 and 600 metres, a simple change of coils enables Daventry to be included, the change being but the work of a moment. All coils are contained within the cabinet and unsightly external projections are thus avoided.

The Circuit

The circuit used includes one H.F. valve, a detector and one note magnifying valve. The H.F. valve is coupled to the aerial through a new form of low-loss transformer, this being the commercial form manufactured by Messrs. Peto-Scott of a coil I devised and personally described in *Wireless Weekly* recently. In order that the particular coil may be suited to widely differing aerials, tapping points and a switch are provided on the top, so that when making the first adjustments of the receiver, the best connection for the aerial used can be found at once, and left at that adjustment.

Tendency to Oscillation

As many readers are aware, a circuit containing a high-frequency valve frequently has an inherent tendency to self-oscillation, due to the fact that the grid circuit and the anode circuit, when both tuned, interact; some of the amplified energy in the anode cir-

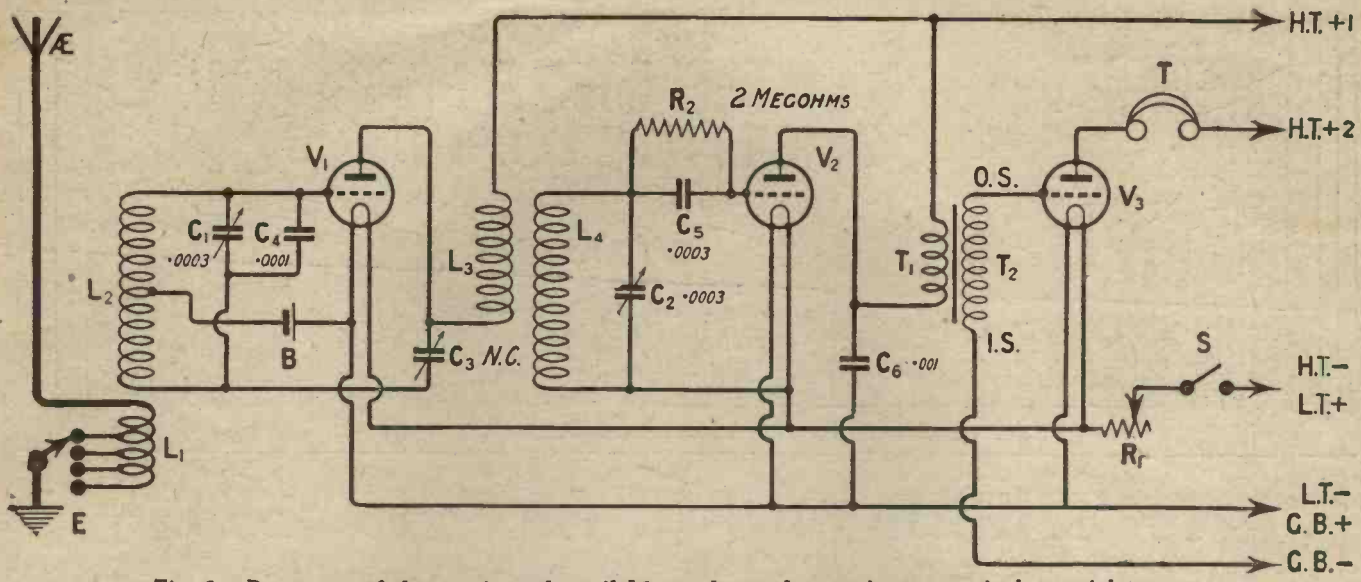


Fig. 1.—By means of the tappings the coil L1 can be made to suit any particular aerial system.

cuit (more than enough to replace the losses in the grid circuit) being handed back, thus maintaining a state of continuous oscillation.

Neutralising Methods

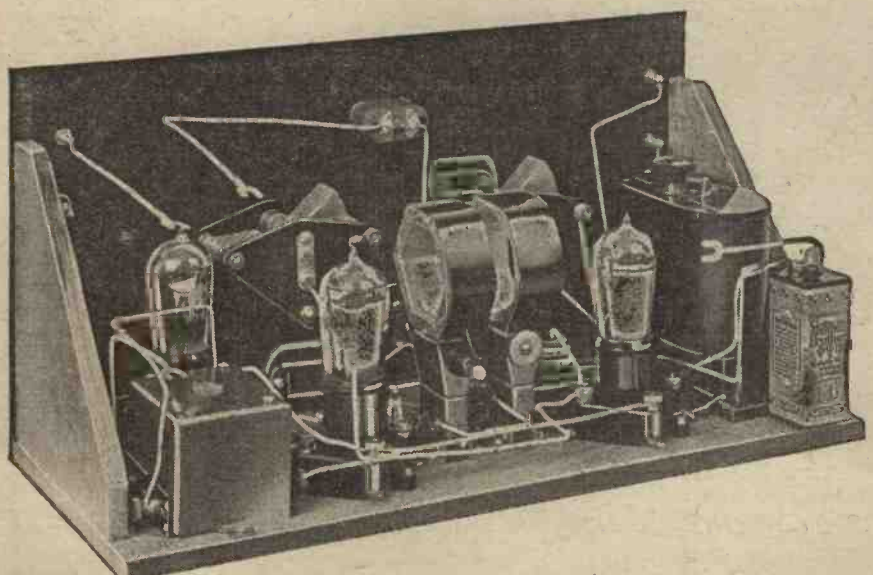
In early wireless days the tendency to self-oscillation was reduced by damping one of the two circuits, the stability thus obtained being paid for in loss of signal strength and selectivity. Modern receivers with radio-frequency amplifiers check the tendency to self-oscillation by neutralising the cause of the trouble, *i.e.*, the capacity in the valve itself between the grid and the anode.

There are a number of methods of neutralising a receiver of this kind, and one of the most effective is that known as the Rice circuit, which is used in the receiver I am describing. By using such a method, stability can be obtained without any sacrifice of signal strength, there being consequently a considerable increase in efficiency over the older sets.

Reducing External Fields

To continue the digression on the subject of self-oscillation, I would like to mention here that in many receivers the stray fields set up by the grid and anode coils do more to maintain self-oscillation than does the self capacity in the valve, and to neutralise a receiver with stray fields interacting is by no means an easy task.

A particular feature of the present receiver is the use of a special grid coil (combined with the aerial coupling) wound in such a way as to have a very small external field. This considerably reduces the chance of interaction between this coil and the coils forming the transformer which couples the first and second valves, making the set easier and more efficient to neutralise. The coupling between the first and second valve is by means of conventional plug-in coils, while the detector valve is coupled to the note magnifier by means of a low-frequency transformer.



General purpose valves of the '06 ampere type can be used with excellent results.

Filament Control

As simplicity of adjustment is a special feature in this set, only one filament resistance is used to control all three valves, which consequently should all be of the same type. This does not necessarily mean that all three valves should be of the same *make*. What is intended is that if one valve is, say, of the .06 ampere type, the others must also be of the same kind. As a matter of fact in testing this receiver with the type of valve mentioned I used three different makes of .06 ampere valves simultaneously with excellent results. Good results can be obtained not only with any of the .06 ampere valves of reliable make, but also with a number of others which will subsequently be mentioned.

Notes on Requirements

The cabinet is of a standard size to take a 16-in. × 8-in. panel, and the panel itself is also a standard size. In conformity with the usual practice in this magazine, the makers' names are given after all components used, but in practically all cases (the aerial coil is an exception) any other reliable make of similar component can be substituted without loss of efficiency. If you wish to substitute other makes of parts, you will not go wrong if you use those previously recommended in this paper, as all parts used in constructional articles have been carefully tested before incorporation in any set.

Components

Here, then, is a complete list of the components used:—

One cabinet to take panel 16 in. ×

8 in. × ¼ in. (Caxton Wood Turnery Co., Ltd.).

One ebonite panel 16 in. × 8 in. × ¼ in. (Pilot) (Peto-Scott Co., Ltd.).

Four Belling-Lee indicating terminals (aerial, earth, telephones —, telephones +) (Belling and Lee, Ltd.).

One Universal aerial coupler (Keystone Astatic) (Peto-Scott Co., Ltd.).

One dry cell (Siemens Type T).

Three valve sockets (Benjamin Electric, Ltd.).

Two variable condensers, .0003 (Bowyer-Lowe Co., Ltd.).

One neutralising condenser (British Radio Corporation).

Two board mounting coil sockets (Magnum) (Burne-Jones and Co., Ltd.).

One "on and off" switch (Igranic Electric Co., Ltd.).

One fixed condenser, .0001 (Sangamo).

One fixed condenser, .001 (Sangamo).

One fixed condenser with grid-leak clips and grid-leak, .0003 and 2 megohms (Therla) (Sel-Ezi Wireless Supply Co.).

One 30-ohm filament resistance (Yesly Electical Supplies, Ltd.).

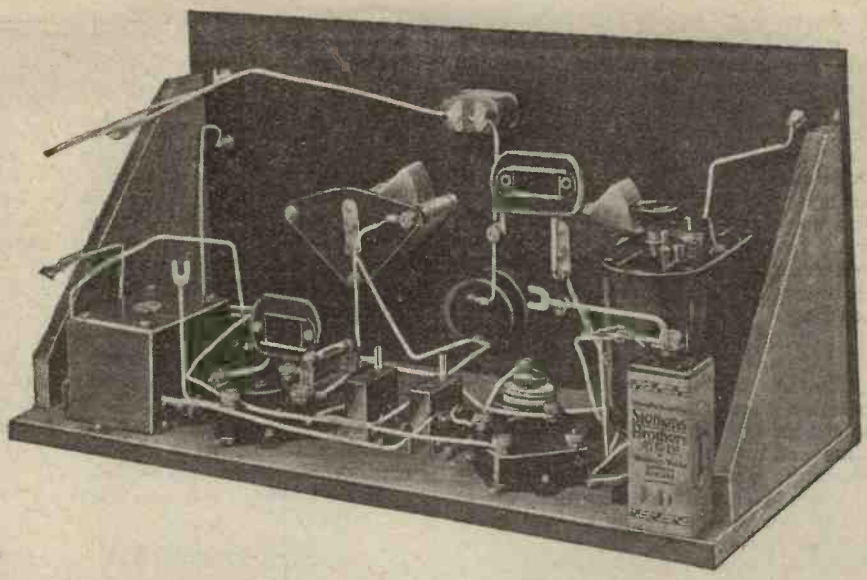
One low-frequency transformer, stage 1 (Gambrell Bros., Ltd.).

Glazite wire for wiring up.

Valves, coils and batteries to be mentioned.

How Leads are Connected

It will be noticed, on examining Fig. 3 and the photographs, that certain wires terminate in spade connectors. It is not essential that these should be used, and those shown are of the thin brass type, obtainable from any wireless dealer for a few pence a dozen. I have used them in the set more for the purpose of enabling me to show clearly the points for external connections in the photographs, and to enable a rapid change of connections to be made during the Laboratory tests.



Certain wires terminate in spade tags to facilitate external connections.

It would be just as convenient to finish off these ends with Clix or Newey snap connectors, both of which are very useful in cases where a change of leads is often desired, but, in a set like this, it is far cheaper and more convenient to solder to each of the points shown a length of flexible wire, which can be connected on to the batteries when needed. These flexible wires can be threaded through suitable holes at the back of the cabinet, and can have small labels tied to them to indicate their purpose. In adopting this method, I am following a plan, which is fast becoming popular with American set manufacturers, of connecting flexible leads directly to the points required, without the use of terminals.

The Neutralising Condenser

The particular neutralising condenser used is of a type not previously described in this journal, and consists of a circular ebonite base, a smaller circular brass plate screwed to it, and connected to a soldering lug, a central threaded rod insulated from the bottom brass plate, a second brass disc running on this threaded rod, and an ebonite knob connected to the last-mentioned brass disc.

By rotating the ebonite knob the upper plate can be brought closer to or moved farther away from the lower

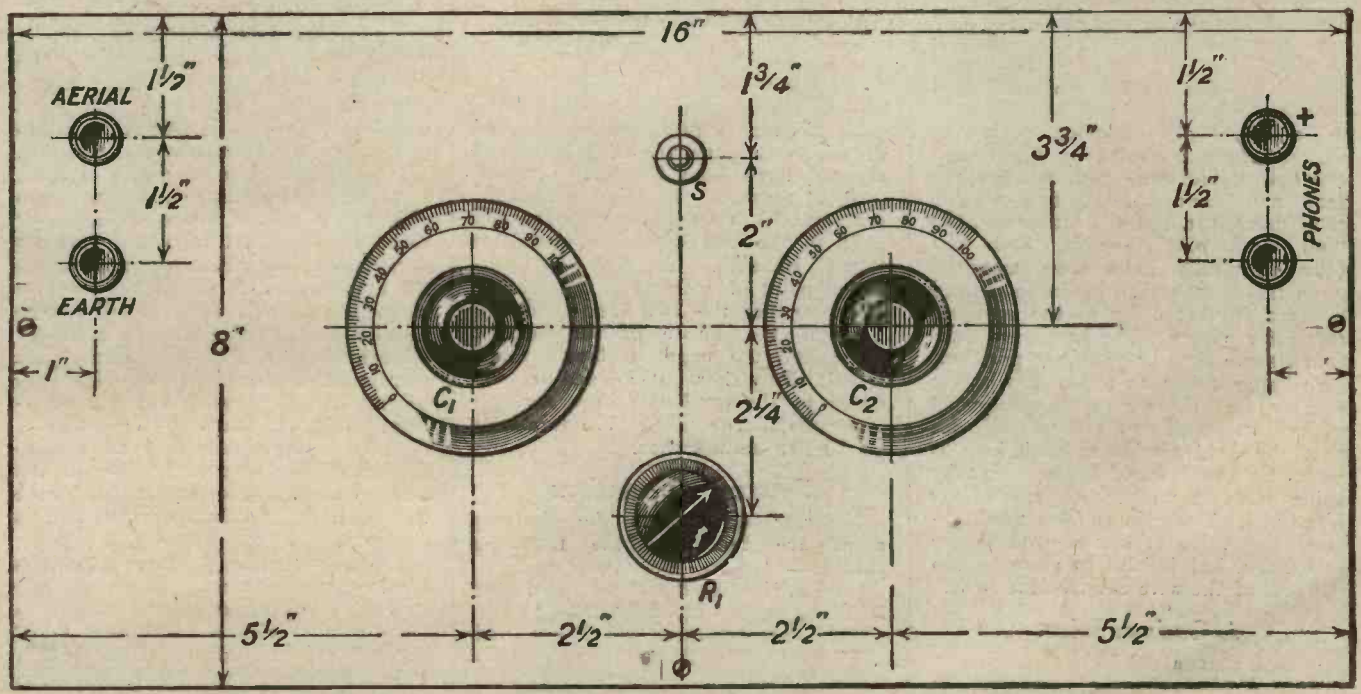


Fig. 2.—Details of the panel, which is attractively arranged. Blueprint C 1043A.

plate, thus giving smooth adjustment of capacity between limits suitable for use in a circuit such as this. Once the best position has been found, the neutralising condenser can be left adjusted. This condenser is mounted on the baseboard of the set in a position sufficiently accessible to allow initial adjustment, but also sufficiently out of the way to prevent it being tampered with by some curious person. I do not recommend here a type for panel mounting, as this would make the leads too long.

Negative Bias

The use of a single dry cell in the position shown gives a negative bias to the grid of the high-frequency valve, thus adding to the efficiency of working, and, incidentally, reducing the anode current consumption, or, in other words, the drain on the high-tension battery. No difficulty will be found in assembling the components on the baseboard, for without exception these screw down to it with small wood screws.

The baseboard supplied with the Caxton cabinet is already fitted with side pieces, forming supports for the front panel, and, once the two variable condensers, the filament resistance, the "on and off" switch, and the four terminals have been mounted upon this front panel, it can be secured without further delay to the uprights ready for wiring. The baseboard components can then be placed in position, care being taken to follow the layout exactly, and the wiring up proceeded with in the ordinary course. Notice that the grid condenser with leak is secured to the second valve socket by being screwed underneath one of its terminals. The grid cell for the high-frequency valve is not secured to the baseboard, but is kept in place by the stiffness of the wire connections to it.

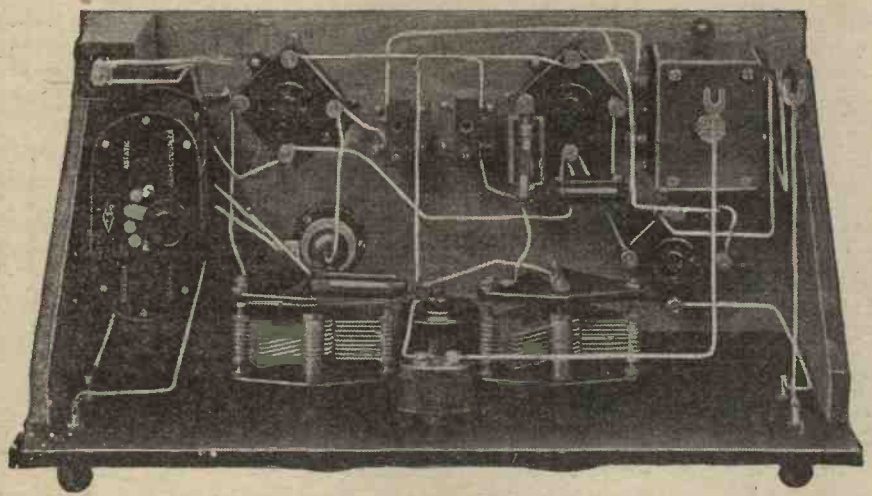
A Curious Effect

Notice that a .0001 fixed condenser is joined across, and, therefore, in parallel with, the first variable condenser. This condenser is placed here, not for the purpose of raising the upper limit of the wavelengths that can be covered with the aerial coil used (although it also has this effect), but to avoid a peculiar effect, often found with the Rice circuit, of an ultra-high-frequency oscillation set up when the tuning condenser is brought to very small capacity value, such as is the case when the last few degrees at the lower end of the scale are used.

With the coil shown, and with the variable condenser of .0003 capacity, with a .0001 fixed condenser across it, a capacity variation of from .0001 to .0004 is obtained, giving a wavelength range of from 300 metres to well over 500 metres, thus including all of the B.B.C. stations, main and relay, excluding Daventry, which, as will be explained later, can be obtained by changing the coils.

H.F. Transformer

For the high-frequency transformer a Gambrell B coil in the primary socket (the left-hand socket looking from the front) and a Gambrell C coil in the secondary socket (right-hand socket), have been found to give excellent results. In the numbered makes, a 50 or 60 in the primary and a 75 in the secondary has also been found suitable. Another constructional point of interest is the method of connecting the .001 fixed condenser between the anode of the detector valve and the negative filament terminal. Two short stiff leads are soldered to the condenser lugs, and are screwed underneath the two terminals of the Benjamin socket.



The tapping switch on the aerial coupling unit is clearly visible at the left of the set.

External Connections

Exterior connections for battery wires are taken to the following points:—

(1) Positive terminal of grid cell (L.T. negative connection).

(2) One terminal of "on and off" switch (L.T. positive connection).

(3) Intermediate point between the I.P. connection of L.F. transformer and the primary coil of H.F. transformer (H.T. + 1).

(4) Upper telephone or loud-speaker terminal (H.T. + 2).

(5) I.S. terminal of L.F. transformer (grid bias negative).

The two remaining connections for battery leads are the common H.T. negative and the grid bias positive. The grid bias positive should go to the same connection as the L.T. negative (i.e., the positive terminal of the grid cell. This is directly connected to the negative L.T. circuit). H.T. negative can go to either L.T. negative or L.T. positive; for the preliminary adjustments I would suggest that you connect it to the L.T. negative, as if by any chance you should short-circuit the neutralising condenser, by making the plates touch, the connection to the L.T. negative will prevent the valve from being burnt out. When the adjustments have been made, the negative H.T. can be transferred to the positive L.T. The advantage of this latter connection is that the voltage of the low-tension battery is added to that of the high tension, thus giving a slightly higher effective high-tension voltage with the same H.T. battery, a small but useful aid to efficiency.

Valves

As previously mentioned, all three valves must be of the same type, although several different types may be used if all three are the same. A high-tension value of 48 volts for H.T.1 and 90 volts for H.T.2, suits most valves. Grid bias for the note magnifying valve should have the value as given by the makers on the valve or in the box. This differs with different valves. Any wireless dealer can supply you with a suitable grid-bias battery with tappings.

Notes on Batteries

The set works excellently with the Philips-Mullard P.M.4 valves, which also have a filament consumption sufficiently low to enable the set to be worked off dry cells if necessary.

If a dry cell filament supply is used, I would recommend you to use three .06-ampere valves, three P.M.4's, or three of any good type the filament consumption of which does not exceed .12 ampere each. As a 30-ohm filament resistance is used, it will not be possible to use valves having a higher filament consumption than those just mentioned, but if it is desired to use bright emitter valves or the semi-bright emitters burning a $\frac{1}{4}$ ampere, then it is only necessary to change the filament resistance for one of the 6-ohm variety. The set will then work well with these valves or with bright emitters.

The high-tension battery should be of the tapped variety, and although 90 volts is better, excellent results can be obtained with a maximum of 72 volts, this figure being used for H.T.2. For H.T.1 I recommend not more than 48 volts, as nothing is gained by in-

creasing the voltage of H.T.1 above this figure, while, on the contrary, an increased drain is made upon the high-tension battery, thus reducing its life. If .06 ampere or similar valves are used (rated at 2.8 to 3 volts on the filament), three large dry cells in series can provide the necessary current, or better still, a small 4-volt accumulator designed for running dull emitters.

Adjustment

When the set is completely wired, insert the coils and put the "on-and-off" switch to the "off" position (pushed right in), the filament resistance to the "off" position, the neutralising condenser to a fairly wide opening, and insert three valves in the sockets. Connect up the L.T. battery, the H.T., grid bias, and telephones, and put the switch to the "on" position. Remember that the P.M.4 valve, if used, shows no visible glow when alight. Turn on the filament resistance about one-third of the way for .06-ampere valves, or four-fifths or so for P.M.4 or the .1- or .12-ampere valves. Leave the aerial and earth wires unconnected at the moment. Turn the neutralising condenser to a position about half-way between minimum and maximum opening between plates, set the switch of the aerial coupler to any one of the studs, put the first condenser near the zero point and rotate the second condenser backwards and forwards. You will soon find a point if you are using the P.M.4 or other dull emitting power valves, where a "plopping" sound indicates that the set is going in and out of oscillation as you pass backwards and forwards over the scale.

Neutralising

With the .06-ampere type of valve you will probably not hear such a sound, and if you are satisfied by turning the condenser backwards and forwards that there is no "plop" (listen

(*Continued on p. 791.*)

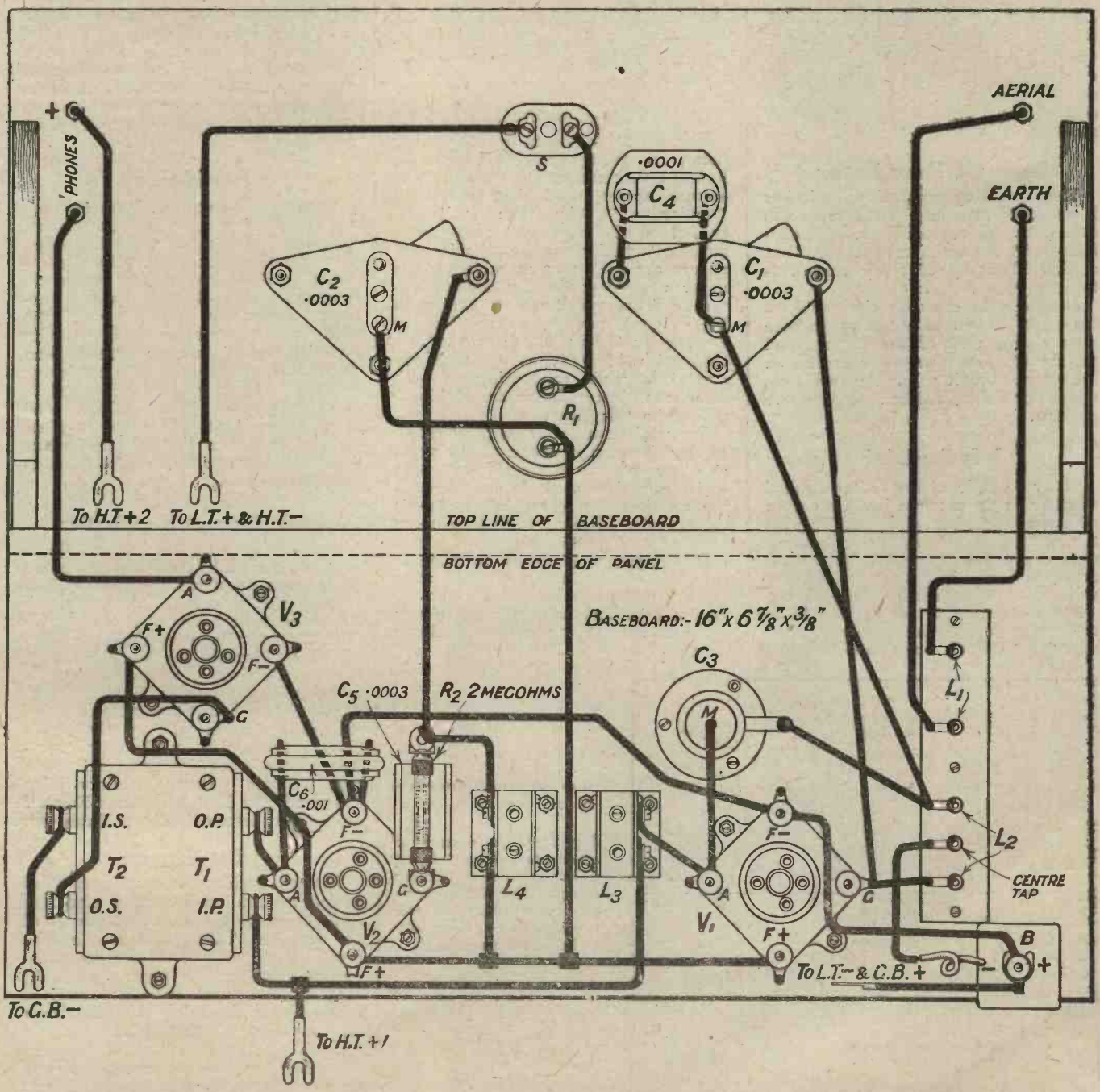


Fig. 3.—All battery connections and wiring can be followed easily from this diagram. Ask for Blueprint C 1043B.

CRYSTAL OR VALVE RECTIFICATION?

By H. J. BARTON-CHAPPLE, Wh.Sch., B.Sc. (Hons.),
A.C.G.I., D.I.C., A.M.I.E.E.

The crystal has many merits as a rectifier, but, like most good things, is subject to one or two drawbacks. Even so the writer of this article prefers it to the valve, and below the matter is fully discussed.

AMONGST the many problems which come up for discussion in connection with wireless, one of the most persistent is that concerning crystal rectification *versus* valve rectification. The question is a particularly interesting one, especially in view of the fact that people are becoming more critical in their demands as to the quality of reproduction desired from this or that particular receiver.

Improved Reproduction

The increasing popularity of wireless is no doubt in a large measure due to this improved reproduction, and anything that can be done to further that object is worthy of every consideration.

In order to examine the problems before us it will be necessary to take a very wide view of the matter; and certain technicalities, while having an important bearing on the problems under discussion, will be avoided where possible.

Is It Possible?

Many people have often asked whether it is not possible to obtain all the effects of a valve rectifier with a piece of apparatus which can be more easily handled and is quite foolproof, and it is then that crystal considerations become more material.

The initial outlay for a valve to be used as a rectifier alone is somewhat costly, and it does not stop at this, for the valve must receive "endowments" in the form of an accumulator to light the filament, and, of course, this battery has to be periodically charged. Added to this, we have the high-tension battery, while care in handling is essential or the breakage bill may assume undue proportions.

Ease of Operation

The crystal detector, on the other hand, is relatively cheap, can be handled with comparative ease by the merest novice, and does not need "endowing." Why then isn't the crystal used in every case as a rectifier? Unfortunately, the laws of nature are such that an advantage is never unaccompanied by a disadvantage. The crystal cannot deal with large input powers, as rectification becomes inefficient owing to the fact that with large input voltages the crystal is made conducting in both directions. An examination of Fig. 1 will make this clear.

For small input voltages the positive current is much in excess of the negative current, but after about 3 volts (this figure is a variable one, depending on the type of crystal employed) the negative current begins to increase rather rapidly, while the positive current exhibits a tendency to increase only slightly. Thus the rectification efficiency becomes impaired. Damage may also be done to the crystal if any attempt is made to deal with large powers.

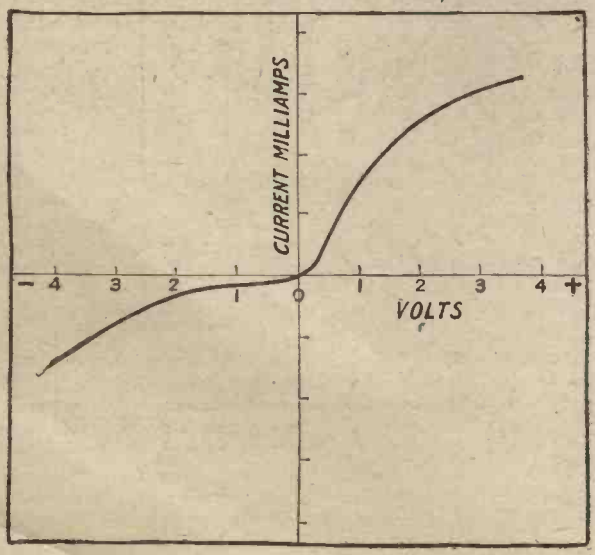


Fig. 1.—In the case of a crystal, large input voltages tend to equalise the positive and negative currents, and the rectification efficiency becomes impaired.

Limited Input

Thus we have a certain limit put upon the application of a crystal as a rectifier. The number of stages of high-frequency amplification which can precede the crystal will be fixed by the initial magnitude of the incoming signal and the characteristic of the crystal itself, and in order to bring the signal up to the required strength low-frequency amplification is necessary.

Two Methods

Turning to the valve, however, such a delimitation is not apparent, although this statement will depend upon which method of rectification is being utilised with the valve in question. This brings us to another important point, viz., the fact that a valve will rectify signals in a manner other than the usual grid leak and condenser method. People get so accustomed to specifying the usual .0003 and 2 megohms that the other method known as anode current or bottom bend rectification seems forced into the background.

Anode Current Rectification

Readers of our journals will have noticed, however, that recently there have been receivers described which employ this principle. To quote one or two cases we have "A Set for Valve Rectification Experiments," by Mr. A. V. D. Hort in the March issue of MODERN WIRELESS, where the results of some qualitative tests were given for both methods, the "Remarkable Five-Valve Receiver," by the Radio Press Laboratories in the April number of the same journal, and again "A Single Control Four-Valve Receiver," by Mr. A. Johnson-Randall in the May issue of MODERN WIRELESS.

What Happens

Let us consider for a moment what happens when an incoming signal is brought on to the input terminals of the rectifier. Taking the case of the crystal first, we will assume the characteristic takes the form A B C of Fig. 2. A voltage cycle will cause a current change similar to that shown on the right of the figure, and we have a greater increase of current than decrease, so the average effect is to produce a current in the output circuit which fluctuates or alternates

at an acoustic frequency, and produces the desired sound of speech or music.

Type of Circuit Used

Anode current rectification works on almost an identical principle, and here advantage is taken of the bend in the anode current/grid voltage

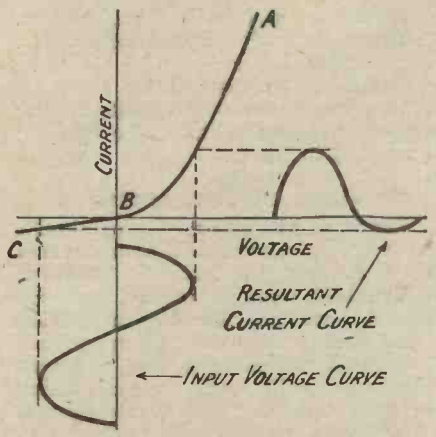


Fig. 2.—In this figure A B C represents the characteristic curve of the crystal, while the other curves represent the input voltage variation and the current change it causes.

characteristic (the bottom bend being most generally used) so that the average effect in the anode circuit is an audio-frequency change which affects the telephones or loud-speaker.

The usual type of circuit for a valve connected to function with anode current rectification is shown in Fig. 3.

A negative bias is given to the grid of the valve through a small tapped dry battery, fine variations being made possible with the aid of the potentiometer across the low-tension supply. The value of this bias will naturally depend on the magnitudes of the filament and high-tension voltages utilised for the valve, but it is always arranged for the steady condition to be such that no grid current flows.

Leaky Condenser Rectification

With the familiar grid leak and condenser method of rectification (sometimes called cumulative grid or grid-current) the steady potential or voltage on the grid is adjusted by means of the particular grid leak employed.

The incoming signals are brought on to the grid, and the shape of the resultant current curve in the anode circuit will depend upon the values of the grid leak and condenser. Now, it is possible to so adjust the values of the grid leak and condenser that no distortion will be produced for a given audio frequency, but for all other frequencies exact reproduction of the signal will not take place.

Distortion in Other Places

If that is the case, why do we find this method still being employed? The answer to this question lies in the fact that the other pieces of apparatus associated with the circuit, such as transformers, loud-speakers, etc., produce distortion in themselves, and thus the contribution made by the grid leak and condenser rectification method is reduced to a relatively small proportion of the whole.

Are There Drawbacks?

Returning once again to our anode current rectification, what objections can be found to the system? Well, the characteristic at the bottom bend portion is not sufficiently sharp and steep to give loud signals unless the input voltage is comparatively large. This means that one must be near to a main broadcasting station, or add stages of high-frequency amplification to produce the desired effect on the more distant stations.

Soft valves, i.e., valves with a certain percentage of gas present, fulfil the necessary stipulations as far as the characteristic is concerned, but the gas is very susceptible to changes of pressure and temperature, and consequently their action is prone to irregularities.

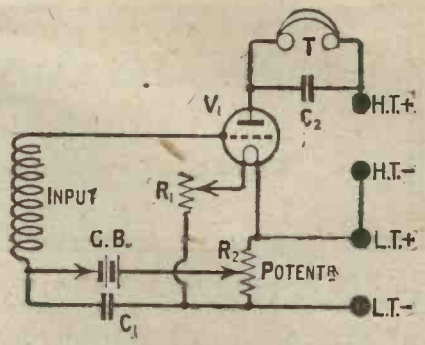
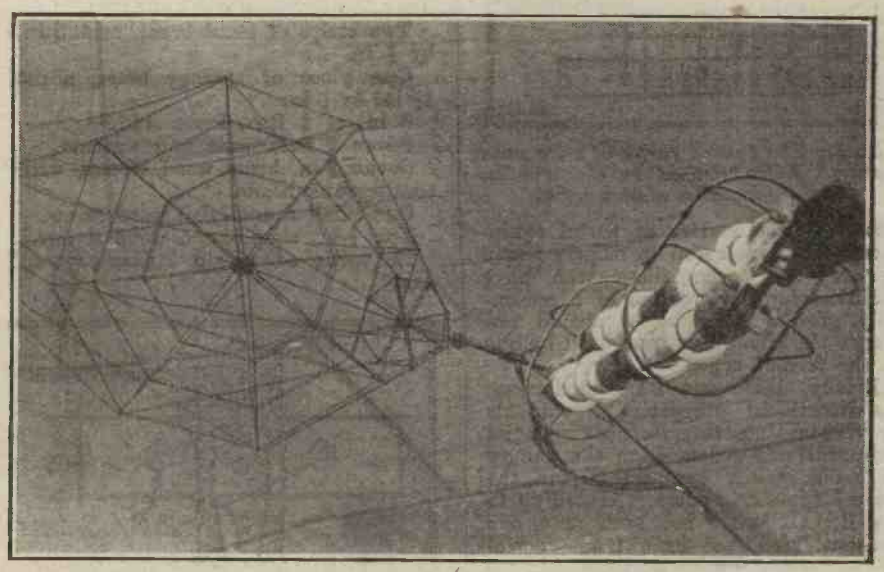


Fig. 3.—An anode current rectification circuit. The battery G.B. gives a negative bias to the grid of V1.

Which is the Best?

Taking all these facts into consideration, I feel forced to the conclusion that for the distortionless reproduction of speech and music the crystal detector is the best. No amplification is at present practicable as far as the crystal itself is concerned, such as we have with the case of the valve, but provided careful adjustment of the catswhisker on the crystal surface is made (or regarding this as an objection a resort is made to permanent or semi-permanent forms) and the limitations mentioned at the beginning of this article are allowed for, then the palm must be awarded to the humble crystal.



A view from the top of one of the masts at the Rugby Wireless Station, showing the insulators and one end of the cage aerial.

The Damping Effect

On the other hand, whereas with the cumulative grid method damping is introduced since grid current flows, with the other type of rectification the negative bias given to the grid is sufficient to prevent this damping action. The same damping effect is present in a more marked degree with the crystal, but this objection can be minimised by arranging suitable tappings on the input coil—methods which will be familiar to readers of THE WIRELESS CONSTRUCTOR.

Your Opinion Welcomed

Following this we have the valve used as an anode current rectifier with the reservation that the input to this valve must be large, while last in order of merit is the grid leak and condenser. Any comment that readers may like to make in view of their own experiences will be welcomed by the Editor.

HOW TO MAKE A FOLDING FRAME AERIAL

By PHILIP H. WOOD, B.Sc. (Hons.), F.P.S.L.

The efficient frame aerial described below costs only seven shillings to make and is so constructed that it will fold into a very small compass.

FRAME aerials do not seem to have achieved any great degree of popularity in this country, but the increasing employment of supersonic heterodyne receivers has brought them into greater prominence of late. Furthermore, it has been established that even a crystal set can be made to give good results in conjunction with a frame aerial, and a receiver designed expressly for that purpose was described in the April 24 issue of *Wireless* (Vol. 3, No. 8).

The Frame's Advantages

Some listeners, through the limitations imposed by the apartments in which they dwell, have little or no

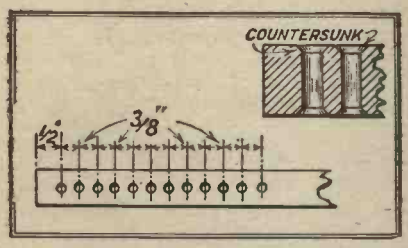


Fig. 1.—The twelve turns of wire pass through holes drilled in the wooden arms spaced as shown here.

choice in the matter of aerial equipment, and are forced to employ frame aerials; but even those who have facilities for the erection of a reasonably good outdoor aerial should not forget the advantages possessed by one of the former type.

Briefly, these are its compactness, its directional properties (invaluable in eliminating interference) and its comparative freedom from the danger of being struck by lightning in the stormy summer months. According to the B.B.C., there has been only one authenticated case of a frame aerial being struck by lightning, whereas numerous outdoor aerials have suffered damage from that cause, as many as half a dozen being torn down by a single lightning discharge during a recent storm in North London.

Popular Prejudice

There is no doubt that many listeners are prejudiced against the use of a frame aerial on account of its unwieldiness, but if one of folding type is employed, the frame can be made to collapse into a very small compass when not in use—a point of great importance when travelling, especially in regard to portable sets.

Good quality folding frame aerials are, however, fairly expensive accessories to purchase, and in this article I propose to give constructional details of a collapsible frame aerial which is both inexpensive and easy to construct. Just one word of warning: although the constructional work involved is not difficult, it will take a fair amount of time; personally, it took me over six hours of actual working time to complete the instrument.

Materials Required

It will be most convenient to give first of all a list of the components and materials required for making an exact copy of the aerial shown in the photographs. You will need:—

Two 3-ft. lengths and one 1-ft. 6-in. length of well-seasoned hardwood, ¾ in. square. (Hobbies, Ltd.)

One *strong* brass hinge, ¾ in. across.

One 4 B.A. screw, 1 in. long, with nut and washer. This screw should have a countersunk head and be of brass.

Two strips of stout brass, each 3 in. by ¾ in.

One piece of springy brass, about 1½ in. by ½ in.

6 in. of 2 B.A. brass studding.

Seven 2 B.A. nuts and washers.

Seven ⅝-in. brass wood screws, with countersunk heads.

One small round-head wood screw.

Two ⅞-in. round-head wood screws.

30 yards of single rubber-covered flex.

Ebonite strip, 5 in. by 1 in. by ⅛ in.

Three "Clix" plugs and sockets. (Autoveyors, Ltd.)

One 3-in. condenser dial.

Two small pieces of ebonite tubing or other material to make spacing washers ⅜ in. thick.

Notes on Components

The wood will probably be obtainable from any cabinet-maker's or from a shop dealing in fretwork supplies. Cheap soft wood is useless, but you should have no difficulty in getting good quality material, ready planed, for about twopence a foot, so that the wood will cost you something between a shilling and eighteenpence.

You will notice that I have emphasised that the metal fittings should be of brass, the reason being that the presence of any magnetic material, *i.e.*, iron or steel, in the immediate vicinity of the windings might cause a loss in efficiency and other undesirable effects.

Preparing the Wood

Now for the carpentry. The two side arms are each 17 in. long, and can be cut from one of the 3-ft. lengths of wood, leaving a couple of inches over, of course. Smooth the cut surfaces with glasspaper, and with a coarse file slightly bevel the edges of what will be the outside ends of each arm.

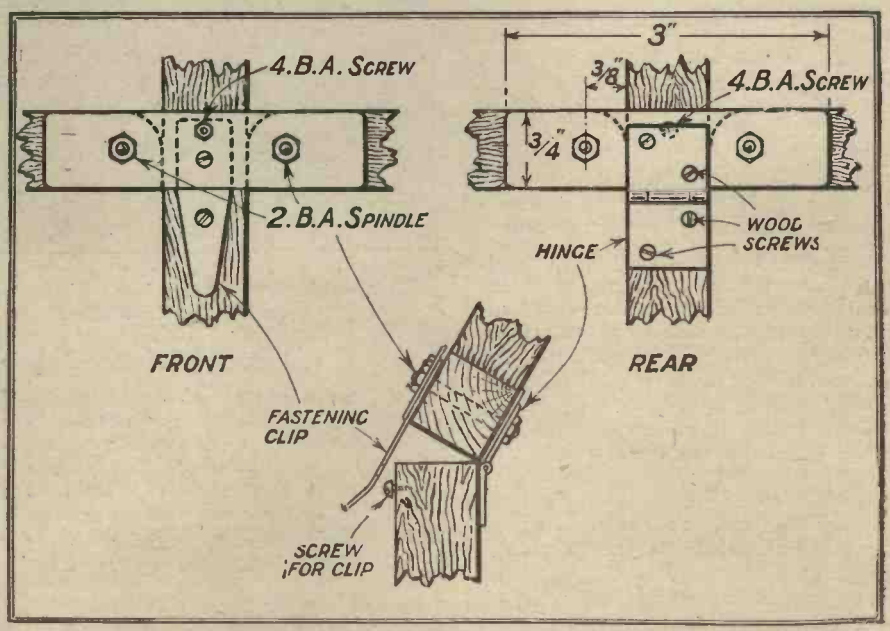


Fig. 2.—Brass plates are used as bearings and guides for the swivelling side arms, while a hinge allows the whole top structure to fold downwards.

Measuring from these outside ends, make a row of twelve marks along the centre line of the top surface of each arm, starting ½ in. from the end, the marks to be ⅜ in. apart. At each point drill a hole right through the wood of sufficient diameter just to accommodate the flex you intend to use. With a countersinking bit open out the start of each hole on the top surface of the wood and the corresponding point on the under-surface, as shown in Fig. 1.

It is important that the holes should go perpendicularly through the wood, so that the row of holes has the same appearance when viewed from either surface of the material.

Shaping the Arms

Next deal with the "inner" ends of the arms—*i.e.*, the ends which will be fixed to the centre post of the frame. The upper portion of each end must be rounded off to the shape of a quadrant, as indicated by the dotted lines seen in the two upper sketches in Fig. 2. This rounding-off process is to allow the arms to be folded against the centre post when the completed aerial is not in use.

Holes for Spindles

When this is done, drill a 2 B.A. clearance hole through the inner end of each arm, from back to front, to take the spindles, as shown in Fig. 2. This hole is, of course, midway between and parallel to the upper and lower surfaces of the arm, and its centre should be a tiny fraction of an inch less than ⅜ in. from the end.

Finish off the arms where necessary with fine glasspaper, and put them aside for the time being. Now the central upright post can be dealt with. This is made in two sections, one 17⅜ in. long and the other 18⅝ in.—just 3 ft. altogether.

The Top Section

The top section is the shorter, and its upper end must be drilled with twelve holes in exactly the same manner as the side arms. The lower section, which is 18⅝ in. in length, is drilled from side to side with *thirteen* clearance holes ⅜ in. apart, the first hole being 12 in. from the upper end of the section. This will leave you with a clear space of about 2 in. to form a supporting leg for the frame. A hole should be drilled from the front surface of the wood to intersect with the eighth side-to-side hole, counting from the top, as in Fig. 3 (c).

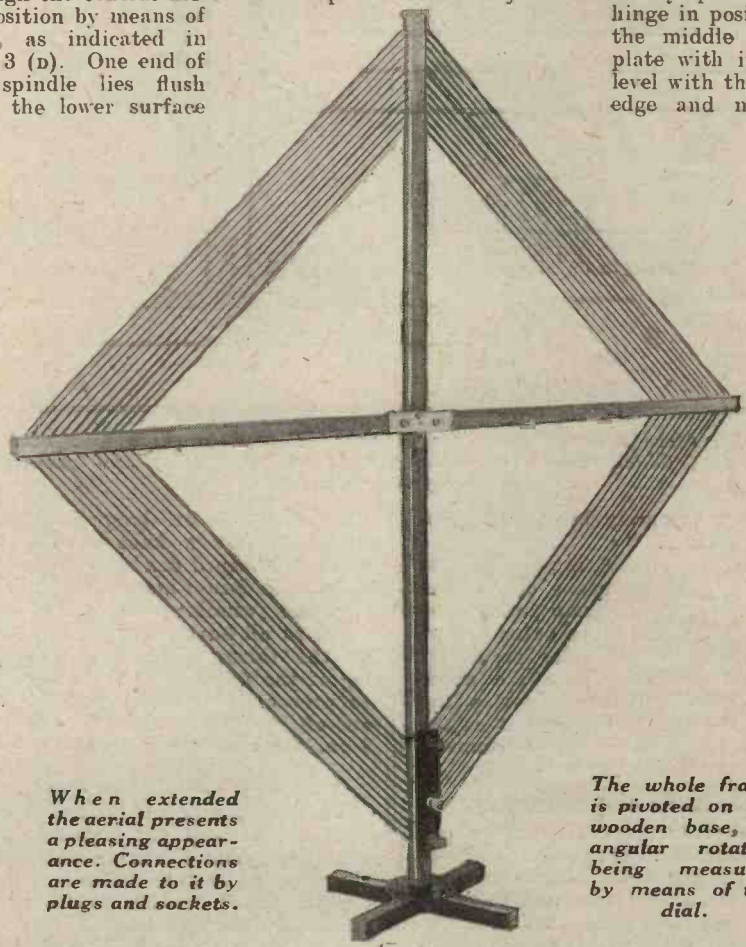
Finishing Off

The lower end of this length of wood must next be drilled to take the 2 B.A. spindle upon which the whole frame turns, a hole being drilled centrally up through the end to a depth of about 2 in. When these operations are finished the wood may be varnished or waxed, if desired, to improve its appearance.

The Base

The construction of the base presents little difficulty. Two 9-in. lengths of the ¾-in. square wood are required. These are grooved at the centres and put together to form a cross, being also drilled to take the 2 B.A. spindle, as indicated in Fig. 3 (A). The holes are reamed out or drilled larger for a portion of their depth to accommodate the clamping nuts.

To complete the base the two pieces are put together with a cross-halving joint, as stated above, and a piece of 2 B.A. studding 2¾ in. long passed through the central holes and clamped in position by means of nuts, as indicated in Fig. 3 (D). One end of the spindle lies flush with the lower surface of the cross, while the other projects for 2 in., and thus forms a spike, which slips into the hole prepared for the purpose in the lower end of the centre post of the frame.



When extended the aerial presents a pleasing appearance. Connections are made to it by plugs and sockets.

The whole frame is pivoted on the wooden base, its angular rotation being measured by means of the dial.

Bearing Plates

Two brass plates form the bearings for the spindles which support the two side arms of the aerial. These are 3 in. by ⅝ in., and each must be drilled with two 2 B.A. clearance holes to take the spindles, which are made of pieces of 2 B.A. studding 1⅛ in. long. These holes must be ⅜ in. (half the thickness of the wooden arms) away from the centre post, which is ¾ in. thick; therefore it is obvious that they are placed ¾ in. in from the ends of the brass plates (see Fig. 2).

Other Holes Required

A 4 B.A. clearance hole is needed in the middle of each plate near the top edge, that in the back plate being countersunk to take the head of a 4 B.A. screw, while Fig. 2 also shows that a second hole is required in the front plate about ¼ in. below the other. This is to take a woodscrew, which assists in the fixing of this plate.

Two additional holes are needed in the back plate, these being for the screws which fix both this plate and the hinge. The positions of these holes may be found by placing the hinge in position in the middle of the plate with its back level with the lower edge and marking with a punch the places where the holes come (see Fig. 2, rear view).

Fastening Clip

The fastening clip is to be fixed under the front plate and is drilled with two holes in the same relative positions as those in the front plate, and a third hole in its lower half for clipping over a small wood screw, which will be inserted in the lower portion of the centre post.

You can now fix the plates, hinge and clip in position, as shown in Fig. 2, a 4 B.A. tapping hole being previously drilled through the lower end of the upper portion of the centre post to take the 4 B.A. fastening screw. The lower edges of the plates must be level with the end of the

wooden post and be disposed symmetrically about the latter.

Mounting the Plates

First pass the 4 B.A. screw through the back plate (making sure its head lies snugly in the countersunk hole) and screw it through the hole drilled in the wooden post. Slip first the clip and then the front plate over the end which protrudes through the wood and clamp them securely by means of a nut and washer.

Next complete the fixing of the front plate and clip by means of a wood screw. The hinge can now be fastened over the back plate, the fixing screws passing through the holes previously drilled in the latter into the wood. The hinge will probably overlap the head of the 4 B.A. screw, but as the latter is lying flush in its countersunk hole, no difficulty arises.

Completing the Assembly

The lower flange of the hinge can now be screwed to the top of the lower post, and the side arms inserted between the side plates and fastened in position by the 2 B.A. spindles and nuts. See that the arms can be raised and lowered with ease and that the hinge is working properly.

Winding Process

Assuming that the frame folds up properly and is mechanically satisfactory, the winding process may be commenced. First see that the flex is completely free from tangles, and place the frame with its arms extended flat on a table, with the "front" upwards.

Thread one end of the flex through the highest hole in the lower centre leg from right to left and tie a knot in it about 4 in. from the end. Now take the free end of the flex and pull it through the "inside" hole of the right-hand arm, and so on, continuing the windings in an anti-clockwise manner until seven complete turns have been put on.

The Tapping Point

The seventh turn will finish at the eighth hole in the lower leg, counting from the top, and this is the hole which is pierced by an additional opening from the front. Pull the flex through this opening with the aid of a wire hook until you have a double loop about 3 in. long for tapping purposes. Tie a knot at the point where the looped flex emerges from the front hole (see Fig. 3 (c)), and then continue winding until the twelve turns in all have been put on, ending at the thirteenth hole in the lower leg of the frame. Knot the flex here to prevent it from slipping back and cut off the excess, after leaving about 4 in. for connecting purposes.

Taking up the Slack

Keeping the frame quite rigid, get a friend to help you tighten up the windings. You will have to start from the tapping point, working inwards for the seven smaller turns put on first and outwards for the remaining five turns. Readjust the knots at the ends to take up any slack you have managed to pull through.

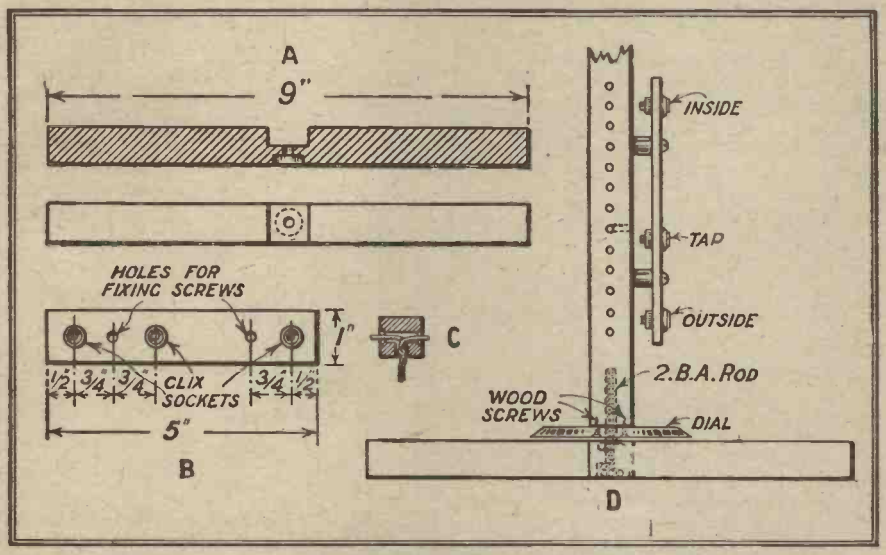


Fig. 3.—More constructional details are indicated in these four scale drawings, which show the base, socket strip, tapping and general assembly respectively.

Sockets for Connections

A strip of ebonite 5 in. by 1 in. is used for mounting the Clix sockets, which are employed for connecting purposes. The ebonite is drilled as in Fig. 3 (B), two small holes being wanted for the round-head wood screws used for fixing, while three larger holes are made for the sockets. The latter may now be fitted with coloured bushes, pushed into the holes and fastened in position with the milled nuts supplied with them.

This strip is mounted as shown in Fig. 3 (D), short lengths of ebonite tube being used as washers to hold it away from the wood. The tapping connection and end leads are cut to the required length, bared at their ends and soldered to the Clix sockets, care being taken that both strands of the double tapping lead are securely soldered to the middle socket.

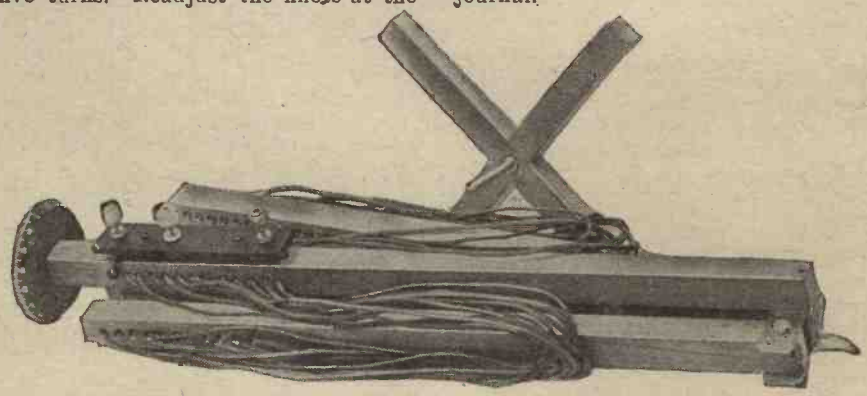
Indicating Dial

Finally, a condenser dial is fastened by two screws to the lower end of the centre leg to form both a firm bearing and an indicator. The central hole of this dial must be in line with the hole in the leg which is to accommodate the spindle, and should be reamed out so that the latter slides through it easily.

How It Folds

On releasing the fastening clip of the frame, the upper portion falls back, while the arms fold in to lie parallel with it. When completely collapsed, all four arms lie together, as seen in the photograph, forming a compact bundle only about 19 in. long by 4 in. diameter, with the base removed. The base is quite small, but even that can be pulled to pieces in a few seconds if desired.

The tapping provided is approximately at the electrical centre of the aerial and may prove useful in certain circumstances. Next month it is hoped that an article on the use of frame aerials will appear in this journal.



This photograph shows how the frame appears when folded. The total weight is only 1¾ pounds.

SLIDING CONTACTS FOR CRYSTAL SETS

By H. BRAMFORD.

These simple sliders can be used in conjunction with a suitable coil for a variety of purposes.

OF all the types of tuning arrangements available for use in conjunction with the crystal receiver, few can surpass the principle of a sliding contact upon an inductance coil for both efficiency and simplicity.

This article describes how to make a simple type of slider which is easy to construct and entails little or no work, and how to employ it in a set.

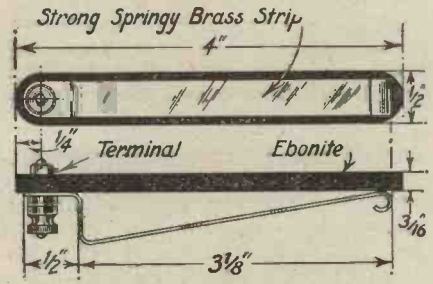


Fig. 1.—Details and dimensions of the slider. The ebonite strip should be as light as possible to avoid undue strain on the brass contact.

First consider the construction of the slider itself, which is simple in design and may be made for a few pence. In order to adapt the idea in a number of ways, it is good scheme while occupied in the construction to make, say, three or four of these sliders at the same time.

Material

The only material which will be necessary for the making of one slider is as follows:—

A strip of ebonite, 4 in. long by ½ in. wide by 1/16 in. thick.

Some fairly strong, springy strip brass, ⅜ in. wide.

One 4 B.A. terminal, complete with nuts and washers.

Construction of Slider

The details relating to the actual construction of one of these sliders are clearly shown in the diagram, Fig. 1, together with all the necessary dimensions. Little need be said in relation to this part of the work, with the exception of the fact that it will be seen from the drawing that the springy brass strip, having been cut and bent to the shape indicated and drilled with a 4 B.A. clearance hole, is finally secured to the ebonite piece by means of the terminal.

Practical Use

Fig. 2 shows how one of these sliders would be used upon an inductance wound upon an ordinary cylindrical former. The winding upon this former may be of closely wound enamelled or cotton-covered wire of any desirable gauge, the covering of the wire being partly removed by the simple process of scraping along the line of the path taken by the slider. The number of turns of wire upon such a coil will, of course, be in accordance with the purpose for which such a coil is intended.

The actual coil used consisted of 50 turns of No. 22 S.W.G. enamelled wire, closely wound on a stout cardboard former measuring 3 in. in length by 3 in. in external diameter.

Various Adaptations

Fig. 3 shows a theoretical circuit diagram which suggests a simple method by which two of these sliders may be employed. First prepare an inductance coil somewhat on the lines described. Bare the wire on opposite sides of this coil along the path taken by each of the sliders. Provide two terminals upon the actual former, one connected to the beginning of the winding upon the former, X, and the other, Y, to the end of the winding.

A Tapped-Coil Receiver

It is now a simple matter to construct an efficient receiver, by incorporating in addition to these items a variable condenser, a crystal detector, a baseboard, and two telephone terminals. Construction or arrangement may be left to the ingenuity of the reader. The connections would be as follows: Connect the variable condenser to the two terminals upon the coil former, as shown in the circuit. The moving vane connection should be taken to the terminal which is connected to earth. Connection is then made from the terminal upon the slider S_2 to one side of the crystal detector, the other side of the detector going to the telephones and thence to earth. The aerial is then connected direct to the terminal of the slider S_1.

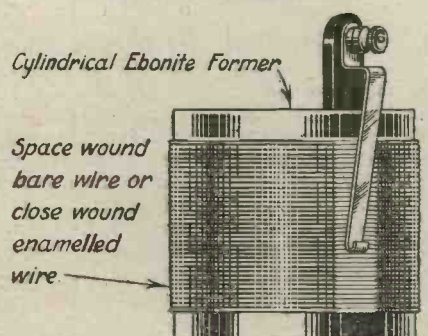


Fig. 2.—A slider in use on an ordinary solenoid coil. The turns are bared along the path taken by the contact arm.

Thus, by the use of these simple sliders, one may construct an efficient crystal receiver which gives excellent results in practice. There are, of course, various other ways of adapting these sliders to any given circuit, and as has been suggested, one, two, or three sliders may be used.

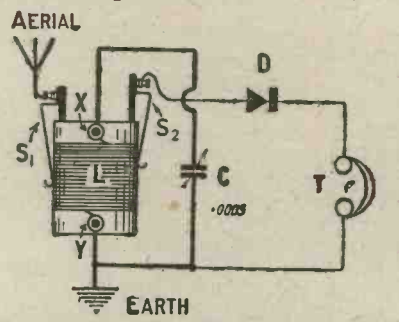


Fig. 3.—A suggested use of two sliders in a simple crystal circuit for taking crystal and aerial tappings.

A 13-YEAR-OLD CONSTRUCTOR AND HIS "TWIN-VALVE" RECEIVER

SIR,—I am writing this letter to thank Mr. Scott-Taggart for his excellent circuit in the "Twin-Valve Receiver" (Radio Press Envelope No. 10). For the last six months I have been looking for a really good two-valver, and this is the best I have ever come across, especially as I am using a very poor aerial. The set, although only roughly wired, is very stable and fairly selective. 5IT, the local station, comes in at excellent loud-speaker strength, quite as loud as, and much clearer than, some three-valve sets I have heard and made. On the first night it was made Radio-Toulouse came in at good 'phone strength, as well as many other Continental stations which I did not wait to identify. I have also had several English stations, including London, Nottingham, Manchester, and Leeds—Bradford, at excellent 'phone strength. I am only 13½ years of age, and think this is very good under the aforesaid conditions. I close by wishing your publications (of which I am a regular reader) every success.

Yours faithfully,

Birmingham. V. E. CLIFT.

MAKING USE OF H.F. CHOKES

Some notes on the construction and employment of high-frequency chokes and the principles involved.

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

MODERN design shows an increasing tendency towards the use of high-frequency chokes in various portions of an amplifying circuit. It is proposed in this article to discuss some of the applications of the principle, and also the reasons for the effects which are obtained. First of all, therefore, let us have a definition of a high-frequency choke.

What is a Choke?

Strictly speaking, a choke coil is an inductance of such a value that it offers a very high impedance or choking action to a current flowing through it. It is well known that a coil of wire will have little effect on an ordinary steady current, beyond that which is due to the resistance of the wire itself.

If the current flowing is varied in any way, however, then the magnetic field of the coil has also to be varied, and any such attempt is strongly resisted by the coil, which much prefers to remain in a state of equilibrium. The ultimate effect, therefore, is that

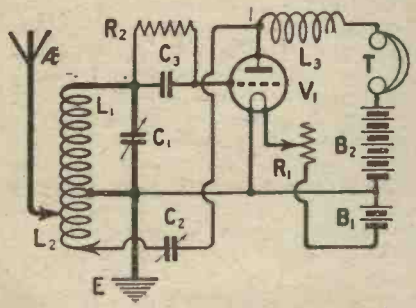


Fig. 1.—In the Reinartz method of reaction control a choke L3 is used to stop the H.F. currents from passing through the telephones.

the coil tends to damp out any variation of current, and the more rapid the variation the greater will be the damping out or choking effect.

Stopping the H.F. Currents

If we have a circuit carrying a wireless current, which is varying at an extremely rapid rate, then the effect of placing a choke coil in the circuit will be practically to prevent the flow of any high-frequency current in the circuit. We shall see later how to design a coil which gives the best results in practice, but if the choke is reasonably efficient, then the amount of high-frequency current which is allowed to pass is very small indeed.

The Reinartz Arrangement

One of the earliest circuits making use of a choking action of this kind was the original Reinartz arrangement. A circuit of this type is shown in Fig. 1. Here we have varying voltages applied across the grid and filament of the valve, and these cause amplified currents to flow in the anode circuit. Now the anode circuit contains two branches. One of these is through the choke coil L_3, the telephones, and the high-tension battery, while the other is through the condenser C_2 and the coil L_2.

Condenser Control

Now the choke coil, as we have just seen, acts as a barrier to the high-frequency currents, so that the only alternative path is through the condenser C_2 and the coil L_2. This coil is coupled to the coil L_1 in the grid circuit of the valve in such a manner as to cause reaction, and the extent of this reaction can be controlled by varying the value of the condenser C_2. If this condenser is made very small, then only a small proportion of the high-frequency current can force its way through the condenser, whereas as we increase the value, so more and more high-frequency current flows round the circuit, and the reaction effect is increased.

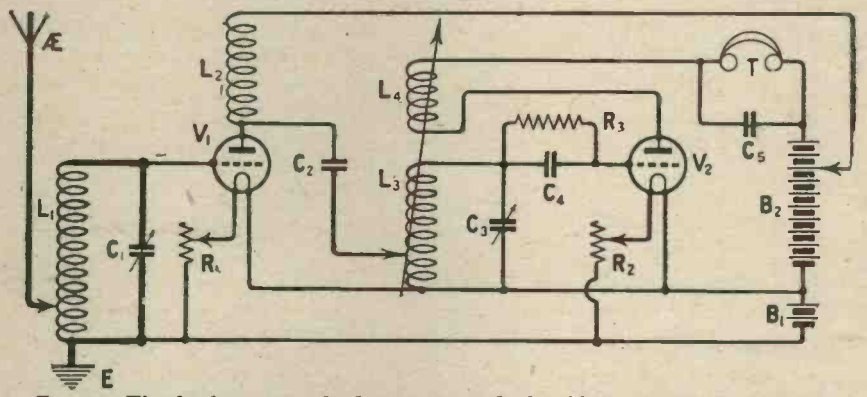


Fig. 2.—The high-tension feed current and the H.F. oscillating current are completely separated by the choke L2 in this arrangement.

Effect on L.F. Currents

The low-frequency currents, on the other hand, find the impedance of the condenser C_2 distinctly higher than that of the alternative path through the choke coil and the telephones. The choke coil in this case is so designed that it only exercises an appreciable choking effect on the high-frequency currents, leaving the low-frequency telephone currents practically unaffected.

The original Reinartz circuit omitted the choke L_3, and relied upon the telephone windings to produce a choking effect. It was recommended that the primary of a low-frequency transformer or some other such device should be inserted in series with the telephones to act as an additional barrier to the high-frequency currents. When the action of the circuit was better understood, however, it was realised that the provision of the high-frequency choke such as is shown in Figure 1 was a better and more scientific solution of the problem.

A Definite Separation

In this circuit, therefore, we have definitely separated the high-frequency and the low-frequency currents. The former flow through the

reaction circuit, and are controlled by the condenser C_2. The low-frequency currents flow through the telephones, finding the impedance of the reaction circuit too high for them. This principle of the separation of the currents is very useful, and may be extended still further.

H.T. Fluctuations

It is sometimes found desirable to keep the high-frequency currents out of the high-tension battery. If the battery has any appreciable internal resistance, then the voltage across the battery will not be steady, but will be subject to small fluctuations in accordance with the high-frequency currents flowing through the batteries, and this will sometimes produce sufficient reaction effect in the receiver to cause it to howl.

The circuit shown in Figure 2 is one in which the high-frequency currents have been kept out of the high-tension battery by using a choke coil. The currents in the anode circuit of the valve V_1 are prevented from flowing through the high-tension battery by the choke coil L_2, so that they take the alternative path through the condenser C_2 and the tapped portion of the coil L_3. The high-frequency energy is thus handed on to the tuned circuit L_3 C_3, which is connected across the grid and filament of the valve V_2, while the high-tension supply to the valve V_1 is obtained through the choke coil L_2.

Improved Selectivity

Here again we have a complete separation of the high-tension feed current and the high-frequency oscillating current, and this very often gives a marked improvement both in the selectivity and the stability of the particular receiver. In the case shown the condenser C_4, with a suitable leak connected across it, is inserted in the grid lead of the valve V_2 in order to effect rectification, while the reaction coil L_4 in the anode circuit of V_2 is coupled to L_3 to produce reaction to the desired extent.

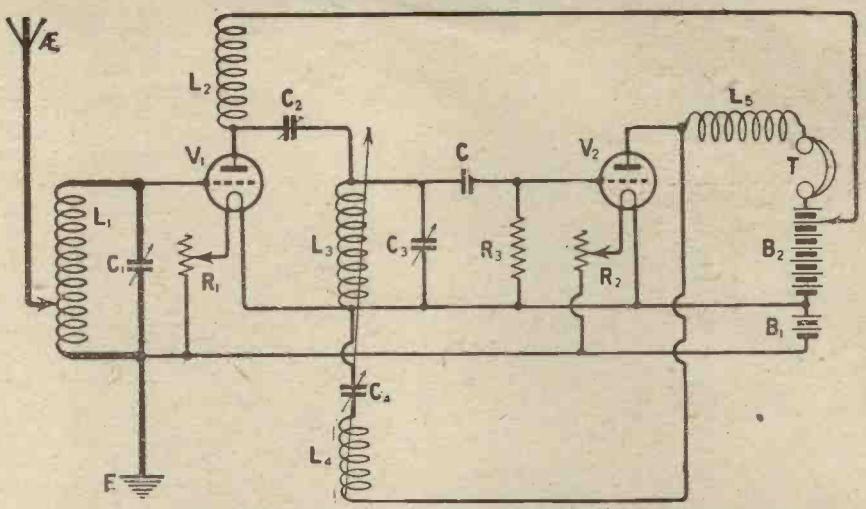


Fig. 3.—If the condenser C2 has only a small capacity self-oscillation can be kept in check very easily.

Checking Self-Oscillation

Although this circuit will eliminate the tendency to oscillate due to any resistance in the high-tension battery lead, it does not overcome any difficulty due to the fact that both the grid and arc anode circuits of the valve V_1 are tuned. Self-oscillation, therefore, due to this cause is checked by connecting the anode tap from the valve V_1 across only a small portion of the coil L_3. The condenser C_2 should be fairly large, say .01, and by a method of trial and error a suitable tapping on the coil L_3 can readily be found. The coil should be tapped every few turns up to about one-third of the whole.

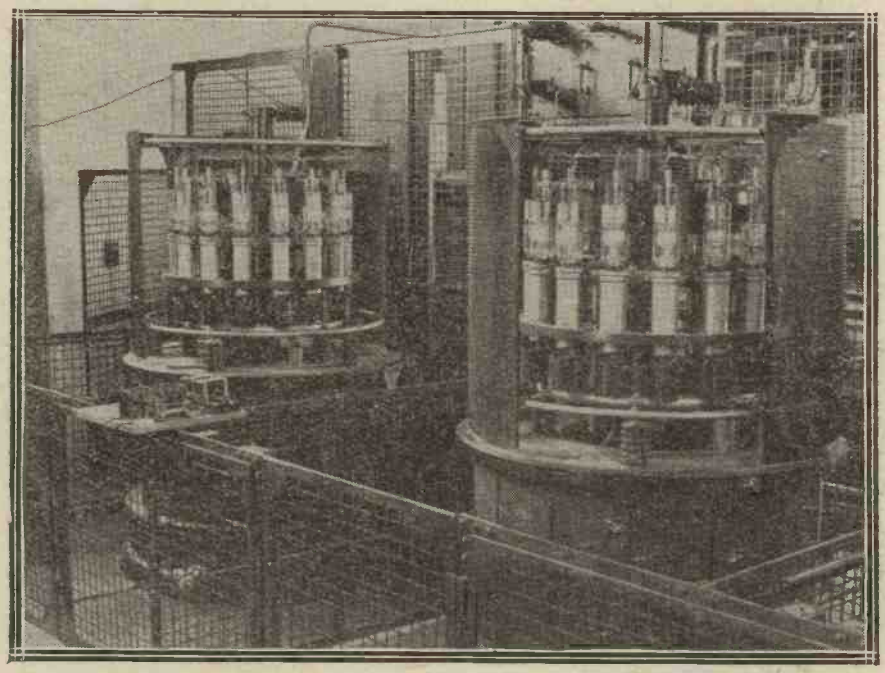
Another Circuit

Another method employing a somewhat similar arrangement is that shown in Figure 3. Here, as before, the high-frequency currents are kept away from the high-tension battery by means of the choke coil L_2, and the high-frequency energy is therefore handed on to the next valve through the condenser C_2. In this case, however, the condenser C_2 is connected to the top end of the coil L_3, but the condenser itself is very considerably smaller and is also variable. It will be found that if this condenser is made very small any tendency to self-oscillation may easily be kept in check, while selectivity can be considerably improved by an arrangement such as this.

Actually the condenser C_2 can conveniently be made as small as .00005, a neutralising condenser serving very well for the purpose. Reaction in this case has been provided by means of a coil L_4 coupled to L_3, the reaction itself being controlled by the condenser C_4, so obtaining a form of Reinartz connection. The choke coil L_5 has therefore been inserted in the anode lead of the valve V_2 in order to prevent the high-frequency current in that circuit from passing through the high-tension battery instead of through the reaction coil.

Utilising Chokes

These are just a few of the various types of circuits which may be employed utilising a high-frequency choke. It is usually found that both selectivity and stability are improved if the high-frequency currents can be confined to a small portion of the circuit only, and are not permitted to flow through the battery leads and



The two third-stage power amplifiers at Rugby. Fifteen valves are used in each.

low-frequency connections in the set. We can now turn our attention to the question of the design of suitable high-frequency chokes. We have seen that in many cases it is desirable that the choke coil shall pass low-frequency currents quite easily, but act as a more or less complete barrier to the high-frequency components.

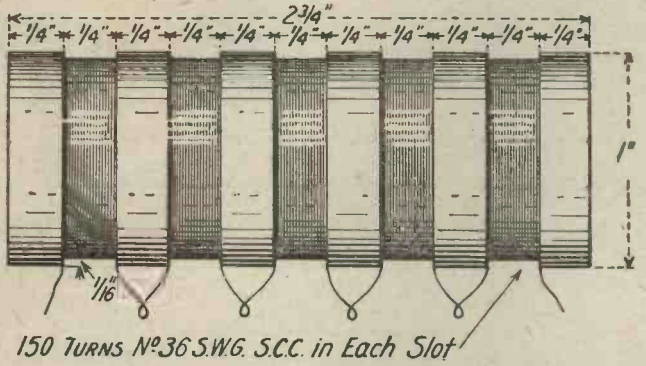


Fig. 4.—Very satisfactory results are obtainable with a tapped choke, and the one shown here is suitable for any of the circuits discussed.

Capacity and Inductance

Now, if we wind a coil of wire, as we increase the number of turns, so we increase the inductance of the coil. The greater the inductance of the coil, other things being equal, the greater will be the choking effect of the arrangement. At first sight, therefore, it would appear that the best type of choke would be one employing as many turns as is possible to obtain in a comparatively small space.

This is not the case, however, because as the number of turns of wire is increased, so the capacity effect between the various turns also increases, and the self-capacity of the whole coil goes up. There is therefore a limit at which the coil and the self-capacity tune to the frequency of the high-frequency current which is flowing in the circuit.

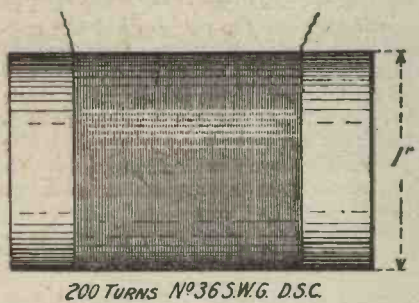


Fig. 5.—For the broadcast band a much more simply constructed choke will suffice.

Effect of Self-Capacity

Now, as is well known, a coil with a condenser in parallel acts as a rejector to any currents flowing, if the coil and condenser are such as to tune to the frequency of the particular current. Thus, if we increase the number of turns on a choke coil until the self-capacity tunes to the frequency of the current, we shall obtain a very efficient choke. Beyond this point the capacity exercises an increasing effect, and the high-frequency current, instead of being damped out by the inductance of the coil, tends to flow through the self-capacity of the windings, so that the choke will be practically short-circuited.

Now it is found in practice that the choke coil still operates in quite an efficient manner even if the coil is somewhat above that which will tune to the particular frequency of the currents to be choked, provided the self-capacity is not too great. It is of considerable convenience if one can arrange that a choke will act efficiently over a wavelength of, say, 300 to 2,000 or 3,000 metres. This can, as a matter of fact, be accomplished in practice by arranging that the choke shall tune with its own self-capacity at a wavelength round about 1,200 to 1,500 metres. For any wavelength above this, therefore, the choke coil behaves as an inductance, and the choking effect is considerable up to 2,000 or 3,000 metres.

Lower Wavelengths

For wavelengths lower than the "natural wavelength" of the choke, the choking effect is somewhat discounted by the increasing tendency for the current to short circuit through the self-capacity as we have just seen. It is found in practice, however, that this short circuiting is not serious until the wavelength becomes comparatively low, so that a choke such as this could be conveniently used on wavelengths as low as 300 metres.

Definitely more efficient chokes could be constructed for the lower wavelengths, but having in mind the convenience of utilising only one instrument for the whole wavelength range, one is prepared to sacrifice a certain amount of efficiency.

Making a Tapped Choke

For the low broadcasting wavelengths of from 300 to 500 metres a choke of a somewhat simpler character could be utilised. In such a case a coil tuning to a wavelength of about 400 metres with its own self-capacity would be eminently satisfactory. The ideal arrangement, of course, is to employ a tapped choke, so that as the longer wavelengths are employed, so the number of turns in the choke can be increased, and the choking effect increased accordingly.

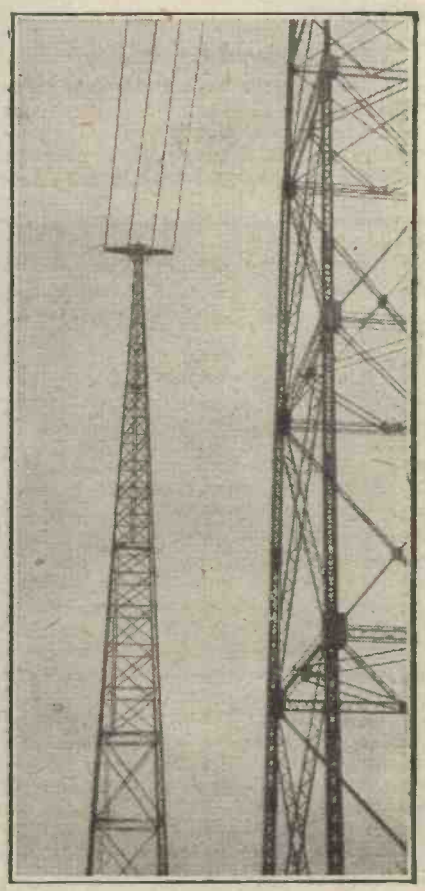
Details of a tapped choke are shown in Fig. 4. The instrument consists of a 1-in. former with five shallow grooves cut therein, ¼ in. wide and 1/16th in. deep. These slots are each filled with 150 turns of 36-gauge wire, either double silk or single cotton covered, the wire being wound on hank fashion. A choke such as this could be satisfactorily used in any of the circuits previously shown.

A Simple Component

Where the circuit, however, is only intended for use on the lower broadcast band, a considerably simpler choke can be made up quite easily by winding 200 turns of 36-gauge d.s.c. or s.c.c. wire on a 1in. former in an ordinary single layer. This choke will be found to give very satisfactory results in any ordinary circuit, and is shown in Fig. 5.

A Two-Valve Circuit

A circuit which is not often used, but which nevertheless can be employed in such circumstances, is that shown in Fig. 6. Here we have a tuned circuit in the grid circuit of the first valve, but the anode circuit, instead of containing a tuned circuit or a transformer, contains simply a tapped choke. The tappings on this choke coil are chosen so that for any particular wavelength band to be received the choking effect is a maximum, and the



The aerial of the Radio-Paris Station, at Clichy.

arrangement then acts in a similar manner to a low-frequency choke-coupled amplifier.

The high-frequency variations of voltage are transferred straight to the grid of the second valve, while the high tension supply is obtained through the choke coil. In this case the tapped choke illustrated in Fig. 4 could very

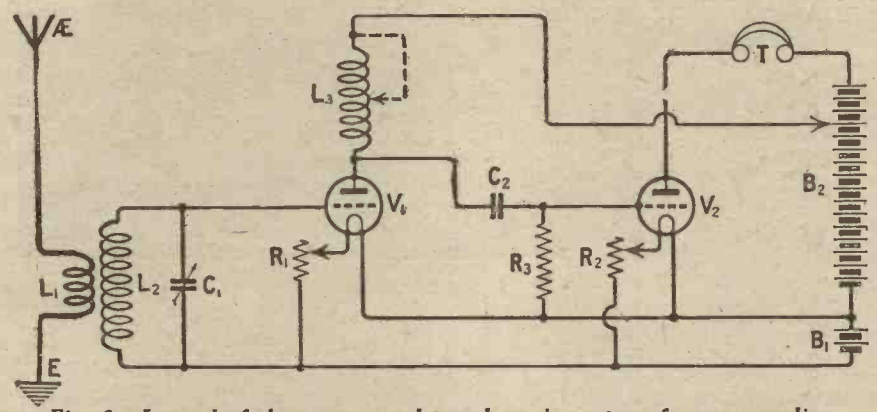


Fig. 6.—Instead of the more usual tuned anode or transformer coupling, a tapped choke is employed in the anode circuit of V1 in this arrangement.

easily be employed, and the tappings could be adjusted by actual trial to give the best results. It would be better in such a case definitely to short circuit the turns not in use rather than just to cut them out, because of the possibility of dead-end effects. The tapping therefore is shown as short circuiting those turns not in use.

Concluding Remarks

These few remarks will indicate briefly the increasing importance of the use of high-frequency chokes. There are many other uses with which it is impossible to deal in this article, but the use of this method of separating the high-frequency and low-frequency currents is one which will give very fascinating results when properly handled.

Those readers who do not wish to make up their own chokes can, of course, obtain very satisfactory articles already on the market, such as those made by Lissen, Success, Metropolitan-Vickers, and the Marconiphone Co., to quote a few only.

CLEANING AND STRIPPING WIRES

By W. H. FULLER

IN spite of its name, wireless makes use of a considerable quantity of wire, and the different sorts used in the construction of even a small receiver are numerous.

Certain of the wires are covered with insulating materials, such as cotton, rubber, enamel and silk, and before connection can be made to such wire this insulation must, of course, be removed.

Do Not Scrape It

The common method of removing the insulation from the wire by scraping with a knife is not advised, as both the knife and the wire may be damaged. The knife edge is blunted by such use, and quite an appreciable amount of copper conductor may be cut away. The best method is to untwist the covering with the fingers until the required amount of wire is bared, when the loose ends may either be cut off with a knife or twisted round the wire out of the way. In the case of double-covered wire, owing to the fact that the layers of insulating material are wound in opposite directions, the ends may be tied securely in many cases.

Razor Blades Useful

Where cotton or silk coverings have to be removed so that tappings can be made, the use of a safety razor blade will be found very convenient. The blade should be kept parallel with the wire, or nearly so, to prevent cutting into the conductor. Any fluff which cannot be cut off may be singed off with a match or lighted taper.

The covering of very small wires may sometimes be drawn back with the fingers to enable enough wire to be bared to make a joint or other connection.

Rubber covering may often be pulled off after a small incision has been made in it, but should this not be possible a slit may be made in the rubber, and the insulation pulled back, when it will be found that the insulation will split easily. This may be continued until enough wire has been bared.

Braided Coverings

The plaited cotton or silk covering known as braid with which some wires are covered, particularly flexible wires, may be stripped by first cutting through the braid with a sharp knife and pulling it off, thus exposing the rubber, which can then be removed by the method mentioned above. Flexible wires must not be bared by dragging a knife through the insulation, as the risk of breaking the fine strands is very great.

London listeners will receive with regret the news that Uncle Caractacus (Capt. Cecil A. Lewis) has decided to desert broadcasting in favour of literary work.

Loud-Speaker Leads

Telephone and loud-speaker cords should be very carefully treated when being bared. Each layer of insulation must be carefully removed until the cotton-protected flex is revealed. Each separate metal strand should then be removed from its cotton support and the whole bunch twisted together and finally soldered.

Enamelled Wire

Enamelled wire, which causes quite a large amount of trouble to some amateurs, may be quite easily cleaned with a small piece of emery paper. Sufficient use should be made of the emery paper just to remove the enamel, as it is quite possible to considerably reduce the gauge of wire by overdoing the operation.

SELECTIVITY WITH A SINGLE VALVE

By JOHN W. BARBER

A selective one-valve receiver employing the condenser method of reaction control.

MANY constructors who desire a set to be really sharp in tuning hesitate before building a receiver, on the score that a set to be really selective must, of necessity, employ several valves and many tuned circuits. That this is most emphatically not the case is proved by the many selective receivers recently produced, among which may be mentioned the writer's "Wavetrap Reinartz Receiver," described in *Wireless Weekly* dated February 3, 1926.

Although this receiver employed three valves, the last two were note-magnifiers, and it is thus possible to dispense with them, when a very selective single-valve receiver will result. With the set referred to it was possible to cut out London at 1½ miles, and to receive Cardiff on the loud-speaker.

Following upon this, the writer described a two-valve receiver in *Wireless*, under the title of "Selectivity," the article appearing in the issue dated February 13, 1926. This set consisted of a detector and one note-magnifier; thus another selective single-valver could be made by dispensing with the second valve.

The Present Design

The receiver with which this article is primarily concerned employs a centre-tapped coil for tuning purposes, this being of the deservedly popular "Dimic" pattern. On reference to the circuit diagram, it will be seen that this coil, the whole of which is tuned by the variable condenser C_1, is connected across anode and grid of the valve V_1, a grid condenser and leak being employed in order that rectification shall take place.

Reaction Control

Interposed between the anode of the valve and the upper end of the tuning circuit is a variable condenser C_2, which controls the reaction effect, the high-tension feed to the valve being made through the telephones and a high-frequency choke coil L_3, this latter being necessary in order to prevent the high-frequency component of the anode current from flowing away to filament through the telephones and high-tension battery, in which case we should not obtain the full reaction effect.

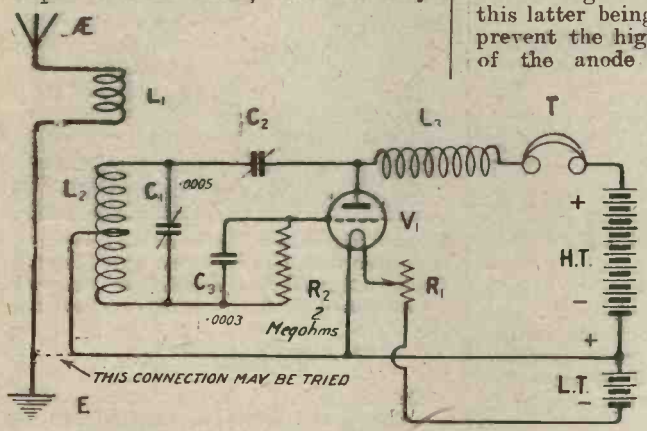


Fig. 1.—After considerable experiment this circuit was found to give best results and is employed in the receiver described.

In order that reaction may be obtained, it is necessary that the high-frequency current should flow through the condenser C_2 back to the grid of the valve, when we have a good control by means of the condenser C_2, which should have a low minimum value, a good neutralising condenser being eminently suitable.

Aerial Coupling

The aerial is coupled to the tuned circuit by means of the coil L_1, which is fixed in its relationship to L_2, and which may conveniently be of the plug-in variety, a single board-mounting coil socket being employed for mounting purposes. No tuning condenser is used in conjunction with this coil, the coupling being what is known nowadays as "tight coupling," the older name being "semi-aperiodic."

The Centre Tap

The centre tapping upon the coil L_2 is taken directly to the positive lead to the valve filament; thus the grid leak may be joined across the condenser. In early experiments with this circuit, the leak was joined across grid and positive filament, but as results seemed to favour the positive connection of the centre tapping, the leak was, in the final form of the set, joined as indicated, this being the simpler manner from the constructional viewpoint.

Components

The following list of components may be taken as comprising those necessary for the construction of this set, the manufacturers' names mentioned being those of the actual parts employed. It may safely be assumed, however, that other pieces of apparatus of equal merit may be substituted for those specified, without detriment to the functioning of the receiver, except such as may hereinafter be mentioned.

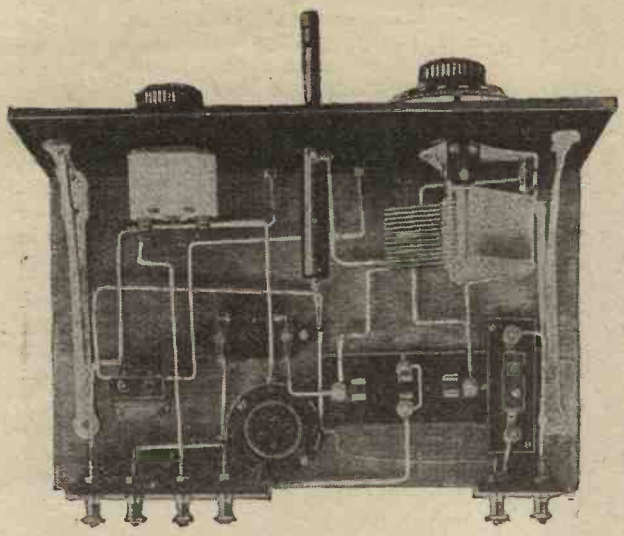
In this connection it should be noted that, should components other than those specified be used, care must be taken to ensure that sufficient room is available for their accommodation upon the panel or baseboard, as otherwise considerable disappointment may result from the fact that a larger panel or baseboard will be required, thus increasing the cost, and incurring some unnecessary delay in the construction of the receiver.

The following will be required:—

One panel of guaranteed, branded ebonite, 12 in. by 6 in. by $\frac{3}{16}$ in.

"Camco" cabinet, baseboard, and brackets (Carrington Manufacturing Co., Ltd.).

One "Utility" slow-motion .0005 square-law variable condenser (Wilkins & Wright, Ltd.).



A view of the baseboard wiring and layout from above.

One No. 1 "Dimic" coil with base (L. McMichael, Ltd.).

One "Antiphonic" valve holder (Burndept Wireless, Ltd.).

One "Neutrovernia" condenser (Gambrell Bros., Ltd.).

One "Atlas" filament control (H. Clarke & Co. (Mcr.), Ltd.).

One "Atlas" .0003 condenser and 2-megohm leak (H. Clarke & Co. (Mcr.), Ltd.).

Two single-coil mounts.

Eight terminals.

Eighteen small wood screws for securing components, brackets, and terminal strips to the baseboard.

One piece of ebonite, 5 in. by 2 in. by ¼ in., for battery terminals.

One piece of ebonite, 2 in. by 2 in. by ¼ in., for aerial and earth terminals.

Four countersunk 6B.A. screws, ½ in long, with nuts and washers, for securing the panel to the brackets.

Glazite for wiring up.

Radio Press panel transfers.

Construction

The first step in the constructional work involved should be the drilling of the panel for securing it to the brackets. This will be a fairly easy matter if the baseboard be laid upon a flat surface, the brackets rested upon it, and the panel held in a vertical position in contact with the front edge of the baseboard. The positions of the necessary holes may then be marked by means of a scriber, after which a drill may be brought into use. Next drill the remaining five holes in the panel, and mount the components thereon, after having secured the panel to the brackets, which should already be screwed to the baseboard.

The Baseboard Components

The coil mounts, valve holder, and grid condenser may then be fastened in position by means of the wood screws mentioned in the foregoing list, care being taken to ensure that the socket for the choke coil L_3 is not displaced relative to L_1, from the relative position shown in Fig. 3 and the photographs. The choke should be at right angles to, and in line with, the centre of L_1 in order that any interaction between these two coils may be reduced to a minimum.

The Terminal Strips

Next comes the construction of the terminal strips. In the case of the larger strip the terminals are spaced 1 in. apart, while two smaller holes are required at about $\frac{3}{16}$ in. from the lower edge of the strip, one near each end, to take the screws which secure the strip to the baseboard. The smaller strip is similar in construction, having instead only two terminals, spaced 1 in. apart. As will be seen, this smaller strip is secured to the left, and the larger to the right, of the baseboard, the set being viewed from the front in this case.

The Question of Fillets

A point in construction arises here which should be mentioned. If the cabinet you obtain has what are called "fillets," that is, strips of wood down each side of the front opening, take care to set in your brackets sufficiently to allow the set to be pushed home into the cabinet. If this point is overlooked, it will either be necessary to remove the fillets or to refix the brackets in a better position, the latter

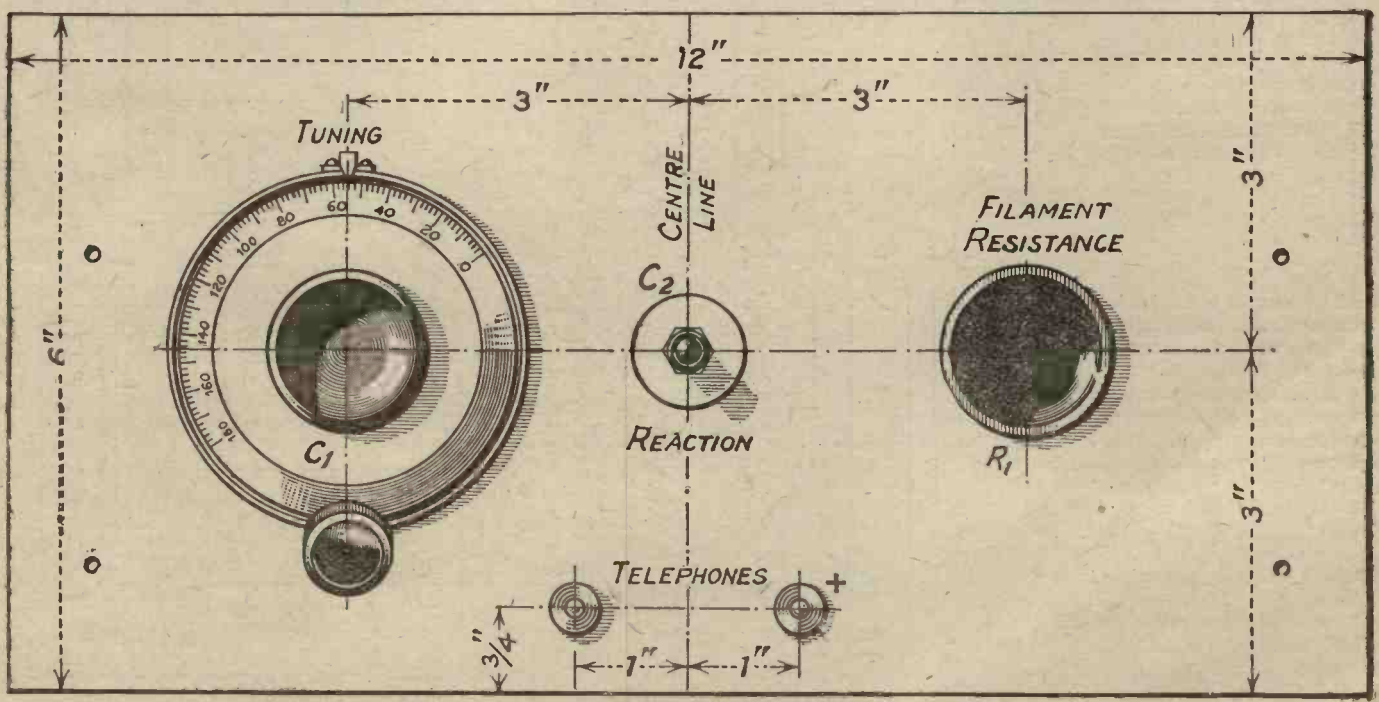
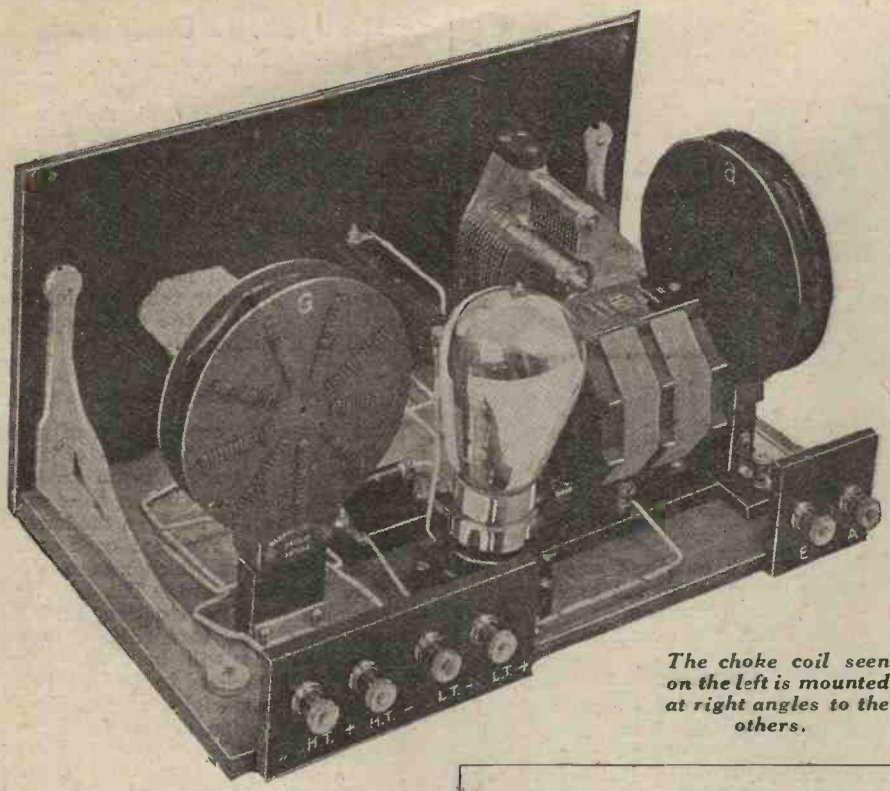


Fig. 2.—How to drill the panel. Blueprint C 1045A.



The choke coil seen on the left is mounted at right angles to the others.

course involving the drilling of fresh holes, thus spoiling the appearance of the receiver.

Wiring Up

Having secured the components and terminal strips in position, the wiring may be commenced. Take first of all the leads from the variable condenser C_1 to the Dimic coil mount, and secure these first, as being the most awkward. The leads from the telephone terminals on the panel to the choke coil mount and H.T. positive terminal respectively should next be affixed, after which the remainder of the wiring is simple and easily carried out. Do not omit to join together the two terminals on the centre contacts of the Dimic coil mount, as otherwise you will be trying to work with the tuning coil broken in the middle!

The Earth Connection

The earth lead is joined, through the appropriate terminal, to one side of the aerial coil mounting, and in my own case I did not find it necessary to join the filament of the valve to earth. Such a connection may be tried, however, and in the event of its proving advantageous or beneficial, may be made permanent.

Coil Sizes

As previously stated, a No. 1 Dimic coil will be required for the broadcast wave band, this coil covering a range of 300 to 600 metres when tuned with a .0005 condenser. A Gambrell "a" coil, or its equivalent in the numbered series, No. 25, may be used in the aerial socket L_1, while for the high-frequency choke a large coil, say No. 250 or larger, should be employed. I use a Gambrell F or G.

The Valve Question

Coming now to the type of valve to be used in this set, I would unhesitatingly recommend the Marconi or Osram D.E.5 B., or equivalent valve in other makes, such as the D.F.A.4 in the Mullard range, as being eminently suitable for this circuit. I have, however, used with success such other valves as the Marconi D.E.2, Cosmos S.P.18, Nelson Multi, and Osram D.E.3B.

Initial Tests

In order to prevent possible damage to the valve by reason of an error in wiring it is advisable to test through before joining up the high-tension battery. This is done as follows:—Join up the accumulator or L.T. battery to the correct terminals, insert the valve, and turn the current on by means of the resistance provided. If the valve lights up correctly, turn it off, connect the accumulator leads across the H.T. terminals, and again

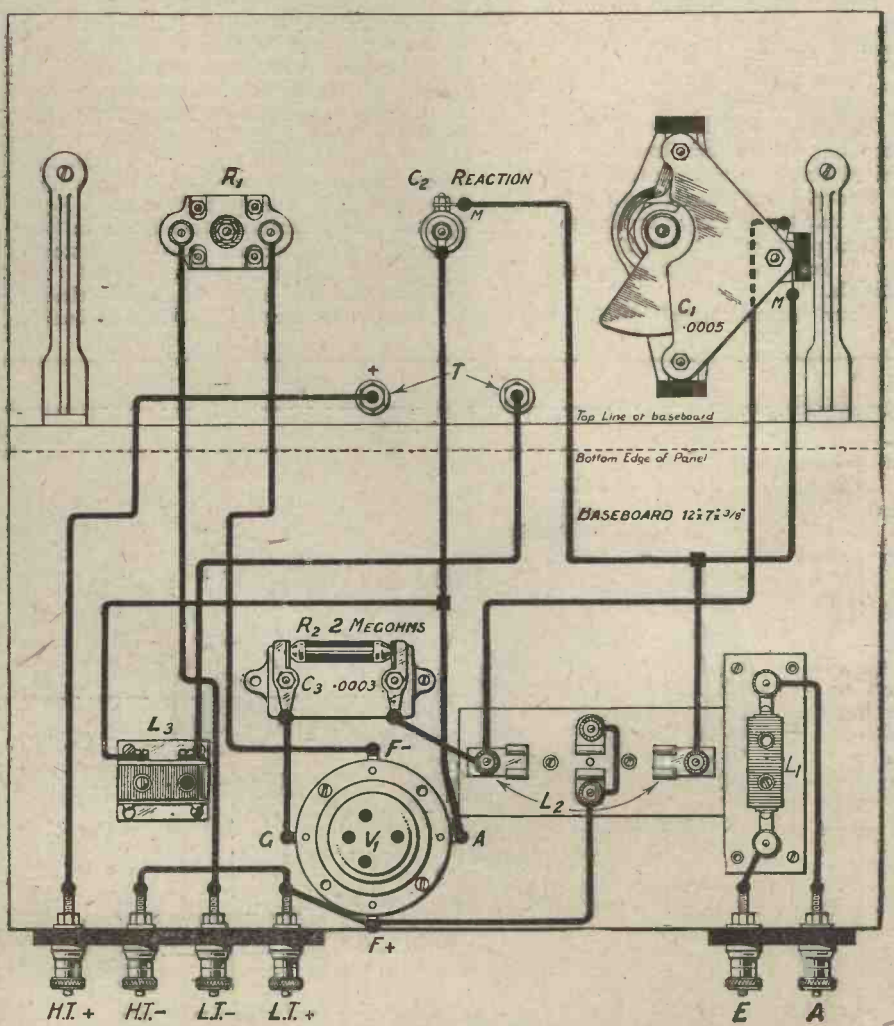


Fig. 3.—Follow the baseboard layout carefully when constructing the set. This wiring diagram may be obtained as a full-size blueprint, C 1045B.

turn the resistance to the " on " position. The valve should not now light up, and if it does so, the wiring should carefully be checked over and the fault rectified. If, however, the valve does not light up, remove the L.T. leads to their correct terminals, and join up the H.T., using about 40 volts.

Reaction Control

Connect up aerial, earth, and telephones, and adjust the reaction condenser to its minimum capacity. Turn on the valve, and, with the tuning condenser set near its minimum value, slowly turn the reaction condenser towards the maximum until a rushing sound is heard, probably preceded by a faint " plop," which indicates that the set is in the oscillating condition, when the reaction condenser should immediately be slackened back slightly. On rotating the tuning condenser, using the vernier motion, which should be operative over the whole scale, the nearest station will be heard, when the reaction may be increased slightly, but not sufficiently to cause the speech or music to become distorted, a state of affairs which indicates oscillation, and has to be studiously avoided.

A little practice, preferably conducted outside broadcasting hours, will soon enable the constructor to handle the receiver well, although it may be pointed out that the use of a condenser with sufficient reduction gearing or friction drive is imperative, as tuning is so sharp that it is very easy to miss a station, even when using the fine tuning device.

The H.F. Choke

In adjusting the reaction condenser just to produce oscillation with the tuning condenser set at its maximum value, it should be noticed that as the tuning condenser is rotated toward its minimum position, the oscillation gets stronger, until eventually a howl is produced. This may be obviated by giving the reaction control condenser a few turns in a counter-clockwise direction. This shows that, in order to keep the set just off the oscillating condition, one must when working on the edge of oscillation with the tuning condenser set anywhere other than at its minimum reading slightly slacken back the reaction before reducing the setting of the tuning condenser.

The knob seen below the condenser dial operates the slow-motion gearing of this component.

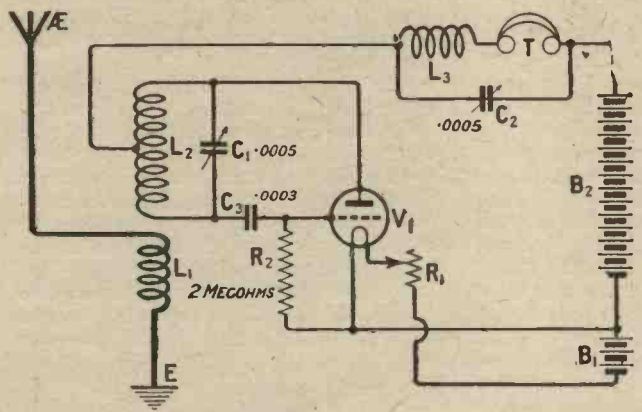


Fig. 4.—This circuit was tried first of all, but proved unsatisfactory for the reasons explained.

If, in adjusting the reaction for various settings of the tuning control, it is found that the receiver will not stop oscillating on the very low readings of the condenser with the reaction condenser turned back as far as it will go, the effect should be tried of inserting different sizes of coil into the choke socket.

An Unsatisfactory Circuit

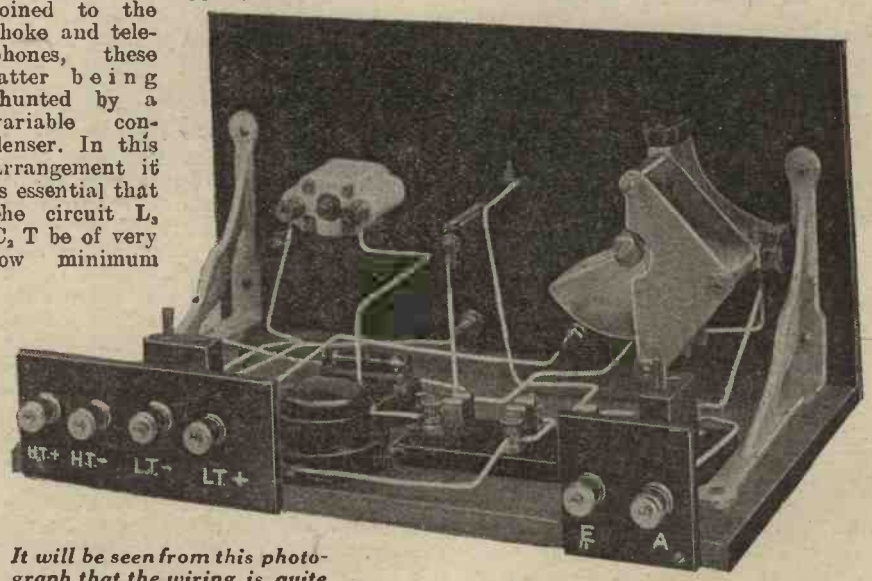
Fig. 4 shows a form of circuit which was tried in early experiments with this receiver, and it will be noticed that the centre tapping on the coil is joined to the choke and telephones, these latter being shunted by a variable condenser. In this arrangement it is essential that the circuit L_2, C_2, T be of very low minimum capacity, otherwise the whole will oscillate violently.

In practice it was found that such a condition was very difficult to satisfy, and after much time had been spent in endeavouring to perfect the circuit, it was eventually shelved and the present arrangement adopted, the latter proving more satisfactory for the requirements of readers of this journal. The arrangement of Fig. 4 will receive further attention, and although it might prove useful in the hands of an expert, it would appear hardly to be recommended to the novice on account of the ease with which it oscillates.

Test Results

When used in conjunction with the writer's standard P.M.G. aerial in South-East London at about 4½ miles from 2LO it was found possible to cut out signals from that station in three or four degrees on either side of the loudest point, it being quite easy to miss the transmission altogether if the condenser was rotated by means of the main knob instead of the slow-motion drive. When tuned in correctly, signals from London were well up to the average for a single-valve set, being rather too loud for comfortable head-

(*Continued on page* 790.)



It will be seen from this photograph that the wiring is quite straightforward.

CHOOSING AND USING YOUR CRYSTAL DETECTOR

The crystal holder—Wood's metal—Catswhiskers—Contact pressure—Metals to use—Enclosed and permanent detectors.

FOLLOWING last month's notes on the methods of tuning commonly employed in crystal receivers, it is proposed in this article to discuss the crystal detector itself.

The detector normally consists of a suitable crystal held in some convenient manner, with which a metal plate or wire or a second crystal makes contact. Of the possible arrangements, that in which a wire is employed is by far the most common, the wire usually being known as the "catswhisker." The plate method of making contact with the crystal is usually limited to the carborundum detector, in which a steel plate or stout wire is used in conjunction with a piece of carborundum (silicon carbide), a small potential being applied across the crystal to get the best results.

The Two-Crystal Detector

Double-crystal arrangements are perhaps not now as popular as they used to be. They are often called "perikon" detectors, and the two crystals employed in the combination are usually of different composition,

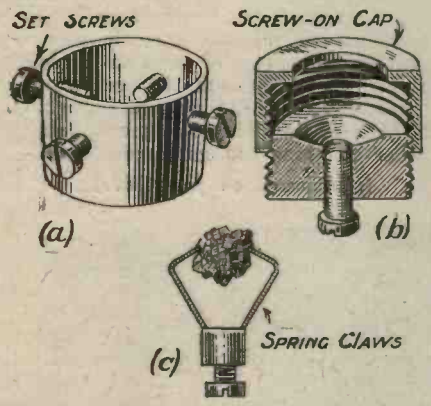


Fig. 1.—Three common types of crystal holder are illustrated here (a) probably being the most familiar.

such as zincite and bornite, to name only one "pair." However, despite the decreased popularity of this type of detector as far as general use is concerned, this arrangement is now often employed in the assembly of permanent and semi-permanent detectors.

A Popular Type

Since the crystal and catswhisker type of detector is the commonest, it will be convenient to discuss that first. The essentials of such a detector are, first, some device for holding the crystal; second, the contact wire or catswhisker; and third, the movable support which holds the catswhisker and allows its position to be adjusted with respect to the crystal.

Cups and Holding Devices

A common form of holder for the crystal is shown in Fig. 1 (a), and consists of a brass cup fitted with set-screws for clamping the crystal in position. This method usually results in a good electrical connection, especially if the lower portion of the crystal is wrapped in thin metal foil. Probably the only drawback to this form of crystal cup is that it is easy to break pieces off the crystal when tightening the set-screws, thus causing considerable waste of what may be an expensive mineral, and at the same time reducing the area available for "searching" with the catswhisker.

Not for Small Crystals

The type of cup provided with a ring-like cap which screws on to a hollowed-out brass base is now often met with, and this to some extent lessens the danger of crystal breakage in the clamping process. Small pieces of crystal cannot be conveniently mounted in such a cup, however, as they tend to slip through the aperture in the cap. This cup is illustrated at (b) in Fig. 1.

A third form of holder for the crystal is seen in Fig. 1 (c). This is a spring claw device and has the merit that it exposes a large surface of the crystal and provides a very reliable connection.

Use of Wood's Metal

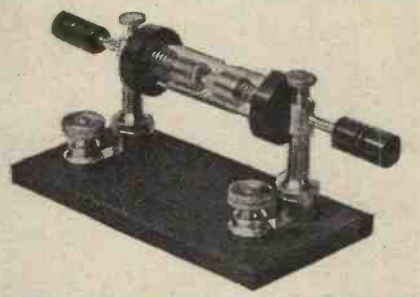
Perhaps the best method of all from an electrical point of view is to mount the crystal in Wood's metal—an alloy of low melting point. This metal softens at so low a temperature that a crystal can be safely pressed into a cup partly filled with the molten alloy without suffering any harm from excessive heat. Ordinary solder must not be used for this purpose, as its melting point is sufficiently high to impair the crystal's properties.

There are, of course, many possible variations of the methods indicated above, as a study of the windows of your dealer will show, but whatever type of fixing is used in your detector make sure that it gives a reliable connection to the crystal and that it allows as large an area as possible to be available for probing with the catswhisker.

The Catswhisker

Now for the catswhisker itself—how shall it be shaped and of what metal shall it be made? Fig. 2 illustrates five possible forms which the catswhisker may take. (a) Consists of a straight piece of wire, and is not generally suitable for the fine-grained synthetic crystals commonly employed at the present day.

It gives a firm contact without springiness, and hence unless the pressure employed is fairly heavy, the whisker is liable to be dislodged if the detector suffers a slight jar. So that unless a really heavy pressure has to be maintained on the crystal, this type of catswhisker is unsuitable. The commonest case in which this form can be used with success is that of carborundum, where a stout steel wire (even a gramophone needle) is used for contact purposes.



A double-crystal detector in which the positions of both crystals are adjustable.

Greater springiness characterises the second catswhisker, shown in Fig. 2 (b). This consists of a turn and a half of wire in line with the contact point, and while giving a rather lighter pressure than (a), and being rather less subject to vibration, yet provides a somewhat heavy contact.

A Light Contact

Of all catswhiskers (c) is easily the most popular, on account of its general suitability and ease of construction. It consists simply of a spiral of fine wire wound in thin cylindrical form with a straight length projecting from each end for contact and fixing purposes respectively.

This spiral catswhisker provides a light and not easily displaced contact which appears to be especially suited to most of the "-ites" now on the

market. Furthermore, should such a catswhisker become damaged, a new one can soon be wound, using a matchstick or knitting needle as a former.

Two More Arrangements

The fourth type of contact wire illustrated in Fig. 2 is somewhat similar to that just described, except that the spiral is wound in conical form and appears to give a lighter and more springy contact that even the (c) pattern.

Last of all is the catswhisker—if such a name can be applied to it—shown in Fig. 3 (e). This is merely a piece of flex with fine strands frayed out as shown, and its use may be tried as an experiment.

What Metal Shall be Used?

What metal should be used for the catswhisker? Undoubtedly one that will not oxidise readily, that will keep its shape, and will not be so hard as to damage the crystal. An oxidised or tarnished catswhisker will result in a bad electrical contact, which must be studiously avoided. Except for this point, copper makes an excellent catswhisker and will prove quite suitable, provided that the end which is in contact with the crystal is snipped off occasionally to expose a new and clean metal surface.

Two Precious Metals

Silver tarnishes much less rapidly than copper, and seems to give very good results. A silver catswhisker costs only about twopence, and is well worth the small expenditure involved. A 9-carat gold catswhisker can be purchased for a few pence, and, like silver, is practically free from the tarnishing trouble, but, at the same time, it is doubtful whether gold gives superior results to silver, so the extra expense seems hardly justified.

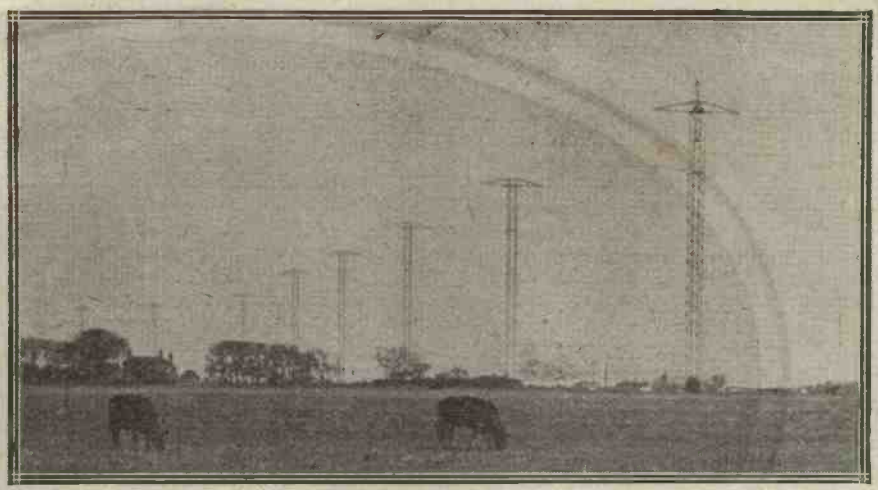
Beware of aluminium. This metal oxidises fairly rapidly in air, but, since aluminium oxide is white, the undesirable process cannot be detected. Steel, as has been mentioned

It is often an advantage to be able to change round the crystals or crystal and catswhisker. Such a process is made possible here by plug and socket mounts.

before, gives by far the best results with carborundum, so there is little choice when using the latter as the crystal.

Experiments to Try

It is well worth while the little trouble involved to experiment with the types of catswhiskers and various



The masts of the new Beam Station at Skegness, Lincolnshire, each 275 feet high.

metals to see which gives the best results and most reliable contact with the crystal you normally employ. Copper may suit one kind of crystal, silver another. One crystal may need a fine wire and light pressure, a second a thicker and firmer contact. You may appreciably improve reception by a little research work carried out on your own set.

Means of Adjustment

The arm which carries the catswhisker should be free to move in all directions, so that the whole of the exposed crystal surface can be explored. Some sort of ball-and-socket joint is usually employed, and it is important to see that the ball is held firmly enough to prevent the arm falling when once it is set in position.

The longitudinal motion of the arm, which allows the whisker to approach and recede from the crystal, is perhaps most important. There is no doubt that some form of micrometer adjustment controlled by a knob and threaded spindle is to be preferred, as this allows of exact adjustments of both position and contact pressure being made.

Closed or Open?

Finally, there is the question of whether the detector is to be enclosed or not. Here there is but one answer—an enclosed detector is much to be preferred to one of open type. Were all crystal sets operated under ideal conditions the question of protection might not arise, since to start with an enclosed detector is no more efficient than an open one.

Effects of Exposure

It must be remembered, however, that by far the larger proportion of crystal sets are used in the living room or kitchen of the house, and are subject to an atmosphere which is smoky, damp with steam, cool or hot by turns. Dust will settle on the crystal of an open detector in the cleanest of rooms, while damp and condensed steam will tend to injure the crystal surface and cause the catswhisker to tarnish. Add to these effects the film of grease which is likely to form in time, and it will be seen that the open detector's electrical efficiency will soon be impaired.

The enclosed type of detector certainly protects the crystal from dust, and to a large degree keeps out condensed moisture, grease, etc. Such a detector, if of ordinary catswhisker

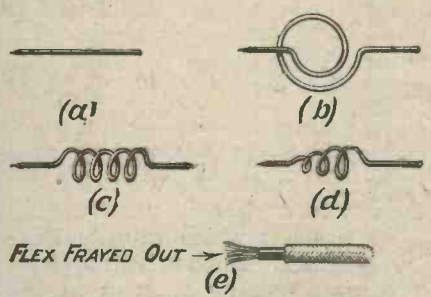


Fig. 2.—Not all crystals require the same degree of pressure, consequently the design of the catswhisker employed merits consideration.

type, should have a covering of glass or some other transparent material, so that the adjustment of the contact wire is a clearly visible operation.

"Permanent" Detectors

"Semi-permanent" and "permanent" detectors are almost invariably of enclosed type, and fall into three main classes. The first is that which employs an ordinary crystal in conjunction with a form of catswhisker which is more or less automatically adjusted by the rotation of a knob. Usually this type functions extremely well, and has the advantage that the crystal can be replaced by a new one when its useful life draws to a close.

Another Good Type

A second type is that in which a spring plunger is fitted with either a

metal wire or a pointed crystal to make contact with another crystal. Thus, in this form again considerable adjustment is possible, and very satisfactory results are obtainable if a good combination of crystal and crystal or crystal and catswhisker is incorporated in the device. Unlike many types of "semi-permanent" detector, the two-crystal arrangement is frequently glass-enclosed, so that the interior details are clearly visible.

Not Recommended

The third type of permanent detector employs a catswhisker fixed in relation to a crystal. The principle adopted is that by some means the most sensitive spot on the crystal is found, and the catswhisker is then sealed in position in contact with this spot. In the writer's opinion, this type of detector is open to several grave objections—namely, the catswhisker may shift during the sealing process, or subsequent use may displace it, while, in any case, the sensitive spot will in time deteriorate, and since no adjustment is possible, the detector will be rendered useless.

Making a Choice

Hence, it is preferable, if a "permanent" detector is to be used, to employ one which allows of some adjustment of the contact, such as those of the two types first mentioned. "Permanent" detectors (including those known as "automatic" and "semi-permanent") are to be preferred to those of ordinary "whisker and cup" type in those types of circuit where a stable contact is desirable. Reflex circuits may be included in this category, and so may those arrangements incorporating a crystal detector followed by L.F. stages.

An enclosed detector is much to be preferred to one of open type.

These detectors, being enclosed, are not affected by dust and damp to any great extent, and, if of reputable manufacture, offer a convenient means of rectification to those who dislike "fiddling" with a catswhisker.

EBONITE BUSHES.

We regret that owing to the dropping of two letters the advertisement of Messrs. the Darex Radio Co. on page 706 of the last issue was headed "Ebonite — — shes." This, of course, should have read "Ebonite Bushes."

AN IMPROVISED BASKET COIL MOUNT

PROBABLY one of the most annoying predicaments in which the experimenter may find himself is to be possessed of a number of basket coils without any means of mounting them.

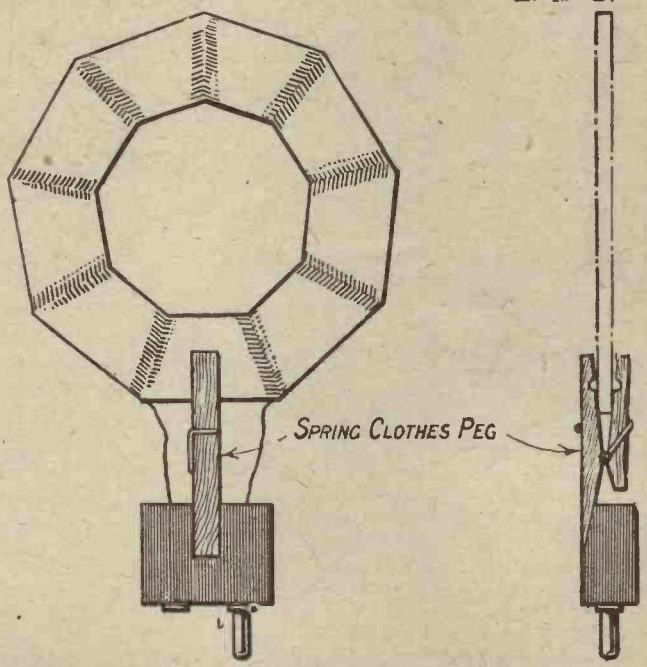
This difficulty is easily surmounted with the aid of a clothes peg—one of the spring type, as shown in the figure—and a coil plug.

First file out a slot in the coil plug, as shown, and drill and tap this. If it is not desired to make it a permanent job it will be sufficient to fix it with any adhesive, such as glue or "seccotine."

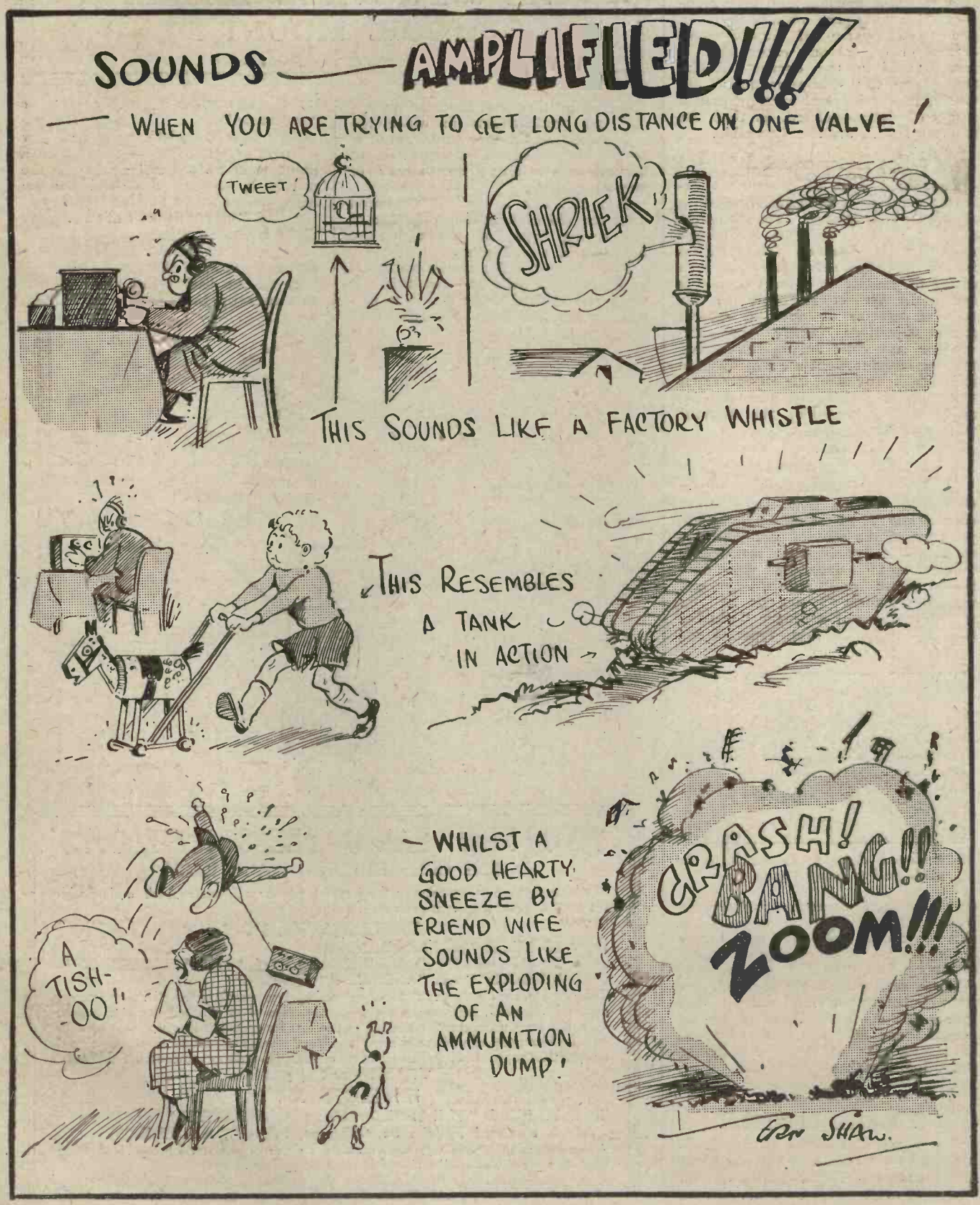
Now take the clothes peg and saw off part of one of the sides at such a point that when the long leg of the peg is in position the short one on being gripped does not foul the top of the coil plug. This will be quite plain from the figure.

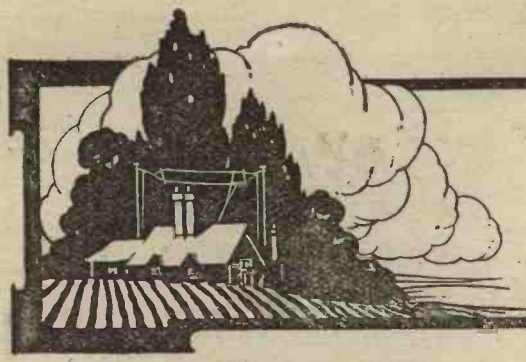
After having done this, it is only necessary to open the jaws of the peg, push in the basket coil and join the two ends up to the plug and socket.

E. H. B.



This sketch shows how a spring clothes peg and a coil plug may be adapted to form a coil mount.


SOUNDS — AMPLIFIED!!!
— WHEN YOU ARE TRYING TO GET LONG DISTANCE ON ONE VALVE!
TWEET!
SHRIEK
THIS SOUNDS LIKE A FACTORY WHISTLE
THIS RESEMBLES A TANK IN ACTION
A TISH-OO!!
— WHILST A GOOD HEARTY SNEEZE BY FRIEND WIFE SOUNDS LIKE THE EXPLODING OF AN AMMUNITION DUMP!
CRASH! BANG!! ZOOM!!!
Geo Shaw.



TALKS TO BEGINNERS

By

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

This is the third of the series of talks to the beginner, the first of which was published in the April issue.

III.—WHEN THE SIGNALS ARRIVE

LAST month we had a talk about the waves we use in wireless, the way they come through the ether to us, and the medium in which they are created. You will remember that we followed them to the point where they set up in our receiving aerial the little pulsating currents which build up in strength if our set is in tune with them.

Tiny Currents

Few people realise how tiny these currents are. Scientists have measured them, and express their value in fractions of an ampere. You will probably know that the ampere is a unit of current. In case you have not troubled a great deal about electric currents and their value, let us consider a few in daily use, so that we may compare our tiny aerial current with them.

Perhaps you are reading this article under an electric light. The lamp above you has an electric current passing through it. If you are connected to 100-volt mains, and you have a 50-watt lamp in the shade above you, the current passing through the lamp will be half an ampere. That convenient little electric fire, which helps to make your bedroom cosy in the winter time takes, perhaps, 5 or 6 amperes.

Energy from Your H.T. Battery

Maybe you are listening to jazz music from your three-valve receiver, to which is connected a high-tension battery. So long as the valves are alight, and the set is operating, current will be drawn from the high-tension battery; the value of that current is perhaps 3 or 4 milliamperes—a milliampere being a thousandth part of an ampere.

This current, drawn from the high-tension battery, provides the energy necessary to give you loud signals. It is, so to speak, the energy "triggered off" by your aerial current. If you are situated some 6 or 10 miles from a main station and have a good aerial, the value of the oscillating current in the aerial, set up by the waves falling upon it, will be possibly 15 or 20 microamperes—a microampere being not a thousandth, but a millionth part of an ampere!

A Million Times as Much!

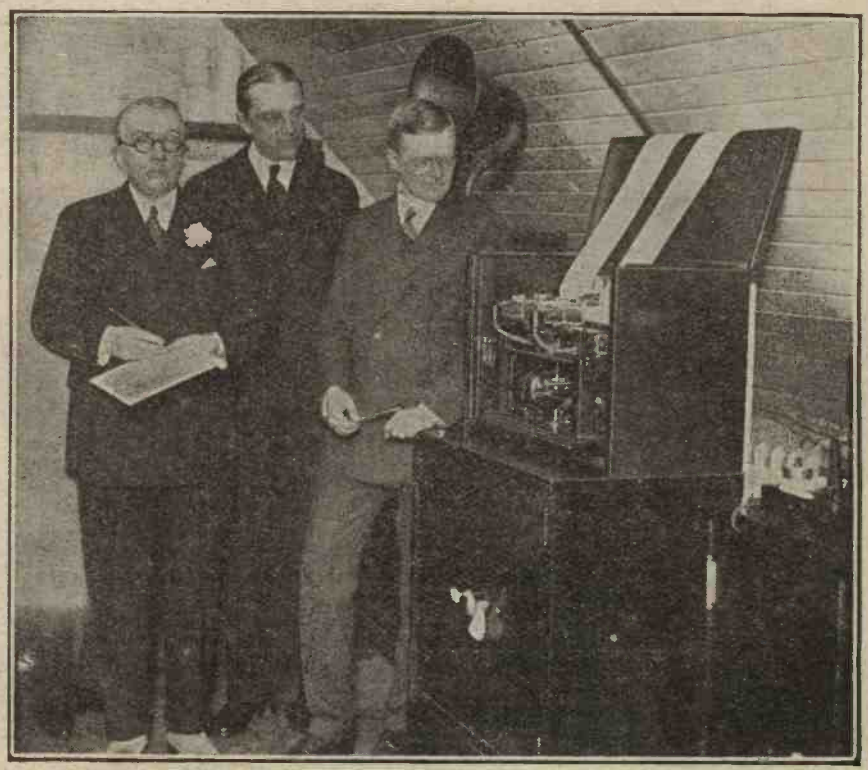
As a matter of fact, a far smaller current than this will give quite good signals in a crystal receiver, so that we can easily imagine a reader in the winter time sitting with the 'phones on his head listening to music from, say, 2LO in front of an electric fire, which is taking just a million times as much current to operate it, as is required to make the crystal set function.

Your Headphones

In speaking of the mysteries and fascination of wireless broadcasting, we are apt to overlook the almost miraculous sensitiveness of the telephone earpiece. As you may know, the telephone earpiece ante-dated wireless telegraphy, or telephony, by very many years, and, indeed, has not greatly changed since its invention by the pioneers of wire telephony.

The Real Detector

Although we are accustomed to speak of a crystal or a valve as a wireless "detector," the real detector of energy received from the broadcasting



An experimental transmission of pictures by wireless in progress in London. On the left is the American Ambassador, while Capt. Ranger, of the Radio Corporation of America, the inventor, is seen by the transmitting apparatus.

station is the telephone headpiece or its magnified equivalent—the loud-speaker.

In passing, I may say that a loud-speaker differs only from a telephone headpiece in being built to handle a great deal more energy than it would be comfortable to use with headpieces, and designed to spread the volume and sound so obtained by means of a horn or its equivalent. Provided you pass sufficient energy through a telephone earpiece, and attach a horn to it, you can get quite passable loud-speaker results, and, indeed, the smaller types of loud-speaker consist for all intents and purposes of a single telephone earpiece screwed into the base of a horn.

How They Work

Telephones are comparatively simple in construction. Each earpiece consists of a box of circular form having a kind of double lid. The outer lid is generally of ebonite, bakelite or some such substance, shaped to press comfortably against the ear, and having in its centre a small aperture. The inner lid consists of a thin flexible disc of iron generally painted black to prevent it rusting.

The outer edge of the metal box is generally threaded so that the outer lid can be screwed down tight on the inner one, holding the disc of iron securely in place.

Underneath the disc of iron are situated the two poles of an electro-magnet, made of special steel, the pole pieces having on each of them a winding of fine wire.

The Diaphragm and Magnets

These two windings are joined together and the two ends taken to insulated terminals in the back of the box or else directly to the cord for connecting to the instrument. The steel of the electromagnet is permanently magnetised, and tends to draw the iron disc towards it. In fact it holds it under a kind of tension. If now we pass an electric current through the windings of the electromagnet in one direction, it will tend to increase the magnetism and attract the iron diaphragm still further towards the poles of the magnet. If now we pass the current in the opposite direction, magnetism will be subtracted from that of the magnet, and the diaphragm will be released slightly.

You will realise that if the current is constant the diaphragm will be held in one position, and as it does not move no sound will issue from it. If, however, we suddenly stop and start the current, the diaphragm will be drawn towards or released from the magnet at every stop and start, so that every time we start or stop the current there will be a click.

Electrical Vibrations into Sound Vibrations

Now you will understand that any variation in current through the windings will vary the position of the diaphragm, and the vibrations so set up will cause the diaphragm to emit the sound waves which thus impinge upon your ears. The telephone earpiece is almost incredibly sensitive to electric current and will give distinctly audible sounds with but a few microamperes.

In fact, less than a microampere will give distinct noises. As then we have in the aerial currents set up by the broadcast waves of more than sufficient value to make distinctly audible sounds, why do we not connect the telephones directly to the aerial and thus dispense with all the paraphernalia of a wireless set?

A view of the studio of the Radio-Paris Station, Boulevard Haussmann.

Why a Set is Wanted

The explanation is that the currents set up in the aerial are very high speed alternating currents or oscillating currents, as we call them, which apart from the variations impressed upon them by the changes in current due to the microphone sounds, change their direction with a speed which may be as great as one million cycles per second.

Obviously the iron diaphragm cannot vibrate at anything like that speed, and in addition to this, such a tiny fraction of a second is quite insufficient to allow the current in the windings to be set up at all. It takes quite an appreciable time after a battery is applied to the end of the telephone cord for the current to start flowing, and the more wire we have in the telephone, the longer it will take for the current to start.

Try this Experiment

A simple analogy will perhaps make this plain. You have no doubt been into a hotel or office provided with swing doors. A gentle, steady pressure on the door will open it quite easily, but if you strike the door sharply, it will resist the sudden pressure and will not move. If, now, you take hold of the handle of the swing door and push it in and draw it back again, you will find you can do this two or three times a second with fair ease. Now take hold of it and try to draw it in and out twice as rapidly as before.

An Impossible Task

You will find it almost impossible to do this, and you will readily realise that any attempt to swing the door backwards and forwards at anything more than a few times per second will be doomed to complete failure.

Similarly, you can make a current rise and fall through the telephone windings a few hundred or even a thousand times per second, and the telephone diaphragm will respond, but the high-frequency currents used for broadcasting will have no effect. How, then, can we overcome this difficulty? By converting the currents which change their direction so rapidly into currents in one direction only. This process is called rectifying, and can be performed by either a crystal or valve.

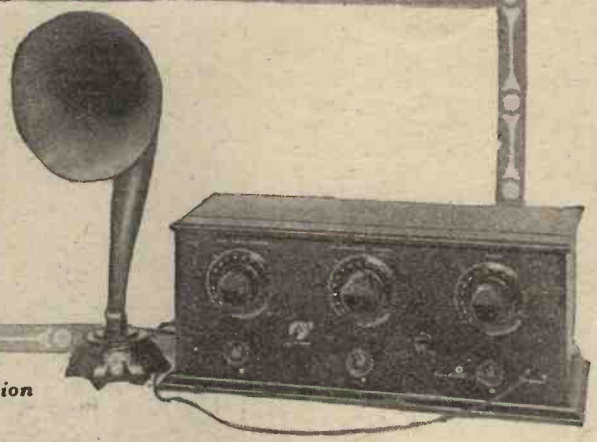
The Crystal's Peculiar Property

A crystal detector or "rectifier," as it is much better termed, is a special mineral found to possess the peculiar property of allowing an alternating or oscillating current—in fact any electric current you like to deal with—to pass through it in one direction and not in the other.

One of the first substances found to possess this peculiar quality was carborundum, which is not really a mineral, but a chemically formed substance known as silicon carbide, made at Niagara Falls by fusing a mass of salt, sand, sawdust and coke. Next month I propose to tell you more about the crystal and its work.

YOUR TUNING CONTROLS

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



Ease and accuracy in tuning are facilitated by the provision of dials of adequate size, as explained below.

SKILL in tuning in stations on a receiver does not consist merely in the ability to turn the dials of the variable condensers. To tune in a crystal set to the local station will usually not call for much skill in handling, but the proper control of a valve receiver, especially a multi-valve receiver, needs a fair amount of practice before speed and accuracy are acquired.

Even with a single-valve set, where there is one main tuning condenser and a reaction coupling control, practice is necessary before a distant station can be brought in with the certainty that the best signals are being heard without any interference having been caused to the neighbours.

Influence of Set Design

Now while practice and experience will necessarily play a large part in the acquiring of the desired "touch," a good deal depends, too, on the design of the receiver itself. To begin with, a bad layout may introduce such serious hand-capacity effects that no amount of skill will ever make the receiver satisfactory to handle. Again, components that are not quite up to the mark in the matter of their mechanical construction may prove a considerable handicap.

Most modern receivers employing several stages of high-frequency amplification are so designed with matched stages that to tune three or more stages is no more difficult than tuning the aerial and anode circuits of a receiver employing the conventional single stage of high-frequency amplification followed by a detector.

Condenser Settings

Nevertheless, in the multi-valve receivers, where two or more of the condenser dials are to be set to the same reading for any given station, it is obviously essential to be able to set them in this way with the greatest accuracy. The tuning of such receivers is usually sharp, and approximate settings of the dials may be far enough apart from each other to prevent the desired signal from being heard. Under such circumstances much depends on the design of the variable condensers, and especially on the dials and knobs fitted for operating them.

When it is desired to calibrate a receiver the need for accuracy and good design of the tuning controls becomes particularly apparent. A tuning condenser with an insecure dial will naturally be a handicap, since it will not be possible to be certain that the capacity of the condenser is the same every time the dial is set to a certain reading.

The Size of the Dial

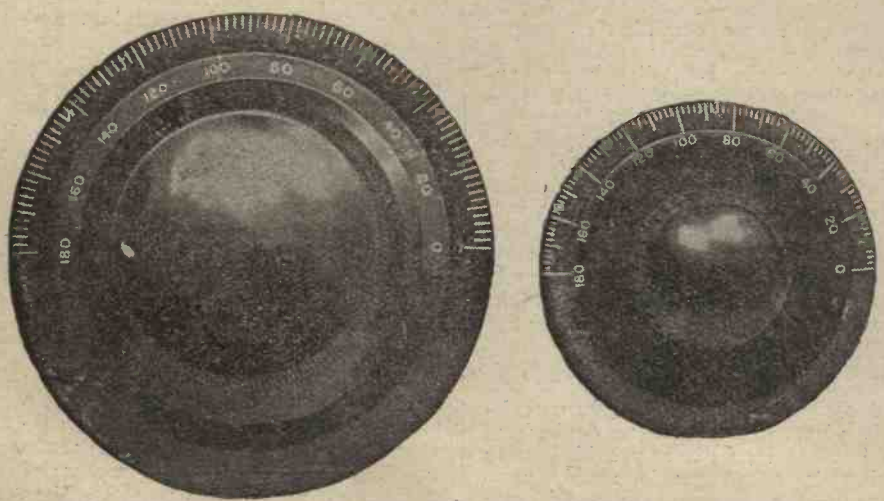
Assuming, however, that the variable condensers in a receiver are mechanically sound and that the dials are secure, it will be found that the choice of a suitable form of dial will be of material assistance in accurate tuning.

The tendency nowadays is to increase the size of dials, a diameter of 4 in. instead of 3 in. being found an immense advantage for ease of control. The increase in the size of the dial allows of the provision of a good-sized knob which is convenient for the fingers to grasp, and, further, the engraved scale automatically becomes much more open, thereby facilitating the taking of accurate readings.

Large Dials Not Always Necessary

It will be apparent from the above that it is worth while to fit dials of large size to a receiver, but it should be noted that it is not necessary to go to the trouble of fitting such dials to the spindles of all the variable condensers on which they are not already provided by the makers. On the multi-stage H.F. type of receiver mentioned already it will certainly be best to have all the dials alike, since by this means it will be an easy matter to obtain identical readings on all of them.

In a receiver employing only one stage of high-frequency amplification, however, with, say, tuned anode coupling, it will be sufficient to fit a large dial to the condenser used for tuning the anode circuit. The tuning of the aerial circuit in such receivers, if an ordinary "straight" circuit is used, is not generally very critical. For calibration of the receiver, if this is carried out, the anode circuit only need be calibrated, since this will remain reasonably constant, while the calibration of the aerial circuit will depend on the particular aerial in use at the moment and on other factors. It will, therefore, be unnecessary to fit a special dial to the aerial tuning



A large dial will give a much more open scale than one of small diameter, as will be seen from this photograph, while the appearance of the panel is often considerably enhanced.

condenser if this is not already provided.

"Reinartz" Reaction

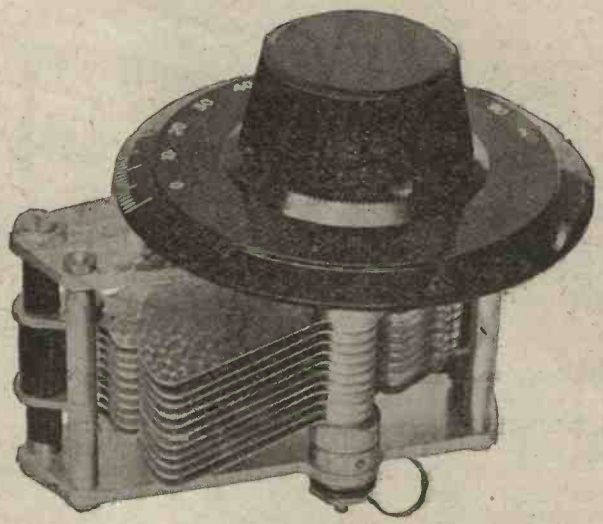
In receivers employing one of the several possible forms of "Reinartz" circuit, in which the reaction is controlled by means of a variable condenser, it will be best to fit large dials to both the main tuning condenser and that used for reaction control. For the reception of distant stations it will then be possible to set the reaction control with great accuracy, the inherent smoothness of this form of reaction being assisted by the improved mechanism available to the operator.

Geared Condensers

So far no mention has been made of gearing or other slow-motion drives as a help to fine tuning. The large dial in itself makes a considerable difference to the "feel" of a receiver and renders it much more pleasant to handle. On the shorter waves especially, when one of the "Reinartz" circuits is used, it becomes possible to set the receiver so that it is just oscillating for the reception of faint continuous wave signals, and to keep it in that state much more readily than with a dial which somewhat cramps the fingers and with which it is not so easy to make minute variations of capacity.

Well constructed geared dials are an additional help to fine control, but they can be more trouble than they are worth if backlash is present in the gearing to any appreciable extent. Though it is possible to "come up to" a station slowly, if the exact tuning point is overshot, backlash in the gearing will mean that the dial has to be turned back "loose" on the spindle for a certain distance, perhaps for a degree or two.

Unless one is thoroughly accustomed to the feel of the dial the spindle may start to move before its movement is noticed, with the result that the correct point is overshot again on the other side.



The provision of a good-sized knob on a variable condenser allows the fingers to obtain a firm and comfortable grip.

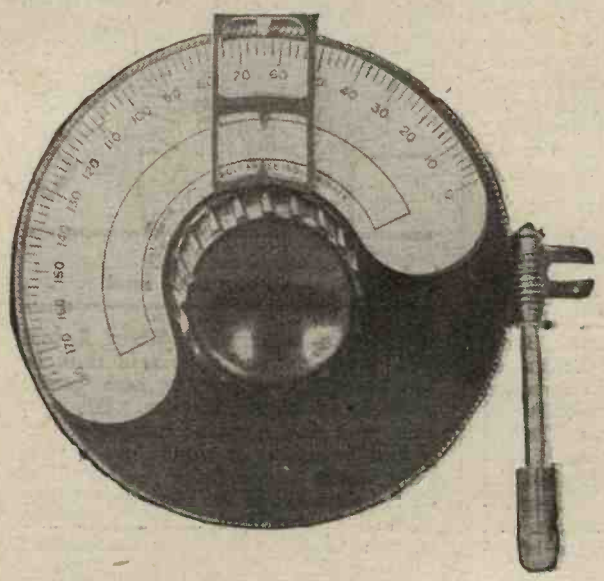
Allowing for Backlash

If a condenser or dial with this defect has been purchased, or if the component has developed backlash from wear and tear, it is possible to overcome the difficulty to a certain extent. It is necessary to find out to how many degrees on the dial the movement due to the backlash corresponds. This is quite easily done by watching the moving plates of the condenser while the dial is rotated, note being taken of the number of degrees of free movement. Then when the receiver is being tuned allowance should be made for this number of degrees whenever the direction of rotation of the dial is reversed in carrying out fine tuning.

Calibration Precautions

When calibration is carried out on a dial with a fault of this nature the dial must be turned in one direction only while the checking of the various readings is being carried out. Otherwise some of the readings may be a degree or so out, depending on the actual amount of the backlash present. For this reason gearing which is incorporated in the condenser itself or in the dial is undesirable for use in the variable condenser of a wavemeter. For the accuracy that is required in such instruments, if gearing is employed at all, it will usually be best to provide some form of external gearing. The dial will then be fixed rigidly on the spindle in the usual way, and a slow-motion device will be brought into use independently when required, acting either on the spindle or on the edge of the dial.

In conclusion, it should not be overlooked by those who like their receivers to possess a good "finish" that the panel of a receiver is often much enhanced by the large type of dial, quite apart from the additional advantages secured in ease of operation.



When choosing a slow-motion dial for a wavemeter condenser it is often best to obtain one with some form of external gearing, so that the dial can be rigidly attached to the spindle.

TWO MORE SUCCESSFUL "MIDGETS"

SIR,—I am just writing you a few lines to say how much I appreciate the "Midget" one-valve set described by Mr. A. S. Clark in the May, 1925, issue of THE WIRELESS CONSTRUCTOR. I have had every number of this good book so far. My aerial is a twin, about 25 ft. high and 32 ft. in length. I have got a poor condenser, it being a standard type, not a square-law. My earth is a good one.

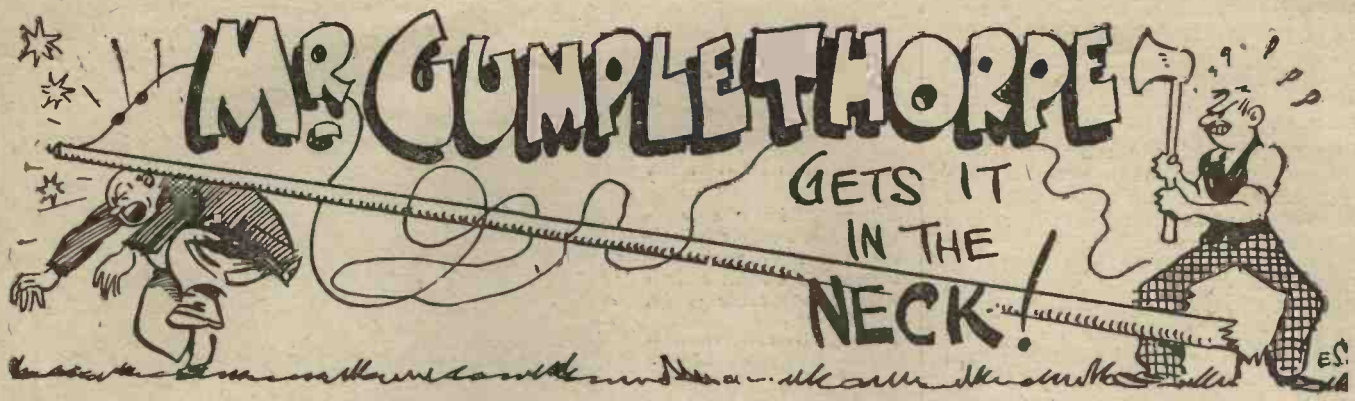
I have received Daventry, London, Birmingham, Cardiff, Bournemouth, Manchester, Nottingham, Stoke-on-Trent, Radio-Toulouse, Berne, Hamburg, Muenster, Rome, Madrid, and San Sebastian. I think that this list is a record one.

My chum has made this set also, and has had the same success. I hope that THE WIRELESS CONSTRUCTOR will continue its good work for a long time. Wishing you all success.

Yours faithfully,

ERIC HUNT (age 16).

Dudley.



POSSIBLY you may have noticed in the papers recently reports of attacks upon howlers by infuriated mobs of listeners in several parts of the country. To say that feeling has run high is to put it mildly. Masts have been hewn down—I am speaking the literal see-this-wet, see-this-dry truth—and their sites sown with salt; aerials have been earthed by the simple expedient of attaching a brick to a piece of wire and lobbing it gently over them; eyes have been blacked and pates cracked.

In fact, in several places wireless enthusiasts have been enjoying themselves as enthusiastically and as thoroughly as if they had been inhabitants of an Irish village on the evening after

. . . eyes have been blacked and pates cracked . . .

a horse fair. I am not surprised, mind you. Not long ago I observed a new aerial in course of erection in a garden which is, as they would say on the other side of the St. George's Channel, "contagious" to my own. Whenever this kind of thing happens I go goosey all over, and usually my apprehensions are more than justified. In this case the worst befell.

Dispensing with a Mast

To begin with, my enthusiastic neighbour had the brilliant idea of slinging his aerial over the telephone wires which cross his garden and mine. The process was quite simple. Attaching a stone to a length of cord, he flung it over the wires. He then fixed the end of the cord to his aerial wire and hauled up. At this point he decided to call it a day, and knocked off until the morrow. Feeling that I had at any rate one evening's respite I retired to my den. I had just entered when the telephone bell rang.

I picked up the receiver and said "Hullo!" There was no reply. I replaced the receiver. The bell rang again. Then *I* rang up exchange. There was no answer from exchange. In short, though I could speak to no one and no one could speak to me I was getting everybody's rings, and so were lots of other people.

Worse and Worse

On the next day my neighbour completed the erection of his aerial, which hung six inches or so above the 'phone wires. It was a calm morning, and all appeared to be well. During the afternoon a breeze sprang up, causing the unstayed mast to sway gracefully, whilst the aerial wire now stretched taut, now slackened off to repose gracefully upon the property of the Post-Master General. My telephone again went mad; madder than ever, for it brought in rings and bits of conversation and odds and ends from 2LO.

My neighbour realised that he had been over-ambitious, and took down his aerial, breaking my telephone line in the process. The next day he reslung his wire at a lower level, which done, he proceeded to tune in.

Musical Moments

For three weeks now he has been tuning in 2LO, but not yet has he got him quite perfectly. He has been almost *there* on dozens of occasions, but he has never succeeded in getting out of his set just that last micro-micro-ounce after which the single-valve beginner strains. Sometimes he runs rapidly up and down the scale from a grunt to a squeak, and back again; sometimes he does a *largo* movement of slow, majestic sweeps; sometimes he emits a steady whistle for a quarter of an hour on end.

A Consultation

All this, of course, is very worrying. If only my neighbour would stick to 2LO I would not mind so much, for I could tune in Hamburg or Belfast or Birmingham; I might even in a sudden access of energy change my coils and get Daventry or Radio-Paris. But if I do attempt to go further afield it is as certain as death and taxes that the other fellow will have the same inspiration. Telepathy? Well, possibly. At any rate, as soon as I try for something else, he does the same, and if I come back to London, hoping that he is coquetting with the other stations, he is sure to come back, too, within a few minutes.

I was just preparing the other night to write an order to the stores for a hundredweight of dynamite when it occurred to me that I had better consult my friend, Mr. Gumplethorpe, before doing anything rash. Having advanced by stages euphemistically called easy from crystal to valve, Mr. Gumplethorpe has now returned from valve to crystal.

Crystal for Comfort

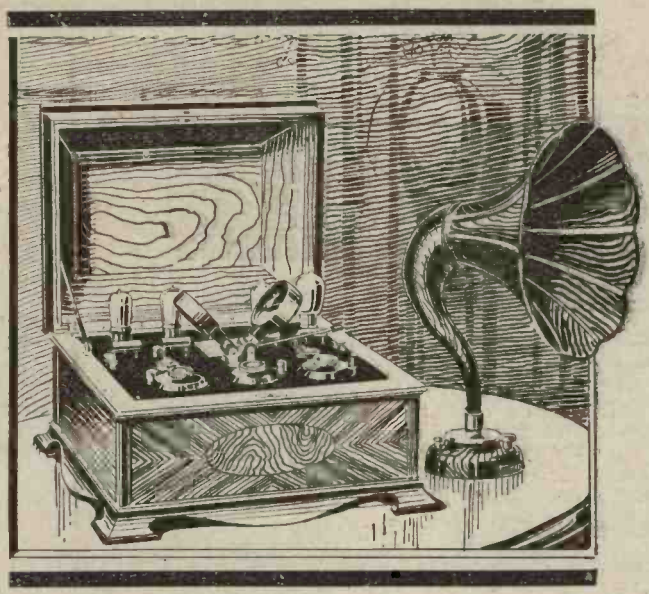
There are, as he explained to me when I was shown into his wireless room, heaps of good points about the crystal. It does not go up in a blue flame if you make a wrong connection, it does not give you shocks when you try to tighten two terminals simultaneously, and it costs far less. Further, it allows you to enjoy wireless properly, since if there is no loud-speaker your family is not always insisting upon having jazz in order that it may dance.

No Gentle Methods

I asked him if he were not bothered by the doings of my neighbour, who is also his. Mr. Gumplethorpe replied with some heat that he was a good deal

. . . my telephone again went mad . . .

more than bothered. When I told him about dynamite he said that he was not a believer in such gentle methods of curing howlers. His own idea was that, having properly disguised ourselves in masks, we should sally forth armed with nail-studded clubs to interview the offender. When we had beaten him into a jelly and thrown the body into the dustbin we would pour a few gallons of petrol



Simplicity~

THERE is nothing complicated or difficult about A.J.S. Receivers. Turn a switch here, and a dial there, and music issues forth from the Loud Speaker—real music, not a poor imitation.

Under normal circumstances you have a choice of programmes; and, moreover, the programmes may be received reasonably free from interference owing to the selective design of the circuits.

A.J.S. Receivers are contained within cabinets of particularly artistic lines. They are beautifully designed from fine woods by expert craftsmen.

May we send you particulars?

The price of the model illustrated, without Loud Speaker, is **£26 15s.** complete.

A·J·S

A. J. STEVENS & CO. (1914), LTD.
Radio Branch, WOLVERHAMPTON.

Telephone: 1748 (7 lines). Telegrams: "Reception, Wolverhampton."

London Showrooms: 122-124, Charing Cross Rd., W.C.
Telephone: Regent 7161-2. Telegrams: "Ajayessco, Westcent, London."

HIRE PURCHASE.

Messrs. TAYLOR & Co., Ltd., 49/53, Sussex Place, South Kensington, S.W.7 (near South Kensington Station), are prepared to arrange for the sale of A.J.S. Receivers and Loud Speakers on easy payments.

A TWO-VALVE LOUD SPEAKER RECEIVER

This Installation represents maximum Radio Value, both as regards efficiency and appearance.

Receiver only - **£8 2s. 6d.**

A.J.S. Junior Loud Speaker, **35/-**

Complete with Loud Speaker and all accessories,

£13 18s. 6d.

[Sign the Coupon]

A. J. STEVENS & CO. (1914), LTD., RADIO BRANCH, WOLVERHAMPTON.

Please send Publications Nos. 118 and 120, describing Loud Speakers and Receivers.

Name.....

Address.....

W.C. June/26. .....

Issued by the Publicity Dept., A.J.S.

Mr. Gumplethorpe—*continued*

about the house and set fire to it. "That," said Mr. Gumplethorpe, "should settle the fellow's hash, I rather fancy."

I pooh-poohed this humanitarian suggestion. I proposed that we should begin by applying the Chinese Torture of The Thousand Cuts. "That," I said, "should make the chappy howl to some purpose." This done, my idea was that we should apply to the soles of his feet black-hot soldering irons connected to the A.C. mains. We could then slowly roast him before a fire made from his own wireless gear.

Bombarded!

I was just warming to my work when a brickbat sailed through one of the panes of the window, and, narrowly missing Mr. Gumplethorpe's right ear, reduced his cherished wavemeter to fragments. Mr. Gumplethorpe leapt to the window, leaping back again with far greater velocity as an exceedingly dead cat hurtled through the night air towards him. The cat was followed by an egg, which was even more dead, its flight through the air being accompanied by howls of execration which proceeded from the garden.

The Attack

Trembling in every limb, Mr. Gumplethorpe sank into a chair. "I will go out," I said, "and see what this hubbub is about." I went to the back door and strode out into the garden, where I was instantly assailed by a raging mob. "Yah!" they shouted. "There he is. Grab him, somebody." In my young days I was something of a sprinter, but never, I think, have I covered ten yards in such wonderful time as I did those which separated me from the door. There are occasions when, as some sapient person remarked long ago, absence of body is infinitely better than presence of mind. This was clearly one of them. I withdrew.

. . . *an exceedingly dead cat hurtled through* . . .

I found Mr. Gumplethorpe trembling with rage and quite prepared to sally forth armed with the poker to do battle with the mob. Knowing that if he did so he would instantly be rent in pieces, I managed with some difficulty to restrain his ardour. Meantime the uproar in the garden was increasing. Mr. Gumplethorpe and I were completely mystified.

The Terrible Truth

The attack seemed utterly unprovoked, for he is the mildest and most genial of men and has no enemies. Why, then, was the whole community thus arrayed against him? Above the noise of the blows of the axes that were biting deep into Mr. Gumplethorpe's aerial mast we made out shouts of "Ether hog" and "Condenser wangler" and "We'll show you how to squeal," accompanied by creditable vocal imitations of the wireless howls that we all know so well.

The truth dawned upon us both simultaneously. They believed that poor Mr. Gumplethorpe was the fellow who had been rending the local welkin of late, and they were out to have his blood. Scarcely had the terrible truth dawned upon us when a crash announced the breaking in of the back door, and the next moment the vanguard of the avengers entered Mr. Gumplethorpe's den.

Mr. Gumplethorpe—*continued*

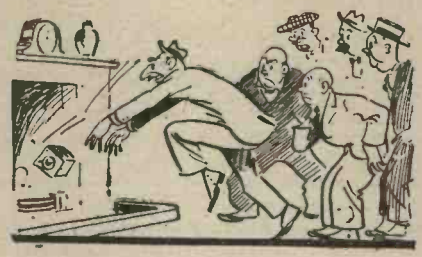
Virtue Triumphant

The leader, the generalissimo, of the attacking force was no other than our neighbour of the newly-erected aerial. With shouts of execration he dashed to the table, seized Mr. Gumplethorpe's poor little set and held it high above his head. "This will teach him," he yelled, as he dashed it into the fireplace. And then a silence fell upon the room as the crowd surveyed the bits and pieces that were rolling upon the floor. They saw the mangled remains of a crystal detector, with never a sign of a valve. They glanced round the room.

No batteries met their gaze, no valve boxes, no rheostats, none of the things that go to make up the kind of set that lets the world know when it is working. The crowd looked abashed. Their leader sought hard for words but failed to find them. Another fellow became spokesman, apologising to Mr. Gumplethorpe and saying that they were quite sure that he would understand.

The Villain's Fate

It was at this moment that I observed the real offender endeavouring to accomplish what on the movies they style a fade-out. "If you want to find the howler," I cried, "you haven't far to look," and I pointed an accusing finger at him. He stammered and spluttered, but his guilt was written plainly upon his face. Giving tongue like a pack of hounds, they fell upon him and bustled him from the house. What happened to him we have not inquired, but there has since been a complete absence of howling in the district.



. . . *dashed it into the fireplace* . . .

From the Beginning

And now the unfortunate Mr. Gumplethorpe must start all over again. He is very cheerful about it. If all his rose trees have been trampled flat, their absence, he explains, will increase the effective height of his aerial. The felling of his old mast will give him just the excuse that he needed for erecting a new one, vastly taller. His set is in smithereens, but it had been in existence for nearly a month, and as Mr. Gumplethorpe is a real wireless enthusiast, it was about due for rebuilding. Anyhow, he says, even if his demesne was laid waste and his gear pulverised, it was worth all this and more to get rid of the arch-howler.

Have You Had Your Free Blueprint Yet?

Use the Coupon (available up to and including June 30th) on p. 792.

Write for a blueprint of the set you like best in this issue.

Notes & Jottings

A page of information of interest to all constructors.

By H. J. BARTON-CHAPPLE, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

IT is often found that home constructors, when testing out a new receiver, or even experimenting with an old one, are prone to cause the set to oscillate unintentionally. Under these circumstances, it will not be out of place to indicate once more the simple test that can be applied in order to ascertain the condition of the receiver as far as "howling" is concerned. The finger is placed on the grid terminal of the valve holder, which is connected in the circuit to be examined, and the nature of the re-resultant click (or absence of same) is indicative of the condition of that circuit, as the following table shows:—

Type of Circuit.	Finger on grid terminal.	Finger Removed.
Grid condenser, no oscillations	Click	Probable click
Grid condenser, oscillations	Loud Click	Loud Click
No grid condenser, no oscillations	No click	No click
No grid condenser, oscillations	Click	Click

THE multi-stranded phosphor bronze wire, such as the "Mars" aerial wire, makes an excellent catswhisker for a crystal detector. A short length should be cut off, and one end of this should be frayed out to provide a number of metallic contacts on the face of the crystal, while the other end must be fixed in the small holding nut which usually accommodates the ordinary catswhisker.

THE burning out of a low-frequency transformer can often be attributed to a too sudden application of current, and, in order to avoid this happening, the filament current should be turned off *via* the filament rheostats, so that this becomes a gradual change. Alterations in high-tension voltage can then be made as desired, after which the valve filaments may once more be heated in a gradual manner.

If this expedient is adopted, sudden rushes of current in the anode circuit will be prevented, and risks of transformer damage are thus considerably reduced.

WHEN performing wireless experiments or testing a receiving set, records of the methods adopted and the results obtained should be made in a notebook kept expressly for the purpose. This will not only save a lot of repetition work, but the notes so recorded will become a fund of information which may be drawn upon when necessary.

THE effects of hand capacity when tuning with a condenser prove a troublesome factor with many wireless experimenters, and several devices are adopted in practice either to eliminate or reduce these effects. One such method, which will prove quite useful, is to provide a sort of shield between the condenser dial and the hand.

This will be best understood by referring to Fig. 1, which shows a sheet of aluminium foil mounted on the underside of the ebonite panel immediately beneath the dial. This metallic shield,

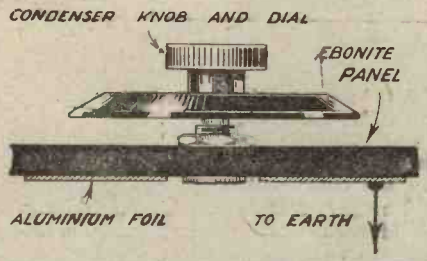


Fig. 1.—Hand capacity effects may be reduced by this method. The foil may be of any non-magnetic metal, brass or copper being as effective as aluminium.

which can be circular in shape, similar to the condenser dial, should then be earthed, and the alteration in tuning due to the presence of the hand is then neutralised.

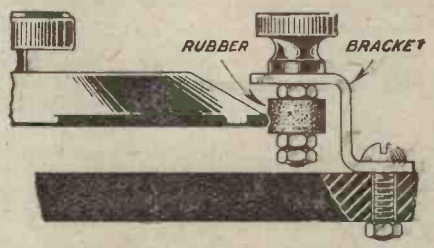


Fig. 2.—How to make and fix a slow-motion device to your variable condenser dial.

SLOW-MOTION devices for attaching to the ordinary variable condenser are often an expensive item, and the simple arrangement indicated in Fig. 2 will be found very effective in many circumstances. A small bracket, made from sheet brass or aluminium, is shaped as shown, being screwed to the ebonite panel of the receiver. This bracket accommodates a small milled nut and screw, to which is attached a piece of rubber of cylindrical form.

This rubber is arranged to have a friction grip with the periphery of the condenser dial, so that, on turning the milled nut, this dial is rotated very slowly, the reduction ratio depending on the relative diameters of the rubber and dial.

WHEN it becomes necessary to compensate for the evaporation of the electrolyte in an accumulator be very careful to add distilled water. If ordinary tap water is used injury to the plates may be caused by the presence of metallic impurities introduced through this medium.

Also, if you make up your own electrolyte from strong sulphuric acid and distilled water, always add the acid to the water and never *vice versa*, as this will then prevent the acid from "spitting" and perhaps causing injury by splashing on to the hands or clothes.

A CORRECTION

In the "Notes and Jottings" appearing in our last issue a choke of "2 henries" was mentioned in the first note. Readers are asked to note that this should have read "20 henries or more."

"DX" with Two Valves

By
Stanley G. Rattee,
M.I.R.E.

This compact receiver is especially suitable for the light evenings of the summer months, as it incorporates a stage of H.F. amplification.

NOW that the days are getting longer, many of the distant stations will be more difficult to get, the difficulty being the outcome of the extended daylight hours.

Those enthusiasts whose receivers are limited to one valve of conventional type with a swinging reaction coil will perhaps in some cases find that stations which could be received during, say, January have now, so far as they are personally concerned, completely disappeared. Such stations as Radio-Belgique, for instance, which closes down about 10 p.m. G.M.T., may quite conceivably be inaudible except during the dark hours, and at the height of the summer season such darkness does not fall until after many Continental stations have "closed-down" for the night.

A Margin of Safety

In such cases as these it is advisable, at this time of the year at any rate, to precede the detector valve with at least one stage of high-frequency amplification. Such a measure will not only assist considerably in making the reception more possible, but will at the same time simplify the operation of actually picking up the station, in that the receiver will not require to be adjusted to the very edge of self-oscillation before the desired station be heard.

Tuning Controls

It is true that the number of controls has been increased, but since the manipulation of these is not particularly difficult, the margin of safety given by the H.F. stage would seem to justify the slight complication involved by the extra valve.

Further, as the reaction control can be of such a type that it is not necessary to vary the coupling between two coils by swinging them apart, this too may be looked upon as being an improvement upon the conventional single-valve circuit utilising a swinging reaction coil.

The Present Case

In the receiver to be described two valves as advocated above are used, the first being a high-frequency valve, while the second is a detector of conventional type. The first valve, that is, the H.F., is stabilised by neutralising the inter-electrode capacity of the valve itself, and while no provision is made for reaction, should such an effect be desired, the requirement is easily satisfied by a slight alteration in the setting of the neutralising condenser.

For ordinary purposes this neutralising condenser may be so adjusted that the H.F. valve is completely stable, whereupon the only variables which have to be operated are the grid and anode tuning condensers, neglecting the two filament resistances, which, once set, remain so for the duration of the evening's reception.

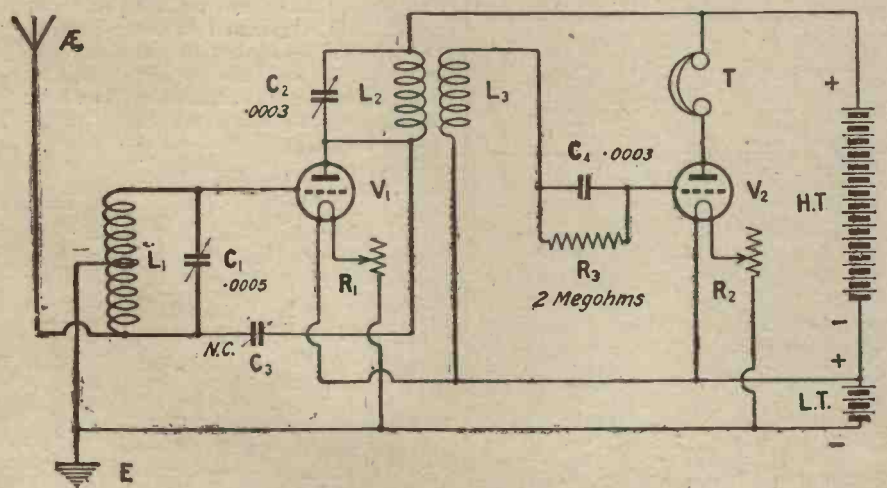


Fig. 1.—The H.F. valve V1, is stabilised by the neutralising condenser C3. No reaction coil is used in this receiver.

Points in Design

The receiver illustrated is built in such a way that the valves, coil, H.F. transformer, in fact, everything except the controlling knobs and terminals, are housed within the cabinet; the latter being fitted to an ebonite strip, which is in turn secured to the back edge of a baseboard, the cabinet being slotted to allow of easy accessibility for battery connections.

The American type of cabinet has been chosen, with upright panel, and baseboard, the two being held together by means of right-angle brackets.

Separate filament resistances have been provided for the valves, thus making it possible for various types of valves to be used in either position; further, since these filament resistances are of the "dual" type, valves of either the bright- or dull-emitter classes may be used for either both positions or singly.

The Circuit

The circuit arrangement of the receiver is one which will not be entirely new to constant readers of THE WIRELESS CONSTRUCTOR, in that the circuit was discussed from a theoretical point by Mr. J. H. Reyner in the last issue.

In the practical design the centre-tapped coil L_1 is of the plug-in type,

and may be either of Lissen or Gambrell manufacture. The H.F. transformer L_2, L_3 is also of the plug-in type, several makes of which will be found in the advertisement pages; the neutralising condenser is of small capacity, and is in this case a "Neutrovernia" condenser of Gambrell manufacture.

The condensers across the L_1 and L_2 coils, this latter being the primary winding of the H.F. transformer, are .0005 and .0003 respectively, while the grid condenser C_4 and grid leak R_3 are of .0003 capacity and 2 megohms resistance. The connection to the centre-tap of the grid coil L_1 is made by means of a flexible lead, which is secured at the other end to the earth terminal fitted to the panel of the set. In this way the coil may be easily changed should it be desired to cover a wavelength beyond the range of the coil in use at the time.

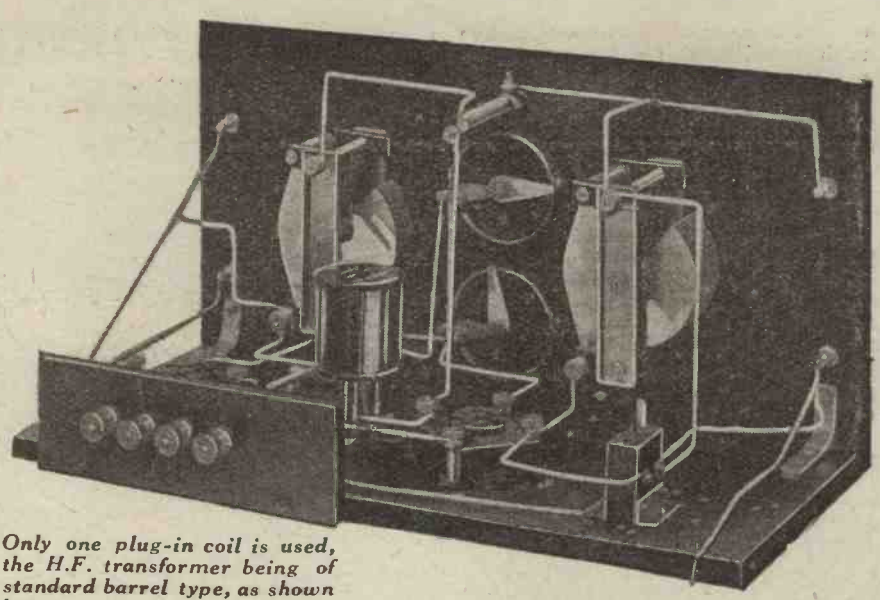
Components and Materials

Readers desirous of building a receiver of this type should first collect together the following components and materials whereupon the actual work of construction may be commenced.

Following upon the item mentioned will be found in most cases the name of the manufacturer (or trade mark), and though, of course, other suitable makes may be found in the advertisement pages, the values where given should be adhered to.

This latter point seems to be one which is sometimes disregarded, in that the builder often seems to fall to the temptation of using some component he already possesses, irrespective of whether its value is suitable or not.

This departure from the values given may quite conceivably result in considerable disappointment following upon the final testing of the set, in that the set may not cover the broadcast band, or it may be unstable, or, on the other hand, it may not give anything like the results claimed for it by the author.



Only one plug-in coil is used, the H.F. transformer being of standard barrel type, as shown here.

What You Will Need

One "Radion" panel 14 in. × 7 in. × $\frac{3}{16}$ in. (American Hard Rubber Co., Ltd.).

"Camco" cabinet and baseboard of suitable size (Carrington Manufacturing Co., Ltd.).

Two variable condensers, .0005 and .0003 respectively, both square-law (Bowyer-Lowe Co., Ltd., "Popular").

Two dual filament resistances (L. McMichael, Ltd.).

One "Neutrovernia" condenser (Gambrell Bros., Ltd.).

Two non-microphonic valve holders (Benjamin Electric, Ltd.).

One ordinary type valve holder for baseboard mounting.

One coil socket for baseboard mounting.

One grid condenser, .0003, and leak, 2 megohms (Dubilier Condenser Co., Ltd.).

Four nickel terminals and ebonite strip.

Four "Belling-Lee" terminals, "A," "E," "P" (red), "P" (black) (Belling & Lee, Ltd.).

Short length of rubber-covered flexible wire.

Quantity No. 16 "Glazite" connecting wire.

Radio Press panel transfers.

Two centre-tapped coils, No. 60 and No. 250 (Lissen, Ltd.), or alternatively Gambrell C and F centre-tapped coils.

Two H.F. transformers, plug-in type; one for the 300-600-metre range and the other to cover the wavelength of 5XX.

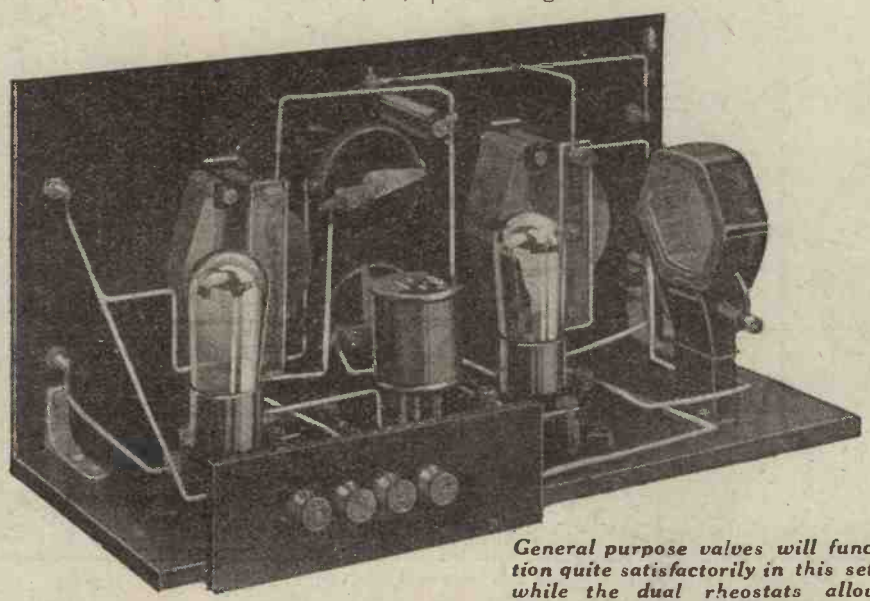
Valves to Use

Any of the "general-purpose" types of valve may be used with this receiver, or alternatively special H.F. valves may be used. Among those which have actually been tried are the Mullard "Red Ring," D.E.8H.F., D.E.5b., D.E.3, Cossor "Pink Top" P_2, and various types of "general-purpose" valves.

Preparing the Panel

After procuring the components, the panel should be marked out and drilled in accordance with the instructions given in Fig. 2, which shows the panel layout. Should any departure be made, however, in the makes of components as given in the list above, care should be taken to see that the same dimensions are appropriate to the components chosen; that is to say, the constructor should assure himself that the dimensions given will allow of sufficient clearance, and, if there should not be, then the measurements should be modified to suit individual requirements, though in general the design must not be departed from.

After the holes have been drilled, the panel should be fitted to the baseboard, and the whole slid into the



General purpose valves will function quite satisfactorily in this set, while the dual rheostats allow either bright or dull emitters to be used.

cabinet to ascertain that a satisfactory fit is possible; should the panel stick or fail to enter the front of the cabinet, then the edges of the panel should be filed until a satisfactory fit results.

Mounting the Components

So far as the panel components are concerned, these are all of the "one-hole" fixing variety, thereby simplifying to a marked degree the actual mounting of these. The components upon the baseboard should be arranged in the manner shown in the wiring diagram, and may be secured by means of small wood screws.

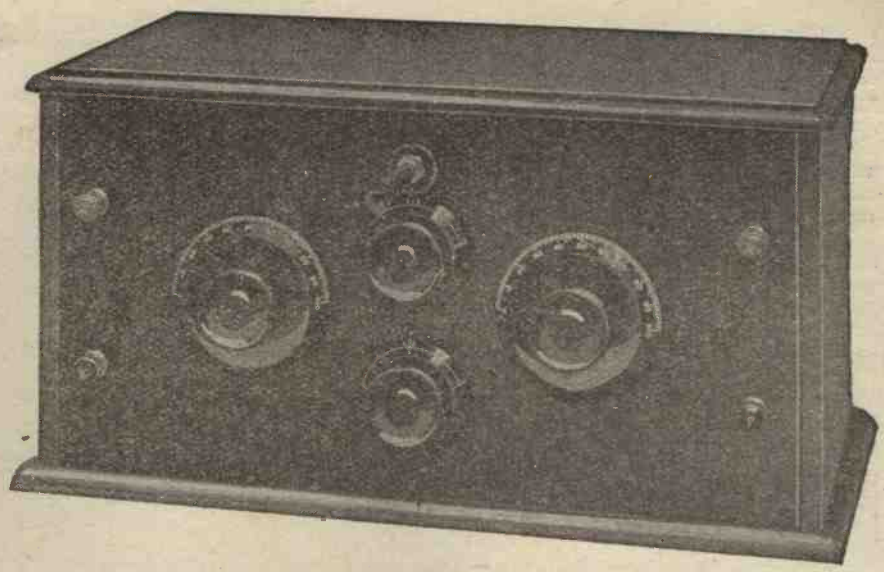
The laying out of the baseboard components should be duplicated as near as possible to the original, as seen in the photographs, ample clearance being given to each for easy accessibility in wiring up.

The coil socket for the centre-tapped coil marked L_1 and the holder for the plug-in transformer should be widely separated, so as to avoid stray coupling between them. The ebonite strip carrying the four battery terminals is secured edgewise to the baseboard by means of two substantial wood screws.

Connecting Up

As to the wiring up of the set, this should be fairly easy on account of the "roomy" layout. Except where terminals are provided on the components every connection is soldered. The actual connecting wires should be well spaced, should not run parallel—particularly those leads which complete the grid and anode circuits—and should, wherever practicable, cross other wires at a right angle.

As to the manner in which to start, or, rather, where to start, it is advisable first to connect the filament lighting circuit, for those leads which are connected to the filament resistances are partly situated below the anode tuning condenser. By reason of their position, should the connections to the rheostat be left to a later stage, it may be found difficult to apply the soldering iron at the necessary points.



Only four terminals appear on the front of the receiver, all battery connections being made at the rear.

Condenser Connections

It will be noticed that in this set the fixed vanes of the anode tuning condenser are connected to H.T. positive, and the reason why this was done was to simplify the actual wiring to the neutralising condenser.

In practice there seems to be no ill-effect from this measure so far as the present receiver is concerned, though in other sets it is generally not to be recommended.

The reason for the absence of any appreciable hand-capacity effects resulting from this connection of the moving element is probably due to the fact that the anode circuit tuning is by no means sharp, even when the moving vanes are connected in the more conventional manner; from observation of this point no difference in operation could be found, using either connection; the selectivity of the set being given by the fine tuning afforded by the grid tuning condenser.

Testing the Set

Having satisfied oneself that the wiring is correct by a careful check against the wiring diagram (Fig. 3),

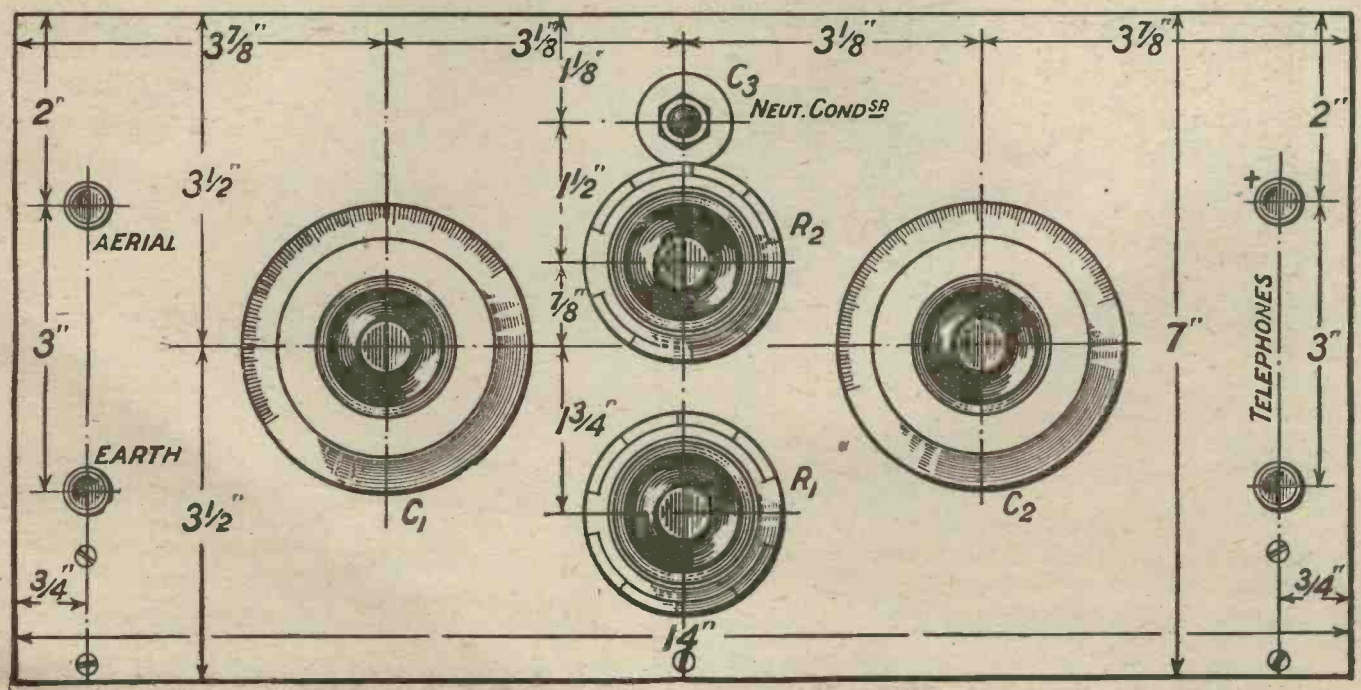


Fig. 2.—The panel layout is symmetrical, and all necessary dimensions are given here. Blueprint C1044A.

Get Rid of Valve Trouble

Get rid of these disturbing microphonic noises—prevent the danger of breakage from shock. Ask your dealer for the new improved Lotus Buoyancy Valve Holder, which absorbs shock and protects your valves.

Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze sockets, nickel-plated.

Without Terminals 2/3

With Terminals 2/6

LOTUS BUOYANCY VALVE HOLDER ANTI-MICROPHONIC

Garnett, Whiteley & Co., Ltd.,
Lotus Works, Broadgreen Rd., Liverpool.
Makers of the famous Lotus Vernier Coil Holder.

J.B. LOW LOSS.		J.B. LOW LOSS GEARED VERNIER (60 to 1)	
.001	13/-	.001	17/6
.00075	11/9	.00075	16/3
.0005	10/6	.0005	15/-
.0003	9/-	.0003	13/6
.00025	8/9	.00025	13/3
.0002	8/6	.0002	13/-
.0001	8/3	.0001	12/-

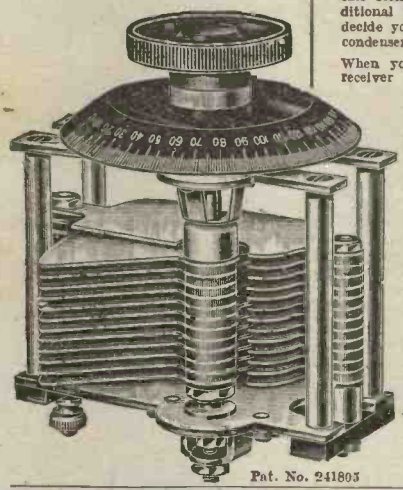
THROUGH MANY EXPERIMENTS

Here is the variable condenser which provides even more than mechanical perfection. It is this often overlooked and additional factor which should decide your choice of variable condensers.

When your first experimental receiver includes J.B. Condensers—you may be sure that further experiments — however exacting—cannot call for a better condenser.

J.B. Condensers are famous throughout the world for complete efficiency. The proud possessors of J.B. Condensers who have consequently contributed towards this world-wide renown, are your guides to *the utmost tuning efficiency.*

For successful experiments and the complete efficiency of any type of receiver you must build with J.B. Variable Condensers.



Pat. No. 241803

JACKSON BROS.

8, POLAND ST—OXFORD ST
LONDON — W.1
(First Floor)

Telephone:—
GERRARD 7414

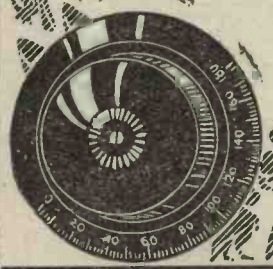
THE MARCH OF THE PELICAN UNIVERNIER

The Pelican Univernier is steadily moving on to more panels because it *does* give absolute vernier control.

Simply take off the dials of your variable condensers and put on the "Pelican."

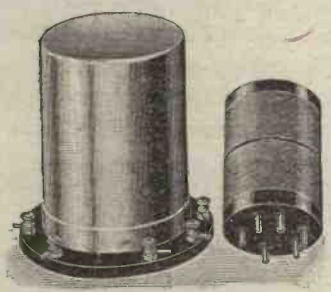
Price **6/-**

Guaranteed throughout.
Obtainable from all dealers.



Cahill & Company, Ltd.,
64, Newman St., London, W.1.

Parrs Ad.



SCREENED COILS

Developed by MR. J. H. REYNER, and described in "Wireless Weekly."

Magnum Screening box complete with 6-pin base mounted on ebonite **15/-**

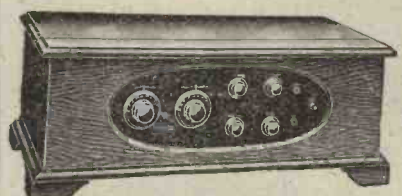
Aerial Coil 250/550 metres **4/6**

H.F. Transformer for use with above **7/6**

APERIODIC H.F. TRANSFORMERS

300/600, 550/1200, 1100/3000 metres

10/- EACH



THE NEW MAGNADYNE SUPER-HET

Demonstrations arranged by appointment.

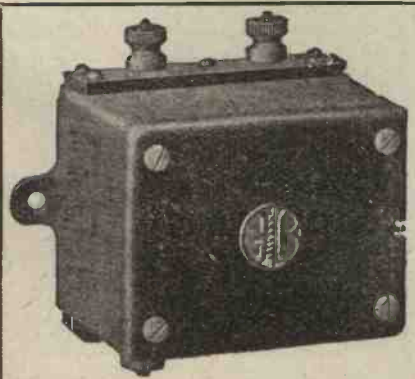
MAGNUM Single Coil Holder. For Baseboard Mounting, as used in several Radio Press sets

PRICE **1/9**

Components supplied for all sets described in this issue. Send stamp for Lists.

BURNE-JONES & CO., Ltd.

Magnum House, 296, Borough High Street, London, S.E.1



PURITY PLUS POWER

GAMBRELL L.F. TRANSFORMERS

are built up to the same standard of efficiency as the wonderful Gambrell Coils. In other words they are unsurpassable at any price. If unable to obtain locally, write direct and ask for literature.

Stage I, 25/6
Stage II, 25/6

GAMBRELL BROTHERS, Ltd., 76, VICTORIA ST., LONDON, S.W.1.

then the valves should be inserted in their holders. The coil L_1 and the H.F. transformer should also be placed in their correct positions, the flexible connection from the earth terminal being taken to the centre tap on the grid coil (L_1), whereupon the accumulator should be connected across the L.T. terminals, having first turned the filament rheostats to the "off" position.

By slowly turning the filament resistances "on," the valves should light up, the brilliancy of the filaments being controlled by the arms of the respective resistances. As a test of the H.T. connections, the accumulator should now be removed from across the L.T. terminals and connected across the H.T. terminals, noting that the valves do not light up.

Adjusting the Neutralising Condenser

With a No. 60 or C centre-tapped coil in the L_1 socket, a 300-600 metres transformer in position, and the accumulator and H.T. battery connected across the appropriate terminals, connect the telephones; a suitable value for H.T. voltage is 45-60 volts.

Light the valves to a suitable degree of brilliancy, and set the grid tuning condenser C_1 to, say, 60 deg.; turn the neutralising condenser in an anti-clockwise direction as far as it will go, and slowly turn the anode tuning condenser, whereupon a position will be found where the set will oscillate. Leaving the two variable condensers for the moment in these two positions, slowly turn the neutralising condenser in a clockwise direction until self-oscillation ceases. Now turn the anode tuning condenser first one way and then the other, and should self-oscillation again start, turn the neutralising condenser just a little more in a clockwise direction until self-oscillation ceases.

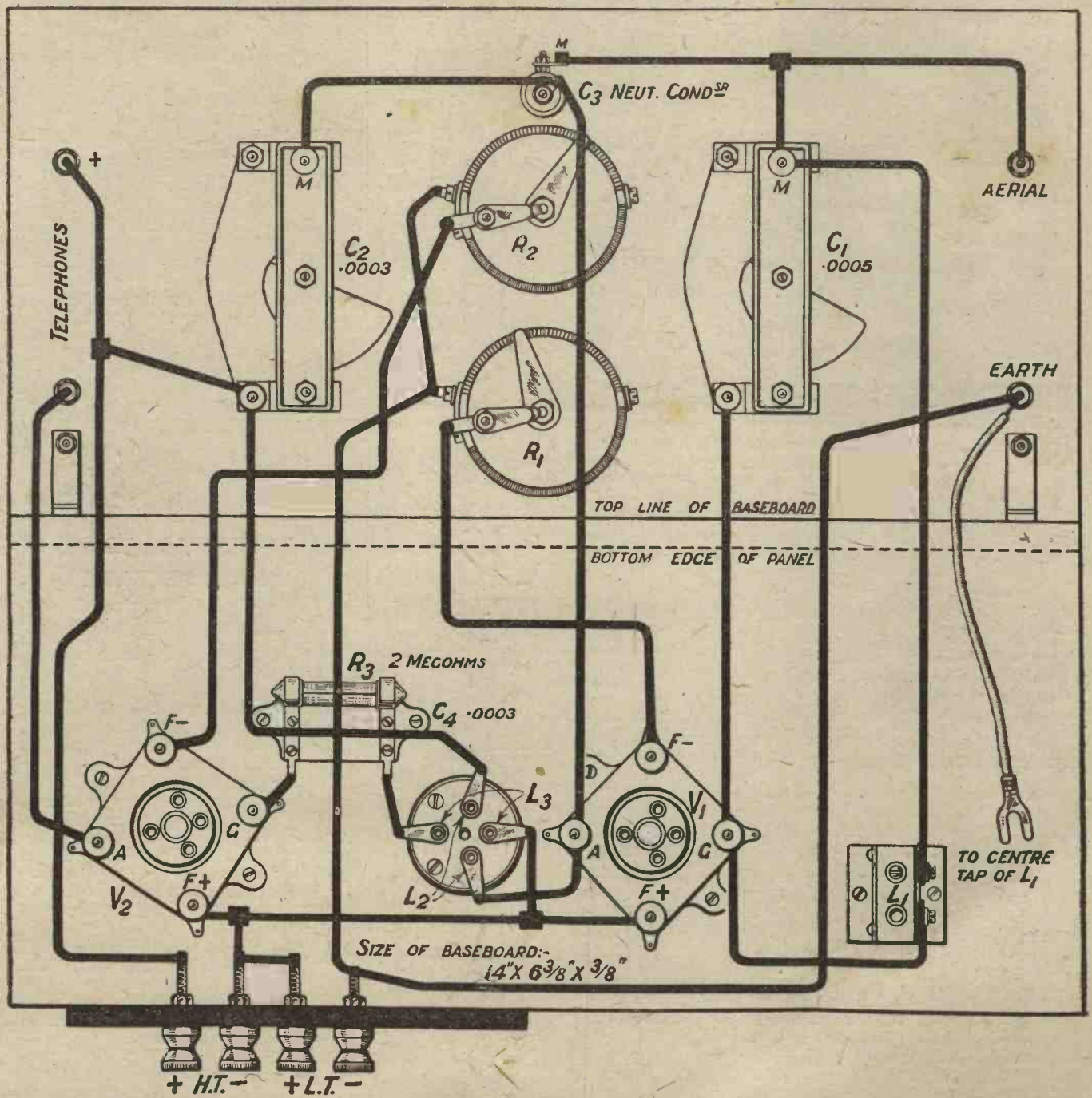
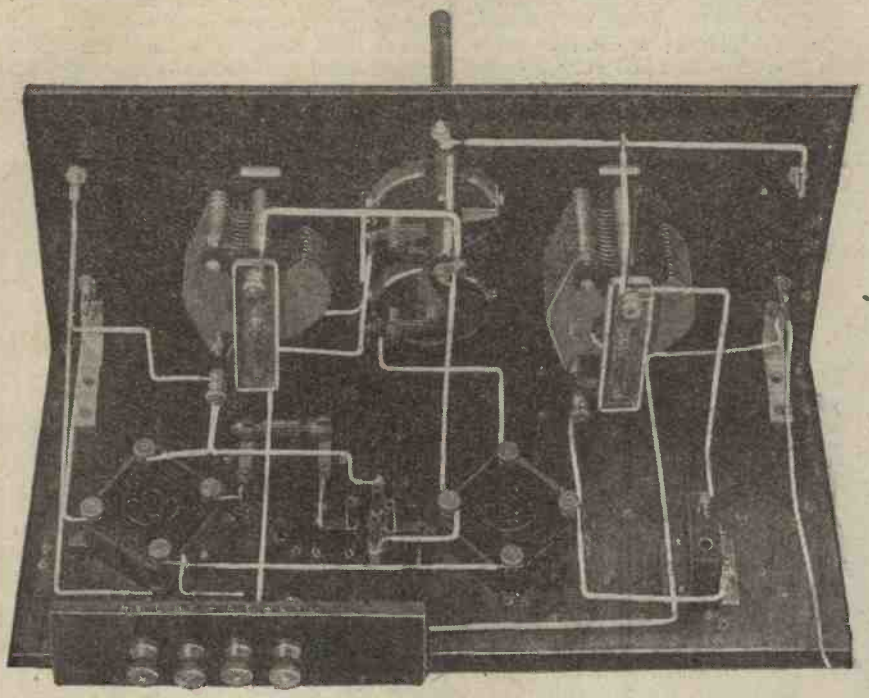


Fig. 3.—This wiring guide gives full details of the connections and terminal markings. Ask for Blueprint C1044B.

Repeat the operation several times at different settings of both the grid and anode tuning condensers to make sure that the set is properly neutralised, making further adjustments to the small neutralising condenser if necessary.

When the latter has been adjusted so that the set will not oscillate over the full tuning range, the aerial and earth may be connected to their appropriate terminals, and the work of tuning in may be commenced.



Use your blueprint in conjunction with this photograph, which shows how the wiring is arranged.

Operation

The operation of tuning with a set of this type is dependent upon the speeds at which the two condensers should be turned in relation to one another. It will generally be found that the C_1 condenser will need to be turned a little faster than the C_2 condenser, and with this latter condenser set to, say, 30 deg., the C_1 condenser should be turned from zero toward its higher readings until the two circuits L_1 C_1 and L_2 C_2 are in tune.

This condition will generally make itself manifest by a slight breathing sound in the telephones, and by turning the two condensers C_1 and C_2 at the correct speeds, this breathing sound may be maintained throughout the full tuning range.

Should the local station be working, handling the set in this way will soon result in this station being picked up, and, if done carefully, more distant stations will also be heard at different settings of the condensers.

The Reaction Effect

Should a station be picked up, and signals be very weak, a reaction effect may be obtained by slightly altering the position of the neutralising condenser, though every care must be taken in the operation to ensure that the set does not oscillate, and so cause interference. If, after this alteration is made, it is desired to vary the position of the C_1 and C_2 condensers, it must be remembered that the setting of the neutralising condenser should be altered to its former position, otherwise, when the grid and anode tuning condensers are moved in the correct manner, the set may quite possibly burst into self-oscillation.

Reception of 5XX

Should it be desired to receive on the longer wavelengths, such as, for instance, those used by Daventry and Radio-Paris, the No. 60 centre-tapped coil should be changed to a No. 250 or F centre-tapped coil, while the 300-600 metre transformer should be changed to one covering the longer wavelengths.

Operation on these long waves is precisely the same as that upon 300-600 metres, though it may be found that the neutralising condenser needs to be readjusted slightly, not necessarily so, but, nevertheless, a possibility. The readjusting operation should be performed, if necessary, in the same manner as previously described. Once the set is properly stabilised, the reception of both 5XX and Radio-Paris may be attempted, the same coil and transformer being suitable for either of these stations.

Results Obtained

Using the receiver in South-east London upon an indifferent aerial, the first station received after the set was completed was Birmingham.

Since that date the receiver has been in constant use for listening purposes by the family, and among the distant stations which have been identified the following are received at good telephone strength:—

Newcastle, Bournemouth, Radio-Paris, Daventry, Ecole Superieure, Hamburg, Rome, Radio-Prague and Radio-Berne.

Quite a number of German stations are also received at varying strengths, but unfortunately the identity of these is not known.

Elstree Test Report

The following are the main points from the test report made by THE WIRELESS CONSTRUCTOR Laboratories at Elstree:—

Operation.—Simple.

Valves.—The set worked well with any general-purpose valves, slightly better results being obtainable with high-impedance valves in both sockets.

Selectivity.—The tuning on the first condenser was very sharp, but rather flat in the case of the second condenser. Newcastle was received with only slight interference from London.

Stations Heard.—London, Bournemouth, Newcastle, Birmingham, Ecole Superieure, Hamburg.

A SINGLE-VALVE THREE-CIRCUIT RECEIVER

SIR,—I wish to thank Mr. John Underdown for the excellent single valve three-circuit receiver described in the January, 1926, issue of THE WIRELESS CONSTRUCTOR. I have just built this set, and must say that it has surpassed all my expectations.

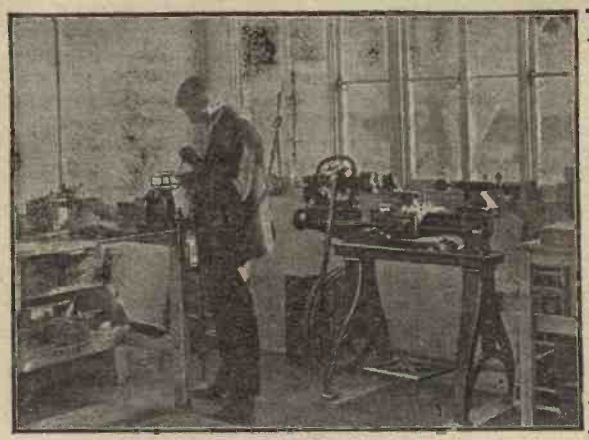
So far I have had, in addition to the local and Daventry stations, Radio-Paris, Koenigswusterhausen, Madrid EAJ7, and San Sebastian. Each of these stations came in at good 'phone strength and quite free from distortion. I have also had at fair 'phone strength amateurs 6TG and 5OD.

This, I think, is excellent, when I say that my aerial is only about 18 ft. high at the free end and about 65 ft. long. Earth consists of a galvanised iron plate about 3 ft. square buried directly under the aerial.

Wishing THE WIRELESS CONSTRUCTOR every success.—Yours faithfully,

HOWARD E. L. PHEAZEY.

Bournemouth.



WORKSHOP HINTS
FOR THE
HOME CONSTRUCTOR

Drills for clearance holes—Loose terminals—One-hole fixing—Taps for ebonite—Constructional toys—Cutting tubes—A non-corrosive flux—Good and bad soldered joints

THE CLEARANCE SIZES

IN nearly all tables dealing with drilling and tapping sizes one finds it stated that the drill number required to make a clearance hole for a 2B.A. screw is No. 12 Morse, whilst No. 26 is given for 4B.A. and No. 34 for 6B.A. I have never been able to understand why these figures are accepted by almost everyone, since actually the holes made with these drills are considerably too large for the respective B.A. sizes. This is a matter of some importance when one is concerned with the mounting of terminals upon a panel, for if the holes drilled are such a poor fit that the shanks are quite slack in them when inserted, then it is a difficult matter to ensure that the terminals shall not work loose when they have been in use for some time.

Screw in Your Terminals

If you take a 2B.A. screw, a 4B.A. and a 6B.A. and pass them through a gauge plate, you will find that the largest size slips quite easily into a No. 13 hole and that it will almost go into a No. 14. No. 13 is therefore the best size to use, though if you want a really tight fit here is a good tip. Make a No. 14 hole and with a screwdriver turn a 2B.A. screw straight into it without any tapping; it will go in quite easily. Remove the screw, and you will have a hole

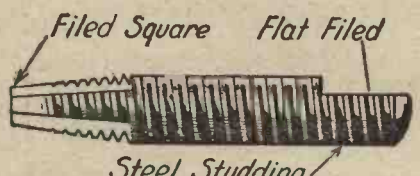


Fig. 1.—Hard-wearing steel taps may easily be made at home.

into which a 2B.A. terminal or other fitting can be inserted readily by screwing it in with the fingers.

In the same way a No. 27 drill (instead of No. 26) makes a tight clearance hole for a 4B.A. terminal, and a still tighter fit can be obtained by making a No. 28 hole and using a screw as a pilot in the way described above. For 6B.A. No. 35 is a good clearance fit, and a size smaller will allow the pilot-screw method to be employed.

Loosening Prevented

If these revised clearance sizes are used for mounting terminals it will seldom be found that they will work loose, provided that the nuts on the lower side of the panels are properly clamped up with a flat washer beneath each. Assurance can be made doubly

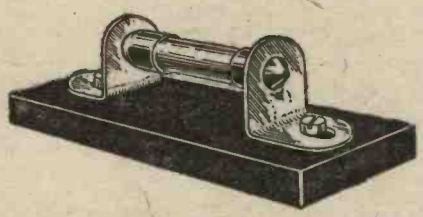


Fig. 2.—The small metal brackets used in constructional toys make excellent grid-leak clips.

sure by smearing the shank of each terminal with Chatterton's compound before inserting it.

Other Cases

On the other hand, there are cases in which it pays to make your clearance holes on the large size. Suppose, for example, that you are mounting on a vertical or horizontal panel a variable condenser which is not provided with a "one-hole" fixing. There will usually be three clearance holes to make in the panel for each set of fixing screws. Even if you make very careful measurements and take pains over the marking out and centre-punching it is quite likely that one or more of the holes drilled will be very slightly out of its proper position—there are so many opportunities for the human factor to creep in and cause a small error.

Sources of Error

You may be a tiny fraction of an inch "out" in your measurements owing to the effects of eye displacement, the point of the centre-punch may be placed not exactly upon the crossing of the scribed centre lines, and you may fail to hold the drill absolutely at right-angles to the panel when making the hole. If, therefore, tightly fitting clearance holes are made, it is possible that you will have difficulty in driving the fixing screws into the tapped holes made for their reception in the condenser, since no margin is allowed for a small error.

When doing jobs such as these I generally make the clearance holes for 4B.A. screws with a No. 24 drill. For 2B.A. a No. 10 is suitable, and a No. 30 for 6B.A. If countersunk screws are used they obtain a very firm grip even with these big clearance holes, owing to the comparatively large amount of contact surface between their heads and the countersunk portion of the holes.

Making a Set of Taps

Some time ago I showed in these notes how emergency taps for ebonite could be made from brass studding by filing up a short length in the way shown in Fig. 1. Such taps when new thread ebonite quite well, but the worst of them is that they do not last very long. A set of taps that will stand hard wear is easily made in the home workshop by using steel studding instead of brass. This material

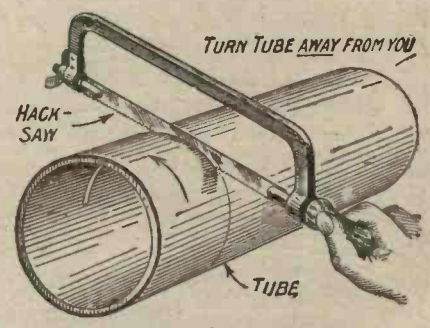


Fig. 3.—When cutting cardboard or ebonite tubing the tube should be turned away from the body.

is obtainable from shops which deal in engineers' supplies and is not expensive. Failing studding of this kind, long steel screws can be turned into hard-wearing taps for working ebonite by cutting off their heads, making a small flat at one end and filling the other end square.

If you use your small taps, as I generally do, in the chuck of the hand

drill instead of in the tap wrench, it is a good tip to make the cut-away square portion rather long. The point of the tap then protrudes from the far side of the hole before the cutting of threads begins. This enables one to see instantly whether the tap is starting straight; if it starts straight it will continue to take its proper course through the hole that is being threaded.

Don't Forget the Turpentine

When using home-made taps of this sort it must be remembered that owing to the absence of slots along the whole length of the cutting threads the tap is not able to clear itself so well as one of the bought variety. One should therefore always remove it and blow away the chips and dust after the first few turns have been made. It can then be turned right through the hole that is being threaded. To lengthen the lives of your taps do not forget to use a little turpentine as a lubricant, especially when you are doing quick work with the tap in the chuck of the drill.

Useful Parts

I wonder how many wireless constructors have realised the usefulness for their work of many of the parts of constructional toys, such as Meccano, Primus and the like? The little brackets shown in Fig. 2, which can be bought at any toy shop, make excellent grid-leak clips, and they can be used for a variety of other purposes.

They are, for example, most handy for the baseboard mounting of inductances wound on tubular or low-loss formers. The holes in Meccano strips and brackets are just too small to take 2B.A. studding, but if they are enlarged by running a No. 13 drill through them, they make good bearings for long 2B.A. spindles.

Geared Coil Holders

In this respect they are especially useful for supporting the actuating spindles of geared coil holders mounted behind the panel upon the baseboard of the receiving set. Such coil holders can be made in the home workshop

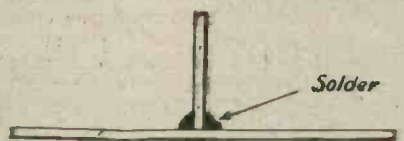


Fig. 4.—A soldered "T" or butt-joint may give trouble, although apparently sound.

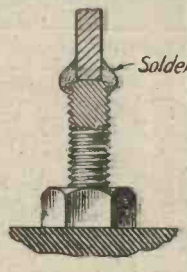
with the help of the straight or bevelled gears, which are obtainable in several different sizes. These gear wheels are drilled and are provided with set-screws. They can be fixed very securely to spindles by running a 2B.A. tap through them. The wheel is then screwed on to the spindle and fixed with a set-screw.

Should you wish to operate two tuning condensers by the turning of one knob you can do so very easily by fixing to the spindle of each a sprocket wheel and using a length of the special chain which fits the teeth of these wheels. There are scores of other uses for these parts, and a visit to the toy shop (or to your boy's toy cupboard!) will often provide a simple solution to a puzzling constructional problem.

Model Engine Parts

If, by the way, you wish to make geared coil holders or geared variable condensers with a really smooth action

Fig. 5.—This joint, though neat, suffers from the same drawback as that in Fig. 4.



without backlash, I would advise you to purchase the necessary pinions or gear wheels from a shop which specialises in model engine parts. I recently made a moving coil holder with a 12½ to 1 reduction through a worm and pinion. The gears used were designed for supplying the drive of a small electric motor to the axle of a model locomotive. There is absolutely no shake or backlash in them, and the action is as near perfection as one could desire.

CUTTING TUBES

SOME constructors find it rather difficult to cut off a length of cardboard or ebonite tubing neatly and straightly. The best way to set about the job is this: Make a small mark (use a scriber in the case of ebonite, and a pencil for cardboard) at the place where the cut is to begin. Measure the distance from this mark to an end of the tube, which is perfectly straight. Go round the tube, making a number of other marks at intervals at the same distance from the end of the tube as the first one. If these are fairly close together you will not have any difficulty in joining them so as to make a continuous guide line right round the tubing.

How to Use the Saw

Now place the tube on the bench and start the hacksaw carefully on the marked line. As soon as you have cut through the wall of the tube at this point turn the tube slightly in a direction *away* from the body, as shown in Fig. 3. As the hacksaw blade should be set to cut on the thrust you can thus see that the teeth meet the guide line as they make the cutting stroke.

Cut only with the "heel" of the blade, holding the saw so that the for-

ward portion of the blade does not touch the material either on the thrust or on the draw. Continue to turn the tube whilst cutting until you have gone right round the guide-line. It will then be found that the cut has been made perfectly straight. The end of an ebonite tube should be trimmed up after cutting with a fine file; for cardboard tubing it is best to use a very sharp knife for the purpose.

IS SOLDERING PLAYED OUT?

NOT a few expert constructors of my acquaintance are beginning seriously to wonder whether it is not better to dispense altogether with soldered joints in wireless receiving sets. Their reasons for assuming this attitude, which but a short time ago would have been regarded as the

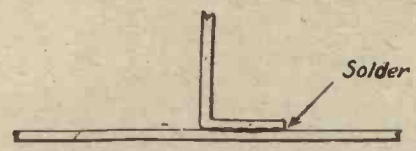


Fig. 6.—For joining wires of the same thickness an "L" joint is excellent.

rankest heresy, are many. Numbers of readers may have noticed that the performances of a receiving set are apt to deteriorate when it has been in use for some months. The most commonly observed symptoms are a gradual loss of sensitiveness, selectivity and signal strength; in fact, the set becomes less and less lively as time goes on.

When this occurs an immediate improvement usually results if all the joints are re-soldered with a hot iron, which seems to prove that the cause of the trouble may be traced to some kind of chemical action at the joint which gradually impairs the connections and introduces a certain amount of resistance at various points. Then as nearly everyone has discovered by bitter experience, certain kinds of soldered joints are apt to come adrift, though to the eye they may appear to be still perfectly sound.

A QUESTION OF FLUXES

PERSONALLY I do not think that soldering is played out, though I feel that we must revise our ideas to some extent and abandon some of our present methods. The flux question is a very important one. The purpose of a flux is two-fold; it assists the melting of the solder, and its application to the metal parts that are to be joined prevents them from oxidising whilst the work is being done. Many kinds of flux commonly used show an acid reaction when tested with litmus paper; even resin when heated may have a chemical effect upon brass and copper Some of the ready-made liquid fluxes sold in bottles have a very powerful action indeed.

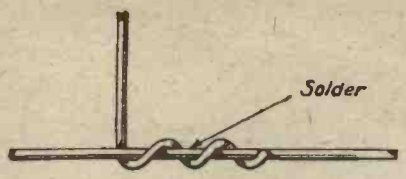


Fig. 7.—If a thin wire is twisted round and soldered to a thicker lead a very reliable joint results.

A piece of No. 18 gauge copper wire immersed in one of these was almost entirely dissolved in a couple of months.

A Home-made Flux

Here is a formula that I have been trying recently which gives a flux easy to work with, though it seems to give rise to no appreciable amount of corrosion:—

Lactic acid	... ...	1 part.
Glycerine	... ...	1 part.
Water	... ...	8 parts.

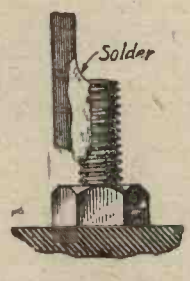
Any chemist will make up the flux from this formula, and it is well worth a trial. It certainly seems most promising so far as I have been able to test it, and it is possible that a slight alteration in the proportions of the ingredients might lead to still better results.

JOINTS THAT GIVE TROUBLE

IN Figs. 4 and 5 are shown two frequently used kinds of joint each of which may give trouble. The first, in Fig. 4, is the "T" joint used by many constructors for connecting leads together. The second is the connection of a lead to the tip of a terminal or valve leg by means of a "blob" of solder. The worst of joints of this kind is that when they give way they often appear to be perfectly sound.

They are particularly apt to come

Fig. 8.— Though not as neat as the Fig. 5 joint, this method of making connections to terminal shanks is to be preferred.



adrift when subjected either to sudden jolts or to constant vibration. Personally I have been let down so often by these joints, after the most careful soldering work and the most stringent tests, that I have given them up altogether, and I believe that other constructors will be wise if they adopt the same course.

Better Methods

For joining wires of the same thickness I use nothing but the "L" joint shown in Fig. 6. This is an easy joint to make, and since the contact surface between the two leads is comparatively large the solder has a better chance of effecting a firm union. When the leads are of different size a very safe joint is that seen in Fig. 7. The thinner wire is twisted two or three times round the thicker and a good blob of solder is run over the junction with a very hot iron. This joint can be relied upon not to come adrift, and I have never known it responsible for any falling off in the performances of a receiving set.

Sound Terminal Joints

Figs. 8 and 9 show two joints which will be found quite reliable for making connections to the shanks of terminals or valve legs. In Fig. 8 the end of the lead is held parallel with the shank, the overlap being about one-third of an inch. It is, of course, essential to see that the shank is per-

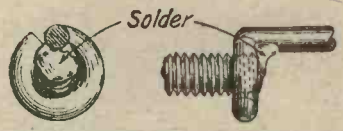


Fig. 9.—A neater joint results if a loop is made at the end of the wire to take the terminal shank.

fectly clean before the job is attempted. Solder is run in between the two with a hot iron, and a sound joint results that will stand a good deal of rough treatment.

The Fig. 9 terminal joint takes a little longer to make, but it has a very neat appearance, and when it is done it makes a solid connection. With a pair of round-nosed pliers make a small loop at the end of the lead. Place this over the shank of the terminal and squeeze up tightly with flat-nosed pliers. Run in sufficient solder to make a good-sized blob and the joint is finished.

For Rough Usage

For portable sets and pieces of apparatus that are likely to be subjected to shocks of a more or less violent nature an absolutely dependable joint can be made by a slight elaboration of the method shown in Fig. 9. Begin by placing a thin nut on the shank of the terminal and run it down until it is about a quarter of an inch below the tip. Then slip the loop in the end of the wire on to the shank of the terminal and follow it with a second thin nut. Lock the two nuts tightly. Lastly, run solder in between the nuts.

Published ***1st*** *of every month.*

Price ***1/-*** *Monthly.*

MODERN WIRELESS, the original 1/- monthly Wireless magazine, fully maintains its high standard. Every issue contains articles interesting and instructive to you. Take it regularly and keep pace with your hobby.

A SUPERHETERODYNE FOR THE OPEN AIR. By G. P. Kendall, B.Sc.

A portable receiver which will appeal to all who desire a set for use in the open air and which gives a wide choice of programmes on the loud-speaker from British and foreign stations.

A MASTER OSCILLATOR TRANSMITTER. By R. W. H. Bloxam (5 L.S).

Transmitters will be particularly interested in this efficient 10-watt transmitter for working on 45 metres.

A SINGLE CONTROL FOUR-VALVE RECEIVER. By A. Johnson-Randall.

This set has been designed with a single control for the reception of the local station and Daventry. Music lovers will appreciate the pure reproduction given.

A COMBINED REACTION THREE-VALVE RECEIVER. By E. H. Berry.

The provision made for varying the inductive reaction and capacitative control enable the best proportion for smooth working to be secured.

AN INDISPENSABLE TESTING UNIT By H. J. Barton-Chapple, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

This simple unit enables accurate measurements of resistances and capacities to be made and will prove useful to all constructors and experimenters.

A MULTIPLE CIRCUIT SINGLE-VALVE RECEIVER. By E. J. Marriott.

Several types of aerial and reaction coupling arrangements can be tried with this set.

OTHER INTERESTING FEATURES.

CIRCUITS THAT WILL NOT HOWL. By J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

SINGLE OR MULTI-VALVE? - - - By Percy W. Harris, M.I.R.E.

IMPROVISING AERIALS FOR THE COUNTRY OUTING. By A. V. D. Hort, B.A.

LOCAL RECEPTION ON FRAME AERIALS. - - By D. J. S. Hartt, B.Sc.

Obtainable from all Newsagents, Booksellers and Bookstalls or direct from The Publishers. - (Subscription Rates, 15/- per annum; 7/6, 6 months.)
Radio Press, Ltd., Bush House, Strand, London, W.C.2.

Modern Wireless

OPERATING A SINGLE VALVE SET

By A. S. CLARK

Do you get the best from your receiver? The suggestions given below may help you to increase your range and improve ease of operation.

THE popularity of single-valve receivers is very great at the present time. This is due, no doubt, to the ease with which they are tuned and to their sensitiveness when some form of reaction is incorporated. Many people consider a single-valve receiver just as sensitive as a multi-valve set where reception of distant stations is concerned, but the single-valver must be used very carefully for DX reception if neighbours are not to be annoyed by howling and all the other weird noises which a badly-controlled single-valve reaction set is capable of producing.

I think that it may safely be said that single-valve sets are responsible for more than half the shrieks that are so prevalent at the present time. This article is therefore written to give some idea of how to obtain proper reaction control, and also to give a few hints on obtaining the best from one valve.

Smooth Control

Before any distant reception can be successful, it is imperative that smooth control of the reaction should be obtained. By smooth control I mean that it must not be possible to tell exactly just when the reaction effect commences, or at what point the set starts to oscillate when reaction is carried beyond its proper and permissible maximum. If your set does not pos-

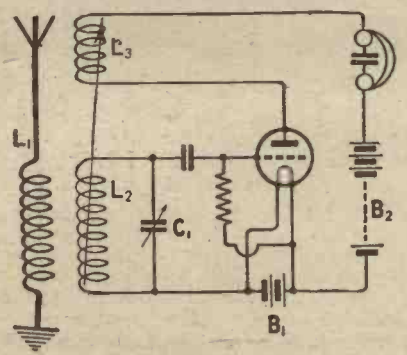


Fig. 1.—A commonly used circuit. The method of aerial coupling shown is only one of several possible arrangements.

sess this property of smooth reaction control, do not for any reason attempt to receive distant stations unless you want poor results and desire to bring the wrath of your fellow-listeners on your head.

Put it right first by following the suggestions given later; or if they prove of no avail, scrap the set and build another of good design.

Effect of Design

Two sets employing the particular reaction circuit shown in Figure 1 may vary considerably in the results they give. Under similar conditions one

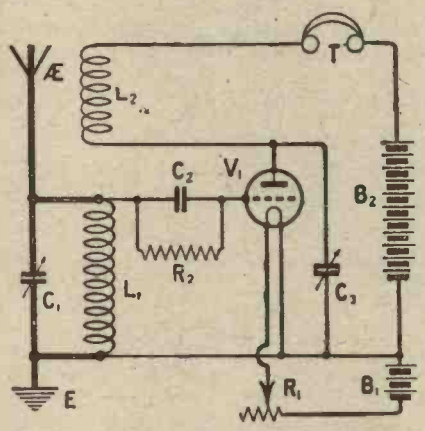


Fig. 2.—In this circuit the condenser C3 controls the feed to the reaction coil L2.

may be capable of receiving American broadcasting, while the other will barely do more than receive the local station. And all this can be due to differences in design, which shows that you must choose a good one, such as those published from time to time in this magazine. It is necessary to obtain the last ounce from the set and the difference made by short wiring is often very remarkable. So have the leads and wiring as short as possible.

Backlash and "Plopping"

Reaction control may be bad in two ways. There may be backlash, that is, the set suddenly goes into oscillation as the reaction control is advanced to a certain point, but does not stop until it is turned back to a point before that at which oscillation commenced. The other trouble is known as "plopping," which means that the set goes into oscillation with a plop and comes out of oscillation with a plop, thus making it impossible to work the set at its most sensitive point, just before oscillation starts. Below is given a list of things to try in order to get rid of either of these nuisances:—

Use a smaller reaction coil.
Reduce the voltage of the high-tension.
Try a grid-leak of smaller value.
Alter the filament current.
Make a better earth connection.
Obtain a different valve.

Method of Control

Nowadays the use of a swinging reaction coil seems less popular. This does not mean that magnetic reaction is no good, but that a different method of controlling it is now preferred. In Fig. 1 is given the usual reaction circuit, in which the position of coil L_3 is variable in relation to L_2.

In Fig. 2 we have a similar circuit except that the relation of the coils L_1 and L_2 is fixed and the degree of reaction is controlled by a variable condenser C_3 connected to one side of the reaction coil and to earth. The smoothness of control obtained by this method is extremely good, and is worth trying by anyone. It will be noticed that no telephone condenser is indicated. In a set made by myself employing this circuit, a telephone condenser appeared to upset things altogether, and was therefore left out.

Reinartz Reaction

In Fig. 3 a circuit is shown employing the Reinartz method of obtaining reaction, which is very good. This again is controlled by a variable con-

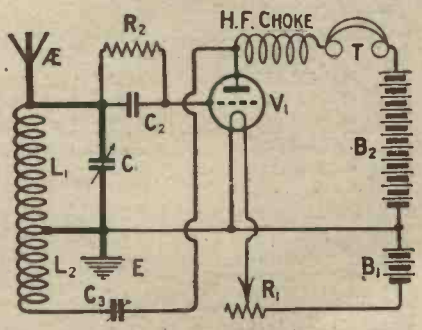


Fig. 3.—This is one of the arrangements based on the Reinartz method of reaction control.

denser, the coil L_2 having a coupling to L_1. It is usual, in order to avoid hand capacity effects, to place the condenser C_3 between the other end of the coil L_2 and earth. A circuit employing true capacitative reaction is given in Fig. 4, but it is often difficult to make this circuit work well.

Choice of Variable Condensers

The variable condensers employed may easily have a great effect on the ease of operation of a set. They should be of good make, with no backlash, and should preferably have some form of slow-motion control. The two controls, the tuning and reaction, whatever their type, must be simultaneously adjusted. In this way it is possible to keep the set on the threshold of oscillation, thus obtaining the best results without causing any interference. It may seem a little difficult to tune in distant broadcasting at first, but have a little patience, and you will later find it quite easy.

Varying Results

Because your friend may be able to receive America sometimes on a single valve and you cannot, do not necessarily consider that his set is better than yours. Conditions make a large

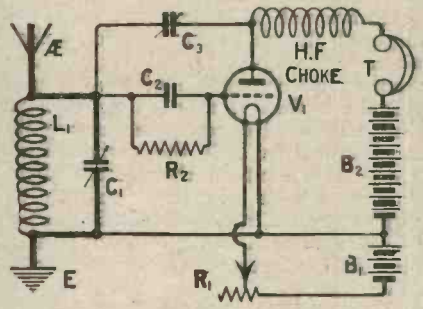


Fig. 4.—A capacitative reaction circuit in which C3 is the control.

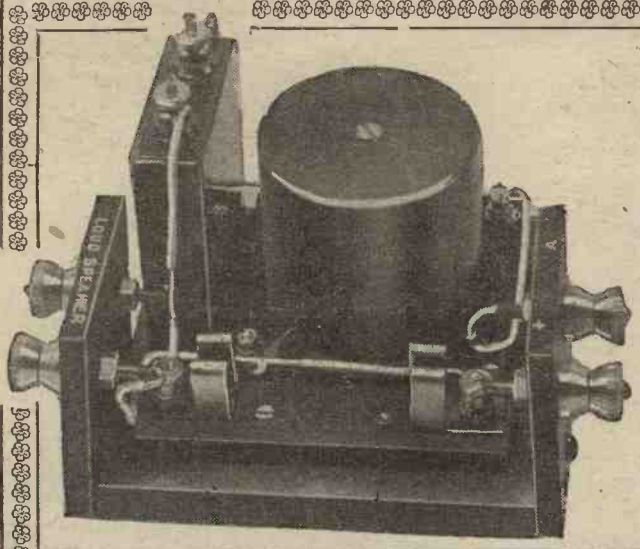
difference in distant reception, and you may have tried when the ether conditions were all against you. Situation also has a great bearing on these matters, and possibly your set at his home, on his aerial, would give even better results than his.

Using a Variable Grid Leak

If you are keen on experimenting and like trying different valves, it is a good idea to fix a variable grid leak to your set in place of a fixed one. This will make it easy to obtain smooth reaction control with each valve, since some valves are very critical in the value of grid-leak they need.

Batteries

One last point to mention is the condition of your batteries. These are important accessories, and must be kept in good condition. Have your accumulator charged as soon as necessary. Make sure you have enough high-tension batteries, and do not try to work with batteries that are run down. A large fixed condenser of about 2 microfarads across the H.T. will work wonders in obtaining a silent background and make distant stations appear much stronger in consequence.



A PROTECTIVE UNIT FOR YOUR LOUD-SPEAKER

By

E. J. MARRIOTT.

This neat unit allows you to control the tone of your loud-speaker, while protecting its windings from heavy anode current.

IT is a well-known fact that in a multi-valve wireless receiver employing one or more stages of low-frequency amplification, generally the best results are obtained when one of the several small power valves now procurable is used in the last position, if not in each L.F. stage, with a fairly high value of H.T. applied to its anode, together with an appropriate negative grid bias.

The Steady Current

Now in any valve set the steady anode current which flows, even when no signals are being received, passes through the windings of the loud-speaker, which is usually connected in series with the H.T. battery.

This anode current, with some types of valve, is very considerable, and care should always be taken to ensure that the connections to the loud-speaker terminals are correctly arranged. That is, the lead from the positive connection on the H.T. battery should join to the loud-speaker terminal marked with a positive sign.

Effect of Wrong Connections

If this is not done, then the steady current will flow through the loud-speaker in the wrong direction, and tend to reduce the permanent magnetism of the magnet which forms an essential part of the loud-speaking unit, with a consequent reduction in the length of its useful life, and a gradual falling off of signal strength.

It is often an advantage if a circuit can be so arranged that no direct current whatever flows through the magnet coils of the loud-speaker, and under these circumstances the instrument can be connected up either way round, no regard being paid to the positive sign.

What the Filter Does

An arrangement which successfully accomplishes this is called a filter, for the obvious reason that while allowing the fluctuating signal currents to pass through the loud-speaker, it offers an impassable barrier to the direct anode current, this taking another path.

Such an instrument is perfectly simple to make, and for the benefit of the novice the writer describes below the small filter unit which he uses in his own experiments.

Arrangement Employed

Fig. 1 shows the theoretical diagram of this, Z being a good-quality low-frequency choke, C_1 a 1 microfarad condenser, and C_2 a fixed condenser, which functions merely as a tone control.

Now when the loud-speaker terminal joined to the anode of the last L.F. valve in a receiver is connected to the

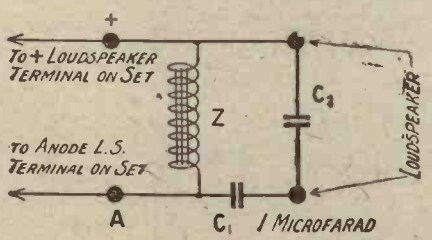


Fig. 1.—The circuit arrangements of the unit are extremely simple.

terminal marked "A" and that marked "+" to the "+" loud-speaker terminal on the set, it will be seen that the L.F. choke Z is in the position usually occupied by the loud-speaker windings, and the steady anode current will flow through it.

Protection Afforded

The loud-speaker itself must now be connected up in the usual manner to the unit terminals so marked.

Now the fluctuating signal currents will build up potentials, depending on strength and frequency, across Z, and these varying potentials will actuate the loud-speaker.

Thus we see that while signals will be heard in the speaker, none of the direct anode current will flow through its windings, owing to the presence of the large capacity condenser C_1, which, whilst not allowing direct current to pass, will offer but little impedance to the fluctuating signal currents.

It might be stated here that the value of C_1 is not at all critical, any value from .25 microfarad to 2 microfarads being suitable.

Tone Control Condenser

The other condenser, C_2, is given no value in the diagrams for the following reason. C_2 is merely a tone control, and various loud-speakers require various values here. With some types no condenser at all is necessary in this position, whilst with other types C_2 is a practical necessity for pure reproduction. The value of C_2, then, must be decided by the constructor himself, according to the loud-speaker in use, and will probably be of from .001 to .01 capacity.

Components and Materials

The components required for this unit are very few, and can be accommodated, as can be seen in the photographs, upon a very small baseboard. Those used in the unit shown are as follows, but, of course, other makes of good quality can be substituted, if desired, without fear.

One small baseboard 4 in. × 4 in. × ⅜ in.

One "Success" L.F. choke (Beard & Fitch, Ltd.).

One 1 microfarad Mansbridge condenser (The Telegraph Condenser Co., Ltd.).

One clip-in condenser with mount and base (L. McMichael, Ltd.). (The value of this condenser will vary according to the loud-speaker used.)

Two small strips of ebonite, each 2 × 2 × ¼ in.
Four terminals, Glazite, screws.
Radio Press panel transfers.

Construction

The construction itself is particularly simple. Having procured the necessary components, arrange them on the baseboard in the manner indicated in Fig. 2 and in the accompanying photographs. If you have used makes other than those mentioned, it may be necessary, of course, to modify the size of the small baseboard.

Now screw the components down in their correct positions and fix the two ebonite strips, with two terminals mounted on each on opposite sides of the base.

The wiring up can then be carried out, and if Fig. 2 is followed carefully no mistake should be made here. Although there are only four terminals, it is a wise plan to use panel transfers, in order that the connections to the input side of the filter shall be correct.

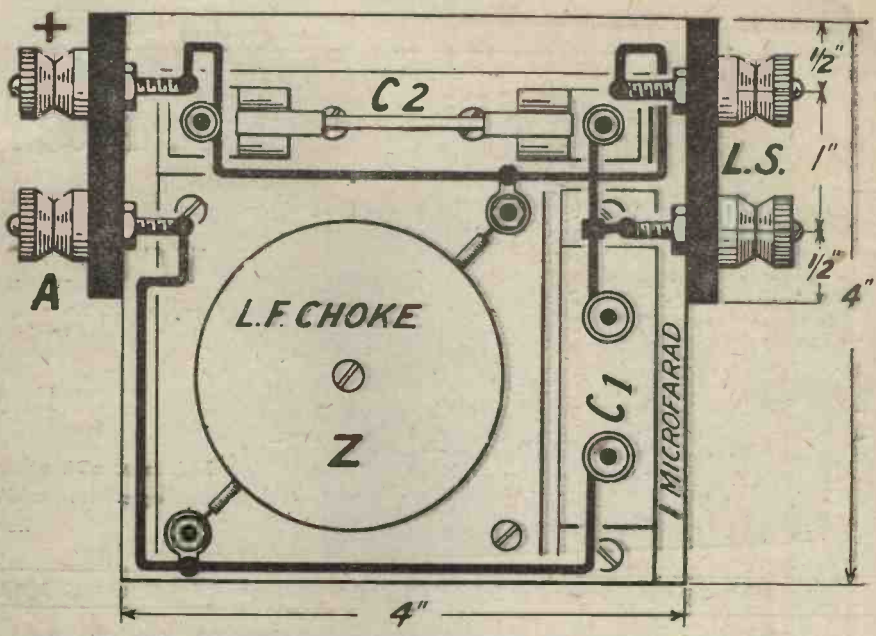


Fig. 2.—This diagram forms a wiring guide and shows details of the layout of the components on the small baseboard.

Improvement in Tone

Having completed the unit, connect it up as indicated in Fig. 1 and operate the set in the usual manner.

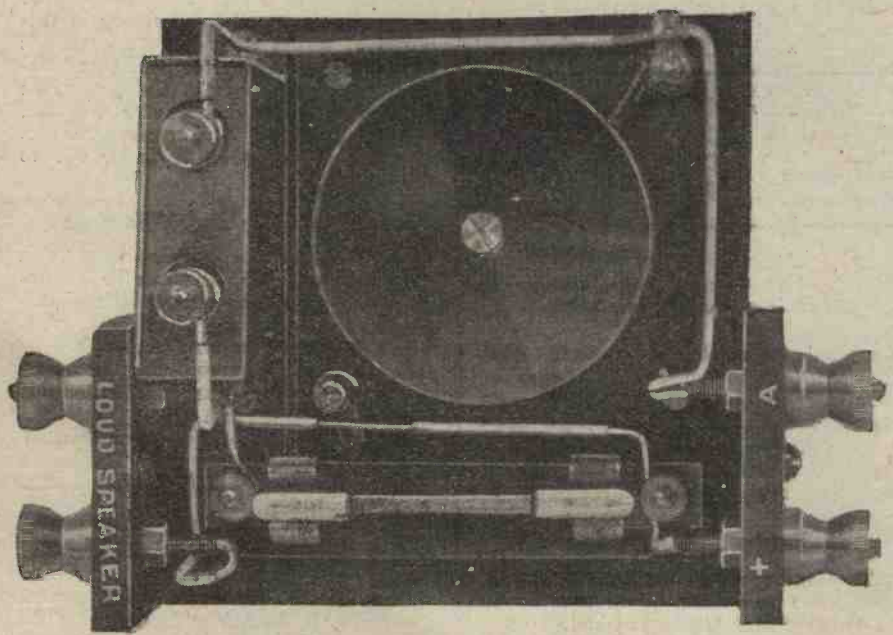
Sometimes a distinct improvement in tone is obtained by the use of such a unit as that described, and when it is intended to have very long leads to the loud-speaker, it will be found to eliminate much of the trouble sometimes experienced under these conditions.

In Conclusion

The writer himself has made this unit a permanent fixture in a convenient position on the experimental bench, and when a multi-valve receiver employing L.F. stages is being used this unit is invariably employed, a loud-speaker being permanently connected to its output terminals.

It is essential, however, in order to get good results that the few components used shall be of really good quality, and although in some emergencies the secondary winding of an L.F. transformer will serve as a choke, it is not recommended for general use. There are, however, several chokes on the market at quite moderate prices, and it must not be thought that a make other than that mentioned will necessarily be unsuitable.

The whole construction can be carried out in an hour, and when it is realised that the loud-speaker windings are being definitely protected, it will be agreed that the time and money spent on such a unit will prove well worth while.



A photograph of the completed device with the tone-control condenser clipped in position. This picture may usefully be compared with Fig. 2.

TWO MONTHS WITH THE "MIDGET"

SIR,—I think perhaps you may be interested to hear of the results I have obtained with Mr. Clark's "Midget" single valve set, described in the May, 1925, issue of THE WIRELESS CONSTRUCTOR.

The aerial is very good as regards position, and the set has been in operation about two months. Up till now I have heard the following:—

Bournemouth,	"Le Petit Parisien,"
Cardiff,	Radiola, Paris,
Manchester,	Madrid,
Birmingham,	Rome,
Swansea,	Prague,
Plymouth,	Hamburg,
Daventry,	KDKA (short-wave),

also several other stations which I have still to identify.

This set is one of many Radio Press sets I have constructed. But for its size, and taking into consideration the fact that it comprises one valve only, I think these results could hardly be excelled.

Yours faithfully,
E. L.

Rodwell, Weymouth.

THREE USEFUL TOOLS

One frequently has difficulty in obtaining small tools really suitable for the light work associated with the construction of radio apparatus, and many home builders will prefer to make their own tools as described below.

TO the home constructor and experimenter a number of tools are essential, and some of them may be made at home with little difficulty. By so doing a saving is effected, and in many cases the tools made will be better suited to the constructor's needs than will bought articles. In the past, I, personally, have seen a large number of home constructed receivers, and often the soldering was extremely poor; there were signs of flux all over the panel; and in places the ebonite showed signs of the application, for too long a period, of a soldering iron to various terminal shanks, etc.

This is not altogether surprising when one sees the type of soldering iron which is commonly used. Although I learned to solder in the test room of a large and well-known instrument maker's works, I doubt whether I could make a much better job with the type of soldering iron mentioned. This latter usually consists of a piece of copper on the usual handle, all of the copper being inserted into the flame when heating the iron.

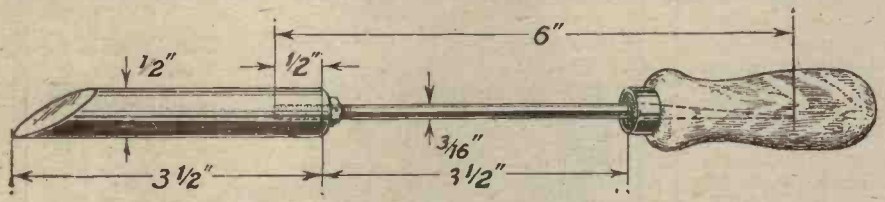


Fig. 1.—A small soldering iron with a long bit shaped as shown is very suitable for wireless work.

A Home-Made Soldering Iron

The type of soldering iron about to be described is a distinct advance, and makes soldering much easier. For its construction the following will be needed:—

One 3½ inch length of ½ inch diameter copper rod.

One 6-inch length of 3/16 inch diameter mild steel.

One wooden file handle, such as may be obtained from any ironmonger.

One 2 B.A. nut.

The great merit of this soldering iron lies in the copper bit. This is long and has one end, which is tinned, cut on a slant, as seen in Fig. 1. The facility with which soldering can be carried out with a bit shaped in this manner has to be seen to be appreciated. The long piece of copper holds the heat well for some time, so that several joints may be made before the iron has to be replaced in the gas flame. When the instrument is heated it can always be arranged that the tinned portion is not in the flame proper, and hence the tinning will last for a very long period.

Construction

In constructing the iron the procedure to follow is given below.

First square one end of the 3½ inch length of ½ inch diameter copper. This should be done with the rod inserted into a vice. With a centre punch mark out the centre of the squared end and proceed to drill a hole about ½ inch deep, of suitable size to be tapped with a 2 B.A. tap. The drilling operation will need some care, since copper is not an easy metal to drill, but providing the rod is held securely in a vice undue difficulty should not be experienced. The next step is to tap the 2 B.A. hole, a taper tap being used for the first cut.

The Steel Stem

The 3/16 inch diameter mild steel rod should next have a 2 B.A. thread cut on it for a length of about ¾ inch from one end, this being done with the rod inserted into the vice; an ordinary 2 B.A. die in the usual die-holder being used.

Next screw the 2 B.A. nut, as far as it will go, on to the steel rod, which latter should then be screwed into the copper bit, the nut being tightened back to hold the copper rod rigidly in position.

The "side band" equipment at the Rugby station.

Fixing the Handle

In order to affix the wooden handle the mild steel rod should be tapered to a point, as shown in the Fig. 1 diagram, using a suitable file. The pointed end thus formed should be heated in the flame of a gas ring or of a bunsen burner until it is red hot, when it should be inserted into the wooden handle, to the appropriate distance, after which it should be withdrawn and allowed to cool. If the steel rod is then held in a vice a couple of taps with a hammer will allow the wooden handle to be firmly fixed.

Tinning the Iron

Having sawn the end of the copper rod off at an angle as shown in Fig. 1, employing a hacksaw, the slanting oval surface should be filed smooth. The bit is now ready for tinning, which process is effected by inserting it into the flame of an ordinary gas ring or bunsen burner, the filed portion being covered with a thin coating of flux so that it does not oxidise, and by taking a stick of solder, on the end of which there is a small quantity of flux, with which the portion of the iron to be tinned is touched from time to time. When the copper is sufficiently hot the solder will run and the end will be tinned.

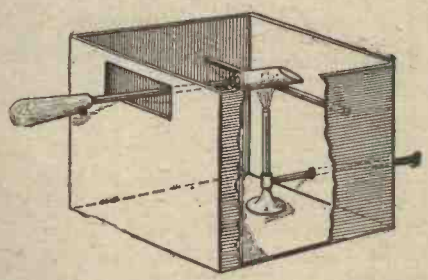


Fig. 2.—When heating a soldering iron do not place the tinned tip in the flame, but arrange things like this.

A somewhat more lasting "tinning" may be effected by rubbing the tinned surface of the heated iron on the metal of a tin lid on which a small quantity of flux has been smeared. The surface of ordinary tins, such as cocoa tins, etc., is usually covered with

a shiny metal surface, a good proportion of which is pure tin. This, therefore, forms a better surface on the iron than does the average solder.

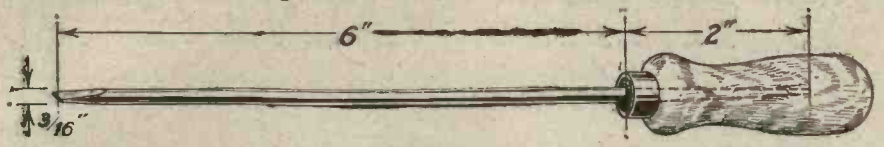


Fig. 3.—A long-handled screwdriver is much more easy to use than one of ordinary type.

Using the Iron

Where a good deal of soldering will be carried out it is well worth while rigging up a convenient arrangement to start with. In my own workshop I employ a large biscuit tin, as seen in Fig. 2. This is cut in the front to form a rest for the handle of the soldering iron, the copper bit of which rests on a crossbar of $\frac{3}{16}$ inch mild steel, fixed as shown. A suitable hole is made in the back of the tin, and through this is taken the flexible pipe of a bunsen burner, such as we generally associate with the chemistry laboratory at school or college.

A Useful Screwdriver

The average screwdriver employed by the constructor is usually more suitable for carpentry than for set constructional work, since its handle is generally of a type which makes it difficult to insert or withdraw a screw quickly. Inserting or withdrawing screws is considerably facilitated if the handle is of circular cross-section, as indicated in the diagrams of Figs. 1 and 3. The blade of the average

Fig. 4.—File the ends of the rods which fit into the wooden handles in the manner shown here.

screwdriver is not sufficiently long to allow the somewhat inaccessible screws in various sets to be reached easily. For wireless work, therefore, a long screwdriver will be found particularly useful, and I would suggest that several be made with blades 6 inches long and $\frac{1}{8}$ inch, $\frac{3}{16}$ inch, and $\frac{1}{4}$ inch wide respectively. For most wireless work the driver with the $\frac{3}{16}$ inch wide blade proves most useful.

Materials for Screwdrivers

To construct three screwdrivers of the type shown, the following materials should be obtained.

Three pieces of silver steel rod 8 inches long and $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ inch diameter respectively.

Three file handles.

For the blade of the screwdriver two flats should be filed, as seen in Fig. 3, and the edge thus formed should be taken off so as to be of a suitable width for insertion into the various slots of screws which will be used. Under no circumstances should the two flats be filed to meet in a sharp edge, as when this is inserted into screw heads there will be a tendency for the driver or the screw to burr.

The ends of the metal rods which are inserted into the handles should be filed, not to a point as shown for the metal rod of the soldering iron, but so that two flats are obtained, as seen in Fig. 4. If the rods are tapered to a point, when screwing operations are carried out, there will be a tendency for the handles to turn round without the blades. This tendency must be counteracted, therefore, by suitably filing the tapered ends which are inserted into the handles. The operations of insertion are carried out in a similar manner to that indicated for the soldering iron.

Tempering

An important operation is to temper correctly the heads or blades of the drivers. After these have been suitably filed into shape the heads should be inserted into a bunsen or gas ring flame and should be heated to as near white heat as possible. They should then be dipped quickly into cold water and cleaned with emery paper until bright. To temper the blades they should be reinsented, this time only into the edge of the gas flame, and the colour changes should be carefully watched. It will be observed that the metal first turns a pale straw colour and then to a bluish purple. If the heads are placed in water when the blue coloration begins to appear the metal will be at a suitable hardness for general work.

Tweezers

An instrument which I would not be without for a great deal is a pair of tweezers, which may be constructed

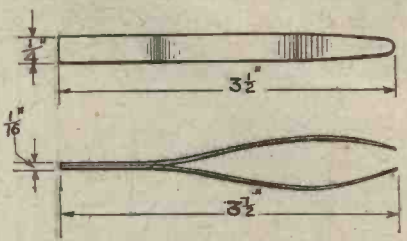
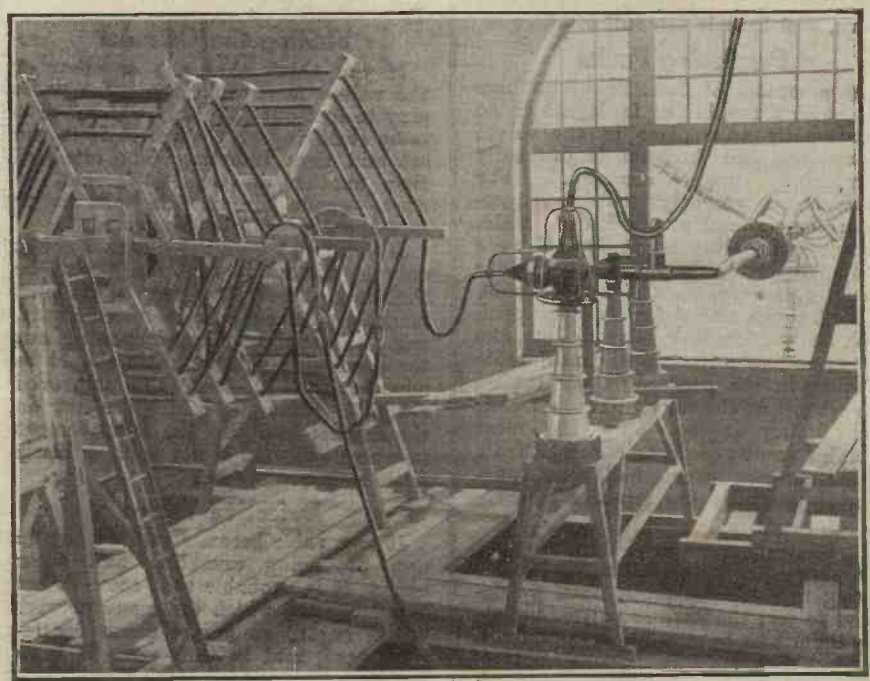
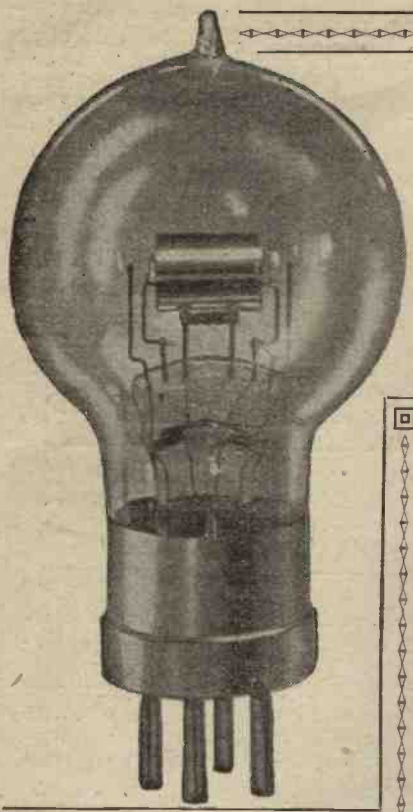


Fig. 5.—Details of a useful pair of tweezers which can be made quite easily.

quite easily if two pieces of hard drawn phosphor bronze, $\frac{1}{32}$ inch or so thick, and $3\frac{1}{2}$ inches long, are to hand. A suitable width is $\frac{1}{4}$ inch. The two pieces should first be cut with a pair of shears, to the shape indicated in Fig. 5 and should then be bent into the form seen above. The two wide ends should then be soldered together, on which a useful pair of tweezers is obtained. These prove extremely useful for the holding of screws which are to be inserted into somewhat inaccessible positions, or for picking up screws which have dropped into somewhat ungetatable places in the receiver.



Inductances and the lead-in at Rugby. This station is now in regular communication with America.



IS IT THE VALVE?

By G. P. KENDALL, B.Sc.

When a receiving set ceases to function properly one does not as a rule suspect the valve of being the cause. Filament breakage is not the only possible source of trouble, as these notes show.

READERS of THE WIRELESS CONSTRUCTOR have had many articles giving instructions for finding faults of various types in complete sets and components, but I do not recollect having seen any consideration of the possible troubles which may be present in the actual valves used in a set. There is, on the contrary, a tendency to assume that a valve is a valve, and that is the end of it.

Perplexing Faults

As a matter of fact, however, there are quite a number of faults which do occasionally take place in the valves themselves, and these can be decidedly perplexing upon occasion. For example, I recently took a super-heterodyne round to the house of Mr. Harris (who lives about half a mile away from me), the intervening route being decidedly on the bumpy side, and although the super was equipped with shock-absorbing valve sockets, the valves no doubt received a considerable shaking in the process. Upon taking the set out of the car at the other end, and fitting it up, only the most peculiar results could be obtained from an instrument which had been functioning perfectly ten minutes before.

Trouble with a Super-Het

A great deal of time was spent upon trying to trace the fault, until we decided to test the various valves, inserting them one by one in Mr. Harris's test panel.

It was soon found that one of these valves, although it was lighting correctly, had developed some fault, because varying the amount of grid bias applied to it also visibly varied the brilliance of the filament! What had happened was that the filament had broken in two places, and that the free ends had fallen upon the grid, so that the filament circuit was still complete, and yet was in contact with the grid.

Noises

Take now the question of noises. Now, it sometimes happens that one has attended to all the points which should remove an annoying crackle in the receiver, such as the grid-leak, loose connections, and so on, without avail. In such a case, before deciding that the set is bewitched, try the effect of replacing the valves one by one. It may quite well be that one of them is developing an intermittent break in the leads passing up through the pinch or somewhere in its actual construction. For example, one of the welded joints between the supports of the grid and the grid itself may have been imperfectly made, and a poor contact is developing here.

Finding the Offender

If you think that one or other of the valves is causing the noise, it is easy to find out definitely which one it is by removing all the valves from the set and then inserting first one and then another in the last socket, in whose anode circuit the 'phones or loud-speaker will be connected.

If you find that a valve causes noises only at times, it may quite well be that it is merely a matter of its pins making poor contact in the sockets, and the usual remedy of opening out the split pins with a knife should be adopted. This, with the improved design of valve pins which are now on the market and also the improvement in valve sockets, is not such a likely fault as it used to be.

Defective Valves

If any valve becomes really noisy in use, producing crackling and other noises, it is probable that some defect has developed which the manufacturer would regard as a just cause for replacement, and in such cases it is as well to return it for examination, since you will find that the reputable valve manufacturers are just as anxious to replace a defective valve as you are to have it replaced.

Filament Sag

It sometimes happens that the cause of an absolute absence of signals is to be found in a defective valve. I have known this to happen more than once, and the cause is sometimes to be found in the fact that the filament has come into contact with the grid, so when you are entirely unable to discover the cause of a complete absence of signals, even though all the valves light correctly, try a test which will determine whether any of the grids and filaments are in contact.

The invaluable dry cell and telephones method will serve the purpose, if you try the test between one or other of the filament pins and the grid pin, after removing the valve from its socket. There should not be the slightest sign of a click on touching these points, and if there is anything approaching a real indication the valve must be pronounced faulty.

Many modern dull emitters are so constructed that the scarcely-glowing filament is not easily visible.

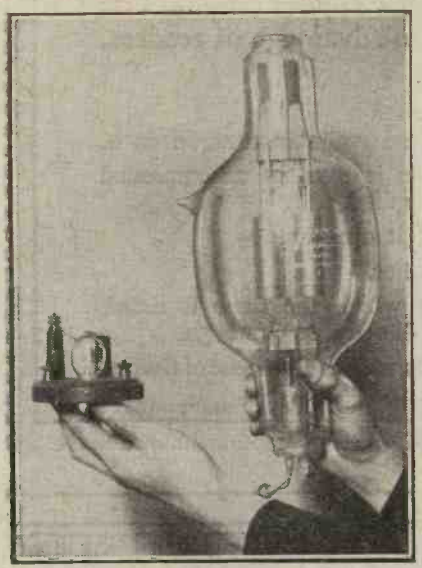
A Curious Fault

Upon two occasions recently I have experienced a fault in valves which I should not have thought was possible until actually confronted with it, and I should like to mention it for the benefit of anyone who may be so unlucky as to strike the same thing. The valves in question were both in use in a power amplifier, one being a D.E.5b and the other a D.E.5. What happened was this: a short circuit took

place across the H.T. battery, which did not involve the valves in any way, neither injuring their filaments nor indeed affecting their circuit in any way except by suddenly cutting off the H.T., and shorting it past them, so to speak.

A Broken Connection

Nevertheless, the effect was to destroy both those valves as far as useful life was concerned, for although their filaments lit perfectly, not the slightest sign of anode current would pass after the episode. It seemed that there was actually a broken connection inside the valve between the anode itself and the anode pin, for not the slightest sound of a signal could be obtained, and, as stated, a sensitive milliammeter gave no sign whatever of anode current passing. This was my first experience of a fault of this nature, but I have heard from others that the same thing may sometimes happen if a valve is given a jolt which just fails to break the filament.



A modern transmitting valve compared in size with Prof. Fleming's original wireless valve.

Loss of Emission

A consideration of possible valve faults would not be complete without taking into account the factor of lost emission, which produces faint and in some cases badly distorted signals when the last valve is a dull-emitter power valve. Lost emission generally results from ill-using the valve in some way, such as by running the filament too bright, or by using a seriously excessive amount of anode voltage.

The moral is obvious, but when confronted with the fault it is sometimes a little difficult to decide what the trouble may be. A milliammeter is really the only effective test, apart from the substitution method, and this will always enable one to decide whether any particular valve is not quite up to scratch, so that the trouble which is being experienced may be laid at its door.

Free Blueprints for All!

THE SIMPLE CONDITIONS YOU MUST OBSERVE.

It has been decided to supply free a back-of-panel blueprint of *any* set in this and future issues of THE WIRELESS CONSTRUCTOR. Only one blueprint can be supplied to each reader, and only postal applications (accompanied by the coupon to be found in each issue) will be considered ; callers will not be supplied. This offer applies only to THE WIRELESS CONSTRUCTOR, and will obviously be greatly to the advantage of readers.

REMEMBER :—

1. Only *one* blueprint supplied to each applicant. Extra blueprints are available at 1s. 6d. each.
2. Only a *postal* application for a blueprint will be considered, and it *must* be accompanied by the necessary coupon. Callers at our offices will not be supplied.
3. A coupon only covers the sets in the particular issue in which it appears.
4. Only back-of-panel blueprints are included in the *free* supply offer.
5. Coupons are available only up to the end of the month for which the issue is *dated*, *i.e.*, the coupon in this issue, published on May 15, is available up to June 30.
6. When ordering state clearly the *number* of the blueprint you want as well as the name of the set.

SETS WHICH WILL NOT INTERFERE

Recently, in the presence of Press representatives, a remarkable demonstration of non-radiating receivers was given at our Research Laboratories.

A DEMONSTRATION of non-radiating receivers of Radio Press design was given at the Elstree Laboratories of THE WIRELESS CONSTRUCTOR recently to a large number of representatives of the Daily Press.

As is well known, the majority of multi-valve receivers employing reaction suffer from the disadvantage that, should the set be made to oscillate, either by intention or accident, serious interference can be caused to near-by receivers.

Sensitivity Without Selfishness

With improved methods of reception, which have been devised recently by the staff of Radio Press, it is possible to obtain all the sensitivity which is required (and, if necessary, to still make use of reaction), in such a manner that no interference will be caused even if the set is made to oscillate in the most violent manner.

All the receivers demonstrated on April 9 have either been recently published in Radio Press journals, or are in process of publication.

The system used to demonstrate the efficacy of these receivers was arranged to duplicate normal conditions, and yet give a really convincing demonstration.

The Test

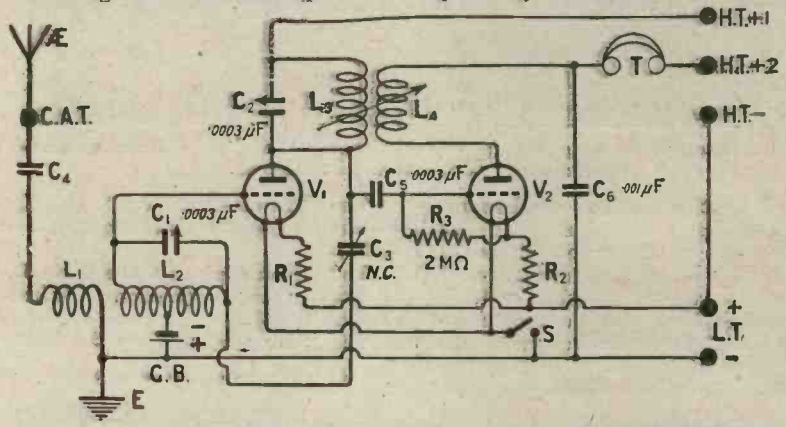
In one of the Laboratory buildings about a hundred yards away a sensitive four-valve receiver was tuned in to receive Birmingham. The signals from this set were then transmitted through a cable to the Demonstration Building, where they operated a loud-speaker.

A Comparison.

For purposes of comparison a two-valve, high-frequency and detector receiver was first tuned in to Birmingham, this set being in the Demonstration Building near the loud-speaker mentioned above. This receiver was capable of causing a normal amount of radiation, and, when permitted to radiate, by mishandling, the radiation caused a series of "howls" and "whistles" to be superimposed on the programme being received from 5IT by the set in the other building which was operating the loud-speaker.

The Result

Birmingham was then received on several non-radiating receivers in the Demonstration Building in turn, ranging from two to six valves. In each case it was clearly apparent that, however the specially designed non-radiating receivers were handled, or, rather, mishandled, it was impossible to cause any interference, for the reception by the receiver in the other building was not affected to any audible degree.



The circuit of the "Huntsman Two," a non-radiating set described in the March issue of this journal.

As one of the Press representatives so aptly said, "Once again Radio Press has demonstrated their sincere and altruistic desire to further the development of the new art or science of Broadcast Reception."

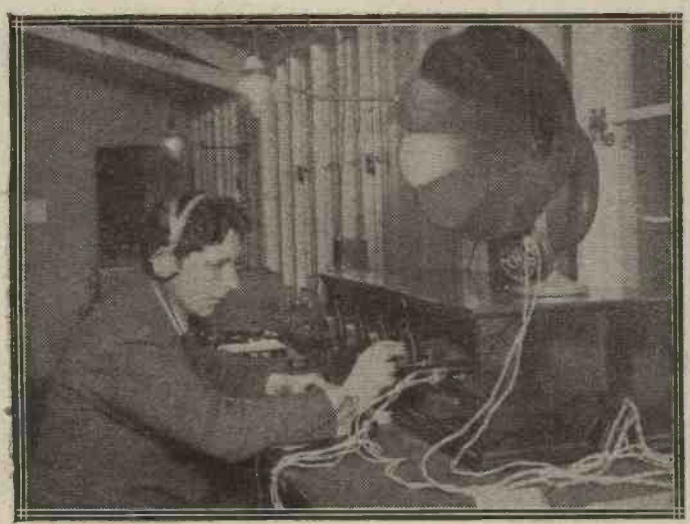
Personal Tests by the Press

Each representative in turn was invited to test for himself. He first selected any non-radiating receiver he might care to try. This was connected up to an aerial, and 'phones were supplied. On tuning in the Birmingham station he then lifted one earpiece away from his ear so that he could also hear the loud-speaker of the neighbouring set, and operated the controls in any manner he pleased. Even when the receiver which he was operating was oscillating no howls could be heard in the loud-speaker, thus indicating that the aerial a few yards away remained unaffected.

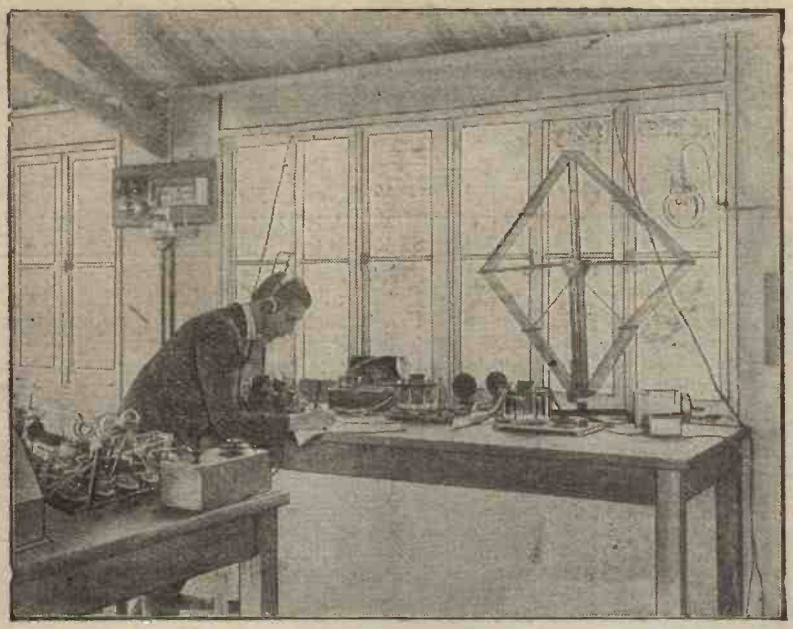
One and all expressed themselves as being amazed at the progress made in these designs.

An "R.P." Triumph

After this demonstration the guests were invited to request the reception of any particular station, an extremely exacting test at any time. Using the "Elstree Six" Receiver,



A member of the Research staff operating the "Elstree Six," with which it is possible to receive even relay stations in daylight at full loud-speaker strength.



Research work in progress in one department of "The Wireless Constructor" Laboratories at Elstree.

designed by the Staff of the Laboratories, station after station was received with certainty and without a trace of the distortion suggestive of the excessive use of reaction. With this receiver it is possible to receive all the B.B.C. main and relay stations at full loud-speaker strength in broad daylight.

The B.B.C. Representative

One of the most interested spectators of the work forming the evening's demonstration was Mr. Whitehouse, of the B.B.C., and his presence on this occasion gives some indication of the value which the Engineering Department of the B.B.C. attaches to the work at present being done at our Laboratories.

Purity of Reproduction

Another point of interest was the wonderful purity of reproduction which was a feature of the evening's reception. One of the guests, who, in addition to being an amateur of considerable technical attainments and experience, is also a musical critic of some repute, remarked that he had never heard such consistently true reproduction from a number of varying types of receivers.

Undoubtedly, he said, great attention had been paid by the designers to every part of the receiver, both for sensitivity and reproduction.

The Sets Used

The five non-radiating receivers which were used for the demonstration were:—

The "Huntsman Two," by Percy W. Harris, M.I.R.E. (the editor) (THE WIRELESS CONSTRUCTOR, March, 1926).

The "Torostyle Two," also by Mr. Harris (*Wireless*, May 1, 1926).

The "Neutroflex Two," by N. J. Gibson (*Wireless Weekly*, April 28, 1926).

The "Neutrophase Four," by J. H. Reyner, B.Sc. (*Modern Wireless*, March, 1926).

The "Elstree Six," by the Staff of the Radio Press Laboratories (to be described in *Modern Wireless*, June, 1926).

B.B.C. APPRECIATION.

We are authorised by the B.B.C. to state that they look with favour on any efforts towards reduction or elimination of the possibility of interference from oscillating receivers, and are appreciative of the research work of this nature which is being carried out by our laboratories.

Press Comments

From among the reports of the demonstrations which have appeared in the Press we quote the following:—

From *The Daily Telegraph*:—

Wireless "Howl"—A New Device

The ingenuity of wireless engineers has been hard pressed for some considerable period in an endeavour to solve the problem which has been the storm-centre of the majority of complaints against wireless, namely, oscillation and its accompanying "howl." It was stated recently that Sir Oliver Lodge had developed a wireless set which would neither radiate nor cause interference. Quite apart from this "N" circuit of Sir Oliver Lodge, sets have already been designed which would reduce interference even when the receiver itself was in a state of oscillation.

The latest development in a circuit design which lays legitimate claim to a removal of the above difficulties was demonstrated by the Radio Press, Ltd., at their laboratories in Elstree on April 9, and the intention to provide the home constructor with reliable non-radiating sets seems to have materialised. Three receiving sets were used to demonstrate the new circuit, viz., a six-valve laboratory receiver, a specially-designed two-valve set ("The Huntsman"), and a so-called "Torostyle" two-valver. As its name implies, the last-named set, perhaps the most interesting of those exhibited, employs specially-designed toroidal coils These two-valve sets, as well as the six-valver, were at different times used to bring in the Birmingham station, and in order to make a contrast between reception results a simple tuned-anode receiver was also brought into operation by way of contrast.

On a loud-speaker the product of over-oscillation was demonstrated by mishandling and the introduction of the usual "howl," and this was entirely absent, no matter how one attempted to produce it, on the

The Editor tuning in on the "Huntsman Two" during the demonstration to Press representatives

several types of the new receiver. The circuit as designed may certainly claim to have accomplished its purpose, and in the case of the reception from Birmingham, and also that from Brussels, no trace of interference, except by telegraphy, could be detected. Unfortunately, the conditions in the ether were not favourable to good reception, and a more thorough inquiry into the efficiency of the system under various other conditions would be desirable before giving a final verdict.

It says much for the industry of the research engineers that they have succeeded so far as they have in constructing even a two-valve set with these undeniable improvements, which were obvious even under last night's conditions of reception, and I was informed that it was hoped shortly to apply the new principle to a one-valve set. One of the greatest merits of the new idea is that it can be incorporated into any ordinary receiving set at a very small cost.

* * *

From *The Daily Express.*

I have just attended a demonstration of receivers which are incapable of causing the slightest interference with neighbouring listeners.

The demonstration had been arranged in the Radio Press laboratories at Elstree to show that it was possible by various means to eliminate any danger of "howling" even with the most powerful receivers. Two, three, and four-valve sets were employed, each embodying a different class of circuit and in each case it was successfully demonstrated that, however they might be mishandled, no interference could result.

Two aerials had been arranged within a few yards of each other, and one of these was used for receiving the transmission from Birmingham on an ordinary set. The other was used for the non-radiating sets.

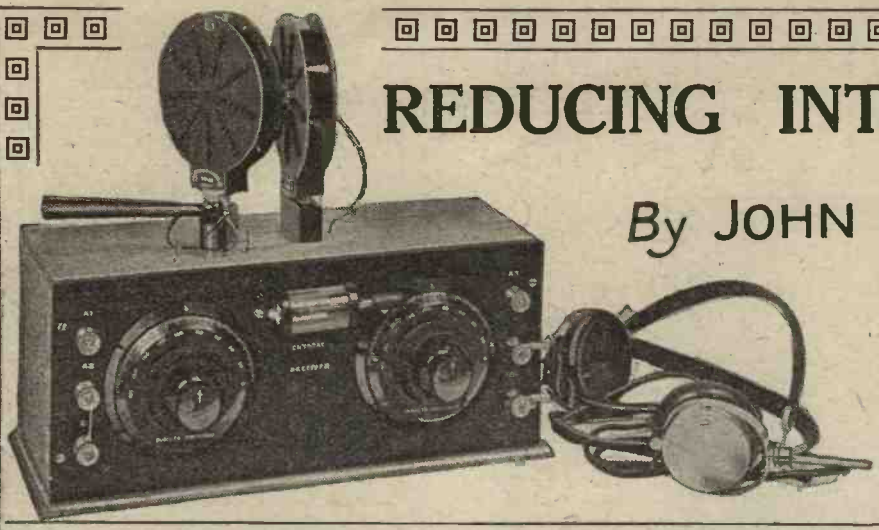
As each was tuned in to Birmingham it was made to oscillate as violently as possible, but not the slightest "howl" occurred to interfere with the reception of the same transmission on the first aerial.

* * *

From *The Times.*

The apparatus showed that, while it is possible to take full advantage of reaction, no amount of mishandling could produce that disturbing aerial oscillation known as "howling," which interferes so seriously with broadcast reception, and for which a remedy has now been provided.

Some of the newspaper men with the Editor inspecting the sets whose non-radiating qualities were demonstrated.



REDUCING INTERFERENCE

By JOHN UNDERDOWN

How to construct a loosely-coupled selective crystal receiver and a cabinet to house it

TO dwellers on the coast, more particularly those situated near commercial stations and busy ports, spark interference considerably mars reception. This interference is of the most serious type with which the average listener has to contend, and the problem of cutting it out, or of considerably minimising its effect, is of vital importance.

Now most crystal sets are provided with only one tuning circuit, which arrangement is not particularly selective, more especially as the crystal is usually placed across the whole aerial coil. The average crystal has only a comparatively low resistance of the order of a few hundred thousand

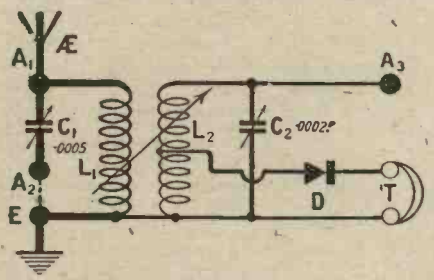


Fig. 1.—Two tuned circuits are employed in this set, the crystal being connected to the centre of L2.

ohms, and, consequently, its introduction across the tuning circuit makes the tuning flatter than otherwise would be the case.

Also, it is of little use to employ a low-loss coil with a direct-coupled crystal set, since the resistance of the aerial and earth systems may easily be many times greater than that of the aerial coil.

Using Two Tuned Circuits

A considerable improvement in selectivity can, however, be brought about by the introduction of two tuned circuits, the effect of the aerial damping being largely minimised. In the set about to be described, therefore, two circuits are incorporated, and both are tuned in order that the selectivity may be as high as possible.

Crystal Damping

By tapping the crystal across part of the coil only the damping effect it introduces can be reduced, but, of course, use is made of only a fraction of the available high-frequency voltage across the coil. Despite this latter fact, however, it has been found that by suitably tapping the crystal across part of the coil an improvement in both signal strength and selectivity, which is well worth while, can be obtained. A centre-tapped coil has therefore been used in the secondary circuit, and the crystal detector is placed across half of the coil only.

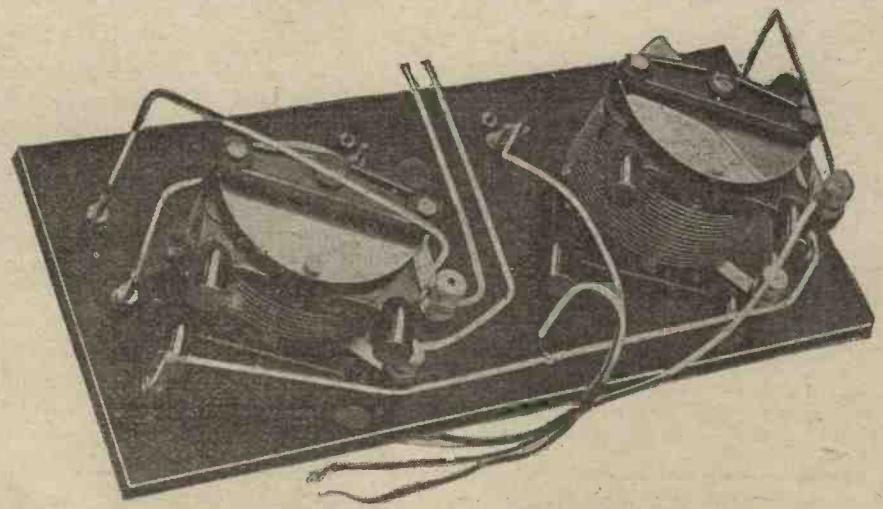
The Theoretical Circuit

The circuit employed in the receiver is shown in Fig. 1. The aerial coil L_1 is variably coupled to the centre-tapped secondary coil L_2, the former being tuned by a .0005 and the latter by a .00025 condenser. The three-terminal arrangement shown permits of series tuning being obtained with the aerial joined to terminal A_2 and the earth to E, whilst C_1 is connected in parallel by joining A_2 to E. The aerial is then joined to A_1. The crystal detector and telephones are connected across half of L_2 only.

The third terminal A_3 serves a dual purpose, namely, that of allowing the receiver to be employed as a direct coupled instrument, in which case the aerial is joined to A_3, whilst the earth remains connected to E. It also allows the set to be used as a loosely-coupled tuner. In this latter case, of course, A_3 is joined to the grid of an H.F. valve, or to one side of the grid condenser, if a valve detector is employed, and the lower telephone terminal goes either to L.T. positive or negative, or to the slider of a potentiometer. It will be observed, therefore, that the instrument is a very suitable one for a beginner, since it will prove useful later on when it is desired to change from a crystal to a valve detector arrangement.

Special Features

In order that the full benefits of employing two tuned circuits may be obtained, it is necessary that a coil



A back-of-panel view of the receiver.

holder which permits of very loose coupling be employed. The type used in the set is one which must be mounted on a horizontal panel, and it has, therefore, been arranged that the two tuning condensers are placed on a vertical panel.

An advantage of this arrangement is that there is no tendency for heavy coils to move, when once adjusted, owing to their weight. The aerial coil is accommodated in the moving coil holder, whilst the fixed coil holder takes the secondary coil, the centre tapping of this latter being joined to a flexible lead, which is brought through the top of the case. This latter is of home construction, and to make it should not be beyond the ability of the average set builder.

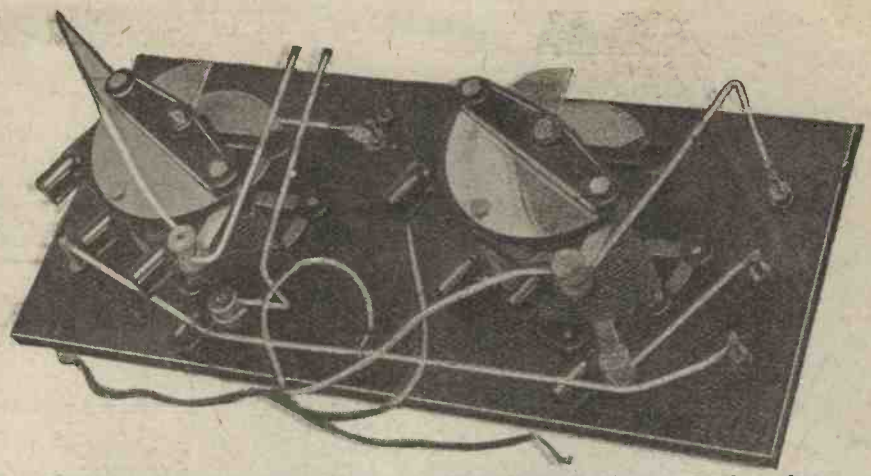
Panel Layout

The photographs indicate the neat appearance of the receiver, and reference to these and to the panel diagram will show that the aerial condenser is placed towards the left-hand side of the panel, the crystal detector is in the centre, and the secondary tuning condenser to the right-hand side. The three terminals on the left-hand side are for the various aerial connections when loose coupling is employed, and for earth.

On the right are situated the aerial terminal for single circuit working and the two telephone terminals respectively. It will be noticed that verniers are incorporated in the two tuning condensers, which feature will be found particularly advantageous in the event of the instrument being used as a loosely-coupled tuner in conjunction with a valve receiver.

Components

The actual components used in the set, together with the makers' names, are given below for the convenience of the constructor, but there is little reason, in most cases, why good



The flexible leads shown here are taken through the top of the cabinet to the coils.

articles of other makes should not be substituted, if to hand:—

One "Pilot" ebonite panel, 12 in. by 5 in. by ¼ in. (Peto-Scott Co., Ltd.).

One .0005 "Vanicon" variable condenser (Dubilier Condenser Co., Ltd.).

One .00025 "Vanicon" variable condenser (Dubilier Condenser Co., Ltd.).

One panel-mounting two-coil holder (Gambrell Bros., Ltd.).

One panel-mounting crystal detector (Burndept Wireless, Ltd.).

Six nickel-plated W.O. type terminals and nuts.

A quantity of Glazite wire and rubber-covered flex.

Six ¾-in. No. 4 wood screws, a quantity of joiners' brads, 2 6B.A. stop pins or screws.

For the Cabinet

The case should be constructed of hard wood, such as oak or teak. For the top, on which the coil holder is mounted, and for the base, ⅜ in. thick material will prove suitable; these two pieces being 12 in. by 4½ in. and 12½ in. by 5 in. respectively. For the sides of the case, material of ⅜ in. thickness should be employed, two pieces 4½ in. by 4 13/16 in. being necessary. For the back of the case, any thin board to hand may be used, the length being 11¼ in. and the width 4¾ in. Two fillets, which are bradded in position so as to allow the back of the case to be flush with the sides and top, allow the back to be screwed into position when the set is assembled and wired.

Constructing the Case

The best method of constructing the case is first to screw the two side pieces to the panel by means of ¾ in. No. 4 wood screws; care being taken to make sure that the side pieces are perfectly square. The top of the cabinet should now be planed so as to be flush with the top of the panel, and when a good fit has been obtained it should be fixed to the two side pieces by means of suitable joiners' brads. The back piece can now be trued up and temporarily placed in position, when the

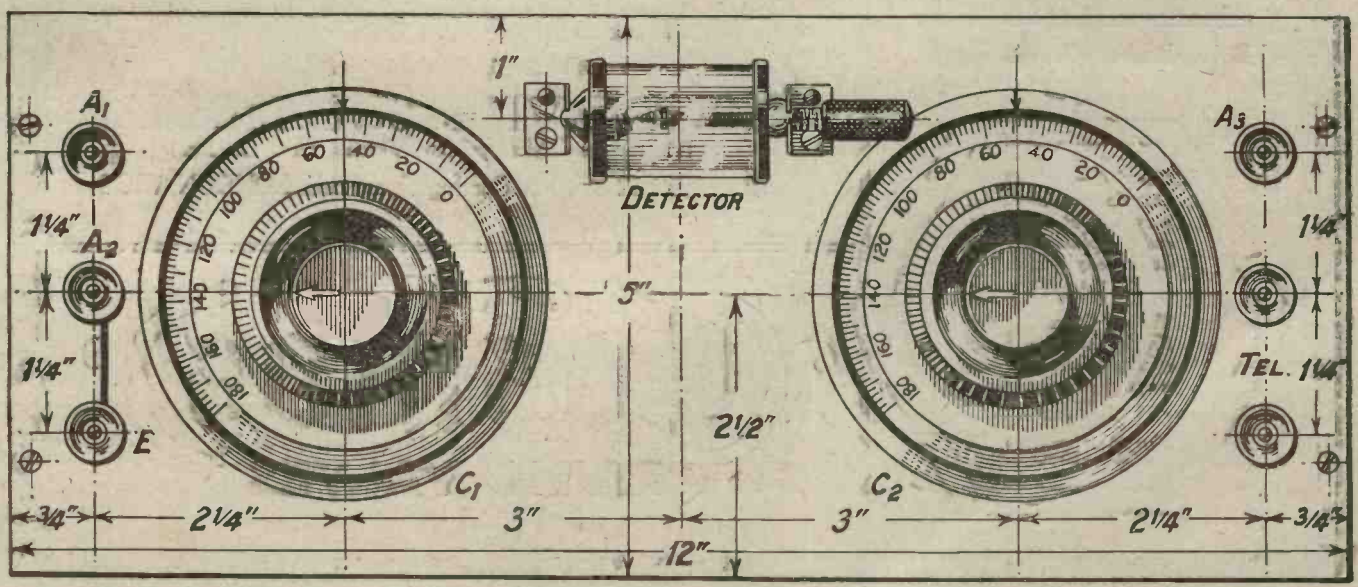


Fig. 2.—It will be seen from this panel-drilling diagram that a symmetrical appearance has been achieved. Blueprint C1046A.

Take the SHORTPATH to Better Reception

KEEN constructors are continually seeking fresh methods of obtaining better results from their sets. There is now available one simple method—one SHORTPATH to improved results.

The unique construction of the "Cosmos" SHORTPATH valves, whereby the path between filament, grid and anode is reduced to an absolute minimum, enables results to be obtained unequalled by any other valve of the one cell accumulator class.

Compare their characteristics with published figures of other makers:

	S.P.18 Red Spot	S.P.18 Green Spot
Voltage Amplification Factor (μ). ..	7	15
Impedance	7,000	17,000
Mutual Conductance (g) micromhos	1,000	850

"Cosmos" S.P. 18 Valves provide a SHORTPATH to: { MORE POWER / FAITHFUL REPRODUCTION / GREATER ECONOMY

S.P. 18 valves consume 0·3 amps., at from 1·6 to 1·8 volts. and require only a single cell 2-volt accumulator. They are recommended for use as shown in adjoining table.

Obtainable from most Wireless Retailers.

METRO-VICK SUPPLIES Ltd.

(Proprietors: Metropolitan Vickers Elec. Co. Ltd.) R/V27

Metro-Vick House, 145, Charing Cross Road, LONDON, W.C.2

FOR BEST RESULTS S.P.18 VALVES should be used as follows:

HIGH FREQUENCY STAGES:	
Tuned Anode	Green ●
Transformer Loose Coupling	Red ●
.. Tight Coupling	Green ●
If set oscillates use Red ● for all H.F. stages, especially for dual stage valves.	

OTHER STAGES:		
STAGE	TRANSFORMER COUPLING	RESISTANCE CAPACITY COUPLING
Detector	Green ●	Green ●
L.F. (1st Stage)	Green ●	Green ●
L.F. Intermediate	Red ●	Green ●
L.F. (Last Stage)	Red ●	Red ●

Price, Red or Green Spot, 12/6

The "Cosmos" D.E 12 Dull Emitter Valve takes 0·25 amp. at 1·1 Volts. and is a splendid Dry Cell Loud Speaker Valve.

12/6

The "Cosmos" A45 Bright Valve is a highly efficient Valve for all reception purposes.

7/6

Have you got your copy of "A Talk to Valve Users?"

Cosmos
RADIO VALVES

position for the two fillets will be obtained. These latter should be of ½ in. square section wood. Finally, the baseboard should be fixed by means of brads, it being arranged that an overlap of ¼ inch is obtained at the two sides and in front of the panel.

Mounting the Coil-Holder

The next step is to mount the coil holder, for which a drilling template is supplied by the makers. Reference to the diagrams and photographs will show the correct position for this component, and it will be observed that two 6B.A. screws and nuts have been used to make stops to prevent the moving coil block having too much play. The two leads to this latter are taken through a ½ in. or ⅜ in. hole drilled in the position shown.

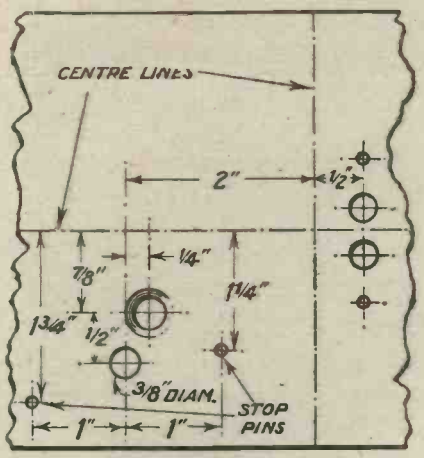


Fig. 3.—This diagram gives the positions of the holes necessary for mounting the coil-holder on top of the case.

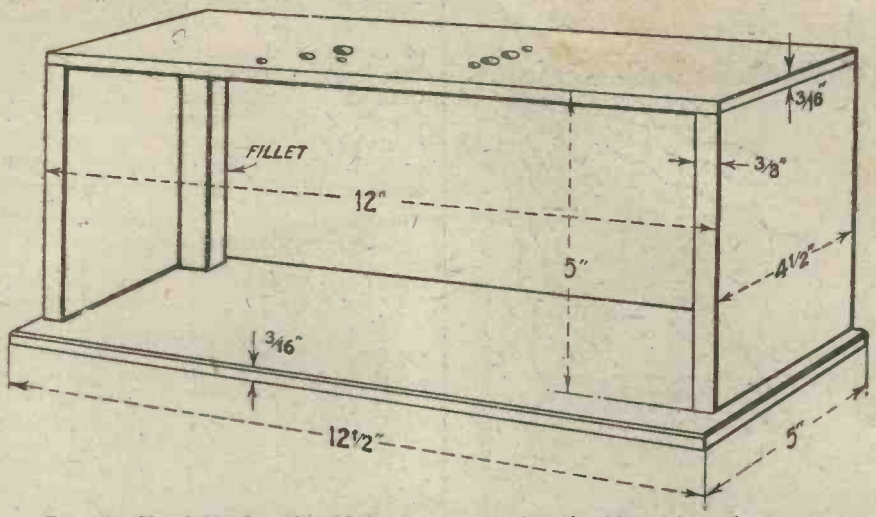


Fig. 5.—No difficulty should be encountered in building the cabinet, as the design has been made as simple as possible.

Drilling the Panel

Drilling the panel is a simple operation. A template is supplied for setting out the necessary holes for the crystal detector, whilst in the case of the variable condensers the circular ebonite pieces, which are mounted below the condenser dials, serve for marking out purposes.

The Wiring

The wiring is carried out with Glazite insulated wire and rubber covered flex, where flexible leads are required, such as those to the moving coil block and to the centre tapping of the secondary coil. The best procedure to adopt is first to wire the components on the panel, which should be removed from the case, the final leads being affixed when the panel is screwed into position.

Testing

If your local station transmits on the lower broadcasting wavelengths a Gambrell B1 coil should be inserted into the aerial coil socket, the aerial should be connected to A_1, and A_2 should be joined to E and to earth. In the secondary coil holder (that is, the fixed block) a centre tapped C coil will be required, and the lead through the top of the case should be joined to the centre tapping of the coil. If 5XX is to be received the aerial coil should be an E1 and the secondary coil a centre tapped F.

Where numbered coils are used the

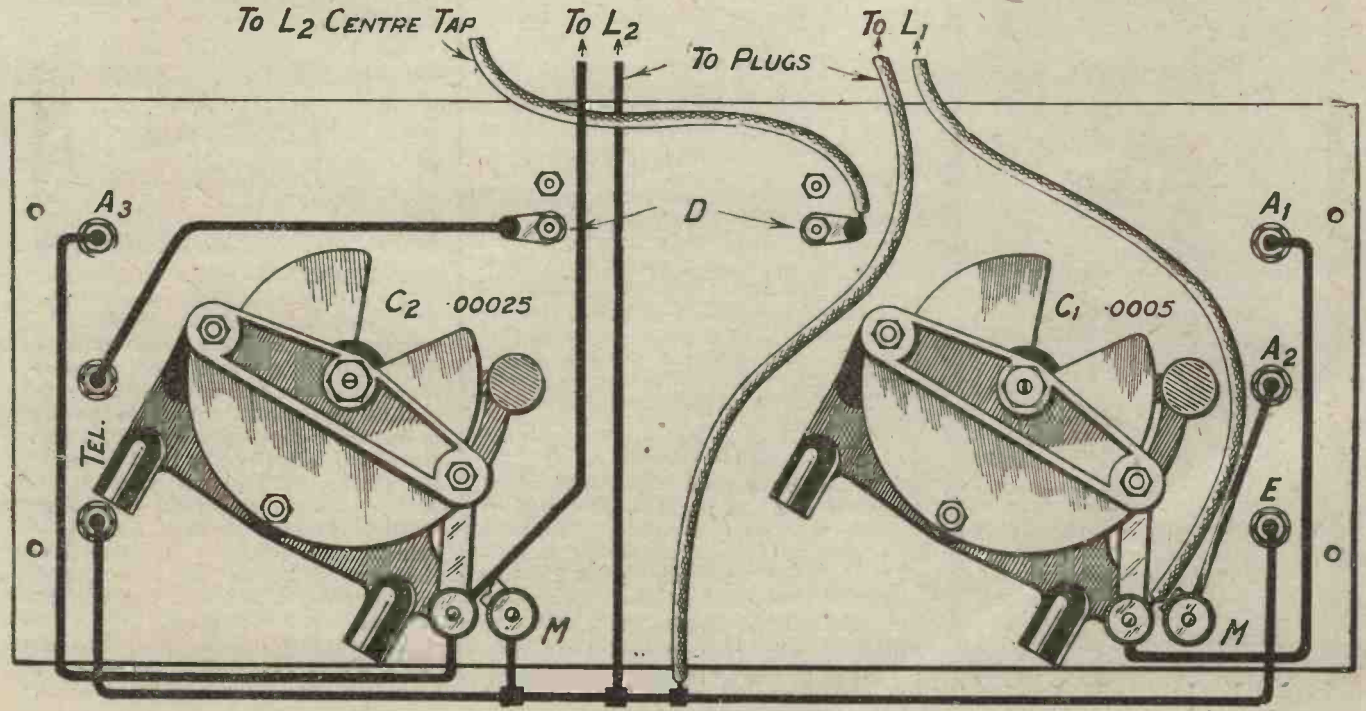


Fig. 4.—The wiring diagram. The leads to the coils are clearly marked. Blueprint C1046B.

aerial coil may be a number 25, 35, or 50, if parallel tuning is used, or a 50 or 75 with series tuning, for the lower broadcast wavelengths. For 5XX, with parallel tuning, a No. 150 coil in the L_1 socket is necessary. In the secondary socket a centre tapped 50 or 60 is suitable for the 300-500 metre band, whilst for 5XX a centre tapped 250 should be used. Centre tapped numbered coils may be obtained from Messrs. Lissen, Ltd.

A view of the completed set. As shown here, terminals A2 and E are normally joined by a strip of wire.

Tuning

Start first with the aerial coil at an angle of, roughly, 45 degrees, and tune on both condensers until the local station is heard. The coupling between the coils should then be adjusted to give maximum signal strength, slight retuning being necessary on both condensers as an alteration to the coupling is made. When interference is experienced loosening the coupling between the coils and consequent retuning on the two condensers will generally allow the interfering signals to be weakened to a greater extent than the required transmission, which makes well worth while the slight loss of signal strength which may be experienced. The weakest coupling, and consequently sharpest tuning, is obtained when the aerial coil is practically at right angles to the secondary coil.

Test Report

Tested on a good high aerial at 12 miles south-east of 2LO, that station was obtained at good telephone strength, and 5XX was hardly noticeably weaker. The tuning, as was expected, was sharper than is obtained with a direct-coupled set, and no noticeable loss of strength resulted from the loosely coupled arrangement. The background of interference from spark transmission was noticeably reduced, and the set should therefore prove particularly suitable for listeners in coastal areas. Gambrell coils, of the sizes indicated, were used throughout the test.

Elstree Tests.

In common with all receivers described in THE WIRELESS CONSTRUCTOR, this set was tested by the technical staff of our Research Laboratories at Elstree. The following are the results:—

Design, etc.—Good.

Operation.—Good, the set giving satisfactory reception on a variety of aerials. The tuning was sharp, and a good degree of selectivity is therefore obtainable.

A USE FOR OLD BLUEPRINTS

BLUEPRINTS whose usefulness as wiring guides has come to an end need not be discarded as wastepaper, as they can still be employed for a variety of purposes. Since they are full-size drawings, the outline representations of the various components depicted form useful templates and should be cut out as guides for drilling and layout purposes for future sets. Drawings of dials, knobs, etc., from front of panel blueprints can be cut out and placed on the panel intended for a new set to give an idea of the appearance of the receiver when completed.

The wording on the blueprints can be utilised for emergency panel transfers and for other labelling purposes.

W.

THE LOUD-SPEAKER AND ITS PROBLEMS

By E. H. BERRY

Like the gramophone, the loud-speaker has successfully emerged from the days when it was regarded as a "tinny" and music-distorting instrument. Some of the problems of loud-speaker design are discussed below.

THE loud-speaker is regarded by many listeners as being the least satisfactory accessory to the modern broadcast receiving installation.

How far this is true is a debatable point, and it should be remembered that bad loud-speaker reproduction is more often than not due to defects in the receiver or unintelligent operation of it. While many listeners are quite ignorant regarding "how it works," many others, with justice, regard it as nothing more or less than a telephone receiver with minor modifications.

Although the telephone receiver is wonderfully efficient, it yet possesses certain inherent defects which are accentuated in the loud-speaker, especially where the large power necessary to fill halls or big rooms is to be handled.

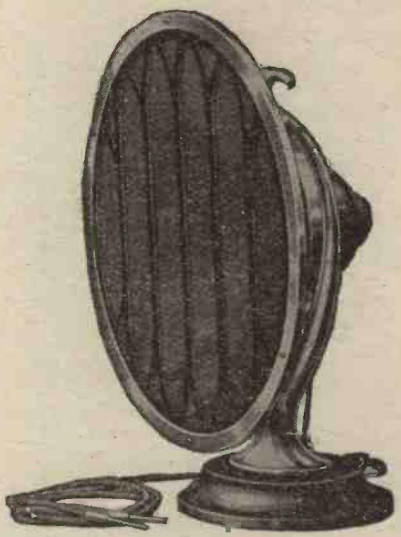
Compromise in Design

These defects, I should like to emphasise, are not the defects of manufacture but are the result of compromise in design. The present design is based on theoretical considerations which make it impossible to produce commercially or even practically an ideal model. The difficulties of obtaining an ideal loud-speaker may be gauged when it is realised that the diaphragm alone should possess the three following properties: it should be weightless, infinitely large, and perfectly rigid.

How Loud-Speakers Work

This is only one of the problems which are encountered in dealing with the conversion of electrical impulses into an acoustical effect. Probably the most popular and best-known loud-speakers are of the electro-magnetic type, of which some well-known examples are the "Amplion" and the "Brown" and other similar kinds. Of course, not all the electro-magnetic types are the same, many of them presenting some important modification in their detailed construction. The usual electro-magnetic type is, as stated previously, very similar to a telephone receiver in construction, there being two electro-magnets which are disposed in close proximity to a diaphragm. These electro-magnets are often capable of adjustment, so varying the air gap between the poles of the magnet and the diaphragm.

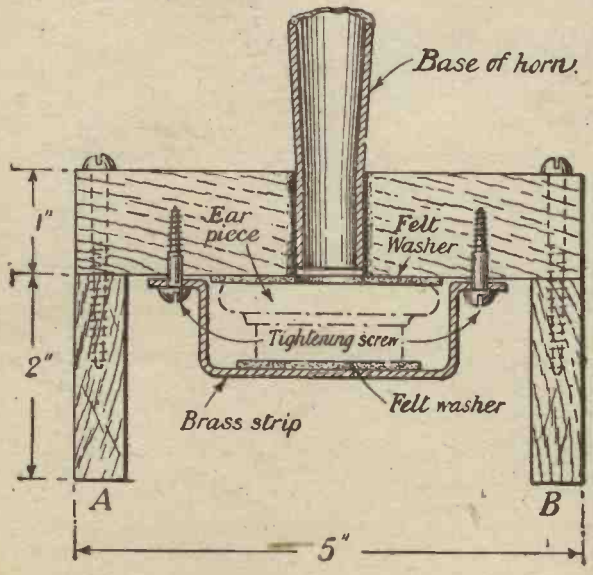
The magnets are of the permanent type, but around each pole is wrapped a bobbin of wire, the two bobbins being connected in series and the ends taken to terminals. The output from the receiver, which is the input to the loud-speaker, is a series of minute pulsating currents, these currents increasing or decreasing the magnetic pull on the diaphragm. It will, of course, be realised that as the magnets are permanent, a permanent pull is exerted on the diaphragm, and this permanent pull is either increased or decreased.



Modern design aims at producing a pleasing appearance as well as good tonal qualities. The handsome instruments shown here and in the heading illustrate this point.

Diaphragm Problems

The question of the rigidity of the diaphragm is solved by reducing the diaphragm to dimensions of the order of a circle between one and a-half inches and three inches in diameter. If the diameter is greater than about three inches, the solution of the problem of rigidity becomes almost incapable of solution on a cheap commercial basis. In one popular form the modification, which, it is



Quite a good loud-speaker for use in a small room can be made by clamping a horn to a telephone earpiece.

claimed greatly increases the purity of reproduction, is to allow the diaphragm to float, as it were.

Instead of being rigidly clamped about its periphery, it is rigid and yet capable of movement as a whole, because the particular construction includes a wavy spring instead of a clamping washer. Most loud-speakers are of the horn type, and in these particular types, where a small diaphragm is incorporated as opposed to the cone or pleated diaphragm type, the diaphragm is so small that the inertia of the volume of air which it affects is insufficient to produce any real volume of sound unless a horn is employed. The horn is merely an artificial way of loading the diaphragm with a column of air. This column of air, being restricted within the confines of the horn, presents a much greater degree of inertia than if the diaphragm was actually open and allowed to influence the small natural loading which would result if no horn were used.

Horn Design

The horn has been the subject of much research, and in the main it has been found that it should be restricted at one end to offer as great a mechanical impedance to the diaphragm as possible, and at the open end this impedance should be as low as it is possible to obtain. Another point in design is that it should be as long as possible, but for various reasons it is impracticable to utilise a horn of anything approaching the ideal length, or even of a length approaching the ideal. In another well-known type of loud-speaker, instead of the magnet being allowed to directly influence the diaphragm, the magnet attracts an armature carrying a reed. This reed has attached to it a conical diaphragm of very finely spun aluminium, and very good results are obtainable with this.

"Hornless" loud-speakers are now popular, although many contain an internal sound conduit.

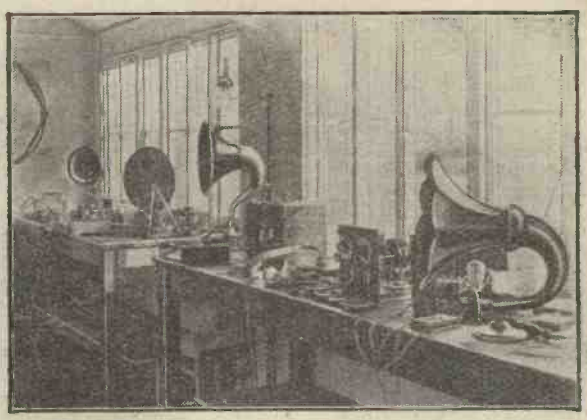
The Electro-Dynamic Type

Another type, referred to as the electro-dynamic, employs a magnet of circular form in which is cut a fine annular air-gap. Into this air gap fits a fine solenoid which is attached to the diaphragm.

The magnets are not permanent but carry a winding which is designed to be supplied with a separate direct current. The small moving coil carries the input currents, and, in conformity with a fundamental electrical law, is attracted into or repelled out of the annular ring, thus causing the diaphragm to vibrate.

A construction of this form is capable of exceptionally powerful results, certain speakers of this type being used for addressing an audience of many thousands.

This photograph, taken at Elstree, shows that our Research Laboratories have not neglected the loud-speaker as a field for investigation.



"Cone" Loud-Speakers

If no horn is employed a much larger diaphragm must be used, as in the cone type. As the mechanical difficulties of attaining a reasonable degree of rigidity are considerable, the "cone" diaphragms are frequently smaller than is required to produce the same volume as a horned model at a corresponding price, although owing to lack of horn resonance effects it is claimed that tonal quality is superior.

An interesting solution of the problem of rigidity for cone-type diaphragms has appeared on the market. This loud-speaker has a reinforced cone-type diaphragm which is not restrained about its circumference. The apex is attracted to magnets, and the whole works as a large piston working against the inertia of the air presented to its surface.

Natural Frequency

Another manufacturer has evolved a very satisfactory speaker of rather unique type. This merits attention in view of the fact that it employs a balanced armature designed to have a natural frequency considerably higher than the mean speech frequency. Its natural frequency, I understand, is of the order of 3,000 cycles per second, resulting in freedom from distortion over that range of frequencies where distortion is usually present, and in increased efficiency on the higher notes.

To obviate this difficulty of the natural frequency of the diaphragm or reed being in close proximity to the usually regarded mean speech frequency of 800 cycles per second, another manufacturer has gone to the opposite extreme and made the natural frequency about 3 cycles per second.

A Special Diaphragm

It was decided to use in this model a special diaphragm which would possess the minimum amount of inertia. Many loud-speakers employ diaphragms which require a comparatively great amount of power to overcome their natural inertia. Much research resulted in the use of an oblong strip of crinkled aluminium foil, this being stretched between two poles of a magnet. When the speech currents or impulses from the receiver are passed through it, this peculiar foil diaphragm is deflected, and the resulting vibrations are communicated to a column of air confined in a horn and thus as sound to the listener's ear.

The vibrations are similar to those of a circular diaphragm, but of a greater amplitude, and it is claimed that audiences of 30,000 or more have been entertained with a speaker of this form.

Friction Arrangements

One of the most interesting types produced and capable of giving considerable volume was the Edison Friction speaker.

This suffered from certain drawbacks, one being that a small motor was required to operate a moving cylinder, while the tone was rather unpleasant.

The principle on which it was based is that the friction between a metal and a substance subject to electrolytic action varies according to the strength of the current passing between the contact points.

Another type was based on a certain electro-adhesive effect. If a conductor bears on certain poor insulating materials, the friction between the surfaces varies with the applied potential. If this potential is varied, then the increased or decreased friction will, if suitable apparatus is used, operate a diaphragm.

Various other experimental types are in existence, and it is quite possible, and in fact probable, that it will be one of these types which will eventually result in a perfect—or almost perfect—loud-speaker.

MORE APPRECIATIVE LETTERS FROM OUR READERS

The Powerful Three-Valve Set

"EXPECTATIONS EXCEEDED"

SIR,—I am writing to inform you of the results obtained from "The Powerful Three" receiver, by Percy W. Harris, M.I.R.E., which I constructed some weeks ago from the directions given in THE WIRELESS CONSTRUCTOR for April, 1925. It has far exceeded my expectations as regards loud-speaker range. The following stations have been received on the loud-speaker: Nottingham, Daventry, Birmingham, London, Manchester, Glasgow, Sheffield, and Brussels. The first five of these can be obtained almost any time. I think this is wonderful in a set which employs no H.F. valves. With telephones it is possible to tour the Continent at will. I may add that my aerial is badly screened and about 35 ft. long, and I employ a waterpipe earth. In making future sets I shall need to do no more than look through my carefully-preserved copies of your invaluable paper.

Yours faithfully,
C. C. ALLEN.

West Bridgford,
Nottingham.

"THE BEST YET"

SIR,—I thought you would like to hear of the results I have obtained with the "Powerful Three-Valve Set," described by Percy W. Harris, M.I.R.E., in the April, 1925, issue of THE WIRELESS CONSTRUCTOR. I have made up a few of the Radio Press sets, but I find that the "Powerful Three" is the best yet. I followed the diagrams to the letter; coils were home-made, and transformers were, 1st stage, C.A.V., and 2nd stage, Ferranti. Valves used are Cosmos S.P. 18.

Results are as follows: Daventry has to be detuned; Belfast, Glasgow and Bournemouth are all good loud-speaker strength, while Radio Paris can be followed quite clearly.

You can rest assured that I shall recommend this excellent set whenever possible. Wishing Radio Press publications an ever-increasing popularity,

Yours faithfully,
ROBT. PEARSON.

Seaton, Cumberland.

"MOST SATISFACTORY"

SIR,—You ask readers who have made up the Powerful Three-Valve Set described by Percy W. Harris, M.I.R.E., in the April number of THE WIRELESS CONSTRUCTOR to let you know the results. Before it came out I had made several sets with one detector only, always leaving room for the addition of amplifiers as required. This set I completed right through, however.

My set gives good loud-speaker strength for Birmingham, Cardiff and 5XX; other stations I have not bothered about, but could work up 2LO and Bournemouth. In fact, we commonly use this set now in preference to a four-valve tuned-anode set, the latter being often unpleasantly loud.

This set, with its ease of tuning, its cheapness and compactness, is to my mind the most satisfactory of all, though if more volume were wanted it would have to be got by a resistance-coupled amplifier.

Your paper is much appreciated, and it is now the only one we take.

Yours faithfully,
F. WANHILL,
Lieut.-Col., R.A.M.C. (R.).

Hampton Park,
Hereford.

With the advent of Summer we shall be thinking of portable sets, and "Constructor" readers will be catered for in this respect in future issues.

Youth and the "Midget"

SIR,—I am writing to let you know of my results with the "Midget" single-valve set described by Mr. A. S. Clark in the May issue of THE WIRELESS CONSTRUCTOR. The local station 2LS comes in very loud, and I can get all the other B.B.C. main stations except Cardiff. I have also picked up Hamburg, Berlin, and four other unidentified German stations. But what I like about the set most is its selectivity, for I can get London and Manchester without any interference from Leeds. Wishing your admirable paper every success.

Yours faithfully,
R. N. HIGGINS (age 14).

Headingley, Leeds.

"TALKS TO BEGINNERS" —A CORRECTION

By a rather obvious error, the figures relating to the "Motoring Analogy," on page 633 of our May issue, were incorrectly worked out. If the cars were separated by a 20th of a mile and were running at 20 miles per hour, then 400 and not 20 cars would pass the gate in the hour. The other figures follow from this.

The Free Blue Print Service Coupon

is to be found on page 792

For "The Wireless Constructor" at our Elstree Laboratories.

High Resistance Potentiometer

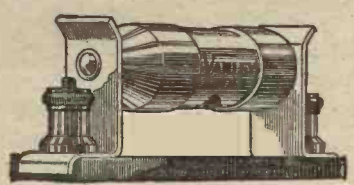
A HIGH resistance potentiometer has been received from Messrs. the Igranic Electric Co., Ltd., for test and report. The resistance element is of graphite, with a sliding carbon brush contact mounted on an insulating moulding. A removable cover and indicating dial are provided. The total resistance of the potentiometer was 50,000 ohms, and it was found to be silent in operation, and well made and finished.

Neutralising Condensers

NEUTRALISING condensers have been submitted for test by Messrs. A. F. Bulgin & Co. The sample tested consisted of a circular ebonite base carrying a small cylinder of insulating material, from the top of which projected a slotted rod. This rod could be adjusted by means of the key supplied to vary the capacity of the condenser. The component was found to have maximum and minimum capacities of 2.6 and 0.3 micro microfarads respectively, and should prove useful in neutralised H.F. amplification circuits.

"Tungstone" Accumulator

WE have tested a 12-volt, 50-ampere-hour (actual) accumulator manufactured by Messrs. the Tungstone Accumulator Co., Ltd. On discharging at 3 and 6 amps., it was



A sketch of the Varley wire-wound anode resistance, mounted on a standard base.

found to have a capacity of 90 ampere hours, as against the maker's 50 a.h. rating, while even after severe tests the plates were in excellent condition. This accumulator is so constructed that any single plate can be easily renewed. It can be thoroughly recommended for its robust construction and ability to withstand heavy discharges and rigorous treatment.

Audio Transformer

THE 5 to 1 ratio low-frequency transformer sent in for test by Messrs. Brandes, Ltd., is of shrouded type, standing 3 in. high, and has both terminals and tags for connecting purposes. On test, it gave excellent quality and amplification above the average in the first stage, while very good quality was maintained in the second stage. It can be thoroughly recommended.

"Varley" Anode Resistance

FROM Messrs. the Varley Magnet Co. (proprietors, Oliver Pell Control, Ltd.) we have received a number of their Varley wire-wound resistances. They are of standard size, and may be had in various values, with or without clips and base.

On test, each resistance was found to be exactly of the value specified and perfectly silent in use as an anode resistance in a resistance-capacity L.F. amplifier. These resistances are well made and finished, and can be thoroughly recommended.

Junior "Ideal" L.F. Transformer

THE Junior model "Ideal" transformer manufactured by Messrs. the Marconiphone Co., Ltd., has been tested for THE WIRELESS CONSTRUCTOR. This instrument was found to produce a high degree of amplification, whilst the quality of reproduction was in every way satisfactory. The transformer can be thoroughly recommended as a general-purpose instrument.

Fixed Air Condenser

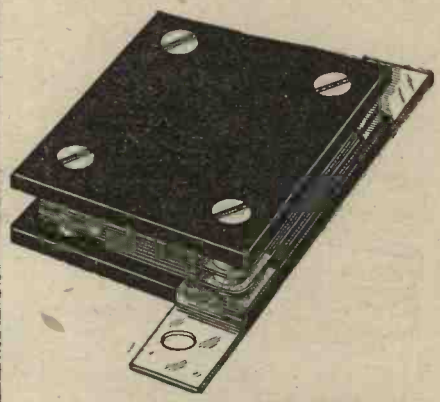
A FIXED air-dielectric condenser has been received from Messrs. the Baltic Radio Co., Ltd. The plates are of stout sheet brass mounted between two ebonite end plates 1¾ in. square. It was found to be of rated capacity, while losses were negligible. This neat and compact component would appear to be especially suitable for short-wave work.

Ormond L.F. Transformer

ONE of the L.F. transformers made by Messrs. the Ormond Engineering Co., Ltd., has been tested at our laboratories with good results. It is of open type, and gave good quality reproduction. Considering its low price its performance may be considered very satisfactory indeed.

"Bico" Multi-Valve Switch

INTENDED for controlling the number of valves in use in a multi-valve receiver, "Bico" switches are made by Messrs. the Burner Insulator Co., three types being available. The sample tested is suitable for use with a detector and 2 L.F. stages, and incorporates a number of contacts actuated by a spindle and a cam device. The switch



Robust construction is a feature of the Baltic fixed air condenser.

was found to be satisfactory electrically, and provides an easy and convenient method of controlling the number of valves in operation in a set. It can be put to a number of other uses also.

Valves

SEVERAL valves have been submitted for test by Messrs. Radio Valves, Ltd. Those of 3.5 volt .5 amp. type and 4 volt .7 amp. type are general-purpose bright emitters, and on test came well up to standard in all three positions in an H.F., detector, and L.F. set.

Two 3 volt .06 amp. valves also gave a good performance. All the valves showed a satisfactory uniformity, and their current consumption agreed with the makers' rating.

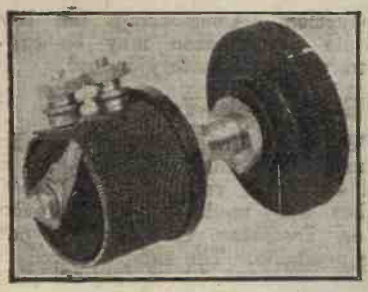
"Cosmos" Anti-Vibration Valve Holder

A "COSMOS" anti-vibration valve holder has been sent for test by Messrs. Metro-Vick Supplies, Ltd.

The socket is mounted on spiral springs fixed to a circular base, stops being provided to limit the movement of the socket during the insertion and removal of a valve. On test its insulation resistance was found to be infinity, while it gave adequate protection from shock and vibration to a dull-emitter valve. Finish and construction are good.

"Lisenin" Tags, Plugs and Sockets

SPADE tags, plugs and sockets have been received from Messrs. the Lisenin Wireless Co., these accessories



This Ediswan 30-ohm rheostat is a very compact component.

being intended for use with flexible battery and other leads. The tags and plugs are fitted with coloured insulating sleeves and incorporate a novel "Positive Grip" device, consisting of a brass cone and nipple. The sockets are fitted with coloured insulating washers. These accessories are very neat and well-finished, and the grip device was found to give a very good electrical and mechanical joint.

Russell's Hertzite

A SAMPLE of Russell's Hertzite crystal has been tested by us for Messrs. the L. G. Russell Laboratories. It is of fairly coarse structure. On test it gave very satisfactory results, many sensitive spots being located with ease.

"Ondia" Wavemeter

MESSRS. GOODCHILD & PARTNERS, LTD., have submitted for test an "Ondia" wavemeter for the 25 to 25,000 metres range, this wavelength band being covered by the four coils supplied. As an absorption wavemeter it was found to be accurate, while it satisfactorily fulfilled a number of other useful purposes. It is compact, simple to operate, and free from hand-capacity effects, and should prove of great use to amateurs.

"Universal" Rheostat

FROM Messrs. the General Electric Co., Ltd., we have received a "Universal" rheostat. The resistance elements are wound on a square insulating rod bent into a circle, a projection being provided at the junction of the two windings. The total resistance was found to be 30 ohms, the dull- and bright-emitter portions having resistances of 23 and 7 ohms respectively. The rheostat is exceptionally quiet in action and robustly constructed.

Sterling "Least Loss" Condenser

A STERLING "Least Loss" variable condenser has been submitted by Messrs. the Marconiphone Co., Ltd. It is a brass vaned

Pye grid leaks are fitted with stout wires for making soldered connections.

instrument, the fixed plates being insulated from the aluminium end-plates by means of Pyrex glass. An 8 to 1 reduction is given by special friction gearing. The efficiency was of a high order and the mechanical design excellent, no side or end play being perceptible in the bearings.

"M-L" Transformer

THE "M-L" low-frequency transformer made by Messrs. S. Smith and Sons (M.A.), Ltd., has been tested for THE WIRELESS

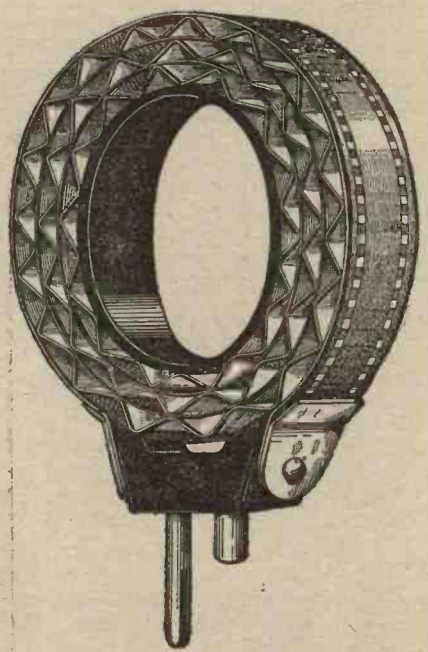
CONSTRUCTOR. A substantial circular core is a feature of this transformer, which is barrel-shaped and partly shrouded. The reproduction was clear and fresh with no sign of roughness, and the instrument appears to be stoutly constructed and well finished.

"Camden" Mansbridge Condensers

MESSRS. THE CAMDEN ELECTRICAL CO.'S Mansbridge type fixed condensers are of the usual size and shape and enclosed in grey metal cases. On test their insulation resistance was found to be infinite, while they stood up satisfactorily to a voltage of 500. These condensers are good specimens of their class and can be recommended.

Ediswan Rheostats

DUAL and dull emitter type filament rheostats have been sent for test by Messrs. the Edison Swan Electric Co., Ltd. Both rheostats are of circular form, with the

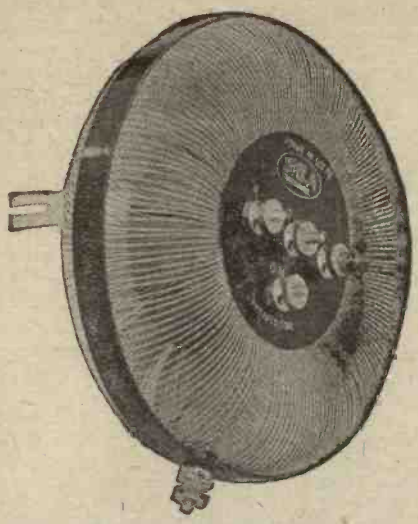


Corrugated celluloid is used to separate the layers of wire in "Lewcos" coils.

usual type of rotating contact arm, and provided with terminals. In the dual rheostat the contact arm can be changed from one resistance element to the other by pressing the rheostat knob, thus allowing the arm to clear a stop. The dual rheostat elements had resistance of 37 and 7.5 ohms, while the dull-emitter pattern had a resistance of 33 ohms. The motion of both was smooth and noiseless, and the finish good.

"Silverex" Crystal

A "SILVEREX" crystal made by Messrs. Sylvex, Ltd., has been tested with excellent results at our laboratories. The crystal is of



"Erla" Balloon Circloid Couplers are so wound that they have no external field.

medium fine structure, possesses a large number of sensitive spots, and is of convenient size for mounting purposes. A special catswhisker is provided with it.

"Lewcos" Coils

FROM Messrs. The London Electric Wire Co. & Smiths, Ltd., we have received several of their new "Lewcos" plug-in coils. These are wound with special Litz wire, the layers being separated by corrugated celluloid and fastened to the standard plug by a celluloid band. The coils were found to be extremely efficient, robust in construction, and pleasingly finished, and can be thoroughly recommended for use.

"Quality" Two-coil Holder

A "QUALITY" two-coil holder made by Messrs. The Goswell Engineering Co., Ltd., has been tested at our laboratories. Both coarse and fine adjustment are obtainable, the latter by means of an eccentrically

A photograph of the Peto-Scott Universal Transformer.

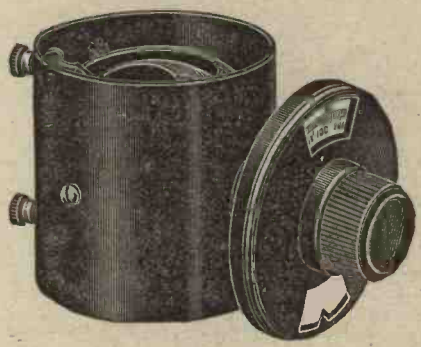
mounted bead on an auxiliary spindle, which causes the "fixed" coil block to move through a small arc. A switch which allows the reaction coil to be shorted or its connections reversed at will is also provided. The construction and finish of this coil holder are good, and an adequate vernier control is obtainable.

Pye Grid Leak

GRID leaks have been submitted for report by Messrs. W. G. Pye & Co. The sample tested was rated at 2 megohms and on test was found to have an actual resistance very close to this. The leak is of familiar shape, but rather short, a stout wire being provided at each end for soldering purposes. This component is strongly constructed, remains constant in value, and can be recommended.

"Erla" Fieldless Coils

TOROIDAL coils have been received from Messrs. C. G. Vokes & Co. They are known as "Erla" Balloon Circloid Couplers, and on test were found to be practically fieldless. One coil was intended for aerial coupling



A special dial is a feature of the Igranic variometers.

and the others for H.F. stages. It was found that absolute stability was obtained over the whole 200-500 metres band, while a satisfactory degree of H.F. amplification resulted. The coils are robust in construction, have a satisfactorily low H.F. resistance, and are provided with brackets for fixing purposes.

"Keystone" Universal Transformer

MESSRS. THE PETO-SCOTT CO., LTD., have sent us one of their "Keystone" Universal Transformers. It consists of two windings of insulated wire on an ebonite tube 4 in. long and 3 in. in diameter. Five split pins are mounted on a strip fixed to the tube, these being for connecting purposes and plugging into a holder. The component can be used for a variety of purposes, but is especially intended for H.F. coupling. Satisfactory results were obtained in use in aerial tuning and H.F. coupling circuits, and the H.F. resistance was found to be low.

"Atlas" Variable Condenser

AN "Atlas" .0005 variable condenser manufactured by Messrs. H. Clarke & Co. (Manchester), Ltd., has been tested. It is of low-loss construction and provided with a clearly marked metal dial. The H.F. resistance was satisfactorily low and the insulation resistance infinite. This condenser is strongly constructed and efficient and can be recommended.

Igranic Variometers

TWO variometers have been sent for test by Messrs. The Igranic Electric Co., Ltd. They are constructed on similar lines, the windings being self-supporting, but protected by a tubular case of insulating material. The type B variometer was found to have a tuning range of from 260 to 450 metres, while the BL type (intended for long-wave work) covered the 700 to 2,400 metres band. Both models are soundly constructed and efficient and can be thoroughly recommended. A special graduated dial and knob is provided with each.

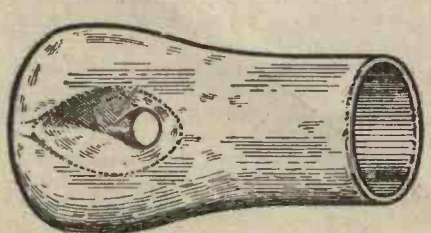
"Salient" Soldering Flux

WE have received a tin of soldering flux from Messrs. "S. A. Cutters," Ltd. This flux is crimson in colour, semi-transparent, and of a jelly-like consistency. It was used successfully to tin a piece of dirty brass and proved suitable for making wiring joints. It spluttered very little and had no effect on the insulation resistance of the panel. We can recommend this flux, since it is non-acid and results in a sound joint being made.

"Hobbs" Aerial Insulators

HOLLOW porcelain aerial insulators have been sent in by Mr. J. A. Brassington, Jun., for test. They are made so that the aerial wire is carried inside, while an eye for the halyard is formed at one end. By this means a large insulating surface is provided, while the inside of the insulator will remain dry under the severest conditions.

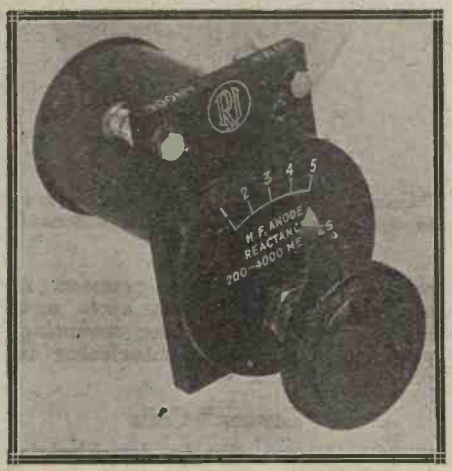
On test, with the halyards and insulators made soaking wet, the insulation resistance was found to be infinity, while with the roughest usage only a small flake could be broken off the insulators. They can be thoroughly recommended.



"Hobbs" insulators are of hollow porcelain construction.

"R.I." H.F. Anode Reactance

THIS anode reactance, made by Messrs. Radio Instruments, Ltd., is intended for H.F. intervalve coupling. It consists of a barrel-shaped case carrying a front panel fitted with a switch arm and studs, and covers (with a .0003 condenser) wavelengths



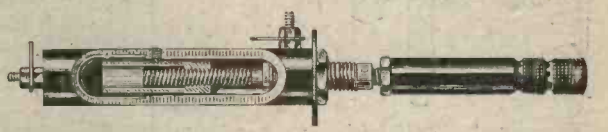
Messrs. Radio Instruments' H.F. anode reactance is a one-hole fixing component.

of from 200 to 4,000 metres. One-hole fixing is employed and a knob and dial provided. The component came successfully through all tests, is very well made, and can be recommended.

"Neutrovernia" Condenser

MESSRS. GAMBRELL BROS., LTD., have submitted for test a "Neutrovernia" condenser. The change from the minimum capacity of about 1 micro-microfarad to the maximum of 28 micro-microfarads is accomplished by the rotation of a long insulating handle, which causes a brass cylinder to slide inside another. Six complete revolutions are necessary to cover the capacity range. On test, this neutralising condenser gave every satisfaction, the movement being smooth and easy. The mechanism is completely enclosed in an insulating case.

A sectional drawing of Messrs. Gambrell Bros.' neutralising condenser, the "Neutrovernia."



"Ne'er Fail" Lead-in Fuse

IT is claimed that the "Ne'er Fail" lead-in fuse, made by Messrs. The Ne'er Fail Manufacturing Co., acts as a lead-in and a fuse box simultaneously. It consists of a length of semi-transparent tubing fitted with terminals, a length of wire being carried inside. The tubing was found to have excellent insulating properties and not to ignite easily, while it could be bent to any desired shape if warmed by steam. The wire fused when made to carry a fair current, and the component is a novel attempt at solving the problem of safeguarding a set from lightning.

Lamplugh Anode Reactance

AN anode reactance has been submitted for test by Messrs. S. A. Lamplugh, Ltd. This consists of a disc, into which may be plugged various anode units, carrying a spindle to which is fixed a reaction coil. It was found that the lower wavelength unit covered a range of from 220 to 600 metres, while the second unit was suitable for 5XX.

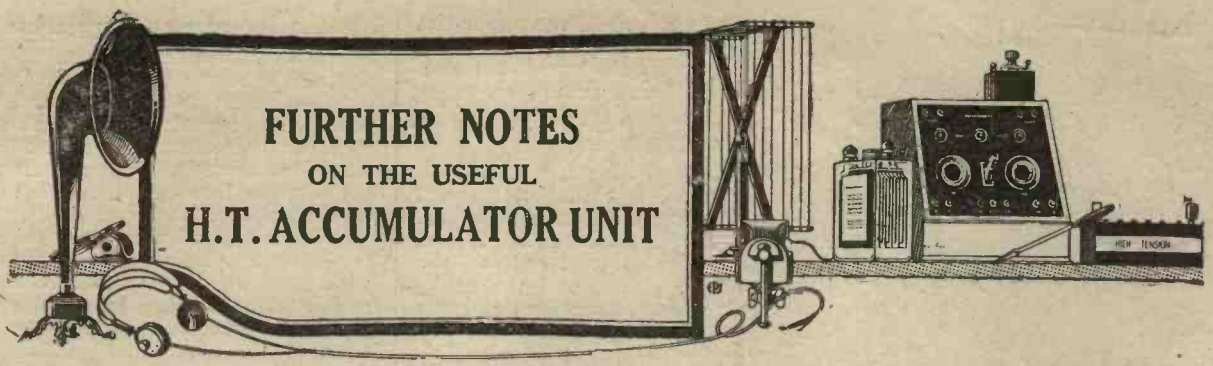
This component is well-constructed and neatly finished, but the size of the reaction winding could be slightly reduced with advantage. It gave good results as an H.F. coupling and the knob and pointer proved useful to indicate the amount of reaction in use.

"Nick-o-Time" Tunometer Coils

MESSRS. THE TUNOMETER WORKS have sent us several of their "Nick-o-Time" Tunometer Coils, some being of continuously variable type and others fixed inductances. All consist of a flat spiral winding laid in a groove cut in an ebonite disc, standard pin and socket mounts being attached. In the variable type a metal arm carrying a grooved wheel which engages with the winding allows the inductance in circuit to be varied. All these coils are well-constructed and highly finished, while their high-frequency resistance was low. The contacts of the variable models were noiseless in action and fine tuning was possible, combined with good signal strength and selectivity.

Vernier Rheostat

SUBMITTED by Messrs. King Quality Products, Ltd., a King Quality Vernier Rheostat has been tested at our laboratories. The ordinary 6.5 ohm resistance element is wound on a fibre strip, while the vernier winding is a single turn. The vernier spindle passes through the hollow main spindle and it was found that the total variation obtainable with the vernier was .15 ohm. The rheostat was found to be exceptionally noiseless in use and to carry .8 ampere without undue heating.



FURTHER NOTES ON THE USEFUL H.T. ACCUMULATOR UNIT

In the January issue of this Journal Mr. H. J. Barton-Chapple described a home-made H.T. accumulator unit, and below he gives further details regarding its use and treatment.

IN the January, 1926, issue of THE WIRELESS CONSTRUCTOR I gave the necessary details to enable the home constructor to make up an accumulator high-tension unit from sheet lead, the plates being "formed" by periodic charging and discharging.

Holding the Charge

One or two readers have written to me complaining that the unit does not appear to hold its charge for a long period, and, consequently, I felt that a short dissertation on a few of the possibilities involved would prove helpful.

Constructors should be warned that the very nature of the method adopted for forming the plates does not lend itself to the expectation of a full service from the unit at the outset; the whole secret lies in allowing the plates to become heavily coated with active material.

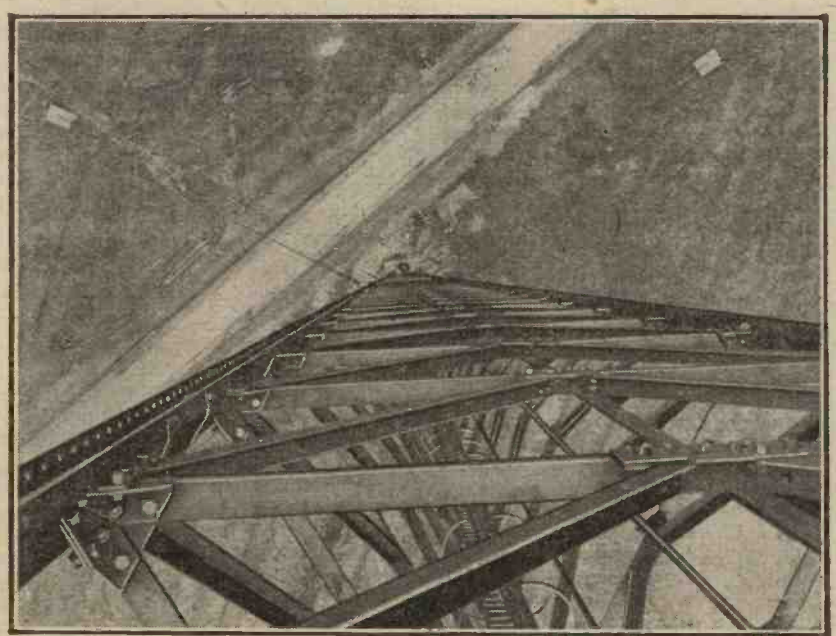
Care at the Start

It was for this reason that I stated at the end of the article that the same care should be exercised with this unit as with all other accumulator units, *especially for the first month or so*, but after a thorough formation this source of high-tension voltage will be found to function well.

Charging Rate

Readers possessing D.C. electric mains can attend to the battery charging themselves, and, if placed in the hands of a charging station, it is necessary to see that the correct charging current is used. During the early stages those with home charging facilities are advised to give the battery a half-hour's "boost," three-quarters of an hour before it is put into commission.

It is essential to prevent the charging current from exceeding the 50 milliamperes specified originally, and a value somewhat less than this may even be found desirable. A heavy current causes the formed material to fall from the plate surfaces, and this, of course, must be guarded against.



A photograph of the road from the top of one of the huge masts of the Rugby Station taken at the dizzy height of 820 feet above ground level.

Holding the Paste

To keep the formed material in place, I have found it almost essential to make the deep serrations on

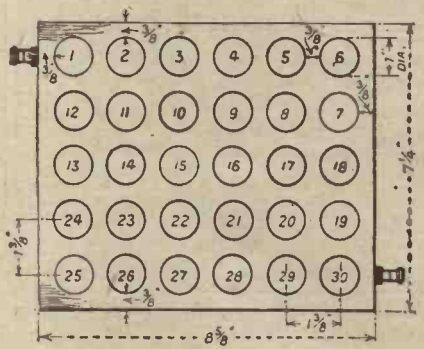


Fig. 1.—The suggested revised layout of the unit. Except for the moving of the terminals no structural alterations are involved.

the plates as suggested in the original article, and, if the vice-jaws are at all worn, the lead can be placed between metal rasps, and then put in the vice, with pieces of wood to protect the rasps from the metal jaws. Cutting into the lead surface with a penknife, as one correspondent suggested, does not give the same degree of surface increase and adequate hold for the formed material as is necessary for satisfactory operation.

Effect of Sediment

Should any formed material fall to the bottoms of the tubes, the ¼-in. clearance allowed will prevent the plates shorting; but if the dimensions have not been strictly adhered to, the individual cells will discharge when not in use, should the base of the tube become "silted up."

The positive and negative plates must not touch at any point throughout their length in the tubes, and the material employed for separating the plates needs to be properly shaped and of reliable quality.

Evaporation of Electrolyte

If the acid shows signs of evaporation owing to exposure in a warm situation, fill up to the required level only with pure distilled water,

as, if tap water is used, the impurities are sure to set up local action. A layer of oil on the top of the electrolyte will be found useful also.

Impure Lead

Traces of impurities in the lead will lead to trouble, and the battery will not hold its charge due to local action. Any metallic impurities present form a number of small local cells on the surface of the plates, and the active material is wasted, since local currents eddy round the small cells so formed.

A Suggested Alteration

Another possible source of trouble may be traced to the piece of ebonite or other insulating material which has been utilised to enable the terminals to be screwed in place. Dirt may collect on this strip, and thus cause a leak between the terminals in question. To overcome this, an alteration in the assembly of the two-volt cells is suggested. This will be made clear by reference to Fig. 1, which shows the top of the battery box. In the initial case the lead electrodes and tubes were

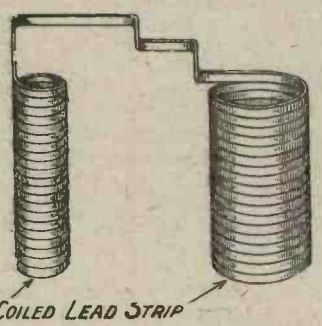


Fig. 2.—One correspondent has obtained good results by adopting this method of construction.

inserted so that the first and last cell were at opposite ends of the same long side of the box.

In the modified arrangement it will be seen that the assembly is such that cells 1 and 30 are against opposite sides, and two small pieces of ebonite can now be placed in position to accommodate the terminals. This will prevent any leakage taking place if dirt is found to accumulate on the original ebonite strip.

Cracked Tubes

Take great care when handling the glass sample tubes so that they do not crack, and thus allow the electrolyte to leak away, and render useless the cells so affected. Two sixty-volt units can be conveniently mounted on a tray with handles, with sawdust at the bottom of the tray to absorb any of the dilute acid, should it be spilt or escape through a cracked tube.

I have purposely stressed all the possible sources of trouble with a unit of this nature, and, if attention is given to the details mentioned, difficulties should be removed.

An Interesting Suggestion

One correspondent informs me that during the course of some experiments on a unit of this type he found that positive and negative plates made up in the manner indicated in Fig. 2 functioned in a very satisfactory manner.

The procedure adopted was to cut up the sheet lead into strips about ¼ in. to ½ in. wide, and these were coiled in fairly close spirals round a mandril, with the connecting piece between the two electrodes shaped as before, to provide the necessary support on the sides of the glass tube. These were formed in the manner indicated in the article, and the battery worked quite well.

SELECTIVITY WITH A SINGLE VALVE

(Continued)

phone reception, especially when listening to a band or similar item.

In eliminating the local station when trying to receive a more distant transmission take care not to cause the set to oscillate, but follow up with the reaction condenser any adjustment made to the tuning control. Madrid was heard at fair strength during the first tests, while subsequently several British and Continental stations were received. The first evening upon which the set was tried happened to be one when simultaneous broadcast from all stations was the order, but in spite of this it was fairly easy to find the carrier waves of several stations.

Other Stations Heard

Subsequently these settings were again tried, and the transmissions received. Birmingham and Bournemouth have been received at good strength, while in the relay band it was noticed how easily several transmissions could be found and resolved. Radio Belge came in at usual strength, but with a background hum, which has been present recently, and Radio Berne was also brought in. For the constructor who wants to hunt around for stations this set will prove very interesting, owing to the ease with which the local station can be eliminated.

Elstree Test Report

This receiver was tested by our Elstree Laboratories, 12 miles from 2LO, as well as by the designer, with the results given below:—

Operation.—Simple.

Selectivity.—By choosing a suitable aerial coil the set could be made selective, Newcastle and Birmingham being received while London was on.

Valves. — General-purpose valves functioned satisfactorily in the set, but D.E.5B and D.F.A.4 type valves gave slightly better results.

General.—Owing to the small number of controls, this is a splendid set for the beginner.

A 3-VALVE SAFETY SET—*continued.*

carefully for it), there is nothing further to do in the way of neutralising. If, however, you are using a P.M.4 or one of the other valves of the small-power type, you will invariably hear this "plop" of oscillation. When you have found the point, screw down the upper plate of the neutralising condenser a few turns and turn the second condenser backwards and forwards again.

You will probably find the area over which the "plop" occurs has been reduced. Go on adjusting the neutralising condenser until a point is reached (probably when the plates are separated by a 1/16th of an inch) where rotation of the secondary condenser backwards and forwards will fail to find any "plop." This is the most sensitive state of the set. In making the adjustments, do not let the two plates of the condenser touch, or you will injure the H.T. battery, and if H.T. negative should be connected to L.T. positive, you will burn out the valve filaments. As a safety precaution it is as well to put a piece of waxed paper or mica between the two plates to prevent them coming into actual contact.

The Local Station

Once this neutral point has been reached, leave the neutralising condenser as it is, connect the aerial and earth and rotate the two dials until you pick up the local station. If you are within eight or ten miles of a broadcasting station, you will probably be able to hear the station quite easily on the earth lead alone, and up to ten or fifteen miles from a broadcasting station you should get good loud-speaker results with fifteen or twenty feet of wire hooked round the picture rail. Be sure to use the value of grid bias specified by the maker of the valve you are using for the note magnifier.

Having found the local station, try placing the switch arm of the aerial coupler on the different studs. For each change of stud, retune the first condenser. One of the studs will give better results than the others, and when you have found this point leave the set permanently so adjusted. Make a final adjustment of the filament resistance for best signals, being sure not to turn it on more than is necessary for good signals.

No Radiation

Used on an ordinary outdoor aerial, you will, of course, get far better results, but once you have neutralised the set in the way indicated, you need have no fear of causing disturbance to your neighbours. My own tests of the receiver showed that using .06 ampere valves or P.M. 4's, good loud-speaker strength for the average room, with excellent quality, was obtained on an aerial consisting of fourteen feet of wire suspended six feet above the instrument. The distance from 2LO was approximately 7 miles.

Distant Stations

Used on an outdoor aerial, medium loud-speaker results were obtained from Rome without interference from London (while that station was working), and after 2LO had closed down loud-speaker results were also obtained from Madrid. Birmingham, Newcastle, L'Ecole Superieure and a number of Continental stations were obtained at really good 'phone strength and at times of sufficient strength to give loud-speaker reproduction suitable for a small room.

Although not primarily designed for use on an outdoor aerial, the above tests are quoted as an indication that there is a big reserve of sensitiveness in the set, sufficient to give a full measure of loud-speaking with the smallest indoor aerial within ten or fifteen miles of a broadcasting station.

A Family Receiver

Once the set has been adjusted and tuned it can be turned on or off by any member of the family simply by pulling out or pushing in the switch. The batteries can all be left connected until a recharge or a replacement is needed, as neither L.T. nor H.T. current is consumed when the switch is "off" (in). The tuning positions will remain constant unless the wavelength of your station is changed, so that this set is truly a family receiver.

For Daventry, a second aerial coupler will be needed for this waveband, and for the transformer a No. 150 in the left and a No. 200 in the right, or the Gambrell equivalents. The neutralising condenser adjustment need not be changed.

Elstree Test Report.

The following is a summary of the report made on the receiver by *The Wireless Constructor* laboratories:—

Operation.—Very simple.

Selectivity.—By suitable choice of the tapping on the aerial coupling coil the receiver could be made fairly selective.

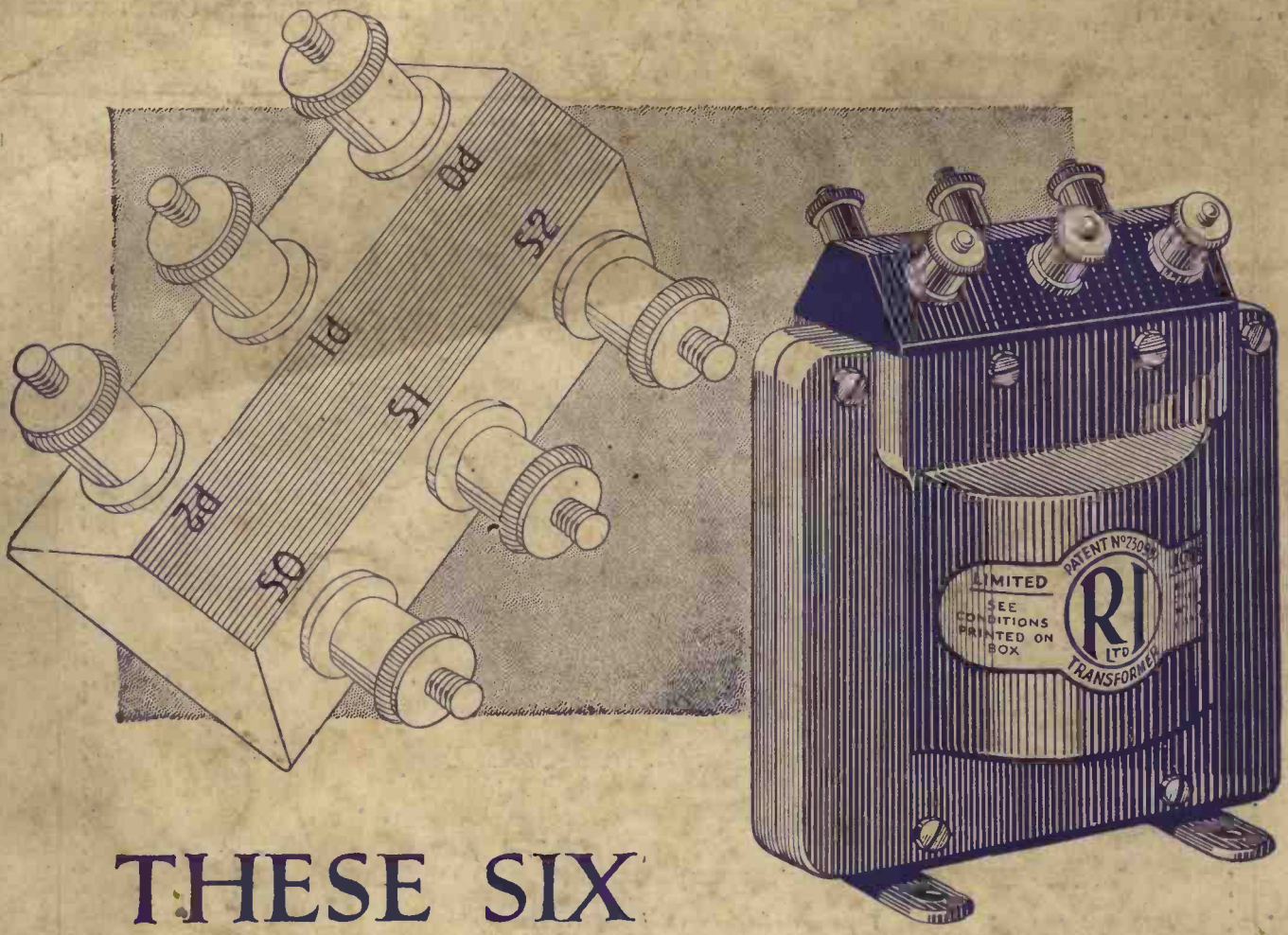
Reproduction, etc. — Good loud-speaker strength on London, even on an indoor aerial. Tone clear. No sign of oscillation over whole tuning range once the neutralising condenser was properly adjusted.

Stations Received.—London, Newcastle, Bournemouth, and nearly all the other main B.B.C. stations, and many Continental stations.

INDEX TO ADVERTISERS.

COUPON
QUESTIONS AND ANSWERS
This Coupon must be accompanied with a 2/6 P.O. and Stamped Addressed Envelope.
"Wireless Constructor," JUNE, 1926.

FREE BLUEPRINT SERVICE
COUPON
Wireless Constructor. *Vol. II.* *No. 8.* *June, 1926.*
This coupon entitles the reader to one back-of-panel blueprint of any set described in the above issue, and must accompany each postal application.



THESE SIX TERMINALS

THE six terminals on the new R.I. Multi-Ratio Transformer are so arranged that they allow you to choose over a range of ratios and three impedance values, which means that you can be absolutely certain that this transformer will be suitable for any valve or any circuit you may have in use.

Most people think their set the best until they hear something better. They are told by all the technical Press that the quality of reception may be improved by using transformers of different ratios, in certain stages of the amplifier. To prove this yourself, means purchasing several transformers, which is costly. The new "R.I." Multi-Ratio Transformer will solve the problem for you once and for all. For an extra 2/6 you get not only a transformer of equal efficiency to the well-known standard "R.I." model, of which some 600,000 are in use, but, in addition, the opportunity of trying the effect of six other ratios, with any type of valve available.

TRY IT YOURSELF; do not just believe what we tell you. You will learn more about the possibilities of improving reception by an evening spent with the new Multi-Ratio Transformer than by any other method.

RI LTD

Price 27/6

Write for Special Leaflet W.C.

THE MARK OF BETTER RADIO

BRITISH

Advt. R.I. Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1

P.C.31

Published by RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on the 15th of each month, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55–57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications :—Bush House, Strand, W.C.2. Address for Advertisements : Advertisement Manager, THE WIRELESS CONSTRUCTOR, Bush House, Strand, W.C.2. 'Phone, City 9911. Registered as a magazine for transmission by Canadian Magazine Post. Subscription rates :—8s. 6d. per annum, 4s. 3d. for six months, post free. Sole Agents for Australia :—GORDON & GOTCH (Australia), LTD. Sole Agents for South Africa :—CENTRAL NEWS AGENCY, LTD., June, 1926.