The Wireless Constructor

6D MONTHLY

EDITED BY
PERCY W. HARRIS, M.I.R.E.
Vol. II AUGUST, 1926 No. 10

The "DAVLOW THREE"

By W. Q. KAY

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The WIRELESS CONSTRUCTOR

— Edited by Percy W. Harris —

Vol. II. No. 10 AUGUST

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

THE "DAVLOW THREE"

By W. Q. KAY

Do you find it a nuisance to have to pull out coils and insert others when you want to change over from Daventry to a low-wave station? On this attractive set you simply move a single switch and the change-over is complete.

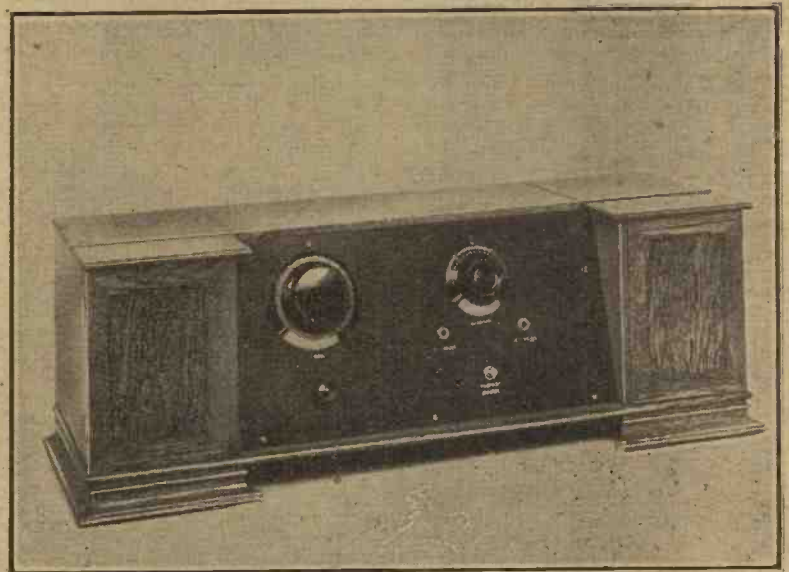
FOR simplicity of operation and construction the straightforward 3-valve receiver, comprising a detector valve followed by two note magnifiers, is a very useful arrangement. The selectivity which can be obtained with such a circuit is, of course, not high, although with some care it can be made reasonably good.

Such a circuit, therefore, is a useful one for what one may term "hack" reception of the local station with occasional listening to more distant programmes. At the same time, if the instrument is to be used for such everyday work, other features are desirable.

Two or Three Valves

In the first place, the reception of the local station can be obtained satisfactorily on the loud-speaker on two valves only at distances of ten or twelve miles. It is desirable, therefore, to be able to cut out the last valve if possible, and arrangements have been made for this to be done in this particular receiver. Should it be desired to produce very loud volume at any time, such, for example, as provision of music for outdoor dancing on the lawn or some such arrangement, the purity of the music is of particular importance. For this reason the last valve has been made resistance-coupled and has been arranged to be switched in or out of circuit at will by means of ordinary jack switches.

The other feature which is very desirable in any receiver of this type is the reception of Daventry and possibly other programmes on this wave-band without the necessity for changing coils. A simple change-over switch has been used in this set, therefore, whereby the circuit may be changed over from the one set of coils to the other, and for this reason the receiver has been called the "Davlow," giving Daventry or the local station with equal facility.



There is only one tuning dial on the set (the large one), the knob of the wave-change switch being placed immediately beneath it.

The Circuit

The circuit adopted is a simple Reinartz arrangement. Various other types of detector circuits were experimented with, but the circuit giving the best results both as regards simplicity of operation, selectivity, and freedom from interaction between the two coils was our old friend the Reinartz arrangement. A simple change-over switch enables the wavelength range to be changed at will, and the remainder of the circuit is straightforward.

Self-Contained Batteries

Still pursuing the policy of making the receiver a true hack model, always ready and giving as little trouble as possible, arrangements have been made to house the L.T. and H.T. batteries in the cabinet. This enables us to obtain a very handsome type of layout, as will be seen from the photographs.

There are two battery compartments, one at each end of the cabinet, while the set is mounted on a slightly sloping panel which is placed in between the two battery compartments. It will be seen that this provides a neat and attractive arrangement, the receiver being self-contained except for the aerial and earth, thereby avoiding a good deal

The "Davlow Three"

of the trouble usually occasioned by the batteries and their attendant connections.

Layout

The layout of the components in the receiver itself has been made somewhat compact. The high-frequency circuit has of necessity to occupy a certain space in order to avoid interaction between the coils. Secondly, the use of a sloping panel always tends to provide a certain waste space which cannot normally be utilised.

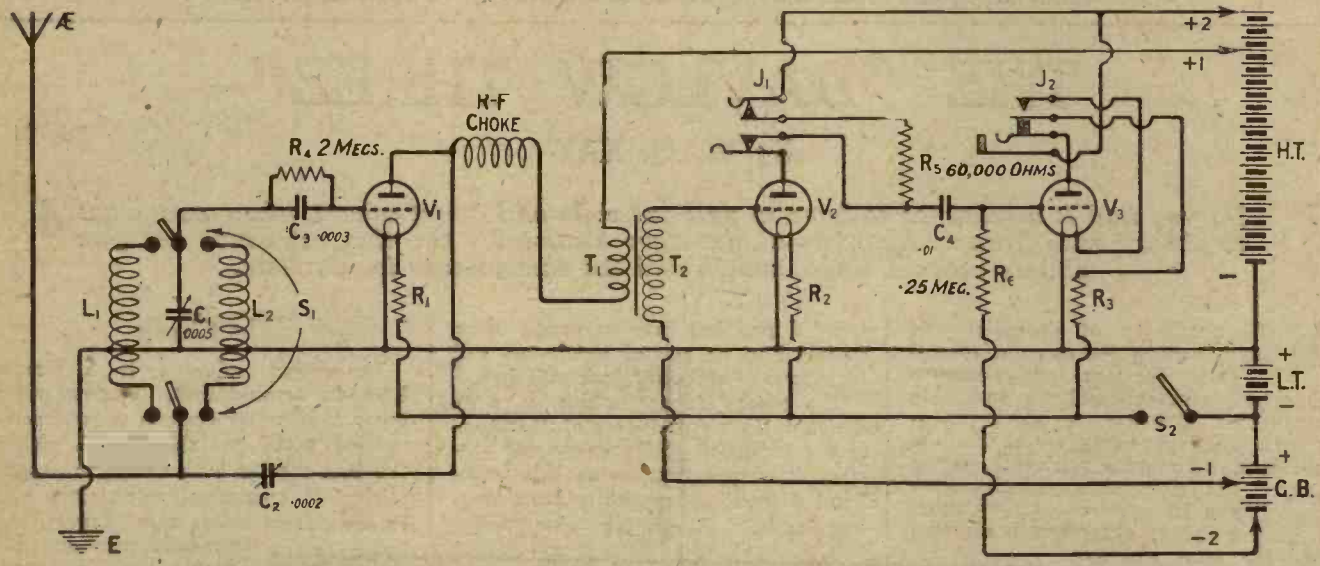


Fig. 1.—The circuit is a straightforward Reinartz arrangement. The switch S1 serves to make the change from one wave range to another.

In order to avoid making the receiver any larger than necessary, therefore, a somewhat unusual layout has been incorporated.

The two coils with the tuning condenser and switching arrangement are housed on the left-hand side of the receiver. The first note magnifier, which is transformer-coupled, is housed at the rear of the baseboard on the right-hand side, while the other note magnifier, resistance-coupled and capable of being switched in or out at will, is at the front of the baseboard underneath the lee of the sloping panel. The circuit thus runs round three sides of the square, but no detrimental effect is obtained from such proceeding.

You will require the following components:—

One special "Davlow" cabinet (Pickett Bros.).

One ebonite panel 16 in. by 8 in. by ¼ in. (Clayton Rubber Co., Ltd.).

One .0005 variable condenser (Cleartron Dikast).

One 4-in. dial to fit the condenser (Cyldon).

One .0002 variable condenser (Jackson Bros.).

One Pacent low-frequency transformer, first stage (Igranic Electrical Co., Ltd.).

One Interchangeable H.F. choke with holder (Bowyer-Lowe Co., Ltd.).

One wire-wound anode resistance, 60,000 ohms (Varley).

One .01 fixed condenser, type 620 (Dubilier).

One .0003 condenser type 600 with grid-leak clips (Dubilier).

One 2-megohm leak (Dubilier).

One .25 megohm leak in holder (Dubilier).

Three fixed resistors to suit the valves in use with sockets.

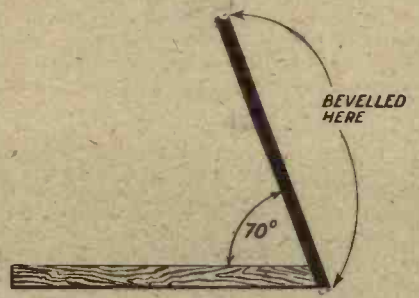


Fig. 2.—The panel is attached to the baseboard at an angle of 70 degrees.

Three vibratory valve holders (Etherplus).

One "On-off" switch (Igranic Electric Co., Ltd.).

One double-circuit jack (Bowyer-Lowe Co., Ltd.).

One two-pole change-over switch (Efesca).

One filament switching jack (Bowyer-Lowe Co., Ltd.).

One ebonite strip 3 in. by ½ in. by ¼ in., carrying two terminals.

One 2-in. length of 2-in. diameter ebonite tube.

One 4-in. length ditto.

Quantity of Glazite wire and flex wire.

One packet of Radio Press panel transfers.

Bevelling the Panel

The first operation is the fitting of the panel into position. The baseboard provided with the cabinet will be found to have one edge bevelled. The two long edges of the panel must also be bevelled at the same angle, so that when the panel is screwed on to the baseboard and is resting at its proper slope the bottom will lie flush upon the cabinet and the top edge will be horizontal. This will be clear from the diagram shown in Fig. 2, which indicates how this bevelling has been carried out.

In order to fix it the best method is to hold the ebonite in a suitable wood-working vice and to bevel the edges with long, slow movements of a file. Care must, of course, be taken to get the bevel uniform all along. If a wood-working vice is not available then the ebonite should either be clamped on to a table or be held by some other means, when the bevelling can be carried out just as usual, the filing in this case being carried out horizontally.

The Panel Components

Having finished the bevelling, the panel should be screwed to the baseboard with three screws and inserted in the cabinet to make sure that it fits accurately. When this has been accomplished the panel may be unscrewed again and then drilled to take the two condensers, the two jacks, and the filament switch into the positions shown. These components should then be mounted in the correct positions. The only component requiring any attention is the reaction condenser, which, as will be seen, is

A "Quick-Change" Three-Valve Set

mounted at an angle so that the bottom end comes approximately between the two jacks.

Winding the Coils

Before proceeding any farther it is necessary to wind the two coils. The coil for the lower wavelengths is wound on the 2-in. former and the coil for the Daventry wave on the former 4 in. long. The windings are simple single-layer windings with a tapping at a suitable point. They can therefore be constructed without difficulty, the details of the windings being as follow:—

Low Wave Coil—70 turns of No. 30 D.S.C. wire tapped at 20 turns.

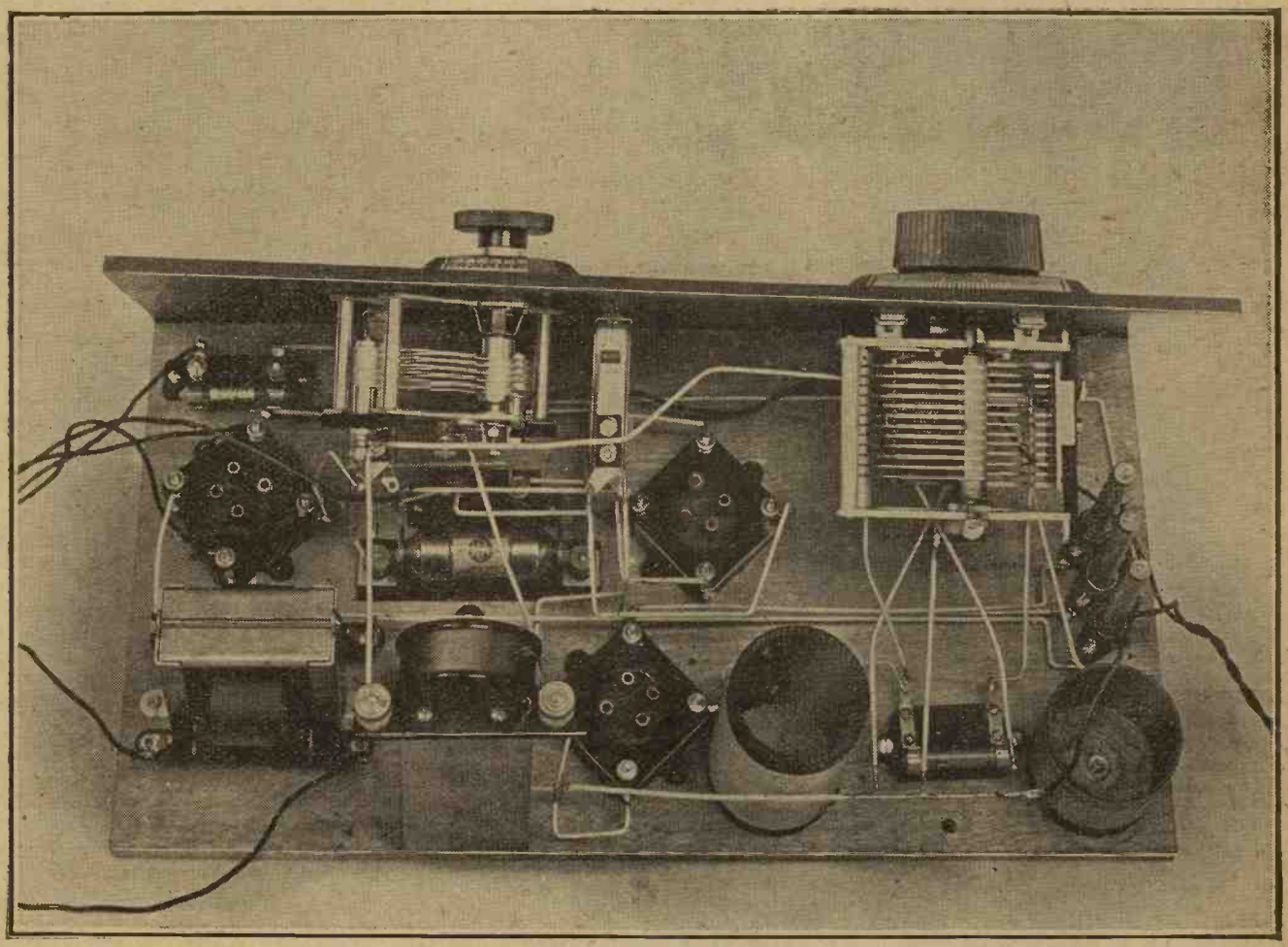
Daventry Coil—300 turns of No. 40 S.C.C. wire tapped at 50 turns.

When these coils have been wound small pieces of wood should be cut and pushed into the bottom to form bases by means of which the coils may be screwed into position on the baseboard.

These bases may either be made a tight fit or, if desired, stuck in with glue or Seccotine.

The Baseboard Components

Now mount the components on the baseboard in the positions shown. Although the layout has been compactly arranged there is ample room for the components, and no difficulty will be experienced in spacing the components. Before finally screwing the components into position, place the panel, with the appropriate components mounted thereon, in the position it should occupy in order to ensure that none of the panel components foul the baseboard components.



The three filament resistors are grouped together for convenience, and the coils are placed well away from any components likely to produce losses.

Wiring Up

The components may now be screwed down into position and the wiring up may be commenced. Wire up the components on the baseboard first of all. These connections may be completed with the exception of the leads to the jacks and the connections from the two coils to the change-over switch. It is advisable not to mount the aerial and earth terminals until later, as this gives better access to the parts when wiring up.

The components on the panel may now be wired up. First take a lead from the centre point of one side of the switch to the reaction condenser as shown in Fig. 4. Then cut off five lengths of Glazite about 8 in. long, which should be soldered to the other connections of the change-over switch. These leads may be allowed to project at the back of the panel in such a direction that they can be connected to the coils when the panel is mounted in position. If these connections are made at this stage no difficulty should be experienced, but if they are left until later the switch is somewhat difficult of access.

The panel may now be mounted in position and the wiring completed. First connect a wire from one side of the on-off switch to the three fixed resistors. Secondly, two long flex leads should both be connected to the other terminal of the switch. One of these runs out to the left of the set and is connected to the low-tension

The "Davlow Three"

accumulator, while the other runs out to the right of the set and is connected to the G.B. positive. The jacks may now be wired in position, and little difficulty will be experienced if the wiring diagram is followed.

plus respectively, the H.T. connection going to the frame of the jack. The two inside contacts are connected to the resistance. When the plug is removed, therefore, the resistance is connected in circuit. Care must be taken to see that the side of the resistance which goes to the coupling condenser is also connected to the spring making contact with the anode spring.

The left-hand jack is simpler to wire. The two bottom springs are connected to the anode and H.T., so that when the jack is in circuit the telephones or loud-speaker are connected in the anode circuit of this valve. The two top springs are connected in the filament circuit of this last valve, so that the insertion of the plug connects up the filament and so lights the valve.

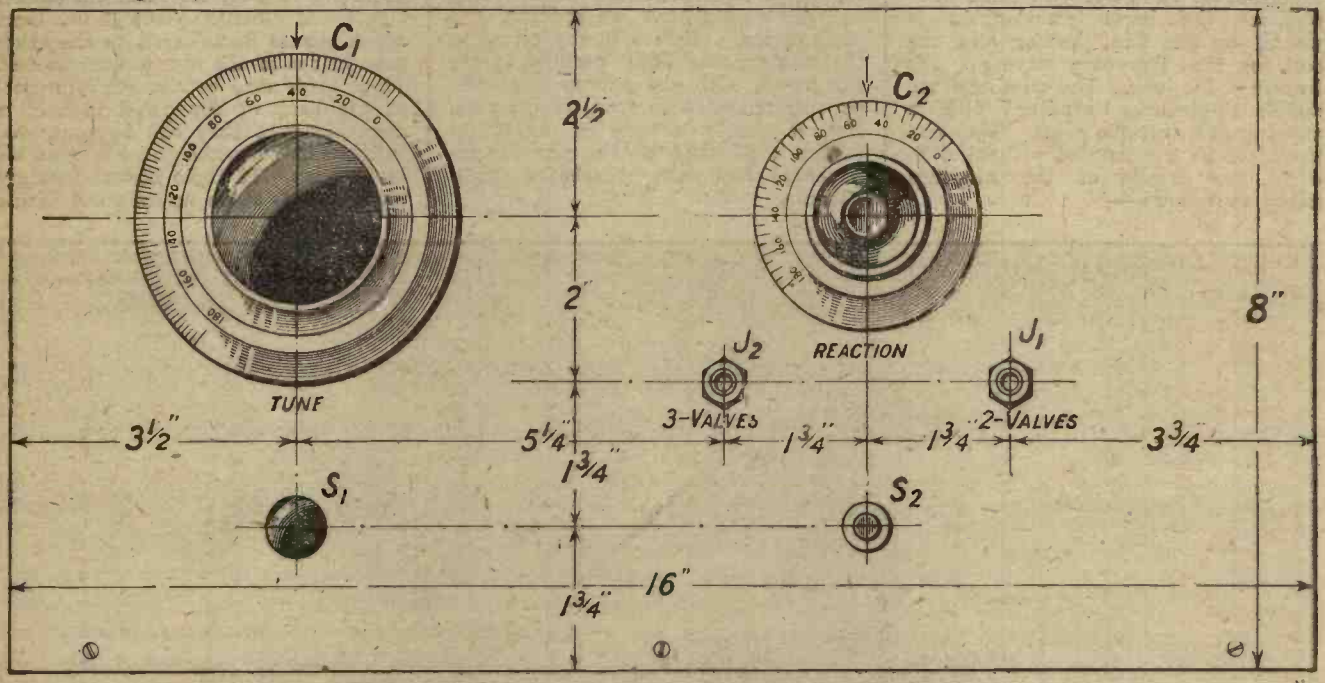
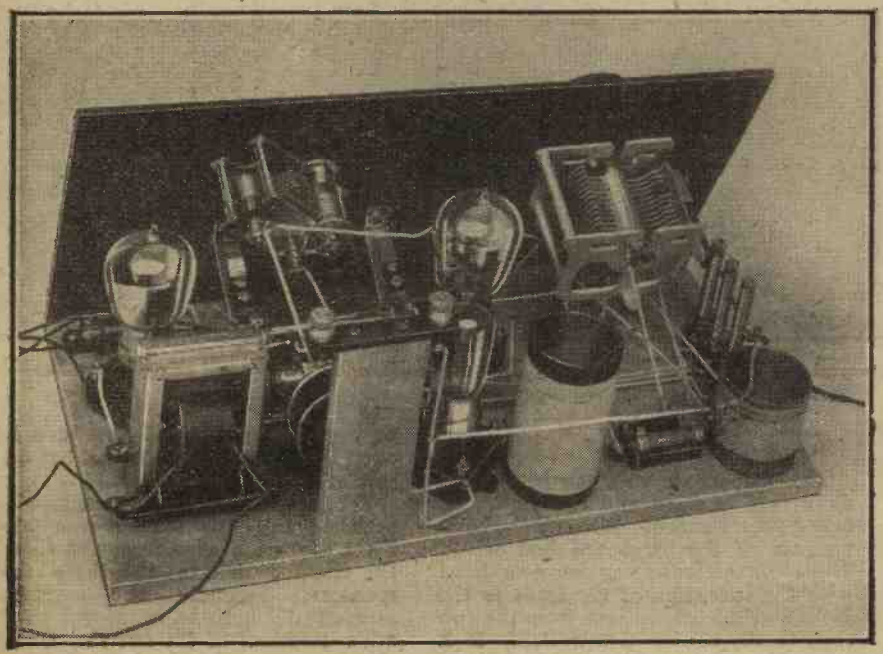


Fig. 3.—Three screws along the lower edge of the panel suffice to attach it to the baseboard.

Connecting the Jacks

The right-hand jack is a simple closed circuit jack. The outside contacts go to the anode of V_2 and H.T.



The aerial and earth terminals are mounted on an elevated platform to facilitate the connection of the necessary leads.

Wiring the Switch

It is now necessary to make the connection from the leads coming from the change-over switch to the two coils. These may be made very simply, the leads being bent into suitable positions as shown in the wiring diagram. The centre points of the switch go to the reaction condenser and to the grid condenser respectively. On the reaction condenser side the two other connections go to the beginnings of the two coils, that is to say, the ends nearest the tappings. The other ends of the coils are connected to the grid condenser side of the switch. Care must, of course, be taken to ensure that when the switch is in any given position the connections both go to the same coil.

The aerial and earth pillar may now be mounted up. This consists of a simple ebonite strip carrying two terminals mounted on a wooden pillar, as can be seen from the diagrams and photographs. This brings the terminals up towards the top of the set, which facilitates connecting up when the set is in use. The earth terminal

A Set all the Family Can Use

is connected to the negatives of all the filaments, and also to the tapping points on the two coils.

The Tuning Condenser

A lead is also taken from this point to the moving plates of the main tuning condenser, the fixed plates of this condenser being connected to the centre point of the change-over switch on the grid condenser side. Finally the aerial terminal is connected straight across to the fixed plates of the reaction condenser, this terminal also being connected to the change-over switch as has previously been described. The moving plates of this reaction condenser are connected to the anode of the detector valve.

The wiring is now completed and the set may be tested out. Make the usual tests for correctness of wiring and to ensure that no high-tension leads are in any way connected with the filament leads. The valves may then be inserted and the batteries connected up.

Testing Out

Plug in the telephones on the two-valve position, and set the reaction condenser at minimum. Switch on the valves, when on rotating the tuning dial the local station or the Daventry Station will be heard without difficulty. Which is actually heard, of course, depends upon the position of the change-over switch. If the receiver is wired exactly in accordance with the diagrams given, then the local station will be received with the switch pushed in and Daventry with the switch pulled out.

Having received signals, the reaction control may be tried, and it should be found that an increase of the reaction condenser causes a gradual strengthening of the signals up to the point of oscillation. The receiver must be adjusted by varying the high-tension tapping on the detector valve until the set slides smoothly into oscillation without any flopping. Any such testing must, of course, be done outside broadcast hours, to avoid any possible interference with one's neighbours.

Interchangeable Chokes

In obtaining this smooth reaction the interchangeable high-frequency

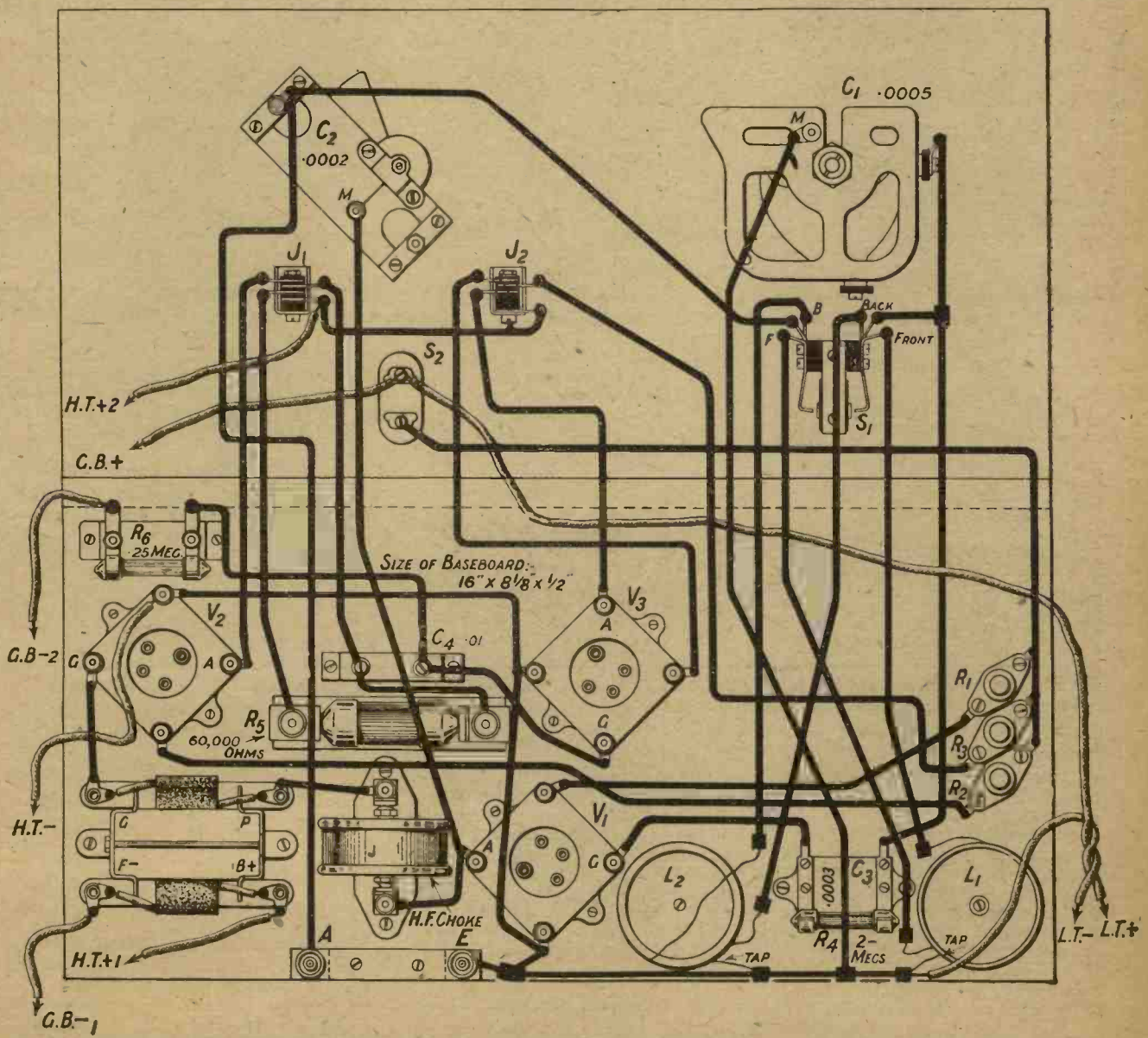


Fig. 4.—The various leads which terminate in arrowheads in this wiring diagram are the connections to the batteries.

The "Davlow Three"—*continued*

choke coil will be found of distinct service. The value of this choke has some effect upon the smoothness of the oscillation, and Messrs. Bowyer-Lowe have accordingly provided a series of interchangeable high-frequency chokes. It is, therefore, quite interesting to try the effect of interchanging the various values of chokes and noting the effect on the reaction control. For normal purposes a value of 20 millihenries will be found to be suitable.

The receiver has been tested twelve miles north of London and gave good loud-speaker reception on both London and Daventry on two valves only. Excellent quality and considerable volume were obtained by plugging in to the left jack. Birmingham, Newcastle, Stoke-on-Trent, Nottingham, and several German relay stations could be obtained quite easily in many cases on the loud-speaker, using the three valves; while on the Daventry range Hilversum and Koenigswusterhausen were easily obtainable.

Valves to Use

The set may be operated with a variety of valves. The first valve should be chosen partly with regard to the rectifying action, *i.e.*, a valve which is a good detector is desirable, and partly with a view to obtaining smooth reaction control. In the 6-volt class the DFA4, DE5B or DE8HF are available, or even the low-impedance valves of similar rating, such as DFA1, DE5, etc. Corresponding types of two-volt and four-volt valves may be employed if desired.

The second valve should be a high-impedance valve for normal working, in order to get the best from the resistance coupling arrangement, while the last valve should, of course, be a power valve of a suitable type.

When only two valves are employed, a certain efficiency has, of course, to be sacrificed, because the high-impedance valve is not suitable as a last-stage valve. If the set is used for any length of time with only two valves, therefore, the second valve should be a low-frequency or power valve. For normal working, however, where two valves are used only for telephone searching, the high-impedance valve is quite satisfactory.

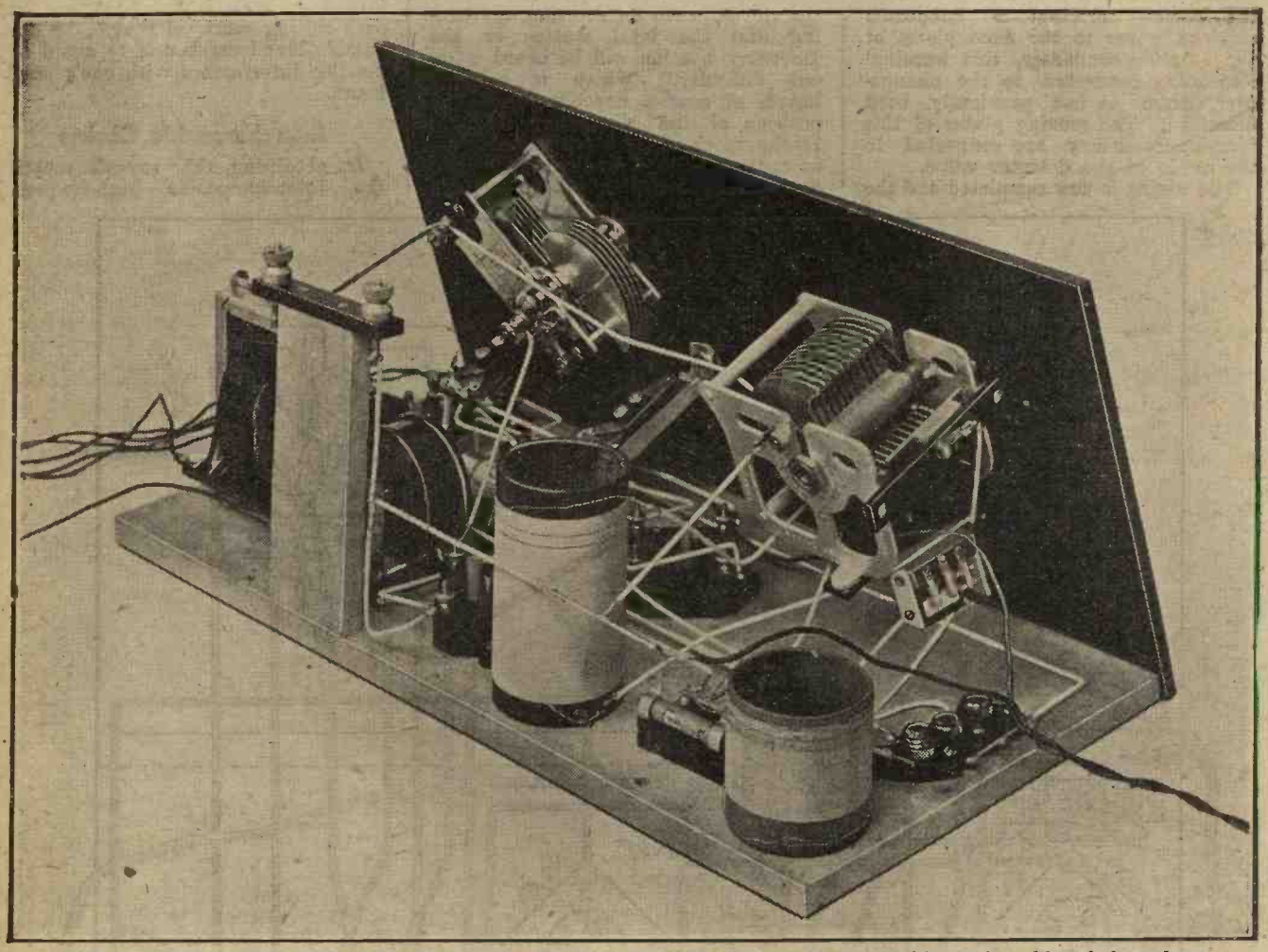
Suitable combinations are as below:—

6-volt: DE5B, DE5B, DE5.
DFA4, DFA4, DFA1.

4-volt: DE3B, DE3B, DE3.
B5, B5, B5.

2-volt: DE2HF, DE2HF, DE2LF or DE6.
SP18, SP18, SP18.
Green spot. Blue spot. Red spot.

Many other combinations will suggest themselves.

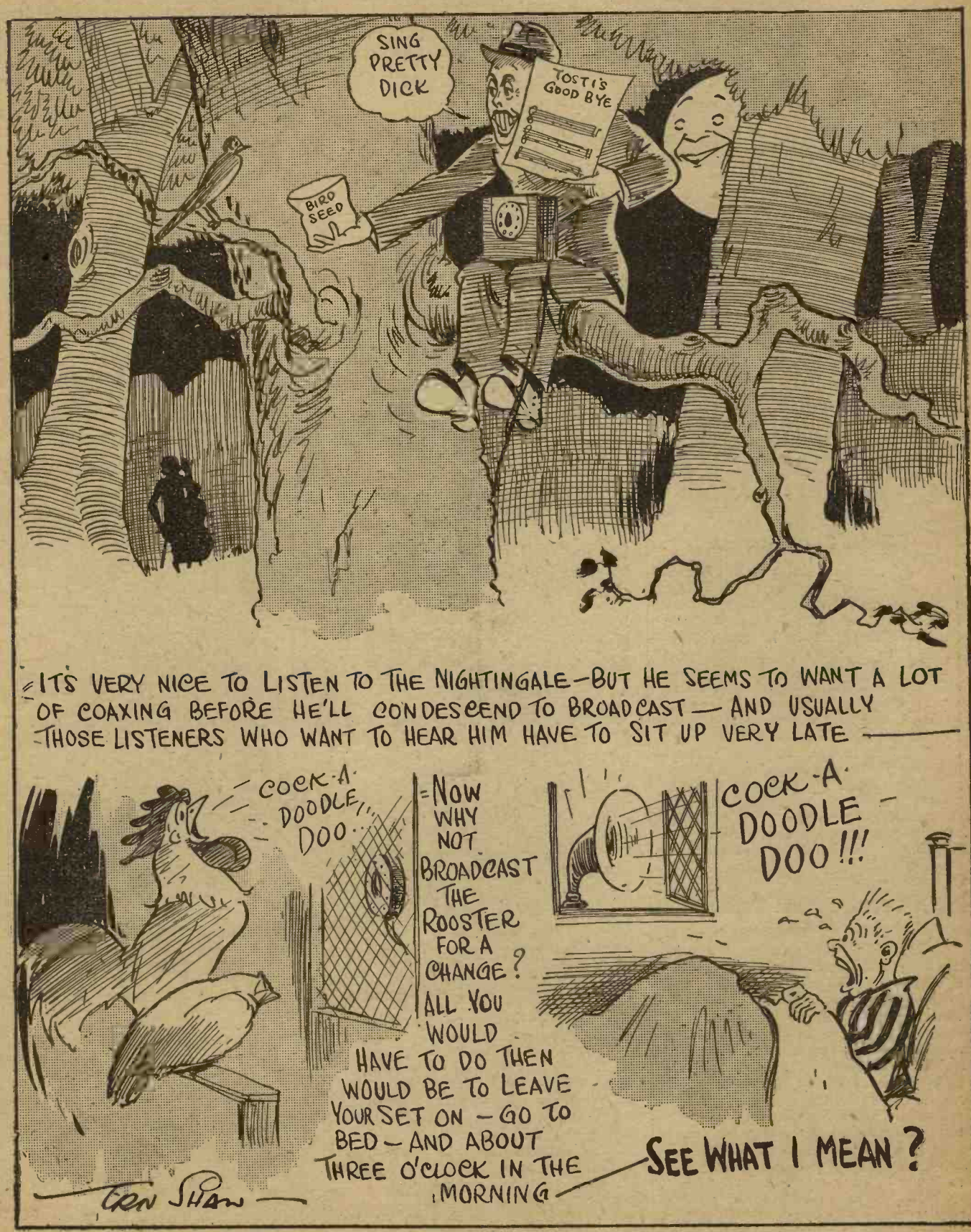


There are no battery terminals on this set. The connections are made with flexible leads soldered directly to appropriate points in the receiver.

High-Tension Voltages

From 40 to 60 volts should be used on the detector, but this depends very largely on the reaction control, and a suitable value should be found at which the set oscillates smoothly. The L.F. and power stages require anything up to the maximum permitted by the makers.

A HELPFUL SUGGESTION.



MAKING THE BEST USE OF YOUR ENVIRONMENT

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

There is room for ingenuity in designing the best form of aerial system under conditions which fall far short of the ideal. In this article a number of practical suggestions are made for arranging an efficient aerial system under difficulties, and the advantages of making efficiency the first consideration are pointed out.

THE range of a broadcasting receiver—that is to say, its capabilities measured in terms of distance—is probably gauged by most people from the number of valves in it and the arrangement of these valves, with possibly some consideration of the type or style of aerial on which the receiver is used or to be used. This is correct enough up to a point, but in fact the immediate surroundings of the receiver and the aerial will in a great many cases, particularly in town areas, play a quite considerable part in the performance of the receiver.

Special Circumstances

There are certain parts of this country which are well known as "blind spots" from the point of view of broadcast reception. In such places far more sensitive and powerful receiving equipment is required for good reception than the distance and power of the local broadcasting station would seem to warrant. These blind spots, however, are in the nature of special freaks, and a discussion of them is outside the scope of the present article. It is proposed here to deal rather with the types of surroundings which are more commonly incidental to broadcast reception, and to make some suggestions for surmounting the difficulties which are sometimes encountered.

A Dream Seldom Realised

The dream of the enthusiast in wireless reception of any kind may perhaps be crystallised into the vision of a full-sized aerial supported by isolated masts at both ends, on the top of a hill clear of trees, with no other hills in the immediate vicinity dominating the one selected. For the great majority of us, however, this sort of dream has no chance of being realised in fact.

The aerial is more commonly a terribly curtailed wire, low down and shut in by buildings on all sides, with a lead-in which wanders round the walls of several rooms before finally reaching the aerial terminal of the receiver. It is necessary to adjust the aerial to suit individual local conditions, and the results of this adjustment are often somewhat curious in appearance, as everybody knows. It is worth while, however, always to have in mind the ideal arrangement, and to make the actual aerial come as nearly as may be to this.

Summer's Advantage

One great advantage of erecting an aerial during the summer months is that due attention can be paid to the matter of "natural" screening, a point which during the winter can very easily be overlooked. If an aerial is put up in the winter, when the leaves are off the trees, there is a natural temptation, if this support is available, to attach one end of it to a convenient tree. The aerial wire is perhaps fastened to a point about one-half or three-quarters of the way up the tree. This proves quite satisfactory while the tree is bare, but when the spring comes along there may be a puzzling decrease in signal strength, which is not altogether accounted for by the incidence of the normal "summer conditions."

A Tree Mast

A tree in full leaf may exert a very considerable screening effect on an aerial, particularly if the latter ends in the tree. If, therefore, a tree is to be used as one support for the aerial, the wire should preferably be slung out from the tree on a long "tail" of rope, in order to minimise this screening effect. Of course, if it is possible, the aerial may with advantage be attached to the top of the tree, so that it is not screened by the great mass of the foliage.

Failing this, and if the tree is not very tall, an excellent aerial can often

Here we see City workers, during their lunch hour, making full use of a congenial environment and listening to wireless orchestral music.

Making the Best Use of Your Environment—*continued*

be put up by fixing a pole in the tree, lashing it to the trunk with the top of it protruding several feet above the top of the tree. By this means one is enabled to take full advantage of the tree as a mast, without much of the attendant disadvantages of its screening effect.

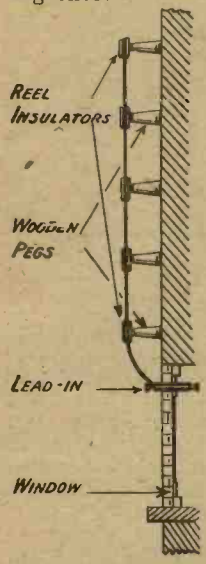


Fig. 1.—A satisfactory form of aerial may be erected on the wall of a building in the manner shown in this sketch.

Buildings with Steel Frameworks

The tendency in modern architecture in the big towns and cities is to use a steel framework for blocks of flats and similar buildings. Anyone who happens to live in one of these steel-framed buildings will know of the screening effect which they exert on any receiver which employs an indoor aerial or a frame. For instance, a superheterodyne receiver using a frame aerial in a steel-framed building at a distance of not more than two miles in a straight line from the aerial of the Londoner has been found to be only just able to bring in signals at faint telephone strength.

This experiment was tried with the receiver and frame situated somewhere near the centre of the building. It was curious and somewhat amusing to note that when the whole apparatus was moved near to one of the windows, which also had a steel frame round the panes, opening the window wide produced an appreciable increase in signal strength!

An Outdoor Aerial Necessary

The effect of hanging a length of wire out of the window to act as an aerial was to make the signals very comfortably audible on the loud-speaker. From this it may be gathered that in buildings which are constructed with a steel frame, one cannot expect to do anything much in the way of distant reception with an indoor aerial or with a frame even with the most sensitive of receivers. An outdoor aerial of some sort is practically essential, however short and apparently inefficient it actually has to be in practice.

Experiments Essential

This screening effect is not, in the experience of the writer, confined only to steel-framed buildings. It may be found to exist in buildings which are not of this type at all, but which for some reason give rise to the same symptoms in reception. The existence or otherwise of such conditions can, of course, only be discovered by actual experiment with a receiver on various types of aerial. If signals appear to be abnormally weak at a short distance from a broadcasting station and it is known that the receiver itself is not at fault, it is always worth while to try the effect of a wire placed temporarily outside the building. This wire should be slung as far from the walls as possible for the purpose of the tests, although it may be necessary to arrange it in a rather less efficient position when it comes to the final fixing.

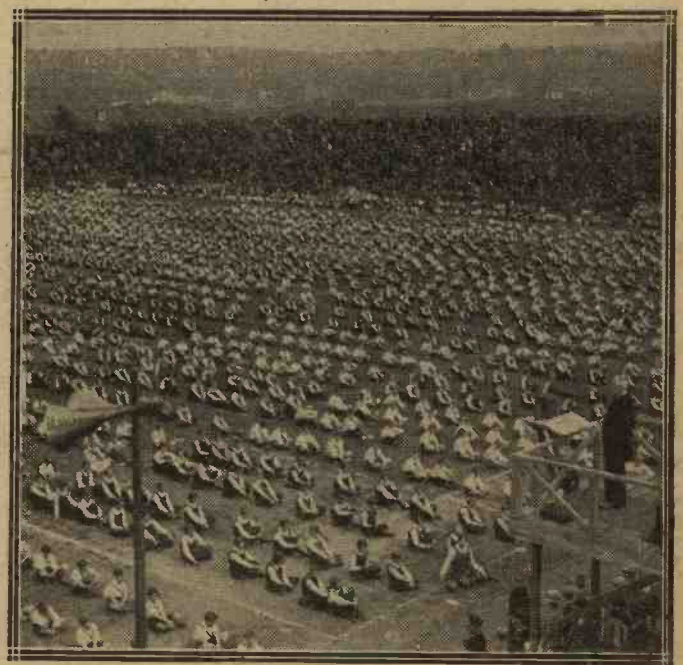
Overcoming the Difficulty

One method of erecting an outside aerial in circumstances such as those which have been described is shown in Fig. 1. This method is particularly suitable for use by the man who lives in a tall block of flats, the receiver, if possible, being situated at the lowest point of the aerial and the latter running up the wall of an area, for example. If the wire can be stretched tightly between the projecting window-sills of windows vertically one above the other, this arrangement may prove satisfactory. It will be preferable in this case to use insulated wire for the aerial, to minimise leakages owing to its swinging against the wall.

The better method is shown in the sketch, the wire, which need not in this case be itself covered with insulation, being supported every few feet by insulators on the ends of pegs fastened in the wall. This type of aerial, while being more troublesome and elaborate to fix than the wire between the window-sills, will prove in practice very satisfactory, because of its immunity from the possibility of swinging.

Another Possibility

When any clear space, such as a backyard or garden, is available, the fullest possible use should be made of it. Assuming that either method of erection is possible to the tenant of the house, he will be wise to make practical trial of reception both with an aerial arranged from the roof of the house down to the remote end of the space available and with a shorter aerial slung up on the roof itself, either between the chimneys or on short masts. If screening is at all noticeable in the locality, the latter method may prove the better of the two, the fact that the top part, at any rate, of the aerial is not down below the level of the roofs or screened by trees compensating for its comparatively short length.



Recently, at Bristol, 8,500 children gave a demonstration of modern methods of physical culture. Marconiphone loud-speakers enabled the voice of Sir Ernest Cook, B.Sc., J.P., to be heard quite clearly by the huge audience.

Locating the Receiver

One point which should be borne in mind always when erecting an aerial is that the receiver should, if possible, be at the lowest point of the aerial.

Making the Best Use of Your Environment—*continued*

It is not denied that results can be obtained without the observance of this rule. The first aerial ever put up by the writer was, in fact, below the receiver for its whole length! It started from the receiver, a crystal set, at a window about 40 ft. above the ground and went steeply down to a small pole about 100 ft. away. Morse signals and amateur telephony, the only signals available in those days, were heard with this arrangement; but it could not be regarded as efficient, especially as the earth lead was 40 ft. long, a wire down the side of the house to a buried mass of metal.

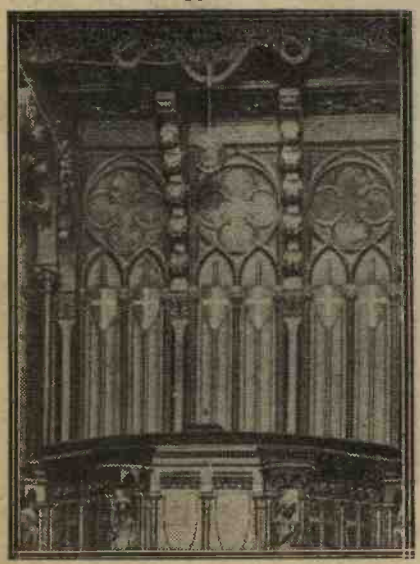
An Analogy

In the vicinity of a broadcasting station this sort of aerial may be enough for local reception, but it will usually have to be regarded as something of a "passenger," not really doing its full part to help the receiver to perform its work. In the same way an aerial system which is so badly arranged that the losses in it are very high really makes unnecessary demands on the skill of the operator.

It is well known that a single-valve receiver with reaction, for example, can reach out to a large number of stations under good conditions and with an efficient aerial system. If, on the other hand, the aerial system is a "high-loss" one, greater demands will be made both on the reaction required and also on the operator's skill in tuning. To couple a thoroughly bad aerial to a good receiver is akin to fitting solid tyres to a car designed for comfortable travelling.

Not Good Practice

The position which the receiver itself is to occupy in the house must necessarily have some effect on the design of the aerial system. It is undesirable to have a lead-in which has to pass through several rooms before reaching the receiver, but at the same time it is often difficult to arrange matters otherwise. Fig. 2 shows how the receiver is sometimes placed relative to the aerial in a small house.



This photograph of the pulpit of the Notre Dame, Paris, shows the microphone suspended from the canopy.

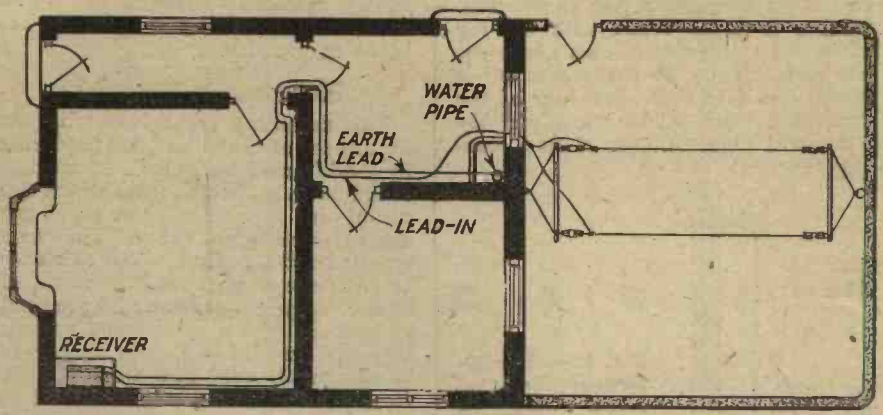


Fig. 2.—The arrangement of the aerial and earth leads shown in this sketch cannot be regarded as efficient, though the positions of the rooms may render it almost unavoidable.

The living room is at the front of the house, while it is most convenient to erect the aerial at the back. The water pipes, which form a suitable earthing point, are also at the back of the house. The result is that the aerial and earth leads start somewhere fairly close together and run together through the house to the receiver.

Sacrificing Comfort to Efficiency

Now the best arrangement here, from the point of view of efficiency, would be to put the receiver close to the place where the lead-in enters the house and so near to the earthing point. Leads for the loud-speaker could then be run into the front room without loss of efficiency, and remote control could be installed also if desired.

This would be satisfactory for the reception of the local programme, but if the tuning-in of distant stations was to be carried out, it would mean that the operator would be exiled to the back room; comfort would have to be sacrificed to efficiency. In a case like this, if the operator, as is to be expected, did not approve of excursions to the back of the house every time that he wished to listen to stations in other countries, it would be worth trying various experiments.

Two Useful Suggestions

Assuming that the earth lead was to be attached to the water pipes at the back, whatever aerial was used, the experiment might be tried of separating the aerial from the earth as far as possible by leading it in at a window on the floor above and bringing it down the stairs into the front room. This might offer chances of keeping the aerial further from the walls than in the other case. Again, provided that circumstances permitted, an aerial might be erected on the roof of the house, and the lead-in brought down over the front of the house as far out from the wall as possible, and so in through the window of the front room.

A Point to Notice

When an excessively long earth lead is necessitated by the position of the receiver, it will usually be worth while to try the effect of a counterpoise earth. This may consist of a length of insulated wire laid round the skirting of the room, and possibly extending out into a passage or another room.

With some valve receivers, notably those employing the simpler types of straight circuits, this change will usually be found to affect considerably the operation of the receiver. The reaction control, especially if reaction is applied to the aerial circuit, may require much "lighter" handling. It should not take long to become accustomed to the new conditions, and this point is only mentioned because some operators might discard the counterpoise without further experiment on finding this alteration in the behaviour of the receiver.

An Indoor Aerial

When it is quite out of the question to erect an outdoor aerial, it remains to make the best use of the space available indoors. If a frame aerial is not adequate for the receiver to be used, it will usually be possible to try two or three different arrangements of the indoor wire. The first and most obvious of these will be simply to hang a wire across or round the room in which the receiver is situated,

(*Continued on page* 958.)

AUSTRALIA ON TWO VALVES

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

Do you know that there are hosts of interesting transmissions on the short-wave band waiting for you to explore them? The receiver described in this article will enable you to listen to them.

EVERY experimenter should have a short-wave receiver. With our present knowledge it is so easy to make and so deadly certain in its results. With no other kind of receiver is it possible to guarantee the reception of American broadcasting on three or four nights of every week, and in the winter months sometimes every night for several weeks at a time. With no other kind of receiver is it possible to hear amateur signals from so far away as Australia and New Zealand, while both in daylight and after dark our Transatlantic cousins can be heard every night without exception. "Only with skilful handling!" you may say. Not at all! In the words of the advertisement, "A child can use it."

Simplicity Itself

In this article I am going to describe to you a very simple short-wave receiver, that can be duplicated by any intelligent reader in an evening, and which, if he has not used a short-wave receiver before, will astound him with the results it will give. As to its sensitivity and general efficiency, I have nothing in my collection of apparatus to beat it, and I use it exclusively for all my short-wave reception at the present time.

It consists, as for that matter do the majority of short-wave receivers used by experienced amateurs, of a two-valve arrangement, the first valve being used as a detector, and the second a note magnifier. The wavelength range is from about 12½ metres to approximately 200 metres. It is quite unnecessary to wind any coils yourself, as these are purchased in a complete set, the coils for various ranges being immediately interchangeable. There are but two tuning controls, both condensers, that on the left tuning the grid circuit, and that on the right controlling the reaction.

The Aerial Circuit

The aerial is loosely coupled by the method often called "semi-aperiodic coupling," the same aerial coil serving for all the grid coils, from the smallest to the largest. In series with the aerial condenser is placed a clip mounting, so that different values of fixed condensers may be tried as desired. In this method of coupling it is advisable that the aerial should not be exactly tuned to the wavelength you wish to receive, and on those adjustments where "dead spots" occur, the insertion of a small fixed condenser—say .0001—will de-tune the aerial and so make good reception possible on this wavelength.

The construction is exceedingly simple. A baseboard is used, measuring 16 in. by 14 in. by ¼ in. or more in thickness, this carrying an ebonite strip screwed to the front with a couple of brackets to support it. With the exception of the variable condensers and an "on and off" switch, the various parts are simply screwed to the baseboard in the positions given, and wired up in the conventional manner.

The Condensers

Here is the complete list of components required. I may say that for coupling the detector to the note-magnifying valve I have used the Watmel Audio-frequency choke unit, which contains the choke coil, coupling condenser and grid leak. I have found this unit very useful and efficient for telephonic reception, as it has a particularly silent background and gives quite good amplification. It can, if desired, be replaced by any good make of low-frequency transformer, while such items as valve sockets, variable condensers, and so forth can be of any good make previously recommended in this journal. As to the variable condensers, care should be taken to get good quality instruments, and I do not recommend the use of variable condensers with single plate verniers operated by a spindle running through the central shaft. Such condensers may serve excellently in certain circumstances, but in short-wave work

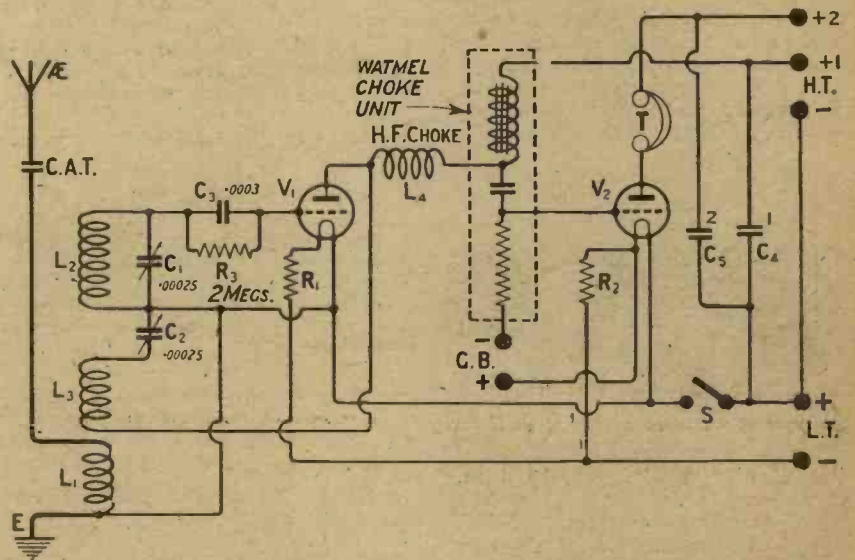


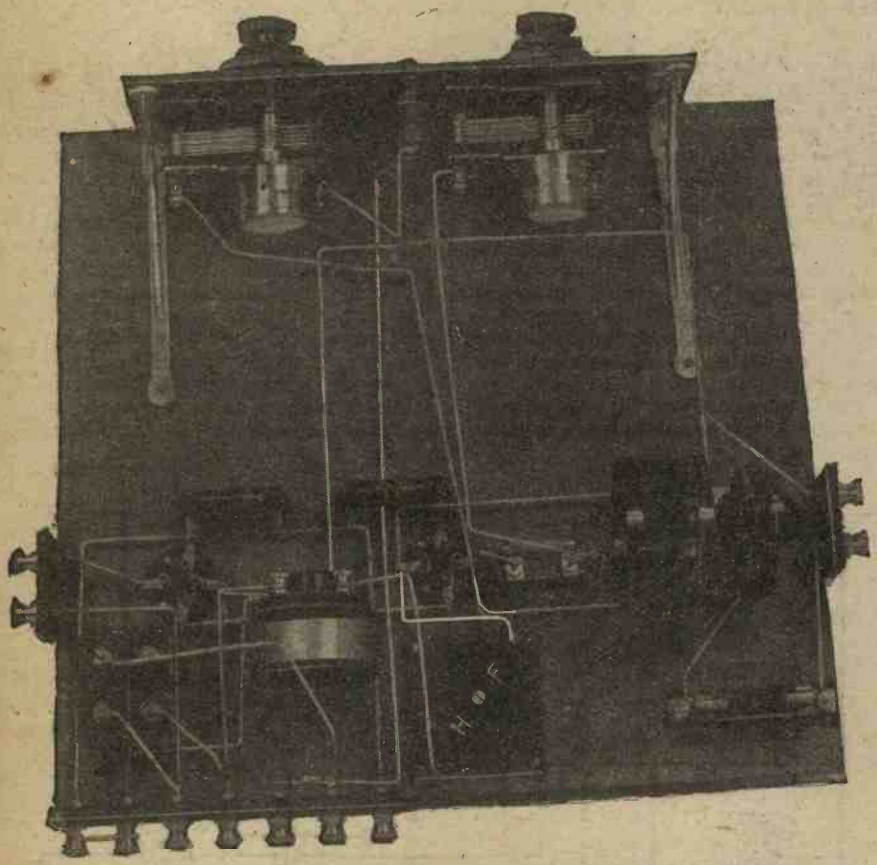
Fig. 1.—It will be observed that choke coupling is utilised for the note-magnifier.

Try Short Wave Reception Yourself

I have not found them satisfactory, and, indeed, some condensers of this type are not satisfactory on any wavelength. The condensers I have used in this set—the Ormond—have a vernier adjustment of a form which has proved particularly useful and efficient on short wavelengths, being perfectly free from backlash and smooth in operation. Tuning is too sharp for condensers without a good vernier adjustment.

Components Used

One baseboard 16 in. by 14 in. by ¼ in. or ⅜ in.



The condensers are kept well away from the rest of the components.

One ebonite panel 12 in. by 4 in. by ¼ in. or $\frac{3}{16}$ in.

Two variable condensers .00025. (Ormond Engineering Co., Ltd.—slow motion.)

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

One set of Bremer-Tully short-wave coils and coupler. (These are obtainable in England through the Rothermel Radio Corporation of Great Britain, Ltd.)

Two valve sockets. Board mounting type. (Peto-Scott Co., Ltd.)

One fixed condenser, with clips for gridleak, .0003. (Telegraph Condenser Co., Ltd.)

One gridleak, 2 megohms. (Dubilier Condenser Co. (1925), Ltd.)

One terminal strip carrying L.T. −, L.T +, H.T. −, H.T. +1, H.T. +2, grid bias +, grid bias −. ("Magnum"—Burne-Jones & Co., Ltd.)

Two small strips of ebonite of any convenient size (approximately 2 in. by 2 in.), with aerial and earth terminals and telephone terminals, as shown.

One base for clip-in condensers. (L. McMichael, Ltd.)

Clip-in condensers, values of, say, .0001 or .0003 (L. McMichael, Ltd.). In most cases a single condenser of .0001 will be sufficient, but it is convenient to have one or two to experiment with.

One radio-frequency choke. (Success—Beard & Fitch, Ltd.)

One audio-frequency choke unit. (Watmel Wireless Co.)

Two fixed condensers, Mansbridge type, of any convenient size over ½ a microfarad. One microfarad each is a good value. (Telegraph Condenser Co., Ltd.)

Two brackets for front ebonite panel. ("Magnum"—Burne-Jones & Co., Ltd.)

Two bases for fixed resistances, and suitable plug-in fixed resistances for controlling filament current. Four ohms each is recommended. ("Magnum"—Burne-Jones & Co., Ltd.)

Constructional Work

Begin by drilling the ebonite panel for the securing screws to hold the brackets, and the three holes to take the two condensers and on and off switch respectively. The three holes for carrying these last can be made with a $\frac{3}{8}$-in. drill. Secure the brackets to the ebonite panel by means of four 6B.A. metal screws and nuts. Next secure the on-and-off switch and the two variable condensers in place (this is but the work of a few moments), and place the front panel with its brackets on the baseboard in the positions shown, securing it with wood screws to the base itself. Now place the other components in position and attach the large and two small terminal strips; wiring up can then be carried out rapidly and neatly, according to the diagram of Fig. 3. A full-sized blue print will help you to measure off and bend the wires accurately, and this, as you know, can be obtained under the WIRELESS CONSTRUCTOR free blue print scheme by sending the coupon on page 960.

Valves to Use

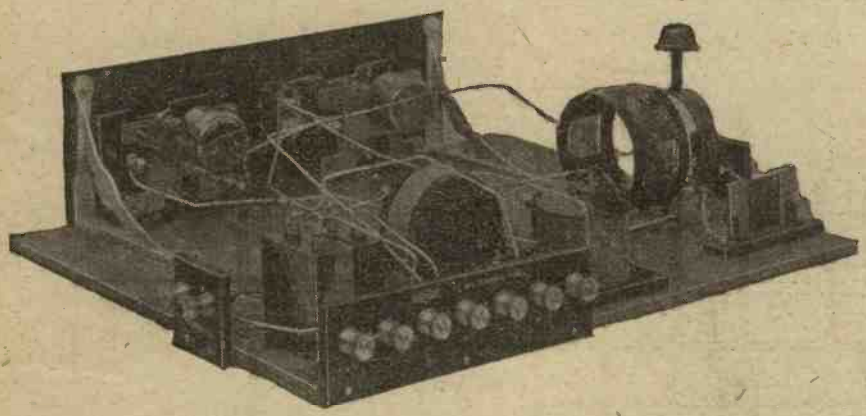
The set is not at all critical in regard to valves, but I have found the best results obtainable with a high-impedance valve, of the type designed for resistance-capacity coupling, as the detector, and what is commonly called a small power valve for the note magnifier. For the detector valves, a D.F.A.4 (Mullard), a D.E.5b (Marconi and Osram), or a C.T.25b (Cleartron) will, any of them, give first-class results. For the second, a D.F.A.1, D.E.5 or C.T.25 of the three makers just named will give equally good results. For high-tension 20 or 30 volts will generally prove sufficient for the detector valve (H.T + 1), and for the note magnifier 60 or 70 volts will be sufficient (H.T. + 2). For the benefit of readers who are just starting experimental work in making sets, it should be said that the H.T. negative socket of the battery is connected to H.T. negative terminal, by means of a lead and a wander plug. H.T. + 1 is connected by a lead to a wander plug which can be plugged in at suitable tapping between 20 and 30 volts (you will find this best by experiment), while H.T. + 2 is joined by a similar lead to a wander plug in the same battery at, say, 72 volts. A grid bias battery tapped at each cell should be used. 3 to 4½ volts will give satisfactory results.

Operation

It is best to practise on the largest of the four coils if you are not used to handling a short-wave receiver. The

A New Field to Explore!

largest of these coils tunes from approximately 100 to 200 metres, and between these ranges you will hear a large number of Morse stations. Plug in the largest coil, set the coupling coil at about 45 degrees to the plug-in coil, plug the two 4-ohm resistances in the two sockets shown, set the right-hand or reaction condenser at zero and the left-hand condenser at zero also; connect up the coil as near to a right angle as possible without weakening the signals unduly. This means loosening the coupling. If you are able to read Morse you will be able to identify the call-signs, but if you do not understand the code you will probably prefer to search until you hear amateur telephony. When hearing telephony the set should be adjusted just below the oscillating point, or you will get



Only a few components are required.

batteries as indicated and pull out the on-and-off switch. Both valves should now light. If all is well, do not trouble to connect aerial and earth, but with the 'phones on your head, turn the reaction condenser slowly from zero onwards until you hear a rushing noise which indicates that the set is oscillating. Turn the left-hand tuning condenser to say 10 degrees and try the reaction again, repeating the process every 10 degrees all the way round the scale from zero to the highest reading. If all is well, the set should pass smoothly into oscillation at any reading of the left-hand condenser when the right-hand condenser is turned slowly from a lower to a higher reading.

Preliminary Searching

Having become accustomed to this reaction control, connect the aerial and earth, turn the left-hand tuning condenser backwards and forwards slowly, keeping the set just below the oscillating point. You will probably hear sundry Morse signals from amateur transmitting stations, some being musical notes and others rough untuned notes. For reception of continuous wave signals, it will be necessary to take the reaction condenser just pass the oscillating point, when you will be able to settle on a convenient musical note for the particular signal by adjustment of the tuning condenser. The best continuous wave signals are heard when the set is only just oscillating, and in such circumstances you should turn the coupling such distortion that the speech and music will be unrecognisable.

American Telephony

Having satisfied yourself that you can control and listen to signals on the biggest of the four coils, take the third coil which tunes approximately from 50 to 100 metres. This is a very interesting coil, and on this you will hear large numbers of amateur signals, both Morse and telephony, and in addition you will be able to hear American broadcasting from the KDKA Station on 63 metres. This station is generally audible from about half-past eleven at night onwards, and frequently is so loud, when properly tuned in, that you can hear it with the 'phone several inches from your head. On one occasion I sat and listened for two hours without a break to the programme from KDKA on such a two-valve receiver, and did not miss a single song, word, or talk during that time. Even after seventeen years of amateur wireless reception I could not help being thrilled by the fascination of listening on such a simple set to perfectly clear telephony from over 3,000 miles away.

On the second coil which tunes from about 25 to 50 metres you will frequently hear telephony from the American Broadcasting Station WGY at Schenectady, the New York Station. This station broadcasts on about 38 or 40 metres, and comes in extremely well in this country. On the shorter wavelength coils you will sometimes find that it is not possible to make the set oscillate on certain readings. When you find such a point either pull out the particular clip-in condenser you are using at the moment or else short-circuit it with a piece of wire. Either method will change the wavelength of the aerial circuit, and will enable you to receive on that portion of the wavelength band.

Amateur Transmitters

Of course, if you are able to read Morse you will be able to find and identify a whole host of stations. The American amateurs generally work on one of the following bands: 18 to 22 metres, 37-43 metres, 75-86 metres. In this country 23, 45, 90-100 metres and 150-200 metres are widely used by amateurs, and similar wavelengths are used by most of the Continental experimenters.

As the reception of American and Continental amateurs is such an easy matter, and there are so many hundreds to be heard on any good night, it would be waste of space to publish a list of the results on this receiver. It should be pointed out, however, that KDKA and WGY, both American Broadcasting Stations, have been received on dozens of occasions within

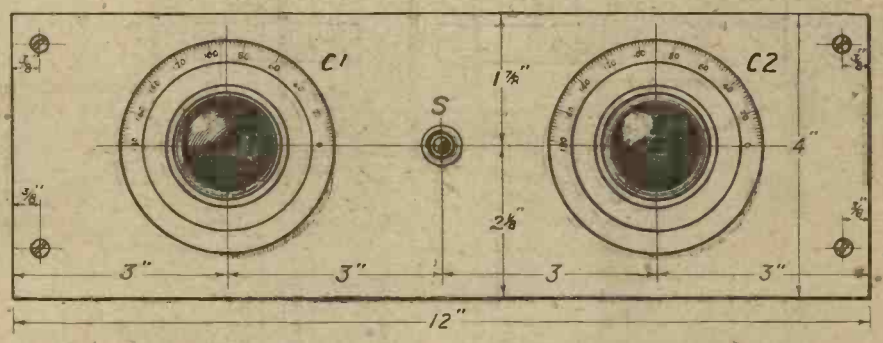


Fig. 2.—Only two controls are required, one for tuning and one for reaction. A blueprint of this panel (No. C1055 (a)) may be obtained under our free blueprint service. See page 960.

Australia on Two Valves—*continued*

the last two or three months, and in fact on only one night have I failed to hear KDKA when I listened for it with this set. In order to compare the results obtained at my home with those obtained elsewhere I lent the set to Mr. L. H. Thomas (6QB), and some of his results are given below. Notice that he received no less than six or seven Australian amateurs' transmissions before breakfast one morning, in broad daylight (eight o'clock in the morning here corresponds with six o'clock in the evening in Eastern Australia).

An Indoor Aerial

As I have indicated above, even if you have no knowledge whatever of the Morse code, the set is worth building for the reception of American broadcast telephony. If conditions are good you will even be able to hear KDKA and WGY on a small indoor aerial.

On one occasion I heard KDKA with a two-valve short wave receiver, not so good as that being described, on but ten feet of wire, strung across my laboratory.

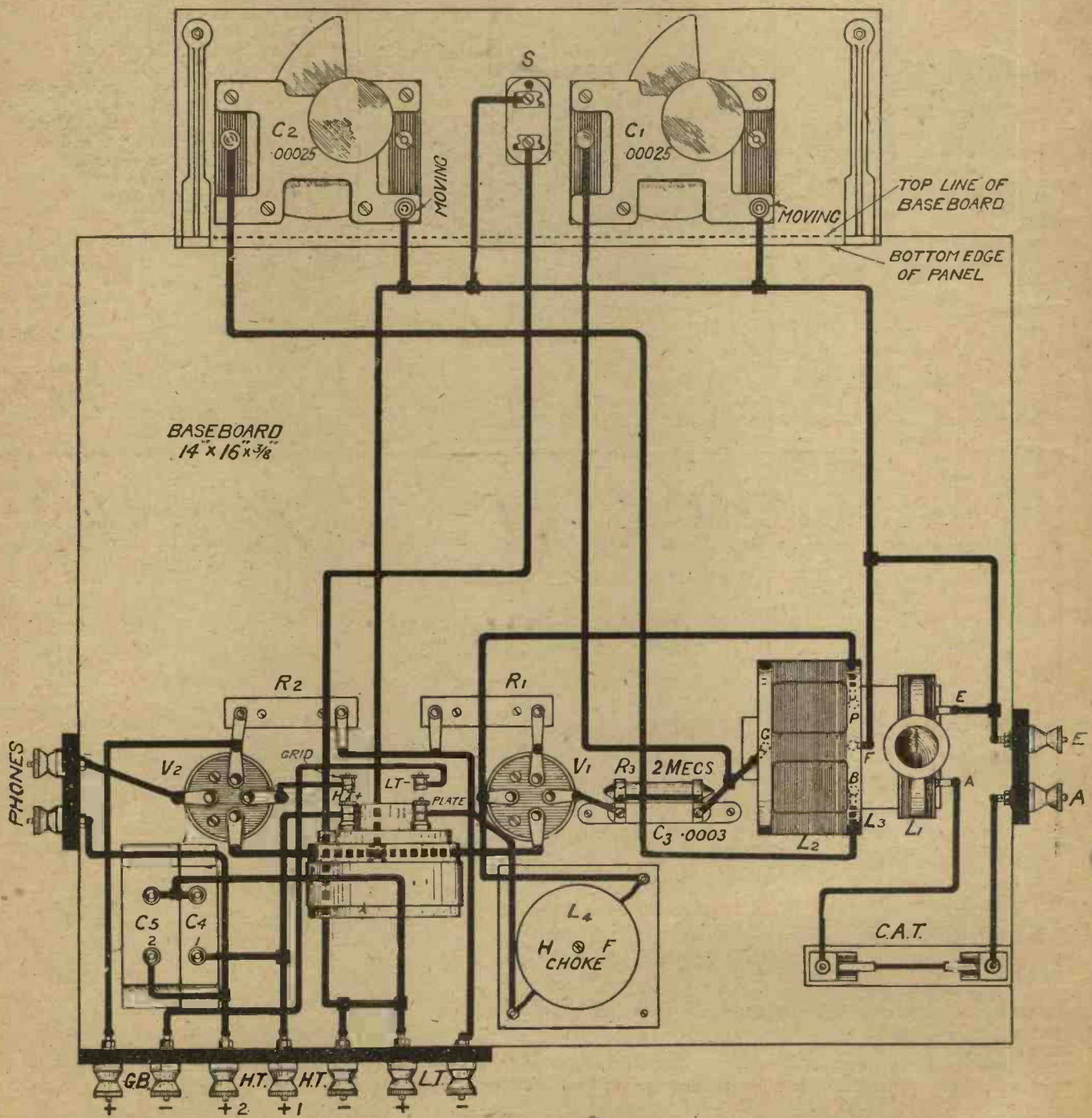
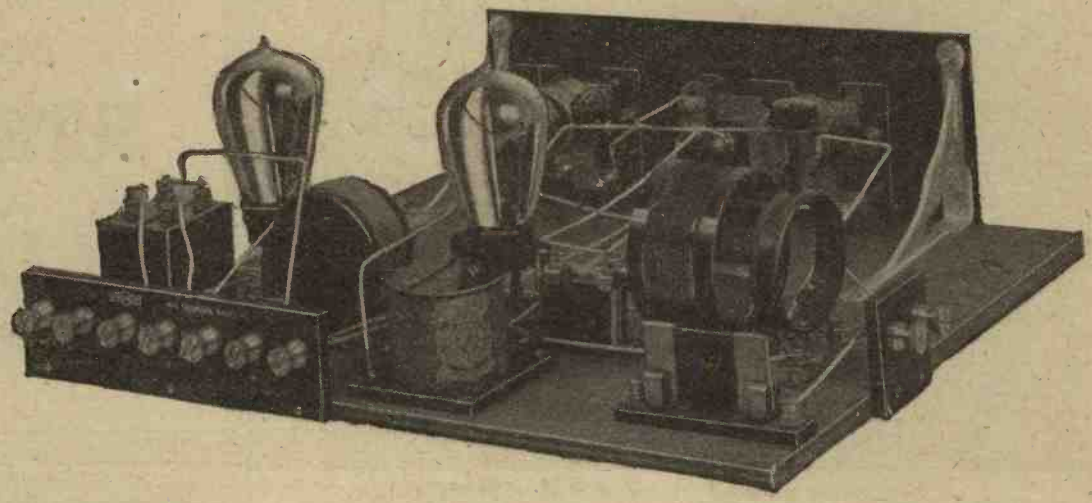


Fig. 3.—This diagram shows the wiring clearly. Blueprint No. C1055 (b) is available for those who prefer it.

See if You can Get it!

As soon as you get American broadcasting on this receiver, please send a postcard giving us your results; if possible, give the name of the items being broadcast at the time which you heard them, so that we can send the results to the Broadcasting Stations in America. At the same time mention the kind of aerial you were using, and the weather, as well as the date. In this way we might be able to find which parts of England are best for short-wave work, and whether the signals are received equally well in several parts of England, at the same time.



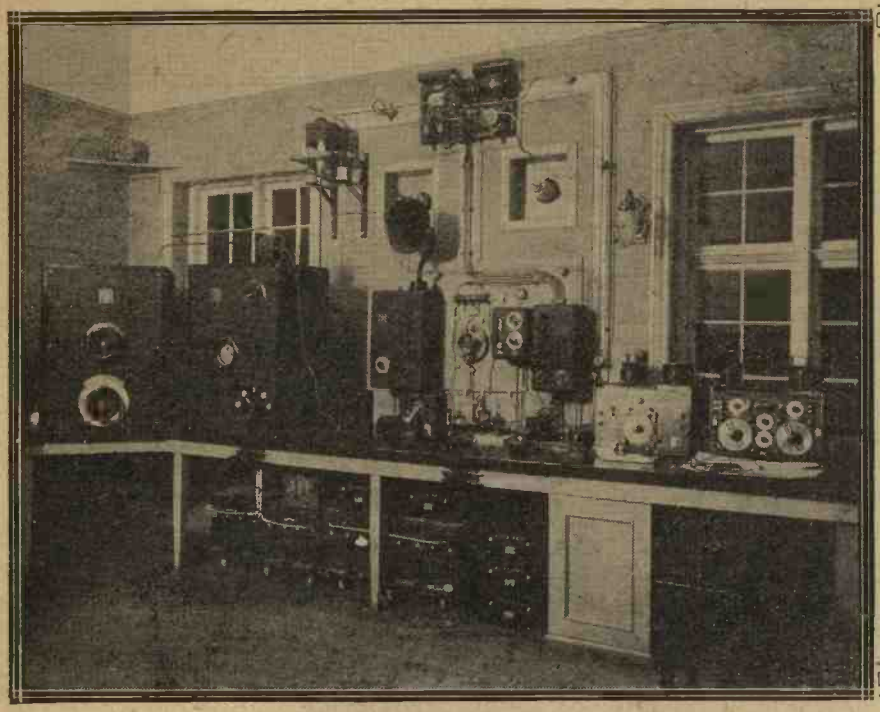
High impedance valves of the quarter ampere type are used in this receiver.

Stations Heard

15-25 metres: Several commercial stations were heard on this wave-band, including LPZ (Buenos Aires) and some of the Nauen stations.

25-45 metres: Various Brazilian stations and numerous Europeans, between 2130 and 2330 GMT. Between 0630 and 0830 various Australian stations were heard, one of them, A-3BD, being received almost at loud-speaker strength.

45-200 metres: Chiefly British amateur stations on telephony, but several Europeans using Morse between 90 and 130 metres.



A view of the transmitting room at the Ryvang station.

IN SCANDINAVIA WITH A SUPERHET

By Capt. L. F. PLUGGE

MID-WINTER, one would say, is hardly the time to choose for a trip to the Northern countries of Europe, but it must be remembered that their climate is far more temperate than that of other countries in similar latitudes, such as Canada, owing to the modifying influence of the Gulf Stream. The winter cold is, of course, severe, but it is a dry, crisp and exhilarating one, and I did not regret my undertaking to pay a flying Christmas visit to Scandinavia, in order to investigate at first hand the conditions of broadcasting among our friendly neighbours across the North Sea.

Speed with Comfort

The journey I am about to describe I have often referred to as an interesting method of spending six nights and five days to go from one platform of Liverpool Street Station to the other. In view of the short time at my disposal such strenuous travelling was necessary in order to visit the five broadcasting stations situated on my itinerary. One cannot help marvelling at the wonderful network of transportation which is daily at the disposal of the hurried traveller. Although speed is the first consideration in such arrangements, the comfort of the traveller is also studied to a remarkable degree, and it was these two factors which made it possible for me to travel 4,000 miles in those five days, passing through five countries and traversing two seas.

I wished during the journey to devote my full attention to the position of broadcasting in these countries, and I realised that in addition to visiting the broadcasting stations, their studios and transmitting gear, exchanging views with the station directors and radio journalists, and investigating the position of wireless trade and legislation in the countries traversed, it was necessary to listen under the best possible conditions to the actual transmissions from all main and relay stations.

Investigating Broadcast Activities

In order to do this a portable set was indispensable, and I accordingly travelled, as I usually do, accompanied by my seven-valve supersonic heterodyne with frame aerial, all enclosed when not in use in portable leather cases. It was thus simple, whenever I found myself with an idle moment to spare, be it in hotel, car, train or boat, to tune in any particular station in the vicinity, and under these most favourable conditions to investigate and become familiar with the methods and activities of the broadcasting world through the ether channel.

Although Denmark, Norway and Sweden are adjacent countries, and are in the minds of many people grouped together as existing under similar conditions, as, indeed, they do from many aspects, they are far from being in the same position with regard to broadcasting. For instance, while the art has reached a high standard of efficiency in Sweden, it is developing very slowly in Denmark.

Conditions in Denmark

During a most enjoyable and illuminating chat with Mr. Axel Petersen, with whom I breakfasted soon after my arrival in Copenhagen, I gained some idea of the confusion that existed in the "wireless world" of Denmark. Here progress is being retarded by conflicting interests opposing one another in order to gain for themselves the maximum amount of advantage from the new venture before them. Mr. Petersen himself is one of the leading members of the Committee of the Radio Society of Denmark, which is called "Litterforeningen," and he and his society advocate the establishment of a private broadcasting organisation like the British Broadcasting Company to take over the whole transmitting service, as is the arrangement in England. Listeners, he told me, are somewhat dissatisfied with what has already been done under direct Government control.

Political Interests

On the other hand, the various political parties wish to retain every possible hold on such a great national asset as a broadcasting service undoubtedly is, both for propaganda purposes abroad and also as a means of moulding public opinion and taste in the homeland. All this contention of rival interests has probably harmed the broadcasting position in Denmark. Until recently, therefore, Denmark was at the level reached by other countries one or two years back.

This was greatly to be deplored, especially as Denmark made a very promising start in the radio field. Denmark was, for instance, the first country to establish two-way communication for the use of passengers between coasting steamers and the mainland. It is pleasing to note how Denmark has now gone ahead in its broadcasting activities, and is daily becoming in this field a more worthy rival to its sister country of Sweden. Danish listeners owe much to the

In Scandinavia with a Superhet—*continued*

activities of the Copenhagen Station Director, Mr. Oleseu, who is also the distinguished editor of the wireless journal, *Radio Uge-Revue*.

Copenhagen Programmes

My short visit to Copenhagen proved extremely interesting, as, in addition to enjoying such interesting conversations with wireless amateurs of the country, I was able to visit both the broadcasting stations which are at present working there. York's Passage, as the older of the two is called, is situated in the centre of the town, and has been working since 1924, having previously been erected by Danish amateurs and radio traders, though it was soon taken over by the State. The programmes given from this station are very good, and transmissions leave little to be desired. It is interesting to find that the arrangement of the programmes include regular lessons in English, and that these are given by a Scotsman who has been resident in Copenhagen for some eight years.

I proceeded in the afternoon by car through the snow to Ryvang, where I found another model broadcasting station, the installation and gear in this great military station being perfect in every respect. Ryvang has become a broadcasting station in the ordinary sense of the term only in order to keep the gear in use and to provide training for the soldiers. It broadcasts only outside concerts and relays, but its transmissions are excellent in quality, and can easily be heard without interference from York's Passage owing to the wide difference in wavelength, Ryvang using the long wave of 1,160 metres, while that used by York's Passage is 347.5 metres.

A New Station

Commander - Engineer Thomsen, Commanding Officer of the Ryvang station, kindly received me and gave me much interesting information as to the present position and probable future of broadcasting in Denmark. It is likely that a large high-power station will shortly be erected, probably at Aarhus, which is a central point for the whole country of Denmark.

I was very interested to discover, both when listening in at odd moments while in Copenhagen, and also when on board the boat in which I crossed to Sweden, that Malmö, though a Swedish station, is quite the best station to listen to even in Denmark, and I was disappointed not to be able on this occasion, owing to lack of time, to visit it. Arrived in Stockholm, however, I found ample occupation for every minute of my time in exploring the position of broadcasting there, and had many very interesting opportunities of comparing it with the state of things in the country I had just left.

Swedish Efficiency

It is well known, of course, that the Swedish broadcasting service has reached a very high standard of efficiency, and is, in fact, in the opinion of many, second to none in the world, not even our own, of which we are justly proud. My visit to the Stockholm station was rendered doubly interesting by the courtesy of Mr. Nils Holmberg, Director of the station, who is one of the most important figures in the broadcasting world of Sweden, as he is also director of programmes to the whole Swedish service. He told me the absorbing story of the wonderful progress of broadcasting in Sweden since its inauguration some two years ago, and put me quite *au fait* with the conditions as they are at present.

Mr. N. Holmberg, the programme director of the "Radiotjanst."

The Licence Question

Licences in Sweden are levied on every listener, as in this country. Half of the money thus paid goes to the Post Office, which is responsible for the engineering, electrical and general technical side of the transmissions. The other half goes to a private company for providing the programmes called "Radiotjanst." This plan has many advantages. The Government is in a position to ensure a highly efficient staff of operators, and the best and most reliable transmitting gear obtainable, while "Radiotjanst," which is naturally composed of men anxious to please the public, ensures excellent programmes and secures frequent novel and interesting outside broadcasts.

The Stockholm station is the only Swedish station situated in the centre of the city, all the others having been erected about three miles away from the town to which they belong in order to enable listeners in the town to tune in distant stations. I noted during my brief visit to the Stockholm station several details of arrangements which give it an individuality of its own. For instance, the beginning of each transmission is indicated, not by a tuning note, as we understand it, but by the playing of certain Swedish folk tunes on a piano, so that Swedish listeners to whom all these national

In Scandinavia with a Superhet—*continued*

tunes are familiar can immediately recognise their own station. The switching on of a double bell during intervals in the programme is a useful device to prevent a gap in the transmission, and thus facilitate accurate tuning in during intervals.

A well-known Swedish baritone, Mr. Gunnar Grijv. At the piano Mr. V. Broman, musical director of the "Radiotjanst."

An Interesting Arrangement

An interesting and highly successful method of increasing the number of relay stations in operation in Sweden might with advantage be followed in other countries also. The citizens of any town who are sufficiently enthusiastic to do so are encouraged to pay for the installation of a relay station. Their responsibility ceases once the station is working—"Radiotjanst" immediately takes over the programmes side of the enterprise, while the Post Office becomes responsible for the technical and engineering section of the new station. The station at the same time never ceases to remain the property of the purchasers, although all further expenses are met by the licence fees levied on listeners.

So successful has this plan proved that to-day Sweden has, in addition to her five main stations, Stockholm, Gothenburg, Malmö, Sundsvall and Boden, some twenty relay stations connected by land line to one of the various main stations.

Excellent Quality

That the proportion of listeners in Sweden works out at about a quarter of the total population of the whole country is a clear proof of the excellence of both programmes and transmission. I discovered that it is often impossible to distinguish by the quality of transmission between programmes from a main station and those relayed by land line. They are both received with equal purity and strength.

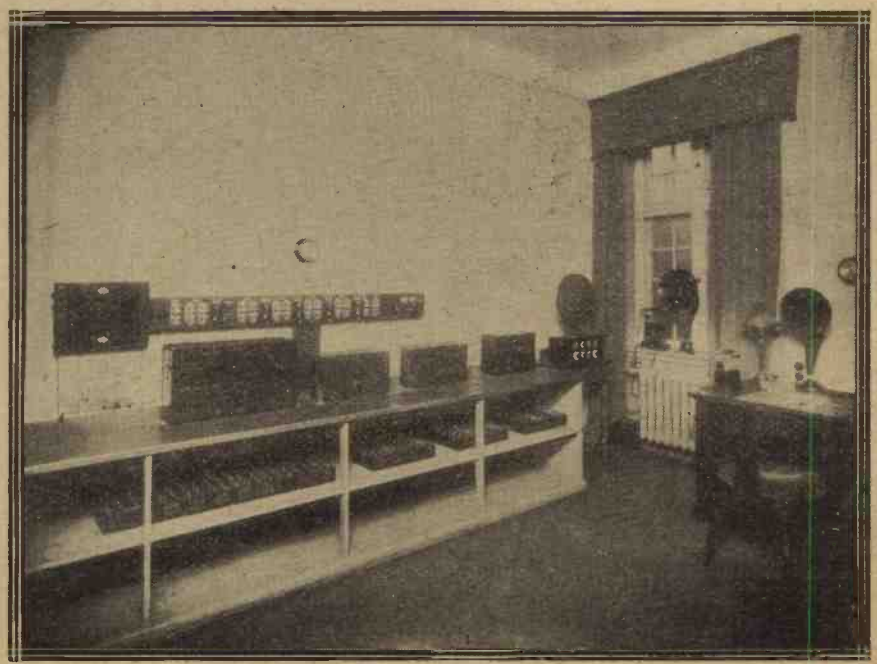
The Swedish nation have always from earliest times been renowned for enterprise, progress, and a vital interest in the world around them and in countries outside their own. This is exemplified in broadcasting as in other forms of expression of the national life. I was very interested to hear on several occasions excellent retransmissions from Swedish stations of some of the best items of foreign programmes. These are primarily received at a Government station situated at Kungsbacka, and sent by land line to the other stations. The excellence of this relay provides an added pleasure for the enthusiastic listener. British transmissions in particular are regularly relayed in this manner, and are much appreciated by the Swedish amateur.

Journalism in Sweden

After carrying out my extremely full and varied programme during my one day in Stockholm, having gained many varied impressions and made many interesting discoveries, I departed on the night train for Gothenburg the same evening, arriving in this most important of Swedish provincial cities just as the dawn was breaking over the snowy landscape. The cold dry air was sufficiently invigorating to make breakfast a welcome prospect, doubly so as, while enjoying it, I was able to "talk radio" with the leading wireless journalist of the city, Mr. Arvid Palmgren, the editor of the best technical radio journal of the country, *Radio Amatoren*. Mr. Palmgren told me that, although many listeners in Sweden prefer to buy their receiving sets, the proportion of those who prefer to make their own is very large, and the sale of technical periodicals such as his is very considerable.

The Gothenburg Station

The broadcasting station at Gothenburg, which I was able to visit later



The control room of the Yorks Passage station, Copenhagen.

Another great contribution to the Science of Radio by Cossor

Red Top :
For H.F. use.

Plain Top :
For Detector or L.F. use.

15/6
For 2-volt Accumulators.

The new Cossor Point One

—the ·1 amp. Valve which utilises Co-axial Mounting

Cossor Stentor Two
Power Valve
Consumption ·15 amp

18/6
For 2-volt Accumulators.

IT was a flash of genius that enabled Simpson eighty years ago to discover chloroform. Genius, too, helped James Watt to read the lesson of the steam engine in the escaping steam from his mother's kettle. Assuredly it was genius that caused Montgolfier to visualise in the floating remnants of a burning paper bag the world's first balloon—the prelude to man's conquest of the air.

And once again a touch of genius has been responsible for an entirely new method of valve construction that bids fair to produce results which, but a year ago, would have been considered impossible.

The new series of Cossor valves employ—for the first time in the history of Radio—a method which, accurately and for all time, ensures perfect alignment for the filament, grid and anode. At the same time it provides a shockproof support for the filament.

Thus throughout the whole life of the valve its working characteristics cannot alter. Age cannot cause filament sag nor can hard wear disturb the exact relative positions of the filament, grid or the anode.

But this is not all. The improved Cossor filament consumes but a moiety of the current required by other Dull Emitters—its consumption at 4·8 volts being barely one-tenth of an ampere. A seven-valve Super Heterodyne, for example, using these new Cossor Point One Valves would not consume as much current as a little one-valve set using a single bright emitter.

As can be imagined, the filament used in this new Cossor is no ordinary filament. Owing to its exceptional length and its scientific method of preparation a great latitude in working voltages is permitted. Satisfactory results are obtainable at a voltage as low as 1·2, so that the valve can, if required, be used with dry cells. Further, its operating temperature is lower than that of any other valve on the market. And everyone knows that low temperature means long life.

The Cossor system of Co-axial Mounting has now finally abolished the last bug-bear of dull emitter valves—microphonic noises. Individual movement of either the grid or the anode in the Cossor Point One is utterly impossible. The seonite insulator holds them both in a vice-like grip which defies the hardest shock.

With its handsome pipless glass bulb, its re-designed low loss moulded base, and its new positive contact pins the introduction of these new valves represents one of the most important events in the progress of the Valve. See your Dealer about them to-day—we can promise you new delights in radio reception. A greater economy, improved sensitivity, a wonderful richness of tone, with a length of life and uniformity of performance which will positively astonish you.

Cossor Valves

—The new Dull Emitters with the long-life ·1 amp. filament.

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5. Gilbert Ad. 5300

IN SCANDINAVIA WITH A SUPERHET—*continued*

in the morning, is, like the other Swedish stations, a model of efficient construction and working. The well-appointed studio is, for the convenience of the artistes, in the centre of the town, but the transmitting gear, which I was also able to inspect, is installed in a compact concrete building situated some two or three miles out of the city, open to the winds of heaven on the high plateau which extends for miles in this direction.

The artistes' waiting room at the York's Passage station.

The station is under the direction of Doctor Rabe, a distinguished personality in the city, and is considered by some to be the best provincial station in Sweden. It is perhaps unique in having created a special department to deal with the broadcasting of scientific and literary lectures, which are greatly appreciated by listeners in the district.

A Reluctant Farewell

I was reluctantly obliged to leave Gothenburg in the afternoon, after a most interesting visit, and proceed to Copenhagen on my way to Berlin, which I was due to visit before my return to England. I departed in the hope of revisiting Scandinavia at some future date, in summer weather, when during the long hours of summer daylight I might renew my acquaintance with the many delightful people and interesting places I had seen on my winter visit. In the delightful summer climate for which these countries are famous, I am looking forward to a revisit to Scandinavia, still accompanied, of course, by my trustworthy friend, my "Super-het."

USING THE MAINS FOR H.T. AND L.T.

SIR,—I have read with interest the article in the July issue of THE WIRELESS CONSTRUCTOR on the subject of the possible sources of H.T. supply. The writer of this article, in discussing the use of direct current mains of higher voltage than required for the H.T. supply to the receiver, mentions the potentiometer method of obtaining any desired voltage up to maximum possible and describes this as being uneconomical. With this view I am in agreement, but I think that it will possibly be of interest to you and to your readers if I give you a few details of a system of using the D.C. mains which I reckon to be quite economical.

Briefly the system consists in placing a group of lamps of suitable resistance in series with the valve filaments, which are themselves in series. In this way the consumption of current by the valves is kept low. The H.T. supply is obtained by taking tappings as required between the lamps, utilising the voltage drop across the lamp filaments to obtain the necessary H.T. voltages for the valve anodes. The current taken for the H.T. supply is of course small, and the whole system cannot, I think, be considered wasteful. The mains in my case are 220 volts D.C., so that I have an ample H.T. voltage for any purpose.

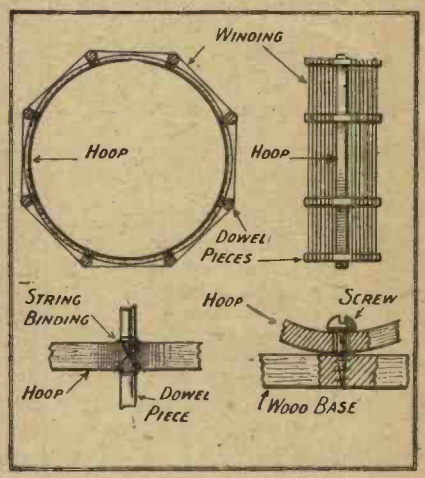
Wishing THE WIRELESS CONSTRUCTOR every success, I am,

Yours faithfully,
JAMES C. ANDERSON.

Nottingham.

AN EASILY MADE FRAME AERIAL

IT is often necessary to construct a frame aerial hurriedly to enable certain tests to be carried out, and the method indicated below has proved very satisfactory and has the advantage of cheapness combined with simplicity. The material required is an ordinary wooden hoop, two dowel rods each about 2 ft.



The construction can readily be seen from these details.

long and ¼-in. diameter, some string, and a quantity of insulated wire.

Simple Construction

The whole of the construction of this frame aerial may be carried out in the space of half-an-hour. First cut off eight pieces of dowel rod, each piece being 6 in. long. Tie these to the wooden hoop as shown in the diagram, and then wind the wire on the cross-pieces, evenly spacing the turns. By equipping the beginning and end of the winding thus made with suitable leads and securing the hoop itself to a small wooden base, the aerial is ready for the test purposes. A suitable method for securing the hoop is to pass a wood screw through a hole drilled in the hoop and into the base piece. This enables the aerial to be turned as desired if the screw fit is not a tight one.

A frame aerial of this type was made by the writer and was found to give extremely satisfactory results.

CHANGE YOUR COIL AND CHANGE YOUR CIRCUIT

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

THE attractive properties possessed by the Reinartz circuit are too well known to comment upon, and it is a modified version of this circuit which is primarily used in the receiver to be described. The chief merit in the present case is that by the use of special coils it is possible to change the circuit of the set, from a modified Reinartz arrangement for reception upon the ordinary broadcast band of wavelengths, to a direct-coupled aerial circuit, employing straightforward variable magnetic reaction for reception upon the longer wavelengths.

In order that this change may be made, all that is actually required is to change the plug-in coil; no switches or jacks are involved, the change-over of connections being automatically brought about by the arrangement of the plug-in-coil unit.

The Circuits Used

An examination of the Fig. 1 circuit will show that the arrangement in the first case greatly resembles,

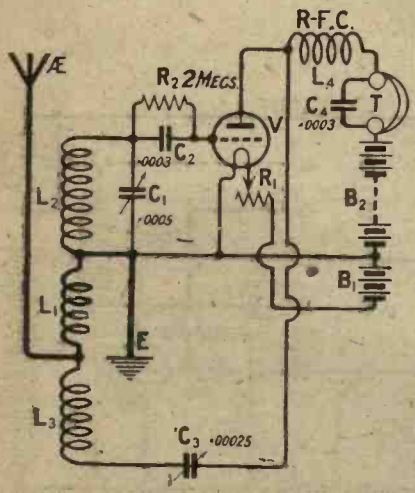
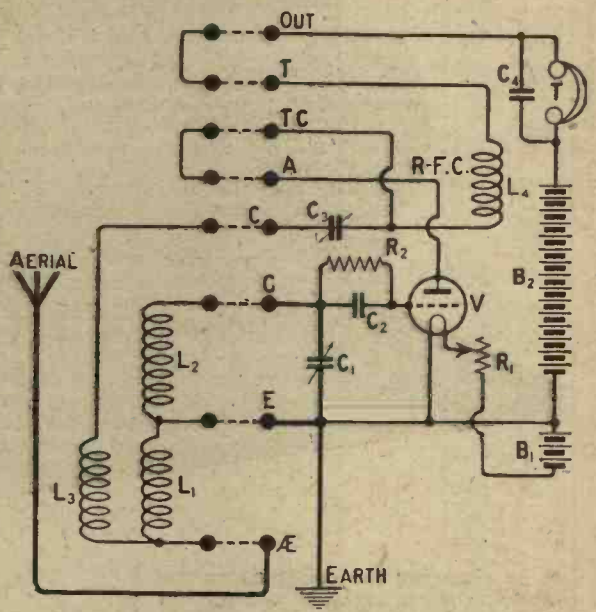


Fig. 1. — This arrangement of the receiver resembles the Reinartz circuit.

as stated above, the Reinartz circuit, while Fig. 2 shows the connections of the actual receiver. The letters AE, E, G, C, A, TC, T and OUT are those marked upon the coil-holder (seen in the photographs), secured to the baseboard, while the dotted lines show how the actual coil unit completes the connections, when pushed into position.

Fig. 2.— The actual connections of the receiver are shown in this diagram.



By following these connections it will be found that the result is to produce the circuit of Fig. 1, the various reference letters of the symbols being the same in both cases.

The Change-Over

In the case of long-wave reception the circuit used is that of Fig. 3, while the connections brought about by the plugging in of the long-wave coil are as shown in Fig. 4. The connections within the set and made to the coil-holder, of course, remain the same, while those of the coil unit itself are as indicated.

The variable coupling between L1 and L2 is given by a knob attached to the top of the coil unit, the reaction coil being contained within the casing of the unit.

Constructional Design

As to the construction of the set, the upright panel and baseboard arrangement has been adopted, as in this particular case the wiring requirements are greatly simplified by so doing.

Looking at the receiver from the front the only components mounted thereon are the grid tuning condenser (left), the filament rheostat and the reaction condenser (right). For reasons of easy operation "slow motion" variable condensers are used, while easy access to the terminals is given by these being also fitted to the front of the panel.

The coil unit, valve, and so on are all contained within the cabinet, which should, of course, be fitted with a hinged top to allow the interior of the set to be quickly attended to when it is desired to change the coil.

Wavelength Range

The flexibility of this receiver is such that not only may reception be made upon the broadcasting waveband and upon the long wavelengths,

"Change Your Coil and Change Your Circuit"—*continued*

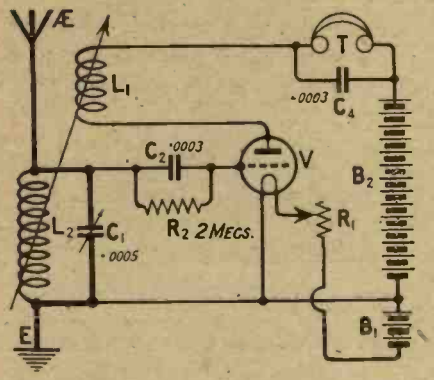


Fig. 3.—The receiver is shown here as arranged for reception on the longer waves.

duplicate the set in every detail, though it will, of course, be understood that other suitable makes may be found in the advertisement pages of this journal.

In so far as the values are concerned, it is not recommended that these be departed from, for, in order that the most suitable values may be decided upon a considerable amount of experimental work has been gone through in all cases of receiver design, and if this effort on the part of an author is to be ignored, then the defaulting reader has only himself to blame if the set does not cover the desired wavelength range, or develops some other undesirable feature:—

One ebonite panel measuring 14 in. by 7 in. by ¼ in. ("Paragon").

One cabinet to panel dimensions, and baseboard ("Camco").

Two variable "slow motion" condensers, .0005 and .00025 (Radio Instruments, Ltd.).

One gridleak and condenser, two megohms and .0003 respectively (Dubilier Condenser Co., Ltd.).

One fixed condenser, .0003 (Watmel Wireless, Ltd.).

Eight terminals.

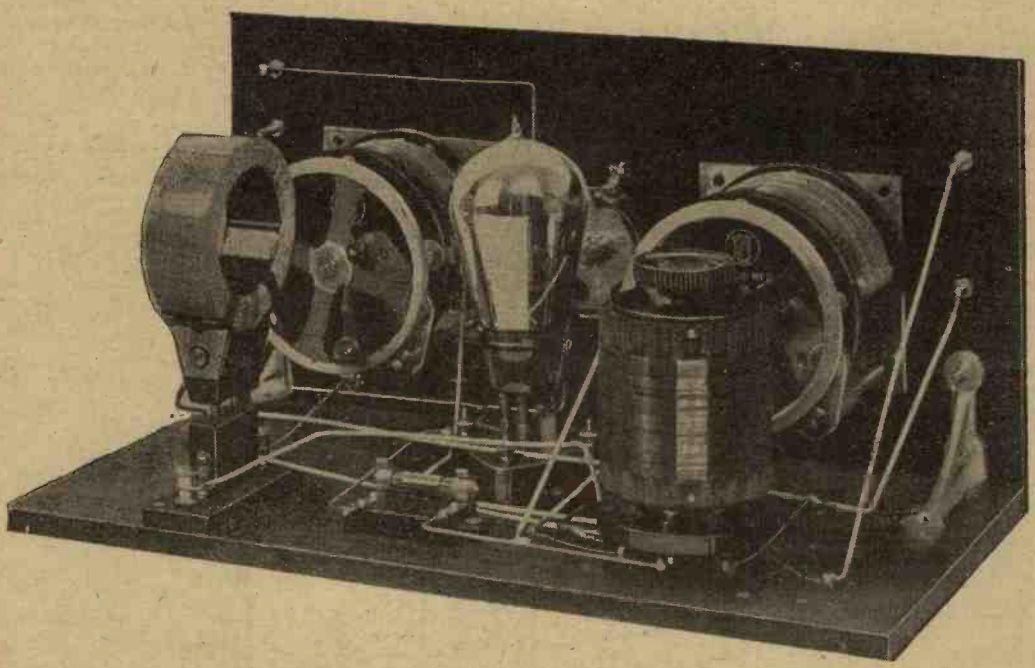
One filament resistance, 30 ohms ("Kay-Ray").

One valve holder ("Etherplus").

One coil-holder, board mounting-type (Beard & Fitch).

Set of special plug-in coils and base (Beard & Fitch).

Two right-angle brackets ("Magnum").



A plug-in coil is used as the radio-frequency choke.

but by changing the coil unit to one containing fewer turns, then reception may be made upon the relatively short waves.

These coil units are of commercial manufacture, and are of three sizes, namely, sizes suitable for reception upon relative short waves, the broadcast band and long waves; the coil-holder is common to all three, yet each coil makes a complete receiver capable of receiving over a definite wavelength range.

Components and Materials

Those readers who desire to build a receiver of this type should first of all collect the following material and components. It will be found that following upon the names of these, the names or trade marks of the manufacturers are also given. The purpose of giving this information is merely to assist those readers who wish to

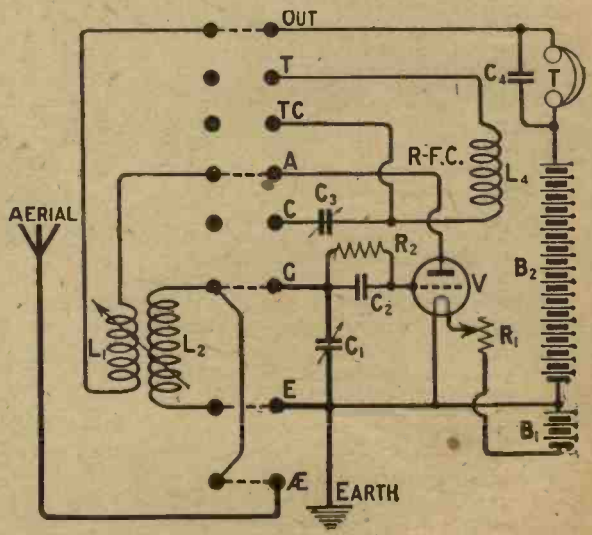


Fig. 4.—The method of arranging the receiver for the circuit of Fig. 3 is shown here.

"Change Your Coil and Change Your Circuit"—*continued*

Quantity No. 16 "Glazite" connecting wire.

Packet Radio Press panel transfers.

One No. 300 plug-in coil (to serve as a radio choke).

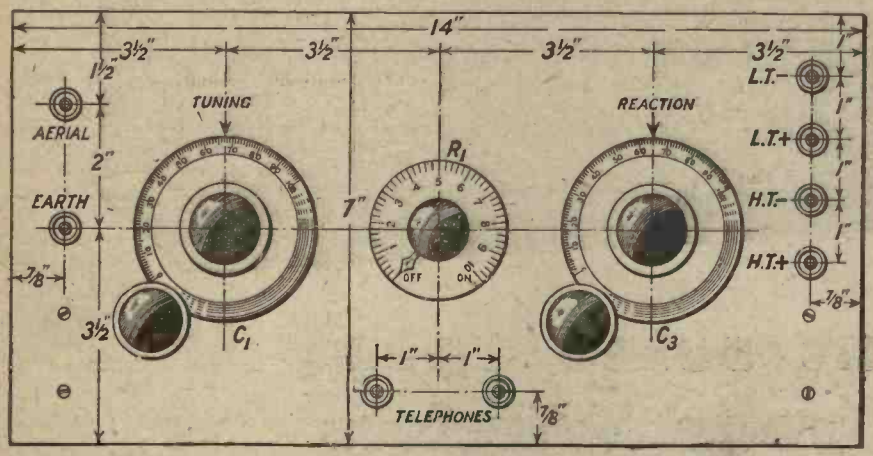


Fig. 5.—The tuning controls are placed in positions which make for ease of handling. (Blueprint No. C1056A).

Mounting the Components

The drilling and preparing of the panel for mounting the components is so simple that this work does not require any further information than that given in Fig. 5. When this has been done the baseboard and panel are secured together in the ordinary way by means of the brackets, whereupon the components may be mounted.

Regarding those to be secured to the baseboard the layout indicated in the photographs and wiring diagram, Fig. 6, should be followed as near as possible.

An Important Detail

Before fixing the coil-holder to the baseboard by means of the three screws provided for the purpose, it is advisable to first solder short lengths of soft tinned copper wire to the tags, as should this not be done it will be found rather difficult to make the required connections to the remainder of the components involved, there being little room between the baseboard and the under-side of the holder when the latter is screwed down.

In the receiver as illustrated these connections were simplified by first soldering about 2 in. of No. 22 wire to each of the tags before screwing the holder in position and arranging these wires so that they projected beyond the ebonite base, any surplus of wire being subsequently cut off.

Wiring the Set

The operation of wiring up should present no difficulty, as there is plenty of room allowed between the components for even a large soldering iron to be used. Care should, however, be exercised when wiring up the coil holder, and for the guidance of readers the following procedure should be adopted:—

The first connection to be made should be that between "OUT" of the coil holder and one of the telephone terminals, and one side of the .0003 fixed condenser; this should be followed by connecting "G" to one side of the grid-leak and condenser.

The remaining connections should be made in the following order:—"E" to L.T. positive, "Æ" to the aerial terminal, "A" to the anode leg of the valve holder, "C" to the fixed vanes of the .00025 variable condenser, "TC" to the moving vanes of the .00025 variable condenser, and one side of the coil socket which will eventually hold the radio frequency choke, and the other side of this socket to "T."

The remaining connections are perfectly straightforward, and may be clearly understood from the wiring diagram.

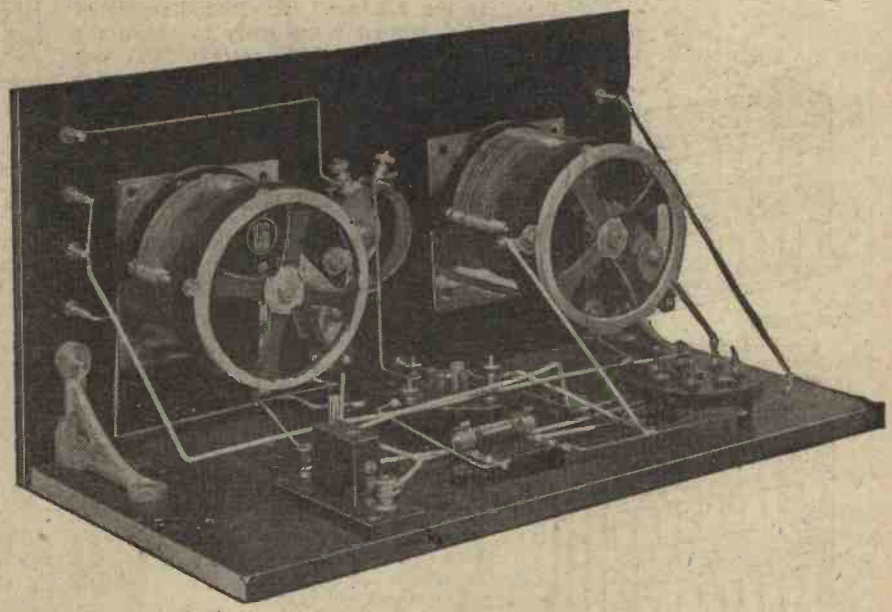
Testing the Receiver

When the wiring has been completed and carefully checked against the wiring diagram as published, insert the coil suitable for the broadcasting band of wavelengths in its holder, insert an ordinary No. 300 plug-in coil in the ordinary coil holder, turn the filament resistance to its "off" position, and insert a valve in the holder. Connect the telephones and L.T. battery to their appropriate terminals, when by slowly turning the filament resistance the valve should light up, its brilliance being controlled by the position of the arm of the rheostat.

Having satisfied oneself upon this point, disconnect the L.T. supply, and connect it across H.T. negative and H.T. positive terminals, noting that the valve does *not* light irrespective of whether the filament resistance be on or off.

Operating and Adjusting

If these preliminary tests have proved satisfactory, connect the L.T. across its proper terminals, and about 45 volts across the H.T. terminals, still keeping the special plug-in coil in position as before; no aerial or earth being connected, however. Set the grid tuning condenser (C_1) to some nominal value, and set the reaction condenser (C_3) to its zero reading, whereupon the valve may be lit to a suitable degree of brilliance and the reaction condenser slowly turned so that its reading is increased.



The wiring is very simple in character.

"Change Your Coil and Change Your Circuit"—*continued*

Self-Oscillation Details

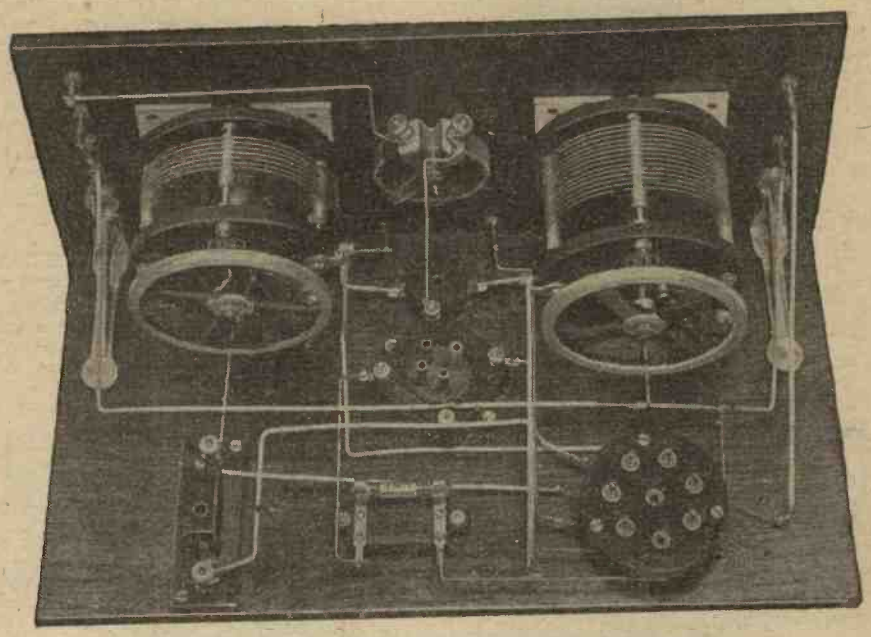
Proceeding in this manner will soon result in the set bursting into self-oscillation, and should this condition come about by a loud "plop" in the 'phones, the value of the H.T. voltage should be reduced until the "plop" becomes only weak in strength, whereupon reducing the filament current will reduce the "plop" still more until a point is reached where the set will not oscillate at all.

Adjust the filament current so that the set will only *just* oscillate at all settings of the C_1 condenser (it should be noted that as C_1 is increased so must the reading of C_3 be increased to keep the set in its most sensitive condition), and connect the aerial and earth.

The First Signals

It may now be noticed that the receiver will not oscillate at all, where upon the value of the H.T. voltage should be increased slightly until the smooth control reaction previously ex-

(*Continued on page 926.*)



The coils are kept well away from other components.

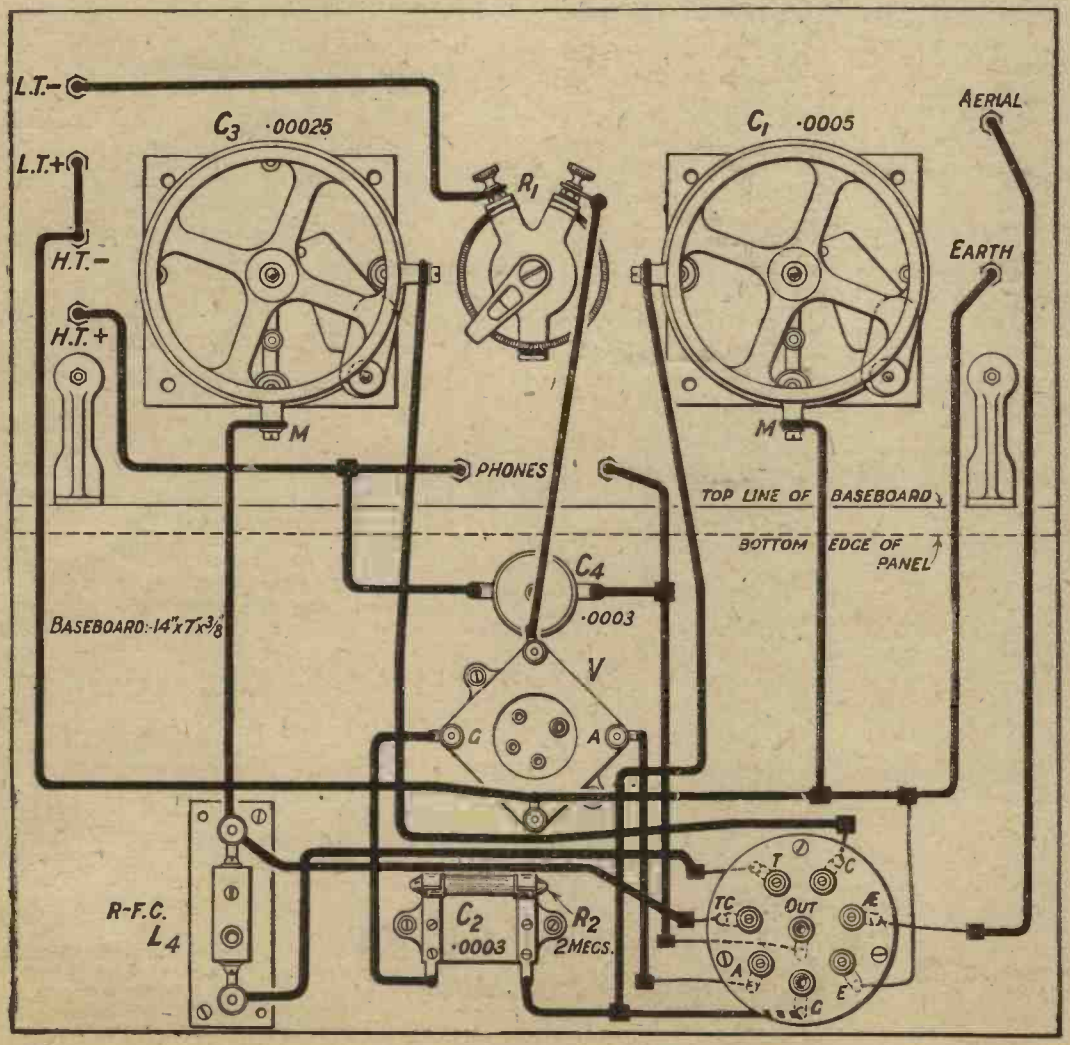


Fig. 6.

The method of making connection to the coils is quite clear from this diagram. (*Blueprint No. C1056B*).

SWITCHING ON THE LOW-FREQUENCY SIDE

By JOHN UNDERDOWN

You can add a number of refinements to your set by arranging to utilise a varying number of low-frequency stages.

IN last month's article attention was devoted chiefly to rotary stud and multi-pole 2-way switches, so this month it is intended briefly to deal with the application of jacks, but before so doing a further use for a 3-pole 2-way switch, which I have been asked to give, will be shown.

A Further Application

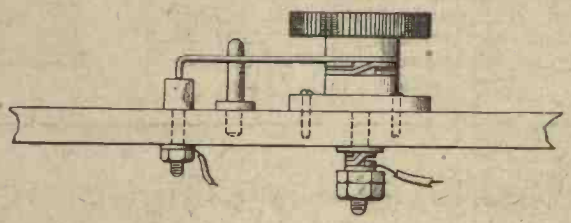
Where it is desired to employ telephones with two valves, for example, for tuning purposes, or to listen on the loud-speaker on the three, a very convenient arrangement is that of Fig. 1. Here a 3-pole 2-way switch is so wired that when working in the upward position, that is, on two valves, the last valve is extinguished and the telephones are brought into circuit. On placing the switch in the 3-valve position the H.T. connection to the detector valve is made through the primary winding of the L.F. transformer T_1 T_2, this valve still receiving its correct high-tension supply, from H.T. + 1, and the loud-speaker is brought into operation.

Plug and Jack Switching

Plug and jack switching has come into much greater vogue during the last few months than it had in the earlier days of broadcasting, being very convenient in use, and is generally quite simple to wire. Various applications and practical points to be observed are indicated in Figs. 2 and 3.

The circuit of Fig. 2 is that of a 4-valve receiver with two resistance-coupled note magnifiers, it being arranged, by means of three jacks, J_1, J_2 and J_3, to listen on the detector valve, on three valves or on four as desired. J_1 is a "closed-circuit" jack, and its connections here are somewhat interesting, in that the anode resistance R_6 is in series with the telephones when tuning is accomplished when the last two valves are out of circuit.

The simple stud switch is useful on many occasions.



An Important Detail

This is a practical point which should be noted, since if it is arranged by means of a double-circuit jack to cut the resistance out of circuit, when the telephone plug is withdrawn R_6 will replace these, and consequently, since the ohmic resistance of the telephones is small, a drop in the voltage applied to the anode of the detector valve V_2 will occur. If the set is carefully adjusted to be working just below the oscillating condition, this drop in applied H.T. voltage may be sufficient to render it far from this sensitive state, making readjustment of the potentiometer or reaction setting necessary to bring up signal strength.

Telephones or Loud-Speaker

J_2 is a "double-circuit" jack, and when the telephones are inserted therein and V_4 is switched off on its filament resistance R_4, the set functions as a three-valve receiver.

J_3 is a further double-circuit jack incorporated in the anode circuit of the fourth valve, and is wired in a somewhat interesting manner. With no telephones inserted, the loud-speaker is in operation, whilst this

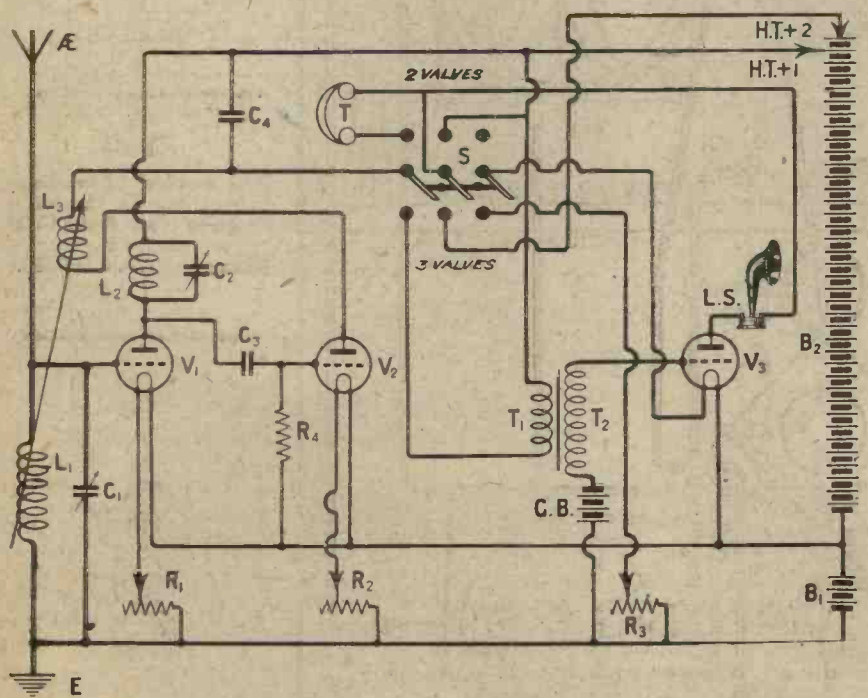


Fig. 1.—A three-pole change-over switch is required in this circuit.

Switching on the Low-Frequency Side—*continued*

latter is thrown out of use on the insertion of telephones.

Introducing Complications

Fig. 3 illustrates the employment of rather more complicated types of jacks, which are arranged to switch the filaments as well as the anode circuits of various valves. Jacks 1 and 2 are "filament-control double-circuit" jacks, and J_3 is a "filament-control single-circuit" jack. The insertion of a telephone or loud-speaker plug into J_3 lights and brings all three valves into use. Inserted into J_2, the last valve is extinguished and only two are in circuit, whilst in J_1, V_2 and V_3 are extinguished, and only the first valve is employed.

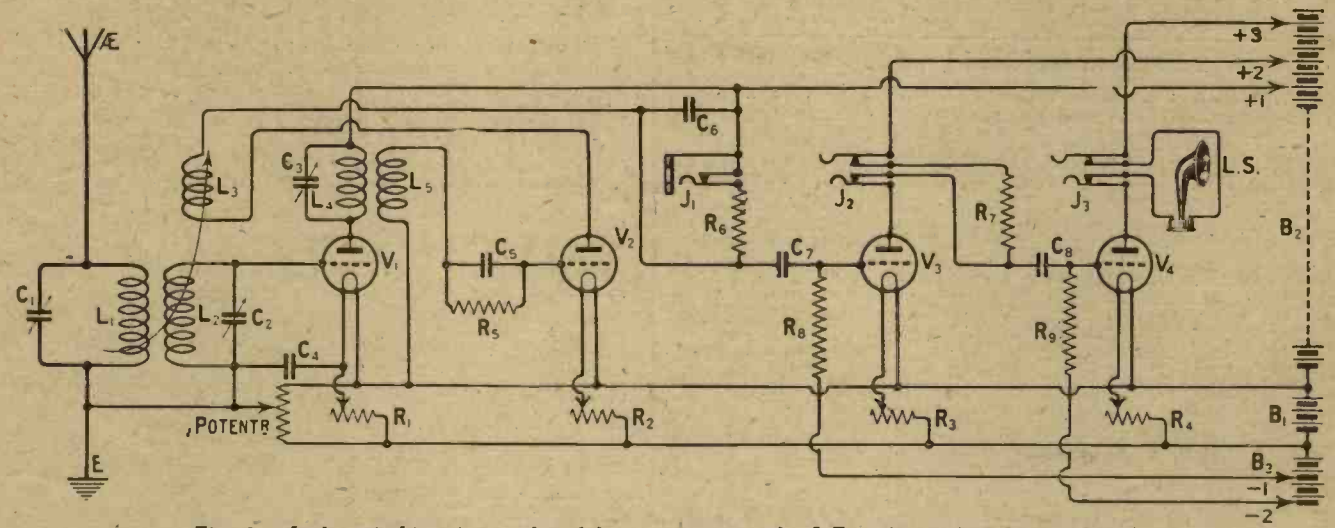


Fig. 2.—Jack switching is employed here to cut out the L.F. valves when not required.

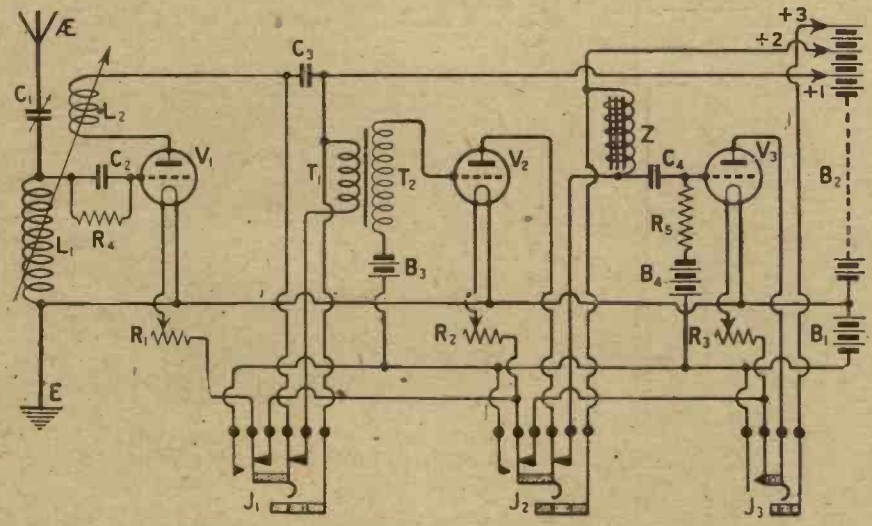


Fig. 3.—In this arrangement the jacks also switch the filaments on or off.

The arrangement of Fig. 3 is a very convenient one, but the wiring necessitated thereby is somewhat complicated, and my own personal preference is for the employment of the simpler types of jacks, the valves not required being switched off on their own filament resistances.

General Considerations

In deciding upon the system of switching to be employed on the low-frequency side the beginner often experiences difficulty in making his choice, but by considering the examples given both the advantages and the limitations of the three types dealt with should be fairly clear. My considered advice is always adopt the simplest possible system, and do not allow the more spectacular arrangements to unduly prejudice you into utilising switching which will make the wiring very complicated. Although there is less risk of introducing instability by incorporating some switching system on the L.F. side, than on the H.F. side of a receiver, the fact that unduly complicated wiring may lead to oscillation at low frequency should not be overlooked.

Important Points to Note

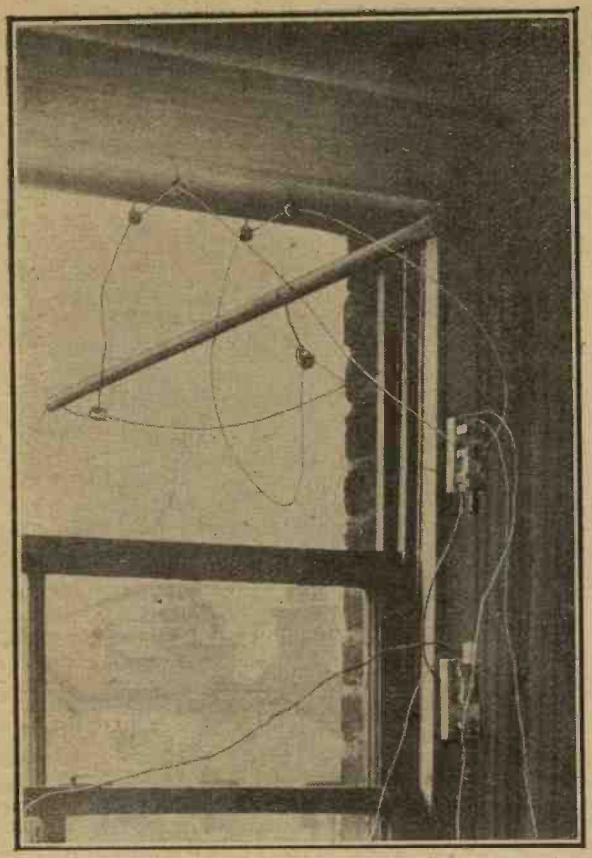
Where it is desired only to cut one valve out of circuit, generally the simplest type of switch to employ is one of the rotary stud type, but here

A simple type of jack.

the valve not required will have to be extinguished upon its own filament resistance, unless a further stud switch is incorporated. Generally, this type of switch will not operate simultaneously in both anode and filament circuits.

Switching the Filament

In cases, therefore, where it is required both to cut a valve out of circuit and to cut off its filament supply simultaneously, a 2-way switch of multi-pole type is to be recommended. Such switches, in the writer's opinion, are not suited for the work where several valves will be cut out of circuit, one at a time, and it is here that the plug and jack system makes its appeal.



SOME HINTS FOR THE SHORT-WAVE BEGINNER

By GEORGE T. KELSEY

Are you interested in short-wave reception? This article contains a full description of an ingenious aerial arrangement, together with some helpful hints and tips for the short-wave beginner.

THERE can be no doubt that the work of the amateur transmitter on short wavelengths has done much to annihilate distance. Only those who have actually listened will know the great thrill accompanying the reception of an amateur station whose call-sign denotes that he is transmitting in some distant land. "It certainly does sound exciting, but how can I listen to these stations?" you will ask. Well, first, it is necessary to acquire a short-wave receiver, and having done that to learn how and when to listen.

Scope for Experiment

An ordinary broadcast aerial can be coupled to the short-wave receiver, but much scope for ingenuity is provided by experimenting with various aerial systems.

In the article to follow, I propose to discuss, amongst other things, a very satisfactory aerial arrangement which is in use at my own home.

An Experimental Aerial

The ideal aerial would seem to be one which, although capable of being used as a broadcast aerial, will lend itself to experimental work. Such an aerial I have had in use for some time, and it is constructed on the lines shown in Fig. 1. The aerial consists of two equal lengths of 7-22's wire AB and CD, which can be shorted for broadcast reception, thus forming a "T" aerial. For the short waves, several different arrangements are possible.

First, AB can be used as an aerial while CD can be made to serve as a counterpoise. With this arrangement, and using two valves, the writer has received many distant stations including Brazilian 5AB.

A Useful Change-Over

The length AB can be used alone as the aerial for another experiment, employing a direct earth connection instead of the counterpoise, and this arrangement has proved quite effective when receiving distant stations. The use of the "T" aerial for short waves is particularly interesting, and by shorting the two lead-in wires this is possible, a direct earth connection being used in conjunction.

Switching Arrangements

By employing two double-pole double-throw switches it is an easy matter to employ any one of these arrangements with very little trouble, the connections being shown in Fig 2. The wires W, X, Y and Z, represent four leads for making connections to the receiver. With the switch arm of the top switch in the position 2, and that on the lower switch in position 1, then Y can be connected to the aerial terminal of the ordinary broadcast receiver, Z to the earth terminal, and the "T" aerial, with direct earth, will then be available.

It is important when constructing the aerial to make the lengths from A to B and from C to D exactly the same, otherwise a perfect "T" aerial will not be obtained when the top switch arm is in position 2.

Aerial and Counterpoise

To use the split arrangement as an aerial and counterpoise, the arm on the top switch should be placed in position 1. The two leads W and X are now ready for connecting to the receiver or coupling coil as the case may be. The lower switch in this instance is out of circuit so need not be touched. Regarding which half to use for the aerial, it matters little, and here again is an opportunity for experimenting. The two leads W and X might even be changed over when a signal is being received to notice whether an improvement in strength results.

Employing a Direct Earth

To try the effect of one half of the arrangement in conjunction with a direct earth is a simple matter. It is only necessary for the lead W or X, according to which is being used for the counterpoise, to be replaced by the lead Z, the arm of the lower switch being in position 1.

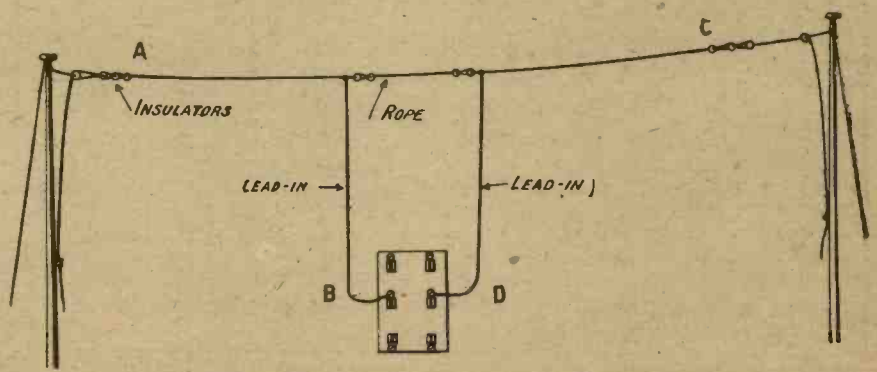


Fig. 1.—It is important when constructing the aerial to make the lengths AB and CD the same.

Some Hints for the Short-Wave Beginner—*continued*

Precautions Against Lightning

The prevalence of atmospheric disturbances during the summer months calls very definitely for some safety measure, and by placing both the switch arms in position 2 each half of the aerial is earthed.

Just one further suggestion before leaving the aerial subject. Try the simultaneous reception of two stations, say one on the broadcast band and one on short waves, by using the two suspended wires, i.e., AB and CD, as

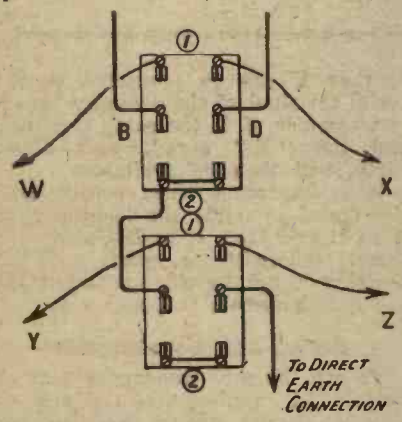


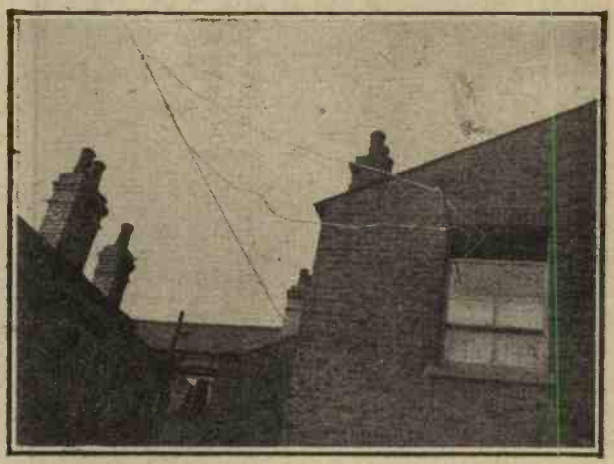
Fig. 2.—The switch arms have been omitted from this diagram in order to make the connections quite clear.

two aerials, connecting one to each receiver, and using a direct earth in each case. The aerial coil in the broadcast receiver will, of course, require to be considerably larger than was used previously in conjunction with the "T" aerial.

Methods of Coupling

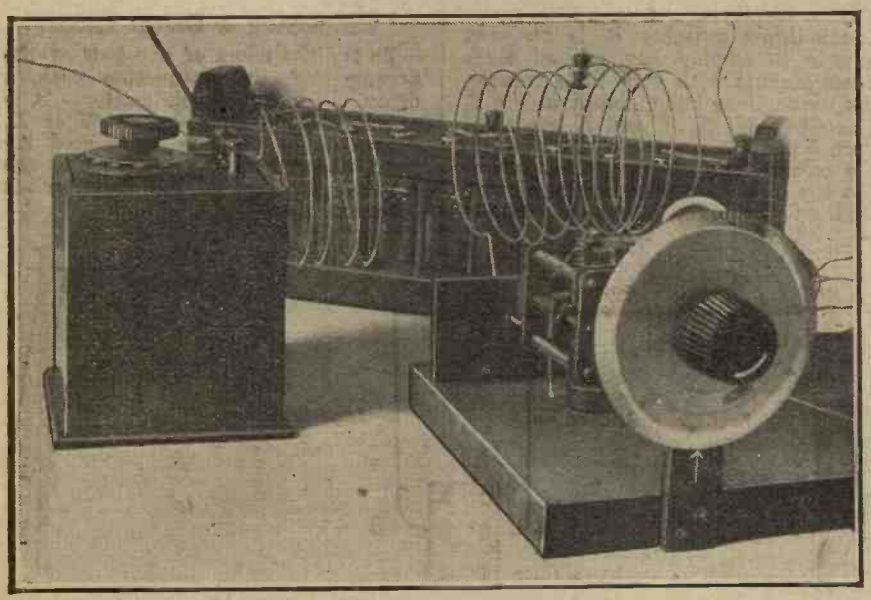
Perhaps a few words regarding loose aerial coupling will be of interest to readers. In one of the photographs accompanying this article the coupling unit used by the writer is shown. It consists of a variable condenser of .001 capacity mounted on a small ebonite panel, together with three terminals. The panel is mounted on the small box seen on the left of the picture. The coil on one side of this small box is the actual coupling coil, and it consists of five turns of 16-gauge tinned copper wire. This is coupled to the grid coil of the receiver, which employs Reinartz reaction.

The pole shown in the heading photograph may be seen in this view projecting from the top left-hand corner of the window.



Degree of Coupling

The distance between the coupling coil and the grid coil is not critical in operation, but if the coupling coil is brought too close it may stop the receiver oscillating.



If the coupling coil is brought too close to the grid coil it may stop the receiver oscillating.

It is often found that at one part of the tuning condenser on the short-wave set the receiver will absolutely refuse to oscillate for no apparent reason. This small range over which oscillation will not take place may be due to the set being tuned to the natural frequency of the aerial.

Curing the Trouble

To overcome this "dead" spot, the variable condenser on the coupling unit comes into service. It should be connected in series with the aerial; that is, between the aerial lead-in and the coil, and by varying the capacity of this condenser the receiver should oscillate in the apparently "dead" spot.

A Note About Reaction

A complete absence of the too-familiar "plop" when the receiver is brought into an oscillating condition is essential if short-wave telephony is to be received. If a "plop" is present, and adjustment of the filament and H.T. voltages fails to bring about a cure, try altering the value of the grid-leak.

It may be found that a fairly high resistance leak is required to cure the "plop," and in my own receiver one having a resistance of four megohms is employed.

When to Listen

There are quite a number of telephony stations to be heard on the 45-metre band, and on Sunday evening between the hours of 6 and 8 many stations can be logged.

Regarding the times to listen for distant C.W. stations, Brazilians may be heard when conditions are good in the evening, and the "BZ" mentioned previously was heard at 10.10 p.m. B.S.T. The American "Hams," whose intermediate letter is "U," can usually be heard under favourable conditions after midnight.

IMPROVE YOUR REACTION CONTROL!

By L. H. THOMAS (6QB).

Reaction, if properly controlled, forms an invaluable asset to a receiver; if improperly handled it is no more than a nuisance.

ONE hardly ever sees a valve receiver nowadays which does not make use of either "magnetic" or "capacity" reaction in some form, yet probably there is no

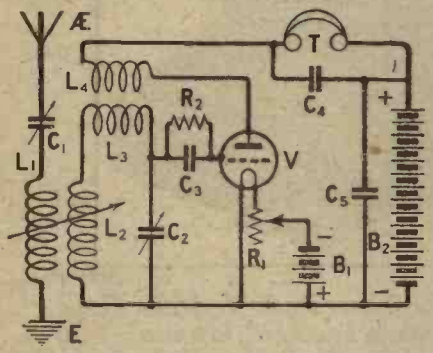


Fig. 1.—The circuit shown employs a "split-secondary" arrangement.

property of the three-electrode valve which is abused (in both senses!) to such a great extent. There seems to be an idea abroad that "reaction" is a kind friend which will compensate for all losses in the most inefficient of sets, and the writer has even met a so-called enthusiast who has expressed the opinion that the "low-loss idea is

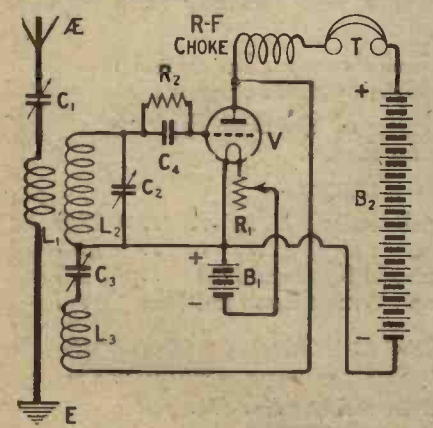


Fig. 2.—The reaction condenser C3 is placed so that one side may be at earth potential.

all bunkum, for if you use reaction, inductances can have as many losses as you like, and it won't make any difference"!

Compensating the Losses

The fact of the matter is that by using reaction in some form we can introduce negative "resistance" into the circuit, which will to some extent compensate for losses caused by badly-designed coils, etc.

A few years ago little thought was given to the use of any other form of reaction than the "swinging-coil" type, which, incidentally, is still a very widely-used system. A disadvantage of this method of controlling oscillation is not that a fine control is impossible—for with modern slow-motion coilholders quite a small movement of the coils relative to one another is obtainable with the greatest of ease—but that the movement of the reaction coil away from the secondary coil or A.T.I. causes a variation in the tuning of the latter circuit.

A Question of Practice

In the direct-coupled type of receiver, if we tune in to a station with a particular setting of the reaction coil and then increase the coupling between the reaction coil and the A.T.I., we shall have to alter the setting of the A.T.C. in order to pick the station up again. The same applies in the case of an inductively-coupled receiver, although, perhaps, to a lesser extent.

Until one has become used to operating the coilholder and the A.T.C., not alternately, but simultaneously, it is difficult to tune in telephony to the best advantage, and also one is extremely liable to oscillate and cause serious interference with neighbouring listeners.

A Way Out of the Difficulty

One way of "getting round" this difficulty is to use a split-secondary type of receiver, in which the aerial and earth are connected to one tuned circuit (corresponding to the ordinary primary coil), and the secondary coil is in two sections, one of which is coupled to the primary, the other being arranged at right-angles to this, and coupled to the reaction coil. The coupling of the reaction coil to this portion of the secondary will then have little effect upon the tuning of the aerial circuit and its part of the secondary. A receiver built on these lines was described by the writer in *Wireless Weekly* for March 17, 1926, and the circuit diagram is shown in Fig. 1.

Reaction may often be controlled by means of a small neutralising condenser.

The Popular "Reinartz"

A rather easier method of controlling reaction, more or less independently of the tuning of the secondary and primary circuits, is to use one of the various forms of capacity reaction, most of which have little effect upon the tuning of the other circuits. Fig. 2 shows one of the best forms of "Reinartz" reaction, which is very easily controlled. Here a high-frequency choke is inserted in the anode circuit of the detector, and no by-pass condenser is usually connected across the telephones.

Thus there is no path provided for H.F. currents in the usual manner *via* the H.T. battery to earth. A path of variable impedance is provided through the condenser C_3, and this is

Improve Your Reaction Control!—*continued*

used to control reaction. It will be seen that this is really produced by the coupling of the coils L_2 and L_3, but is *controlled* by the condenser C_3.

"Throttle" Control

A form of capacity-controlled reaction is easily obtainable on an ordinary "swinging-coil" receiver as follows:—If a low-frequency amplifier is in use after the detector, simply substitute a variable condenser of about .0003 capacity for the fixed by-pass condenser already across the transformer primary, or, better still, connect it across the primary and the H.T. battery, as shown in Fig. 3. This will enable a very fine control of oscillation to be obtained, and one which has only a negligible effect upon the tuning of the aerial circuit.

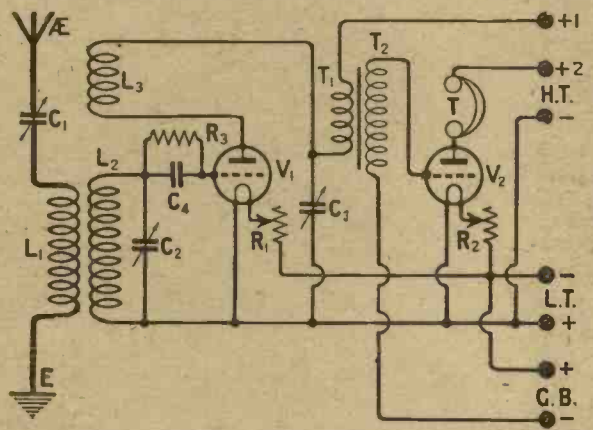


Fig. 3.—A fine control may be obtained by means of a variable condenser connected across the transformer primary and the H.T. battery.

Only a Slight Alteration

If a single valve only is used, however, it will probably not be sufficient to insert a variable condenser across the telephones, since the capacity of the 'phone cords, and the capacity to earth *via* the wearer of the 'phones, will probably by-pass quite enough H.F. current to maintain the receiver in an oscillating state. The obvious remedy is to insert a high-frequency choke between the end of the reaction coil and the telephones, as shown in Fig. 4, and to connect the variable condenser again from the end of the reaction coil to the L.T. +. Both these methods of controlling reaction may probably be brought into use in your own set within a quarter of an hour or so, and the astonishing increase in the ease of operation will certainly make it worth while to add these refinements.

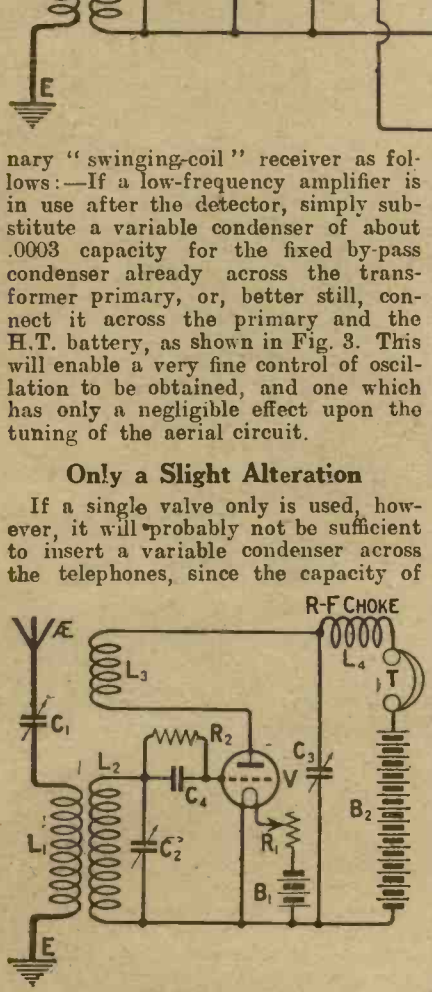
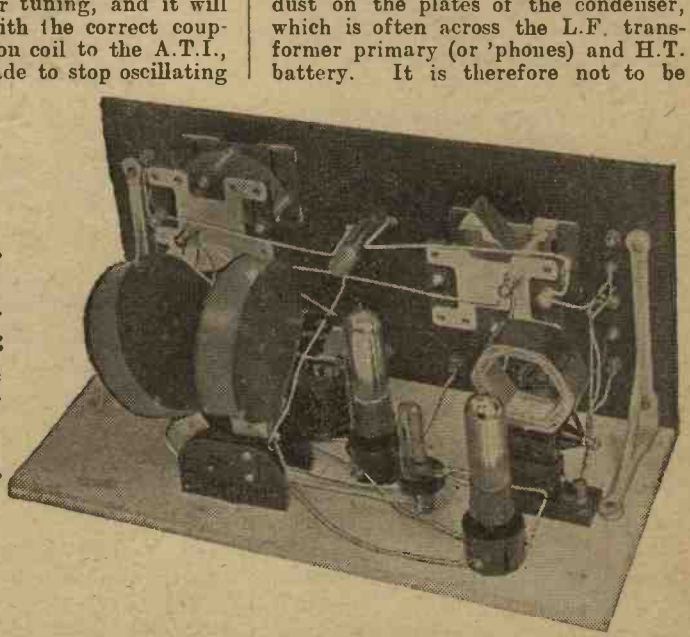


Fig. 4. — Improved results may be obtained by inserting a radio-frequency choke in the position shown.

An Unusual Method

An unusual, but at the same time very efficient, means of controlling the oscillation of a set is to use a direct-coupled or auto-coupled aerial circuit, with a variable condenser in series with the aerial, and another across the A.T.I. (in parallel). The parallel condenser is used for tuning, and it will be found that with the correct coupling of the reaction coil to the A.T.I., the set can be made to stop oscillating by increasing the amount of *series* condenser in circuit. The effect of doing this is to increase the damping effect of the aerial upon the grid circuit, and thus to vary the degree of oscillation.

Unless a good coil-holder is used, "swinging-coil" reaction control is apt to be troublesome.



On the Short Waves

As is well known, for short-wave work the aerial is often coupled to the A.T.I. by a small condenser, and the larger the condenser is made, within reasonable limits, the more efficient is the performanee of the receiver.

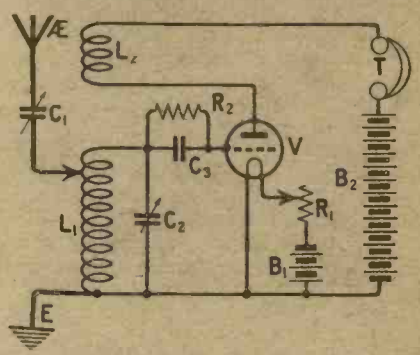


Fig. 5.—Reaction may be controlled here by increasing the amount of capacity in series with the aerial.

I have found that if the aerial series condenser is fairly small, say of .0002 capacity, this method is excellent for controlling reaction on short waves.

A Helpful Refinement

Apropos Reinartz reaction, too often it is found that objectionable noises are heard when the reaction condenser dial is rotated. The writer has found these in most cases to be due to minute leaks caused by an accumulation of dust on the plates of the condenser, which is often across the L.F. transformer primary (or 'phones) and H.T. battery. It is therefore not to be wondered at if the set is noisy. The simplest remedy is to connect a large fixed condenser in series with the variable, which will have the effect of keeping the high potential off the plates of the latter.

MY friend Mr. Gumplethorpe is feeling very perplexed just now. Hardly had the winter departed when his eye was caught by a poster which ordered him peremptorily to take his holiday early and get the best of the weather. Mr. Gumplethorpe, who is a law-abiding soul, is the kind of person who always obeys instructions of this kind. If he sees a sign which says keep to the right he keeps to the right, even if it means cannoning violently into heaps of other people who are failing to do as they are told.

One day, I remember, whilst he was in London he observed written upon a neat little board, "Wait Here For The Highgate Trams." Mr. Gumplethorpe did not in the least desire to go to Highgate, but he felt impelled to wait just the same.

Take Your Holidays Early

Since he is that kind of person, you may imagine that he at once decided to take his holiday in May and get the best of the weather. Lightheartedly he departed for Bogmouth, only to find that there was not any weather worth speaking about, or perhaps I should say that there were samples of all kinds of weather, which everybody was speaking about quite a lot. Chilled to the marrow and without a dry stitch in his wardrobe, he decided at the end of a couple of days that he had possibly taken the advice rather too literally.

The Month of Roses

He returned home, resolving to have a glorious time in June, which other posters assured him was the best of all months. On the first of that month he departed from Skeggspool, where he stuck it for three days. His third attempt resulted in a July visit to Scarbourne, and yet another wash-out—I am using the last word in the literal sense. He tells me that if his August endeavour is unsuccessful he intends to take his real holiday in Spitzbergen at Christmas time, for, as he says, you are pretty certain of the weather there at that season.

Good Intentions, Poor Realisations

All this dashing about the country has, of course, interfered seriously with his practical devotion to wireless. He intended to build a three-valver at Bogmouth, but his hand was shaking so when he tried to use a scriber that all his straight lines looked like the conventional signs for resistances. In June he had made every preparation for building at Skeggspool a fifteen-valve super, but found it quite impossible to eliminate the damping. In July he decided upon a less ambitious programme at Scarbourne, taking away with him the materials for a simple crystal receiver; but as the cabinet and everything else warped, he reluctantly decided to postpone construction until his return home.

. . . *He keeps to the right* . . .

The Worried Professor

When I dropped in to see him a week or two ago I found him much worried about his next receiving set, for he was quite unable to decide what to build. "Why not the Five Fifteen?" I asked. "If you would kindly pay attention," said Mr. Gumplethorpe, "you would find that I am talking about wireless sets, and not about trains." I explained that the Five Fifteen *was* a wireless set, though for the life of me I could not

. . . *Won't that look beautiful* . . .

remember the reason why it was so christened. After some discussion, we came to the conclusion that it must be a receiver specially designed for bringing in the Children's Corner. On thinking it over, I am still not quite sure that this is correct.

That Single Control

Mr. Gumplethorpe hesitated for a long time about making up the Five Fifteen, but after much thought he resolved to produce a design entirely of his own. The main feature was to be that it should possess but a single control. We christened the receiver provisionally the "Simplicity Five," having decided that to call it the "Five One" might savour of plagiarism. Having, fortunately, a 24 × 8 cabinet, complete with panel, at hand, Mr. Gumplethorpe drilled a single three-eighth inch hole right in the middle of the virgin expanse of ebonite, and said with a smile, "Now won't that look beautiful when it is finished."

Selectivity of the Best?

Two or three days later he told me that the "Simplicity Five" was finished, and begged me to come in at once to sample it. I went. There seemed to be something not quite right about the "Simplicity Five." It appeared, for example, to be slightly lacking in selectivity, since he had difficulty in separating Radio-Paris from 2LO. When he was making his original designs Mr. Gumplethorpe had assured me that slight movements of his single knob would enable him to bring in dozens and dozens of stations.

His expectations were fully justified; the only drawback was that it brought them in all at once. You know what happens when you have called in to see a set made by somebody else. Ideas for improvements rush by the dozen into what you are conceited enough to call your brain.

Helpful Suggestions

My first suggestion was that the rectifying valve should have a variable grid-leak. Mr. Gumplethorpe thought that this was a good idea, and that possibly a further improvement would result if he fitted similar gadgets to the two H.F. valves. We got to work at once, and put these in in a neat row on the panel. This made things a little better, though there was still a background of Aberdeen when we tuned in Stoke. Mr. Gumplethorpe thought that he might obtain increased selectivity by rather finer filament control than that provided by the fixed resistances that he was using. By skilful planning we found room for a straight row of five rheostats. It was getting rather late then, but we just had time before we parted to add a variable resistance connected across the secondary of the first low-frequency transformer.

Results Show an Improvement

Next day Mr. Gumplethorpe called in to tell me that he was obtaining promising results from the addition of a vernier rheostat to the rectifier

"THE SIMPLICITY FIVE"—*continued*

valve. I thoroughly approved of this and suggested that he should convert his present single-circuit tuner into a double by adding a two-coil holder. I also told him that I was a great believer in tuning both the aerial and the grid circuit of the first valve. Mr. Gumplethorpe promised to make these little alterations and said that after considerable thought he had decided to tune both the grid and anode circuits of all the high-frequency valves.

. . . Scrap the original cabinet . . .

A Larger Panel

On my next visit we found it necessary to scrap the original cabinet since its panel hardly gave us room for the five variable condensers that were needed in addition to the other gadgets. As we found that all this tuning rendered the receiver somewhat unstable we resolved to neutralise the high-frequency valves and to fit the rectifier with capacity reaction. This meant three more small condensers for which room had to be found. A 36 × 8 panel was promptly ordered and as soon as it arrived we got to work once more.

Vernier Dials Essential

Hardly had we begun to try the set out in its new form when it occurred to me that really fine tuning was prac-

. . . A 72-inch panel was needed . . .

tically impossible with the large condensers fitted. We found that things were very much better when we had provided each with a vernier. As things were becoming unduly crowded Mr. Gumplethorpe despatched an order by wire for a 42-inch panel.

Switches, of Course

This, of course, gave us a much wider field for our activities and we were able to tap the anode coils and to mount selector switches on the panel. Then I began to wonder whether it would not be a good idea to add a potentiometer and a neat little switch for enabling the gridleak to be connected at will to filament positive or filament negative. Mr. Gumplethorpe heartily approved and said that as the question of switches had been raised he proposed to add a series-parallel arrangement as well as one for giving the tune or standby positions at will. These we rigged up without delay.

Still Growing

We now found that with all five valves in use signal strength from the local station was excessive. It was a simple business to add one of those little lever switches which enable one high-frequency valve to be cut out. A 48-inch panel was ordered and we settled down once more to our task. Except that it seemed to need a grid battery with selector switch, the high-frequency end of the set now seemed pretty good. We therefore turned our attention to the note-magnifying department, pausing first for a little while whilst we provided the rectifier with a variable grid condenser.

Further Complications

Having worked out a very neat switching arrangement for cutting out one of the low-frequency valves at will we next fitted a tone filter, using a number of clip-in condensers and arranging for the raising or the lowering of the pitch by means of a particularly neat ten-stud switch. As Mr. Gumplethorpe possesses both high and low resistance loud-speakers we also devised a switch which would enable a telephone transformer to be brought into circuit when required, and another switch enabled him to use the tone filter or not just as he liked.

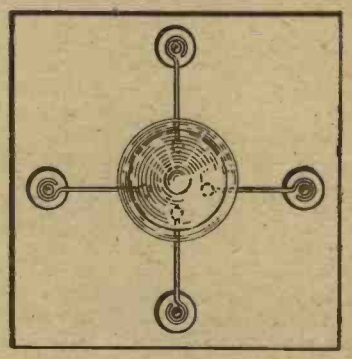
The Result!

Ordering a 60-inch panel so as to be on the safe side we enormously improved the selectivity of the set by building in a wave-trap. When we had added switching arrangements to permit different kinds of wave-trap to be used, and had incorporated a neat device by means of which transformer, or resistance-capacity, or choke-capacity coupling could be obtained at will between the first and second note magnifiers, we found that a 72-inch panel was needed if there were to be any more improvements, as it was practically certain that there would be.

Mr. Gumplethorpe rather hankers over "The Five Fifty-Seven" as a name for his latest production, but somehow I think that "The Tragic Five" suits it better.

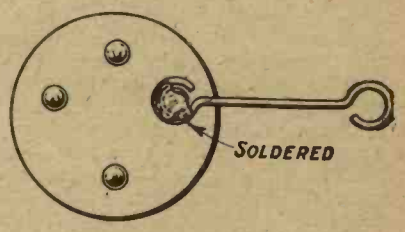
ANOTHER VALVE HOLDER TIP FROM A READER

SIR,—In the issue of THE WIRELESS CONSTRUCTOR for July you publish a letter from a New Zealand reader, Mr. L. J. Mason, giving a tip for valve mounting. May I be allowed to bring to your notice a somewhat similar method of valve mounting which I



have used and found very satisfactory in practice? This consists in forming small loops at the end of lengths of No. 16 S.W.G. bare copper wire, slipping these loops over the tips of the legs of the valve and soldering them in position. The lengths of wire are then cut to be about an inch long, and loops are formed at the free ends. These latter loops fit on to terminals suitably spaced out on a piece of ebonite.

This arrangement, of course, prevents one from using the valves in ordinary valve-holders, unless the wires are taken off and the legs are scraped



clean of solder. Since I make up all my "valve-holders" in this way now, I do not myself find this any great disadvantage. This method of mounting must be of low self-capacity, since there is nothing but air between the valve legs, and I also find that it provides quite a good anti-microphonic support for the valve, owing to the springiness of the lengths of wire. By arranging all the groups of terminals in exactly the same positions in different "holders," the valves are readily made interchangeable.

Yours faithfully,
A. R. WILSON.

Manchester.

DO YOU KEEP A CRYSTAL CHECK?

An interesting adjunct which should be made up by anyone who has a multi-valve set.

THE uses of a crystal set are not confined to simple listening to the programmes from the local station. There are cases in which such a set is of assistance to the multi-valve enthusiast, and the receiver described in this article is designed to serve not only as a simple crystal set, but also as an adjunct to a valve set.

A Check on Quality

Occasions arise from time to time when the quality of the reception deteriorates, and the results are not as satisfactory as usual. It may be that after investigating all the usual sources of trouble, such as run down H.T., incorrect grid bias, etc., the quality still remains poor.

In such circumstances it is useful to be able to obtain an independent check on the transmission itself, and a crystal set is admirable for this purpose, since the reproduction is as nearly perfect as can be and the expense of upkeep is nil.

Other occasions on which a standby crystal set are useful will readily occur to the reader and need not be further elaborated.

Simple Switching

The present set, therefore, has been constructed with a view to providing a simple reasonably efficient arrangement. A change-over switch is provided to enable the set to be cut in or out at will. With the test set cut out, the aerial and earth are connected direct to the receiver, while in the other position the aerial system is connected to the crystal set, the 'phones being removed from the ordinary receiver and connected in the crystal circuit.

The Circuit

The actual circuit is shown in Fig. 1. The aerial and earth are connected to the centre-poles of the change-over switch. One side of the switch goes to further terminals, ultimately connected to the receiver, while the other side goes to the tuned circuit. The aerial circuit is only connected across a portion of the coil. This enables the set to be used on a variety of aerials with satisfactory results. While the position chosen is not necessarily the optimum tapping, it serves to reduce the effect of different sizes of aerial.

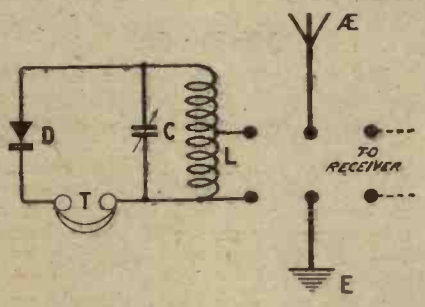


Fig. 1.—The change-over switch connects the aerial and earth either to the set or to the crystal check.

The Components

The construction adopted is of a very simple character, although, nevertheless, quite efficient. The whole has been mounted on a wooden panel, and is only 6½ in. by 4 in. when complete. A dial-o-denser has been used, so that the depth of the set is only about 1 in.

The components required are:—

One dial-o-denser, .0005 (Portable Utilities, Ltd.).
One permanent crystal-detector (R.I., Ltd.).
One change-over switch.
Six terminals.
One plywood panel, 6½ in. by 4 in.
¼ lb. No. 22 d.c.c. wire.
One length of Glazite wire.
Packet of Radio Press panel transfers.

Mounting the Components

The first stage in making up the set is to drill the holes for the variable condenser, the six terminals, the crystal detector and the change-over switch. The instructions for fixing the dial-o-denser are given with the component itself, and no difficulty will be experienced on this point.

Mount the change-over switch and crystal detector in the positions shown and finally insert the six terminals.

The two pairs at the top of the set

A Useful Accessory to Any Valve Set

are for the aerial and earth and the connections to the receiver, the bottom two being for the telephones.

The Coil

The coil itself has been home-wound, and consists of a simple hank coil. This may be wound with 22 double cotton-covered wire on a suitable cylindrical object having a diameter of about 2½ in. or 3 in. An ordinary tumbler will serve if of sufficiently large diameter.

Wind on 10 turns and then take a loop out as shown in Fig. 3. This will serve for the tapping to the crystal detector. Continue the winding now for another 25 turns, making 35 in all. This will tune with the .0005 condenser on an average aerial over the whole of the B.B.C. wavelength range.

Wiring Up

The coil is held in position by the wiring, as will be seen. Wire up the set as shown in Fig. 3. The details are of the simplest, the only special point being the coil.

The beginning of the coil is connected to the earth side of the switch and to the spindle of the dial-o-denser. The tapping at 10 turns is then taken to the aerial side of the switch, and the end of the coil is connected to the crystal detector and the flex lead on the dial-o-denser.

Operation

The receiver is very simple to operate. It may be hung on the wall

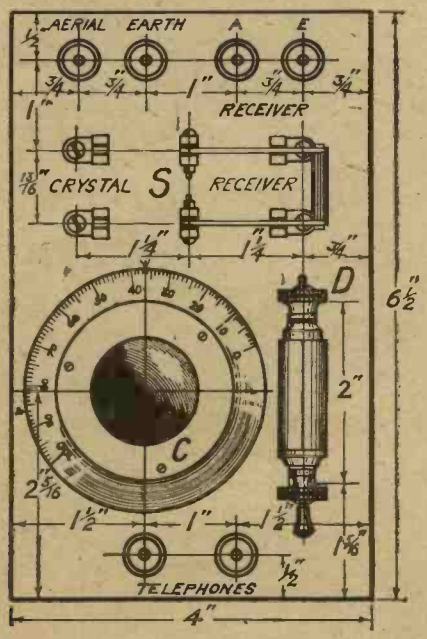
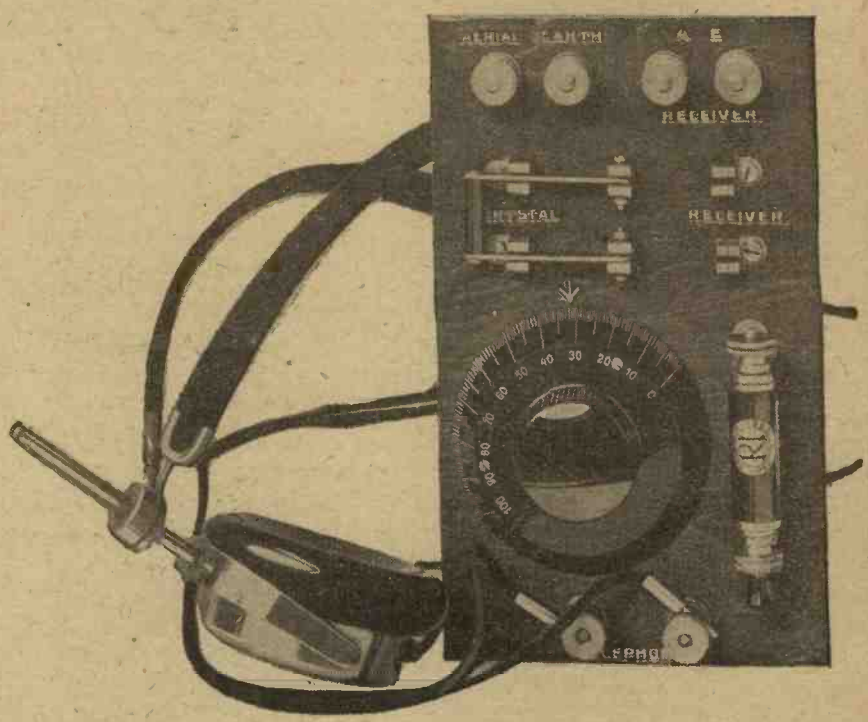


Fig. 2.—The layout of the components may be obtained from this diagram.



The receiver is of very small dimensions.

or placed in any convenient position. The aerial and earth are connected to the top left-hand terminals and two leads then taken from the right-hand terminals to the ordinary receiver.

Place the switch to "receiver," when the receiver may be operated in the usual way.

To obtain a check on the quality, place the switch to "crystal" and connect the 'phones to the terminals provided. On tuning the condenser now the local station will be obtained and the transmission may be accurately gauged.

An Indication

If the quality on the crystal set is satisfactory, this shows that there is a fault on the receiver itself. The usual points may then be looked to in order to trace whether there is any source of distortion in the receiver.

It may be that there is too much reaction on the high-frequency side. This will cause the tuned circuits to be too near the oscillation point, which causes "woolly" quality as if the speaker had a plum in his mouth.

Correct Grid Bias

If this is not the cause of the trouble, the L.F. side may be investigated, and the grid bias on the valve or valves varied slightly to see if the quality is improved by so doing.

Too little grid bias will allow grid current to flow and will give rise to distortion, but on the other hand too much bias will give an equal amount of distortion.

Suitable Valves

If a loud-speaker is used a power valve is essential on the last stage if

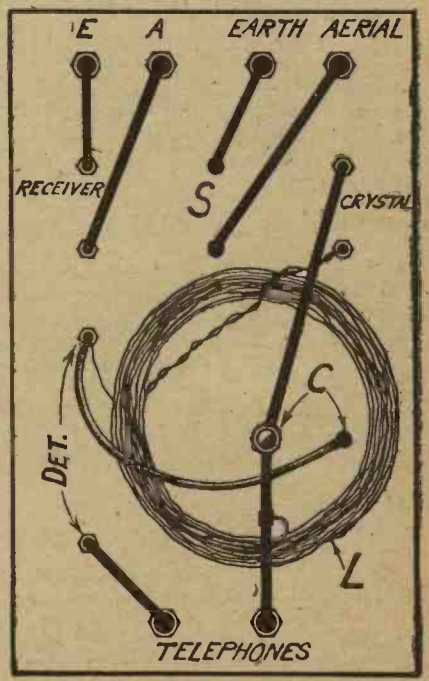


Fig. 3.—The wiring is very simple.

DO YOU KEEP A CRYSTAL CHECK?—*continued*

any volume is to be handled. If an ordinary valve is used the characteristic may not be long enough to provide true reproduction.

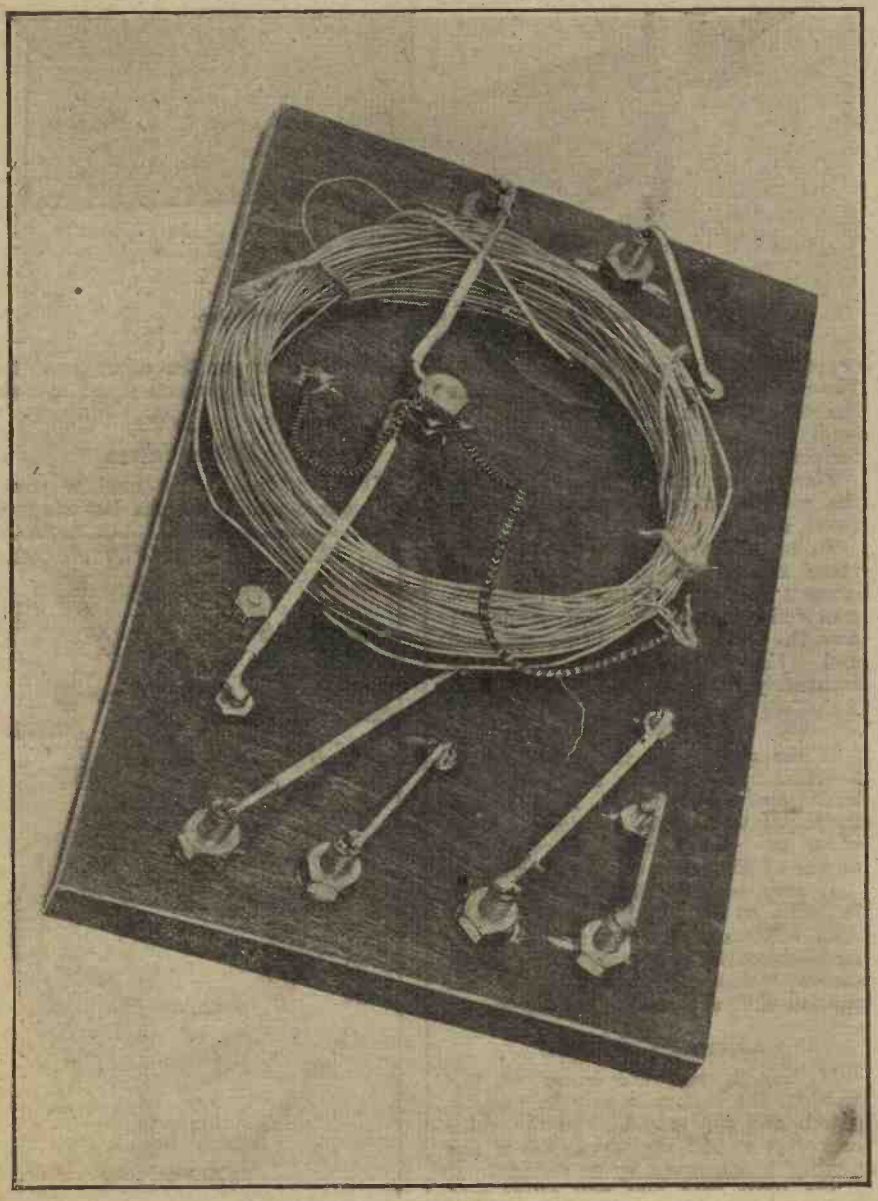
A Useful Adjunct

On the other hand, if the quality on the crystal check set is poor then this shows that for some reason or other the transmission is at fault. This, of course, is not often the case, but it does happen at times, and on such occasions the crystal check will save a good deal of trouble in locating the fault.

In Case of Breakdown

It occasionally happens, too, that a breakdown occurs at the local broadcasting station, and the listener is temporarily in doubt as to whether or not it is his receiver which is at fault. The natural inclination on such occasions is to make all possible adjustments on the receiver to see whether the fault can be put right. Nothing, of course, is achieved by this, and very often a valve receiver will be set into a state of oscillation by such handling, in an endeavour to find the carrier wave from the local station.

This undesirable state of affairs may be avoided if the crystal check is installed. So long as the listener's aerial and earth system is known to be in order, then listening on the crystal set will indicate whether the local station is actually working or not, and much needless trouble and annoyance will be saved.



A hank-wound coil is employed in this receiver.

YOUTH AND THE "MIDGET" RECEIVER

SIR,—I feel I must write and tell you of the splendid results I have had with the "Midget One-Valve Receiver" designed by Mr. A. S. Clark (May, 1925, issue of THE WIRELESS CONSTRUCTOR). I have not long made it up but have got over 90 stations, including amateurs. Some of the broadcasting stations are 5XX and 2LO audible and readable on an Amplion loud-speaker, 6BM, 2ZY, 5WA, 5NG (obtainable in daylight any day), and Leeds-Bradford. The best of the foreigners is Hamburg, then comes Radio-Toulouse, Brussels, Dortmund, Bremen, Hanover, Rome, Union Radio Madrid, Münster and Munich. Koenigswusterhausen and Hilversum are also clear at times.

My aerial is of the single-wire type, 75 ft. long, with lead-in 15 ft., while the earth consists of five wires spread fan-wise under the aerial about 1 ft. deep. The panel is the same size, but slight alterations have been made in the set while keeping the wiring quite short. The set goes down to the short waves well (125-200 metre band), and many amateurs are heard. I am 15 miles from London, and 15 years old.

Wishing you all prosperity.—Yours sincerely,

J. B. COXALL.

Inglenook.

P.S.—I agree with Mr. Clark that the shorter wiring is better. I have made long-wire sets and tested them against the "Midget," which comes out top every time.

* * *

SIR,—I am writing to tell you how much I appreciate the "Midget One-Valve Receiver" as described by Mr. A. S. Clark in the May, 1925, issue of THE WIRELESS CONSTRUCTOR. So far, using 35 and 75 coils, I have received 6KH faint but just readable, 5NO at good 'phone strength, 2LS clear, 2ZY loud, Dublin at good 'phone strength and also one German station whose call-sign I could not identify.

Wishing THE WIRELESS CONSTRUCTOR every success.—Yours faithfully,

BRIAN POMEROY.

Harrogate.

P.S.—Although I am only 14 I found no difficulty in constructing this set.

TALKS TO BEGINNERS

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

This is the fifth article of Mr. Harris' interesting series.

V.—MORE ABOUT TUNING.

LAST month we talked about condensers, and I explained how variable condensers are made to interleave their plates so that the capacity, as it is called, can be varied continuously within limits. I mentioned that when we connect the source of electricity to a condenser a certain time is taken to charge it, and the larger the condenser the longer the charging period.

If the condenser is already charged and we connect the two terminals by means of a wire, the state of electrical strain set up in the insulating medium between the plates (constituting the charge) will be released and a momentary electric current will flow between the two condenser terminals. The condenser will not discharge absolutely instantaneously, but a certain definite minute period will elapse before the discharge is completed. The manner of this discharge is highly important if we are to understand the way a wireless receiver works.

Magnetic Effects

If we connect a length of wire to the two terminals of some source of electrical pressure, such as a battery, a dynamo, or a charged condenser, a current will start to flow in the wire. At the same time a magnetic field will begin to form outside the wire. Until this magnetic field is formed the current will not flow steadily, and as a certain time is taken for the building up of this field, the flow of current is not instantaneous when we connect the wire to the two terminals of a condenser.

Furthermore, if we have a wire wound in the form of a coil, the magnetic field surrounding each turn interacts with the magnetic field surrounding every other turn and hinders its growth. For this reason it takes a longer time for the current to be built up in a coil of wire than in the same length of wire pulled out straight. The longer the wire (coiled or straight) the longer the period taken for the current to reach normal. Similarly, if once the current has reached the steady state, the electrical pressure is varied, the magnetic field surrounding the wire takes a certain time to die down or increase further, and this all tends to hinder any change from taking place.

The Condenser Discharge

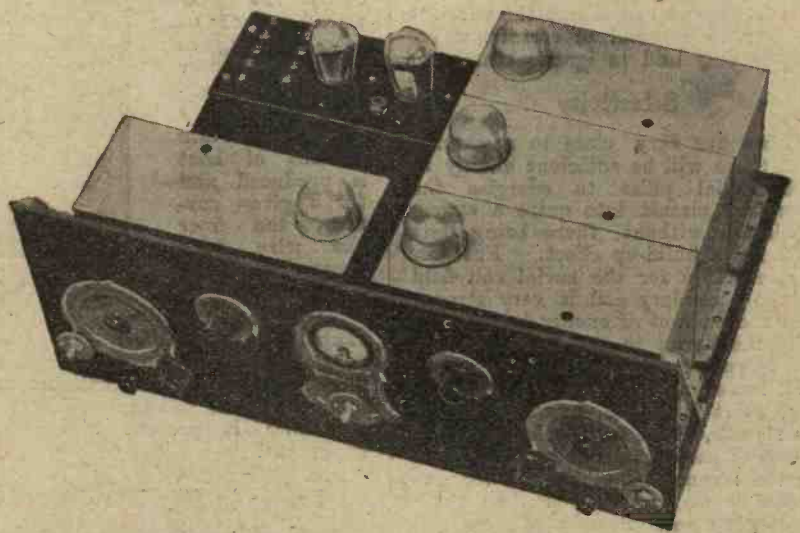
Now let us return to the case of our charged condenser, to the terminals of which we have connected a coil of wire. As mentioned already, the condenser is a source of electrical pressure when in a charged state, and this pressure being applied to the wire, tends to create a current in it. The building up of the magnetic field around the wire occupies a certain time, and with a given size of condenser, the discharge takes longer with a long coil than with a short one. Directly the coil is applied to the terminals of the condenser, a current starts to flow, and as the charge in the condenser is reduced, so the current will fall until a point is reached when the condenser has no further charge in it.

Now remember what we have just said about the magnetic field created around the wire as the current grows. When the point has been reached when there is no further charge in the condenser, there exists around the wire a magnetic field. This field must now die away, but in doing so it tends to make the current persist, and so the condenser over-runs itself, as it were, and is charged up by the effect of this field in the opposite direction. By the time the field has completely collapsed, therefore, there is a further opposite charge in the condenser which once again will tend to discharge, again setting up a magnetic field and again tending to prolong itself.

The phenomenon may be explained in a few words by saying that the discharge of the condenser is "oscillatory," swinging backwards and forwards till the current gradually comes to rest, much in the same way as a child's swing moves backwards and forwards until it gradually comes to rest.

Infinitesimal Time

To give you some idea of the time occupied in this process I may say that a condenser of the size generally used in wireless receivers for tuning, connected to a coil of some fifty turns of wire wound round a two-inch former, will discharge and charge itself again in the opposite direction at something between half-a-million and a million times a second—or rather at this *rate*, for the oscillations will not persist for anything approaching a second in such circumstances.



An example of a completely screened American receiver. Even the valves are screened!

Talks to Beginners—*continued*

If now we arrange what is called a "circuit" with a variable condenser and a coil of wire connected to it and in such a way that the pulses of electric current set up in the aerial by the oncoming wave act on this circuit, then, if the circuit is in "tune" or "resonance" with the frequency of the incoming wave, each little pulsation will add to the electrical oscillation of the circuit giving a building-up effect.

An Aerial Circuit

The manner of making this connection can take several forms. In one form a small coil of wire is connected in the aerial and the magnetic field set up around the coil acts on a second coil of wire to which the variable condenser is connected. Changes of the magnetic field around the aerial coil act on the second or "secondary" coil as it is often called, causing a series of charges in the condenser which are tuned to complete resonance. It is thus possible to build up by resonance quite a large charge in the variable condenser, but only provided that the value of the condenser capacity and the electrical size of the coil are correctly chosen. A built-up effect is therefore obtained on one wavelength only, wavelengths and pulsations of different frequency producing very little build up or "resonance" effect. This is why we can adjust the wireless receiver to respond to certain wavelengths only and to ignore others.

Selectivity

If we are very close to a station then there will be sufficient energy in each aerial pulse to energise the secondary circuit into quite a strong oscillation without there being any need for a build-up effect. Further, if interaction for the aerial coil field on the secondary coil is very strong, then the amount of energy transferred from the aerial to the secondary circuit in each pulsation will be large.

If, however, we "loosen" the coupling, as it is called, however strong the signals, there will be less transfer of energy each swing, and more chance for the resonance build-up on the one frequency we want rather than those we do not want. Sometimes the aerial is so connected that a part of the secondary coil forms the aerial coil while in very simple and non-selective sets, the whole of the secondary coil is also in the aerial circuit. This is called direct coupling.

Effect of Resistance

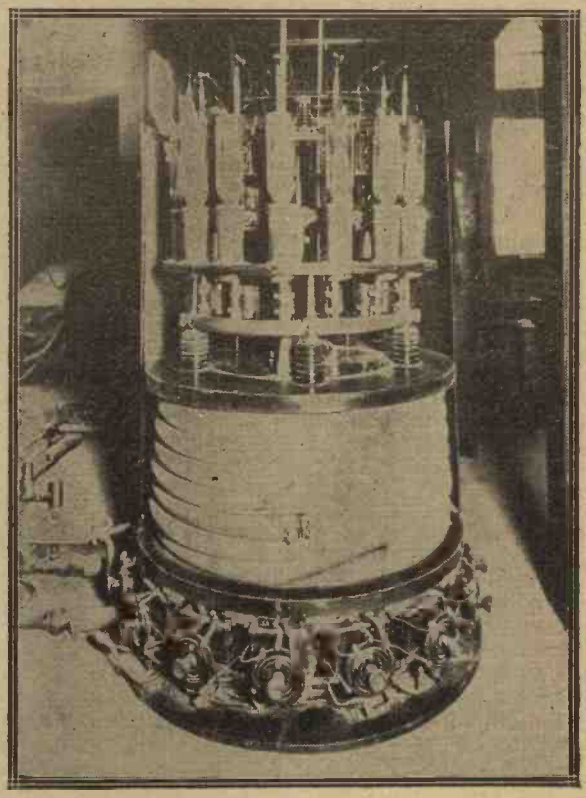
We have thus seen how it is possible to arrange a condenser and a coil of wire which can be adjusted to respond to certain frequencies only and not to others. Before we go further now we must consider the question of damping or resistance. Resistance plays a very important part in wireless in the question of selectivity.

If you try to ride a bicycle the bearings of which have not been oiled you will find it is very stiff going, for there will be friction between the moving and fixed parts in contact with one another. We have in electrical circuits an equivalent of this friction or resistance to movement. Whenever current flows through wire a certain resistance is offered by the wire, varying with the metal and size of the conductor.

An Extreme Case

An extreme case of a very fine wire through which considerable current is forced is evidenced within the bulb of an electric lamp. Here the resistance offered to the flow of the current is such that the wire becomes white hot, and emits the glow which serves us so usefully as light. Whenever an electric current flows in a circuit a certain amount of heat is produced and for a given current, the finer the wire the greater the heat.

In wireless receivers the currents are very, very small, and therefore we can use fine wire in receivers without undue loss in heat, but nevertheless the resistance is present and is very important.



A bank of power amplifying valves used in the Transatlantic Telephony Service.

Losses in Wireless Circuits

Resistance enters into our calculations when we consider the oscillatory current flowing in the circuit consisting of a condenser and a coil of wire or "inductance." Once we start energy oscillating in this circuit, it would continue oscillating indefinitely but for the losses of the circuit. These losses take two main forms, loss by resistance in heat and loss by radiation.

The energy lost by radiation is generally expressed in the same terms as that lost through heat. In a wireless transmitter we want to radiate considerable energy and so lose it from the circuit, but we do not want to waste energy in merely heating up the wire. To separate the two losses due respectively to radiation and heat, it is usual to refer to the former in terms of "radiation resistance" and the latter in terms of "ohmic resistance."

Radiation Resistance

It is the aim of a designer of a wireless transmitter to keep the ohmic resistance as low as possible and to have a good radiation resistance. A wireless transmitter which has no radiation resistance and all ohmic resistance would not broadcast at all, for nothing whatever would be heard from it!

It is usually to our advantage, however, to reduce the ohmic resistance in a tuning circuit as far as possible. For this reason there has been a great vogue of what are called "low-loss coils" or coils wound in such a way and of such material that the ohmic resistance is reduced to a very low figure. Resistance is not invariably bad in a wireless circuit, however, and is used in many cases to produce some useful effects. I will tell you about these in the next instalment of this talk.

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.

WHEN testing out a multi-valve set and using general-purpose valves, the best plan is to keep interchanging the valves so that they work in all positions and combinations. It will then most probably be found that some work better in one position than another, due to a particular inherent characteristic, and it is advisable then to mark the valves with the letters L.F., D., or H.F., so that they can be recognised quickly for future occasions.

IN order to get that "little bit of extra power" from a receiving set there is often a tendency to turn on the valves so that they glow a little brighter, or alternatively the expedient of using too high a value of anode voltage may be tried. With dull-emitter valves in use this practice should always be avoided, for although the filaments may not be burnt out there is a very grave risk of causing these filaments to lose their emission and necessitating a process of rejuvenation.

VALVE filaments that are manufactured from a mixture of thoria and tungsten go through a special heat treatment which enables them to give the same emission as ordinary tungsten, but at a lower filament temperature. To restore the emission lost through over-running as mentioned in the previous note, it is necessary to disconnect the high-tension supply and run the valve (or valves) at normal filament voltage.

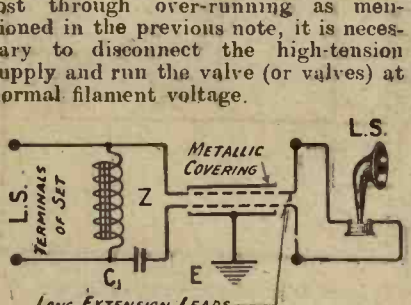


Fig. 1.—An earthed metallic screen round extension leads is helpful if A.C. hum is troublesome.

When this simple process proves ineffective a filament voltage of about three times the normal value should be applied for a *few seconds only* with the H.T. disconnected. Then light the valves at a little above their normal voltage with the H.T. still disconnected, and the emission will then be restored in the majority of cases.

This somewhat drastic treatment may result in a burnt-out valve, but since the valve would be useless in any case the experiment merits a trial.

THE provision of terminals in addition to soldering tags on many wireless components now on the market is, no doubt, welcomed by many home constructors who still experience difficulty with soldered joints. When using these terminals make quite sure that any lacquer is removed from the surface in contact with the connecting wire, and then tighten up the terminal nuts with a pair of pliers.

If this is done it will ensure that a sound electrical joint is made, and no difficulties should arise owing to intermittent contacts in the completed receiver which, of course, would militate against efficient signal reception.

IT often becomes necessary or desirable to remove the loud-speaker or telephones to some position in the house which is remote from the receiving set. When this is effected with the aid of extension leads it is frequently found that if the house is supplied with alternating current for lighting or power purposes an unpleasant humming noise is heard in the telephones or loud-speaker.

This effect can be minimised and often entirely overcome by trying various alternative routes for the run of the leads or by making use of twin cable which is supplied with a metallic sheathing or covering, and earthing this outer casing. If this is used in conjunction with a filter circuit, as shown in Fig. 1, then stability of working and absence of irritating noises can be obtained.

IT is frequently found that when wearing a pair of head 'phones during the hot summer weather the ear-caps and diaphragms become covered with moisture. While this is perhaps unavoidable, unless thoroughly wiped after use there is a liability of the diaphragms becoming rusty.

When there are any signs or oxidisation present steps should be taken immediately to repair the damage. The ear-caps must be removed carefully and the thin metal discs thoroughly wiped with a clean rag which has been

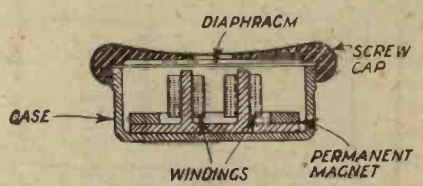


Fig. 2.—Failure in telephone receivers is sometimes caused by a break in the connection between the two coils.

previously soaked in a little paraffin. Since prevention is better than cure, a recurrence of the rust can be prevented if the exposed surface of the diaphragm is smeared over with a very thin layer of vaseline.

WIRELESS enthusiasts are often at a loss to account for a reduced efficiency in their telephones. This may be due to a variety of causes, such as the breaking down of one of the windings (shown diagrammatically in Fig. 2), or perhaps the cords have worn and caused the flexible wire to fracture. The remedy in both these cases is, of course, obvious.

In addition, it is frequently found that the permanent magnet loses its magnetism owing to insufficient ageing during the course of manufacture, rough treatment after purchase, or through passing the steady anode current round the windings in the wrong direction. The reason for employing a permanent magnet in telephones is interesting.

The small fluctuating currents produced by the wireless signal causes a varying pull to be exerted on the diaphragms. Without the magnet this would only result in a small movement of the thin disc, but when this fluctuating effect is superimposed upon the existing pull brought about by the magnet, then a much larger movement takes place and the resultant sound is increased.

TRY THESE NEW SELECTIVE CIRCUITS

By W. S. PERCIVAL, B.Sc. (Hons.), A.R.C.S.

An interesting account of some work carried out at the Elstree Laboratories to obtain selectivity with single-valve and two-valve receivers.

ON a well-designed single-valve detector used in conjunction with a good aerial, and under good atmospheric conditions a very large number of transmissions may be received at varying strengths. By the addition of one or two stages of note magnification many of these can be brought up to loud-speaker strength.

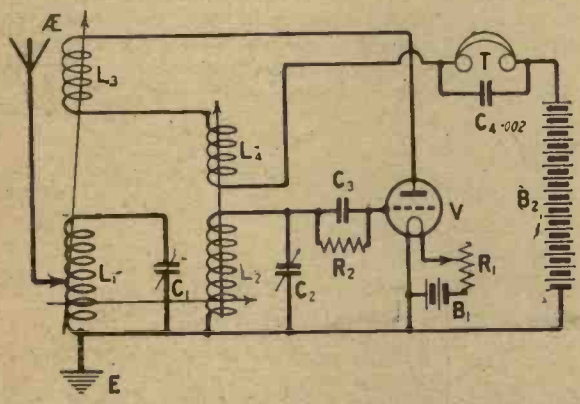


Fig. 1.—Double reaction is employed in this single valve detector circuit.

Unfortunately, a set of this type suffers from the serious disadvantage that quite a wide band of frequencies is partially or entirely blotted out by the transmission from the local station.

The Search After Selectivity

In the search after the requisite degree of selectivity necessary to cut out the local station within a small difference of frequency, several different methods have been devised. In the first place, a Reinartz or modified Reinartz circuit can be employed with which, if carefully designed, a very high degree of selectivity can be obtained. By decreasing the number of turns in the aerial circuit, selectivity can be progressively increased, but after a certain point signal strength falls at the same time. Another disadvantage from which a very selective circuit suffers is that the quality is impaired owing to the cutting off of the sidebands.

Suggested Methods

This difficulty can be removed in two different ways. In the first place a separate trap circuit can be employed, or, on the other hand, an additional tuned circuit may be added. The action of a trap circuit is really analogous to introducing a very high resistance into the aerial circuit at the frequency which it is desired to cut out. This, however, frequently has the effect of cutting down the strength of transmissions at neighbouring frequencies which it is desired to receive. The use of two tuned circuits before a detector valve is of very considerable interest as an alternative method, and although tuning is thereby rendered somewhat difficult to the inexperienced, an extremely high degree of selectivity may be obtained by this method.

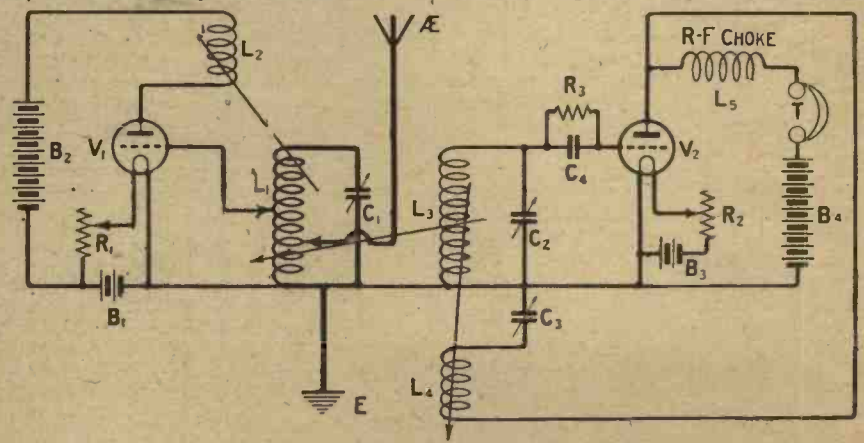


Fig. 2.—In this circuit a separate valve is used to produce reaction in the aerial circuit.

Double Reaction

In Fig. 1 we have a case in which two tuned circuits are employed for the detector, reaction being introduced on to each circuit. In order to make a set of this description function satisfactorily it is essential to have extremely loose coupling between the two tuned circuits. It is impossible to give details for obtaining this, as the separation of the coils depends so much on their size and magnetic field. The distance, however, should be of the order of 4 to 6 inches in most cases.

Practical Results

In some practical experiments a distinct advantage was found to accrue from the use of this double reaction. This was chiefly due to the fact that it enabled the coupling between the two tuned circuits to be reduced to a very small value before the signal strength was seriously impaired. The circuit is extremely interesting, but a somewhat difficult one to handle. Selectivity is, however, of a very high order, and it was found possible at a distance of about 12 miles from London to obtain Manchester with only the very slightest background of the former.

A Separate Reaction Valve

While using the circuit described above, it was thought that a certain amount of undesired coupling between the two circuits took place through the two reaction coils which are shown in series. It was therefore decided as a matter of interest to employ an entirely separate valve to introduce reaction in the aerial circuit. The new circuit is shown in Fig. 2. In this case Reinartz reaction was employed on the detector valve with the object of simplifying reaction control. This is by no means necessary, and involves the use of rather a large number of variable condensers.

Try these New Selective Circuits—*continued*

Reducing the Damping

It will be noted in Fig. 2 that the grid circuit of the second reaction valve is placed across only a part of the aerial coil. This was done in order to limit as far as possible any damping imposed by this valve on the aerial circuit. In practice this should be almost negligible, a distinct advantage over the high-frequency and detector method of coupling two tuned circuits in which the damping of the anode circuit of the high-frequency valve is partially or wholly across the second tuned circuit.

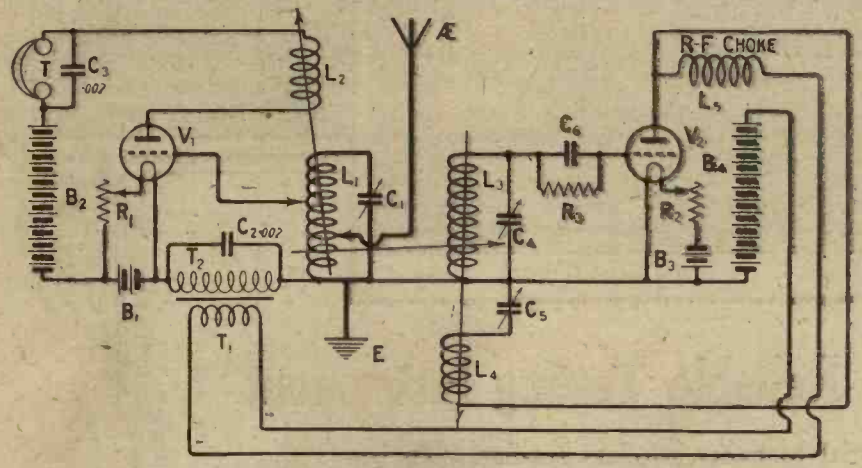


Fig. 3.—In this circuit the reaction valve is reflexed.

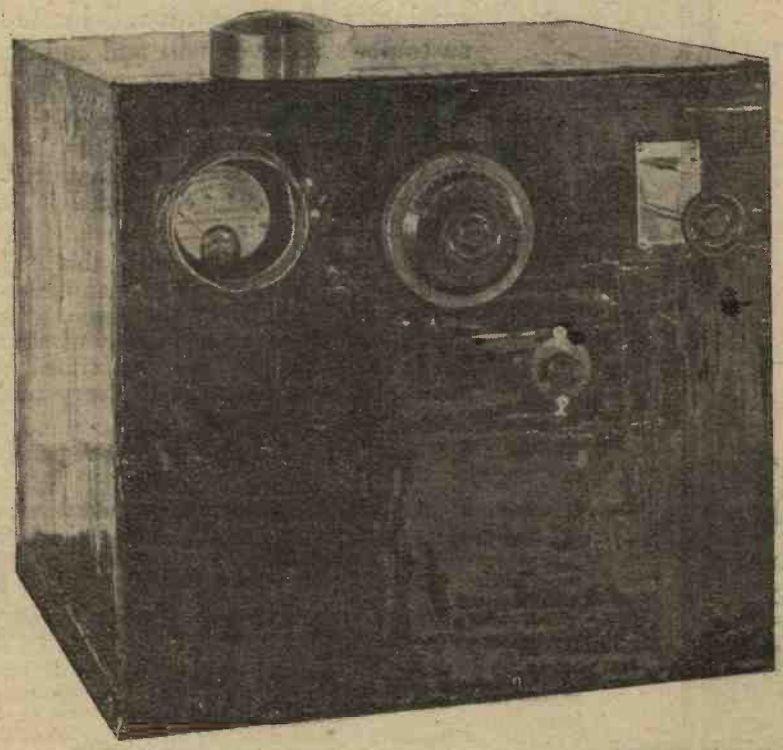
Results Obtained

This circuit was at first very tricky to handle, but once a little experience had been gained, it was found to be much easier to obtain stations than was thought at first. It was found preferable to employ a wavemeter, but in default of this the best procedure is as follows: Having obtained the local station and noted the readings of the tuning condenser, the aerial tuning condenser should be set approximately to the reading at which the required station is expected. The reaction control associated with the special reaction valve should then be increased to a point some way short of oscillation. The tuning condenser of the detector valve, together with the reaction condenser, may then be manipulated as in a simple detector.

During the preliminary experiments the coupling between the two circuits should be moderately tight, *i.e.*, the two coils should be about 3 or 4 inches apart. If the desired station is not obtained by this method, then the aerial tuning condenser should be altered slightly and the procedure repeated.

Good Selectivity

Using this method quite a number of stations were obtained at varying strengths in the headphones. When the coupling was loosened these stations were still obtainable and the selectivity was of an extraordinarily high standard. Thus both Cardiff and Manchester could be entirely separated from London at about 12 miles from the latter station, while quite a gap appeared to exist between London and Manchester.



In experiments on selectivity an artificial signal is often required. This is a small transmitter, completely enclosed in a copper case so that all the energy is under control.

The Disadvantages

It will thus be seen that all the selectivity that could reasonably be desired could be obtained with this circuit, and with the addition of two stages of low-frequency amplification quite a useful receiver could have no doubt been constructed. Unfortunately, the circuit suffers from the grave disadvantage of requiring an extra valve. Actually separate batteries need not be employed, although these are shown to simplify the diagram.

A Double-Purpose Valve

It was therefore decided to attempt to use the reaction valve for a double purpose. In other words, an attempt was made to utilise this valve, not only to provide reaction on the aerial circuit, but also to act as a low-frequency amplifier. The new circuit now appears as in Fig. 3.

On trying this circuit out it was found to suffer from two distinct disadvantages. In the first place the reaction valve was very prone to howl as in a reflex receiver, and in the second place selectivity was diminished.

Partial Rectification

An examination of the circuit diagram indicated that the second fault was due to a partial rectification of the incoming wave by the low-frequency valve. In order to remove this disadvantage the grid bias on the low-frequency valve was carefully adjusted so that no rectification should take place. This was found to

Try these New Selective Circuits—*continued*

be successful in eliminating this defect.

For Experimental Work

We have then remaining the problem of howling, which was much more difficult to eradicate. A considerable degree of success was obtained by being careful not to use too much reaction on the low-frequency and reaction valve, so that this was not prone to oscillate. Although it is not probable that a circuit of the type described would be altogether suitable for the amateur to employ as a permanent receiver, yet some very interesting results may be obtained, chiefly owing to the high degree of selectivity which the receiver affords.

Adding Reaction to a Trap Circuit

It is well known that in order to obtain the best results from a trap circuit the resistance of the trap should be as low as possible. The idea then suggests itself of adding reaction to the trap in order to reduce its resistance still further. This was tried out in the circuit shown in Fig. 4. Although it is well known that a trap of this description is not the most efficient type, yet its action was considerably improved by the addition of reaction.

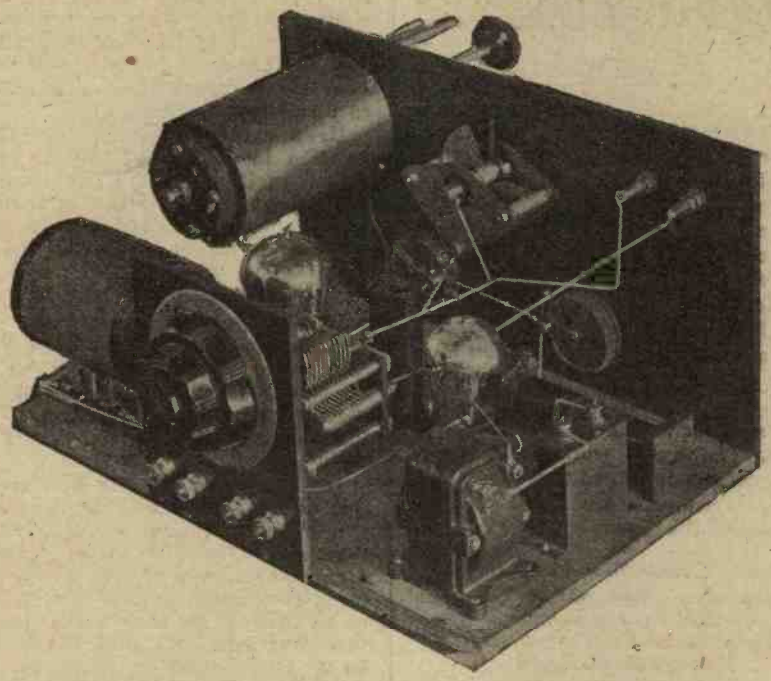
Overcoming Limitations

In the case of a trap the coupling is limited by two factors. If it is too loose it is impossible to cut out the local station, while if, on the other hand, it is too tight, then stations on either side of the local are seriously decreased in strength. By the addition of reaction it was found possible to weaken the coupling of the trap considerably, so that stations near the local could be heard with little diminution in volume, while at the same time the unwanted signals from the local station could be reduced to the required degree.

Reaction Control Effect

A rather undesirable feature which might, however, have been suspected, was that the reaction of the trap and the reaction of the main circuit were not independent. The reason for this is that the trap damps the main circuit, thus requiring more reaction to be added, while, on the other hand, the detector circuit acts as a kind of trap on the trap circuit itself, and thus damps the latter. More reaction is therefore required on the trap circuit for this reason. Thus the two circuits are by no means independent, and it is necessary to adjust both together in order to obtain the best results.

It should be emphasised that all the circuits require considerable skill in handling, and should therefore only be attempted by the experienced reader. At the same time they provide interesting food for thought and experiment for anyone who is minded to try them out.



An interior view of the screened transmitter used at Elstree for research work.

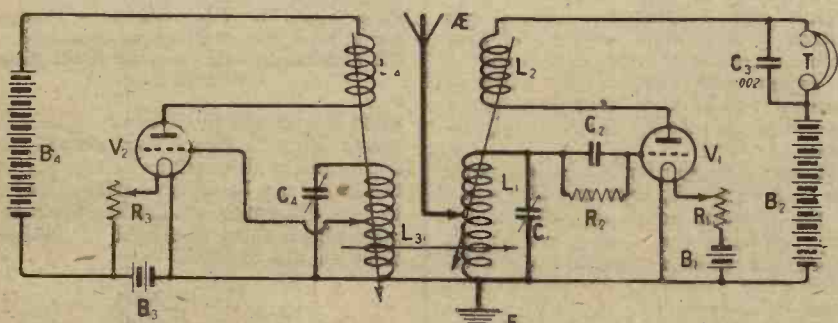


Fig. 4.—A reduction in the effective resistance of the trap circuit was made by applying reaction to it in this manner.

"CHANGE YOUR COIL AND CHANGE YOUR CIRCUIT"

(*continued from page* 905)

perienced is again found. With this adjustment made, turn C_3 again to its zero reading, and tune in the local station by means of the C_1 condenser, when by increasing the reading of C_3 signals may be made to increase in volume until to increase that volume still further may bring the set too near the point of self-oscillation, and so result in interference.

By a careful adjustment of C_3 in relation to C_1 the set may be maintained in its most sensitive condition throughout the whole tuning range of C_1, irrespective of whether the smallest or next size coil be used.

Long-Wave Reception

When using the big coil, the reaction condenser C_3 may be neglected altogether, tuning being carried out by means of C_1 and the control of reaction being given by means of the knob situated on the top of the coil casing.

The operation of the receiver in this case is, of course, simply that of the ordinary direct coupled aerial, variably-coupled magnetic reaction arrangement, and though the adjustment of reaction in this case will not be so smooth as that given by the former circuit, little difficulty is likely to be experienced in tuning-in, say, 5XX at good strength.

Valves to Use

Practically any type of valve may be used with this receiver, and I have personally tried "general-purpose," small power and high impedance types with equal success.

The choice of valve decides to some extent the adjustment of anode voltage and filament current to give smooth reaction control, and it should be remembered that if the valve is changed for another type it may be necessary to make further adjustments.

It may be experienced, when using the long-wave coil, that any alteration of the reaction coupling will necessitate resetting the tuning condenser. This point, though somewhat of a difficulty when searching for distant stations, is, however, one of the disadvantages of using variably-coupled magnetic reaction. On the other hand, when using the Fig. 1 arrangement, it will be found that any alteration of the reaction condenser C_3 will have no appreciable effect upon the adjustment of the tuning condenser C_1, thereby making the tuning-in of the distant stations extremely easy.

The Author's Results

The receiver has been used for some time in south-east London, and during the daylight hours Bournemouth can be received at moderate strength. During the evening hours, when it is still daylight, though not brilliant sunshine, Radio-Belgique, Newcastle and Birmingham can be received at good strength.

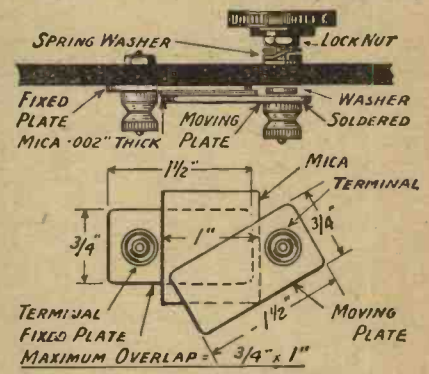
On the long waves, 5XX and Radio-Paris both come in well, neither interfering with the other, while on the shorter waves hosts of Germans have been received from time to time.

A HANDY LITTLE CONDENSER

THE small variable condenser described and illustrated will have many useful applications on the constructor's bench, and since the materials employed will most likely be found on the "junk" pile, the cost incurred is a negligible item.

Dimensions Not Critical

From Fig. 1 it is seen that the condenser consists of two metal plates, one fixed and one movable, with a mica dielectric between, the capacity being varied by rotating the moving



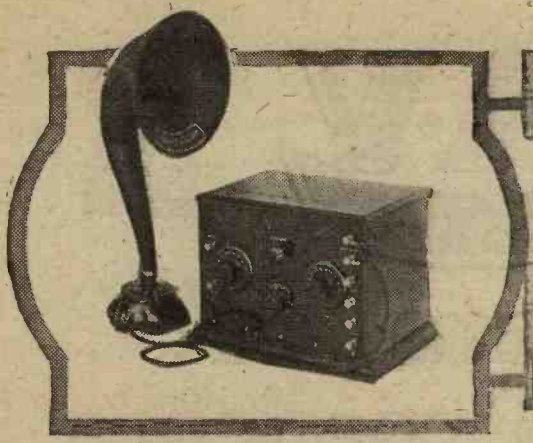
Figs. 1 and 2.—The necessary dimensions and the method of assembling the condenser will be clear from these diagrams.

plate across the fixed one. The diagram, Fig. 2, shows the shape and approximate dimensions of the plates, the latter not being very critical owing to the difference in thickness of the mica obtainable; that sold as .002 in. thick should be used.

Assembly

The fixed plate is clamped firmly to the panel by the terminal shown, which also serves for attaching the connecting wire. A little thick shellac varnish between the plate and the panel before tightening the terminal will assist in holding the plate firmly in position. The mica sheet is then fastened over the fixed plate with more shellac varnish. The mounting of the moving plate is clearly shown, and it should be soldered to the terminal to prevent it from slipping when the knob is turned.

W. E. M.



WAS THE DESIGNER WRONG?

By JOHN PUGH-PRICE

You may have followed the designer's instructions in building your receiver only to find that it will not work properly. Read this article and you will probably find where the fault lies, and that it is not in the design.

"I AM sure the design is all wrong. I have strictly followed the circuit shown in Fig. 1, and can only get weaker signals than were received on my crystal set. I know all the components are correct, since I have tried them in an arrangement consisting of a crystal set and a transformer-coupled note magnifier, and also in a single-valve reaction receiver. I made this set since I understood that maximum volume and good range would be obtained by employing my single valve in a dual capacity. The components are as follows—a detailed list is given; all of the components are of reliable make."

A Beginner's Complaint

This is a typical complaint from a beginner experimenting with reflex circuits. Often in practice the constructor, having completed his reflex receiver from a given circuit, or possibly from a published design, is confronted with this trouble. He sometimes discovers that he can lift the catswhisker from his crystal detector and still receive weak signals, whilst in extreme cases he may even find that he can only receive signals in this way, from which he often infers that the circuit or design is wrong.

A Simple Explanation

Generally there is nothing wrong with the wiring or with the design, but the valve is being worked incorrectly. Readers who have carefully followed the trend in modern design will notice there is a marked tendency to employ lower bend anode current rectification where maximum purity is the aim of the designer. No grid leak or grid condenser is used, but it is arranged that the valve shall work on the lower bend of its anode-current grid-voltage characteristic curve. This is effected by suitably connecting a grid-bias battery in the grid circuit of the rectifier, generally on the filament side of the grid coil.

Easily Rectified

The beginner in reflex circuits generally employs a comparatively small value of high-tension voltage, for example, of 40 to 60 volts, and accidentally he may easily find that he is working his valve at or near to the lower bend in its characteristic curve. As a consequence the valve rectifies instead of amplifying at both radio and audio frequencies, as was intended. When this happens, and signal strength may be improved by lifting the catswhisker or by extinguishing the valve when a valve rectifier is employed, there is no need to be perturbed unduly, since a comparatively simple adjustment will put things right.

Working the Valve Correctly

For amplification at both high and low frequencies, without distortion, it is essential that the working point of the valve on its characteristic curve should be upon the straight portion, which latter should be to the left of the grid-volts zero ordinate. As long and as straight a working portion to the left of the above-mentioned ordinate is required to give pure reproduction, which will be obtained if there is adequate grid-voltage swing without the lower bend being reached or the part of the curve where grid current flows being employed.

This condition of affairs may usually be obtained by increasing the high-tension voltage on the dual valve by 30 or 40 volts, or up to the maximum permitted according to the maker's specification, whilst it will be necessary to adjust grid bias with some care in order that the best working point may be chosen. The valve then amplifies at high and low frequencies and gives negligible rectification effects.

Inserting a Grid-Bias Battery

Where provision is not made for inserting a grid-bias battery this should be placed in the position indicated by dotted line in Fig. 1. A 6- or 9-volt grid-bias battery, tapped in 1½-volt steps, should prove adequate, and if adjustment is made of this voltage and also of the H.T. voltage, in practically all cases difficulty due to rectification by the dual valve will be overcome.

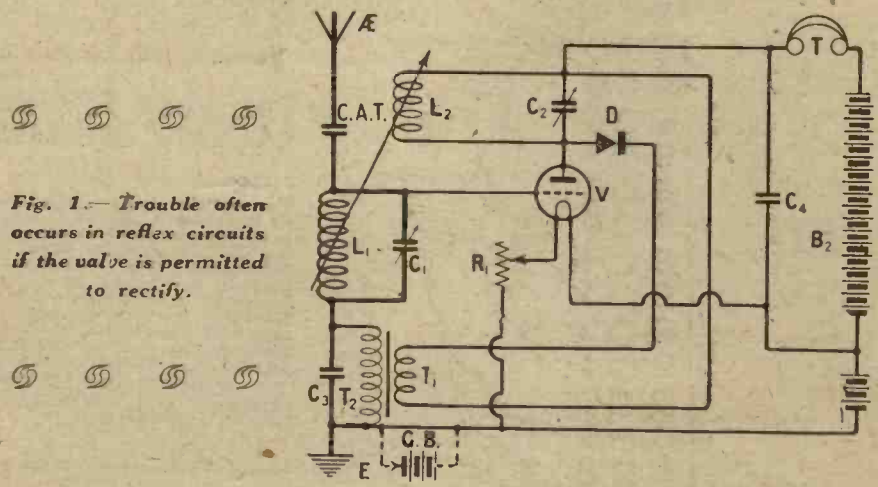


Fig. 1.—Trouble often occurs in reflex circuits if the valve is permitted to rectify.

Final Adjustment

Before final adjustment of H.T. and grid-bias voltages is made it is necessary to find a sensitive spot upon the crystal which will necessitate a slight readjustment of both tuning and reaction controls. When the crystal is brought into circuit the effect is to increase the damping, making it necessary to bring the reaction or anode coil towards the aerial coil. It

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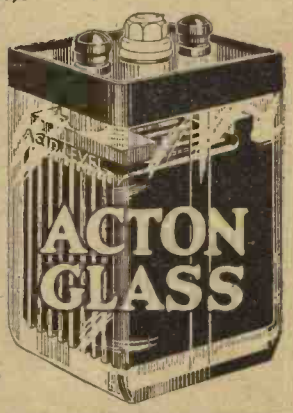

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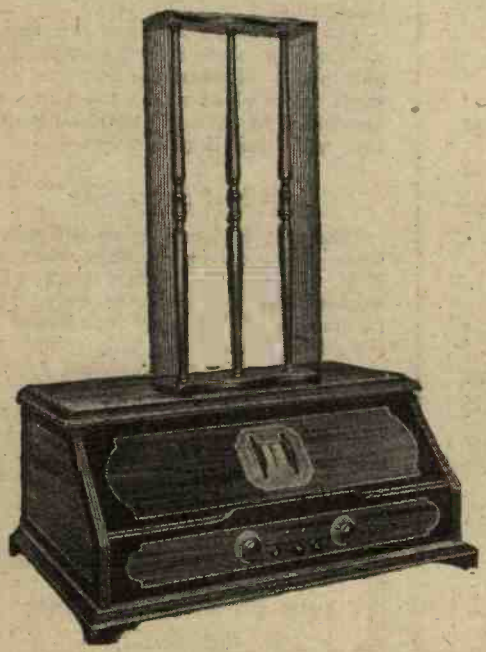
Was the Designer Wrong?—*continued*

is required, therefore, that compensation for the introduction of the crystal be made by a slight readjustment of the reaction setting and of the tuning on both condensers before final adjustment of H.T. and grid-bias voltages can be made finally.

By-Pass Condensers

In the circuit of Fig. 1 it will be observed that the by-pass condenser C_4 is connected both across the telephones and across the high-tension battery. In this position, therefore, it is essential that a suitable size of condenser be employed, and here generally .001 or .002 functions well in practice. In a case which I recently investigated, a 2-microfarad Mansbridge type was employed here, and it was complained that signals were extremely weak and poor in quality. This, of course, is only to be expected, since it should be realised that a large condenser, such as that mentioned, not only by-passes the high-frequency component, which it is intended to do, but also acts, to a large extent, in a similar capacity to audio-frequency currents.

The result is therefore practically equivalent to partially short-circuiting the telephones. Where a Mansbridge type condenser of 1 or 2 microfarads is employed it should be connected across the H.T. battery only, and a further by-pass condenser of .001 or .002 should be connected directly across the telephones.



A handsome American receiver—the Radiola 25

A Useless H.F. Stage

The theoretical circuit diagram of Fig. 2 showing a general-purpose 3-valve arrangement in which a tuned anode H.F. stage is followed by a detector, with reaction on to the aerial coil and one transformer-coupled note magnifier, illustrates other faults which often perplex the beginner. Here a usual complaint is that the H.F. stage does not give the step-up in signal strength on distant stations which it should, or may even be responsible for a step-down in amplification. The first point which should naturally occur to the experimenter is the fact that a reversal of reaction connections is necessary when the H.F. stage is cut out of circuit. This, however, can usually be effected by means of two short flex leads and suitable plugs.

A larger size of reaction coil than is necessary when the H.F. valve is in circuit will be required when the detector valve forms the first valve of the receiver. Even when attention has been paid to these points the difficulty may still be present, and other sources must be explored to locate the fault.

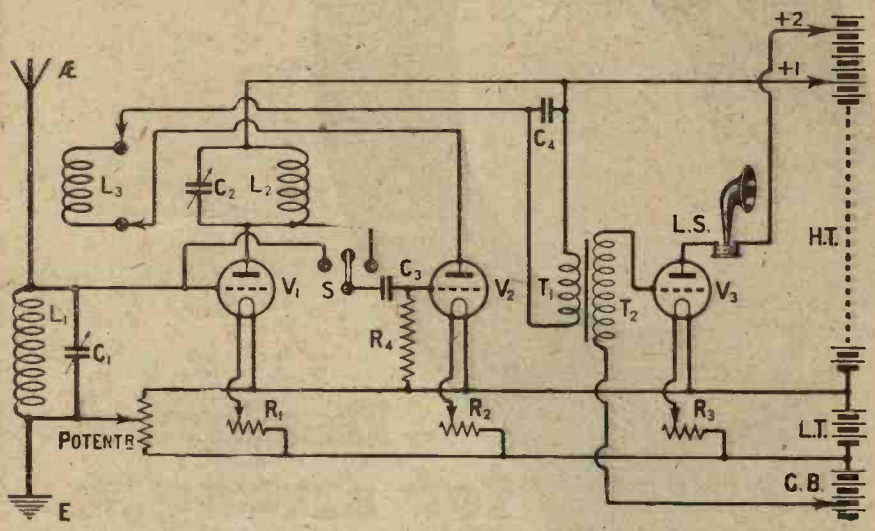


Fig. 2.—Unless correctly adjusted a high-frequency valve may give little or no amplification.

A Simple Cause

At this advanced stage in broadcasting receiving apparatus it would seem unlikely that lack of skill in tuning could be responsible, but in a number of cases this, coupled with the employment of an unsuitable valve in the H.F. valve socket, and incorrect H.T., etc., is often the cause. Unless the tuned-anode circuit is tuned correctly to the wavelength of the station it is desired to receive the H.F. valve will prove a hindrance rather than a help in obtaining good signals. A few words on tuning the set may therefore not come amiss.

Sequence in Tuning

Until the feel of the receiver has been obtained logical sequence in tuning should be followed. Normally the anode circuit will tune more sharply than the aerial circuit so that in searching a satisfactory system to adopt is to advance the aerial condenser by one or two degrees at a time, whilst taking the anode condenser through the whole of its scale divisions slowly. If you do not feel competent to adjust the coupling of the reaction coil at the same time so that the set is kept just below the oscillation condition, in which it is most sensitive, some intermediate setting should be obtained so that the receiver does not oscillate on the lower degrees of the two condensers,

(*Continued on page* 930.)

WAS THE DESIGNER WRONG?

Concluded from page 929

but at the same time is not unduly insensitive on the higher wavelengths.

When a station is heard the reaction coil should be approached towards the aerial coil gradually, whilst the settings of C_1 and C_2 should both be readjusted slightly. It will be found that each alteration of the coupling between the reaction and the aerial coils will necessitate slight retuning on both aerial and anode condensers, and if these points are borne in mind little practice should allow good results to be obtained.

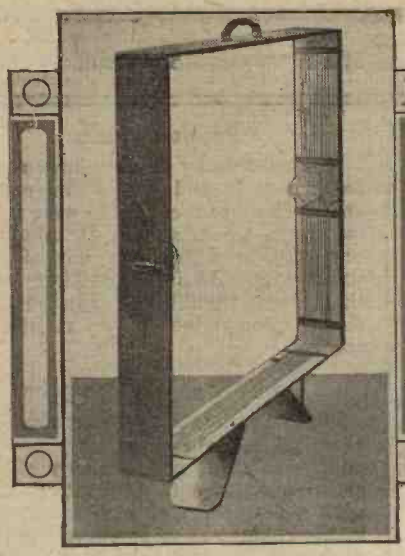
A Defective Anode Coil

Occasionally a discontinuous anode coil is responsible for lack of step-up in amplification, and here the well-known telephones and dry cell test should be employed, a small dry-cell and a pair of telephones being joined in series. The free side of the battery should be connected to one side of the coil, whilst the other side of the coil should be tapped with the free telephone tag. Loud plonks will be heard if the coil is continuous, but only feeble ones if a break is present, in which case the coil should be changed. A further fault, which is not quite so common, is a short circuit of the anode coil. A short-circuited anode coil when inserted into the L_2 position will prevent signals being heard, and only when it is withdrawn will results be obtained.

The telephones and dry cell test is useless here, since a loud plonk will be obtained. Generally, however, the short takes place where the two leads are joined to the coil plug, and inspection will allow it to be located.

Lack of Sensitivity

Where it is found more difficult to make the receiver oscillate when the H.F. stage is in circuit than when working on the detector only, poor insulation of the grid condenser C_3 should be suspected. This component should therefore be replaced by one which has worked effectively in another receiver, since if the insulation is poor considerable positive bias may be communicated to the grid of the detector valve, and this will render the set unusually stable and insensitive.



HAVE YOU MADE YOUR PORTABLE SET?

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

NO doubt at this time of the year many readers are in possession of portable sets, while others, perhaps, contemplate building some such set in order to be able to continue their enjoyment of radio during the summer months, in their outings on the river, picnics, at the tennis club, and on their walking or motoring tours.

Some Preliminary Considerations

It is for the benefit of the latter that this article is written, in order that they may appreciate some of the consideration to be taken into account in their choice of suitable equipment. Now, generally speaking, sets for use in the open-air may be divided into two classes, first, those for use with 'phones only, and secondly, those suitable for loud-speaker work.

The former may be classed strictly as portable sets, while the term "semi-portable" is better suited to the latter class. A further sub-division renders this classification somewhat clearer. Thus we may have two further classes, according to the nature of the results which are expected from the set, namely, reception from the local station or Daventry only, or reception of distant stations as well.

What Are Your Requirements?

There are, then, four distinct types, and before anyone contemplates building or purchasing a set for the open air, he should first of all ascertain exactly what his requirements are likely to be. This procedure simplifies to a considerable extent his choice of a suitable design.

If, for instance, you will be satisfied with 'phone reception of the local station it is useless to incur the expense and trouble of constructing a set which is capable of giving loud-speaker results from that station, not to mention, of course, the trouble of carrying about such a set and its associated equipment.

A Personal Opinion

Personally, I have no use for any set intended for outdoor reception which is not capable of giving at least one station on the loud-speaker at reasonable volume. However, this is, of course, solely a personal opinion, and, although I cannot see myself spending a day on the river listening at intervals to London with headphones, I realise that I may be abnormal in this respect, so I shall endeavour to write this article to present an unbiassed view of the matter.

The Word "Portable"

The word "portable" has been used in rather an elastic way in reference to wireless receiving equipment, but I do not think that it should be applied strictly to any apparatus which is not completely self-contained and which does not entail any greater effort in carrying than does an average-sized attaché case, containing, say, business papers.

To describe a four-valve set, say, H.F., detector, and two transformer-coupled note magnifiers, with its associated equipment, as portable is rather stretching the meaning of the term. I have unpleasant recollections of carrying a similar type of set, together with batteries and loud-speaker, a distance of about half a mile. Such a set is portable only so far as the motorist is concerned.

Suitable Circuits

You may ask what is the best circuit and number of valves you will require for any given purpose. In the first place, this depends to some extent on what type of aerial you propose to use. It is always wise to erect the best possible aerial that circumstances will permit, but do not count on always being able to sling a wire from a fairly high tree.

Straight Circuits

Assuming, first, that you are able to do this, and that you will, there-

Considerable enjoyment can be obtained with a set which will only give telephone strength.

Have You Made Your Portable Set?—*continued*

fore have an aerial approaching in efficiency the average outdoor aerial, then you will probably not need more than a single valve for 'phone reception of the local station at distances up to twenty miles, and two valves, detector and one L.F., transformer coupled, should give you a fair margin of safety for 'phone reception of 5XX practically anywhere in the country under these conditions.

An aerial slung over a tree is quite suitable for outdoor work.

For moderate loud-speaker reception in each case, an extra transformer-coupled L.F. valve will probably suffice, but it must be realised that local conditions will to some extent affect these considerations, so that no hard and fast rules are possible.

Smooth Reaction

Generally speaking, whatever type of temporary aerial you erect, it may be safely said that its resistance will be fairly high, so you will be wise to incorporate some method of smooth reaction control in straight circuits of this type. That usually attributed to Reinartz, or some similar method, is to be preferred. You can then increase the reaction gradually until the point is reached when the extra aerial resistance has been balanced out and provided no further reaction is used the quality of reception should not suffer.

Your Earth Connection

The earth connection is important, and here again it is wise to provide the best possible in the circumstances. This should present no undue difficulty if moist soil is available, for practical experience shows that a 2- or 3-ft. length of the so-called "brass" curtain rod driven into the ground and provided with a terminal usually serves the purpose quite well. Where the earth is dry two such earth connections, connected together, will prove more satisfactory.

Suiting Local Conditions

If you are fortunate enough to be near a lake or stream, a length of bare wire thrown into the water will give you a good earth connection. Where there is a gravel soil the problem is more difficult, and practically the only satisfactory solution is to use a counterpoise. This should be supported about 5 or 6 ft. from the ground upon two poles or other temporary supports, and well insulated. It should extend under the aerial and be slightly longer if possible.

Freak Aerials

No doubt many readers have read of freak aerials and earths for outdoor use, such as connection to wire fences, using the sap of a tree, etc., but it is not wise to *depend* on any of these substitutes. It is interesting to try them experimentally, however, for they often give very satisfactory results.

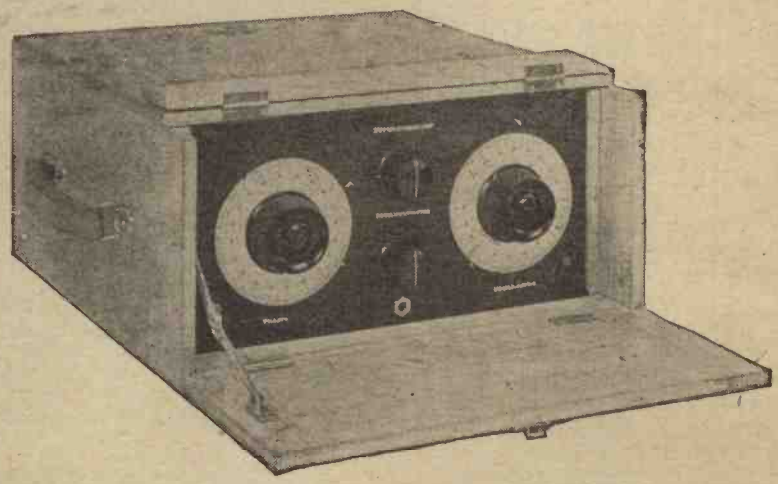
Loud-Speaker Reception

Returning again to the consideration of suitable circuits, suppose you are unable to erect a reasonably efficient aerial and have to be content either with a frame aerial such as is wound in the cabinet of some portable sets or with only a small aerial of the ordinary type. Well, in such cases the same circuits may be used as before, but a stage of high-frequency amplification added to compensate for the relatively inefficient collecting system.

The method of high-frequency amplification used should be simple and easy to control, and either one of the neutralised methods or some such scheme as a "parallel-feed" stage may be incorporated with confidence. Where extreme simplicity is called for, an "aperiodic" transformer coupled stage has much to commend it, though naturally the amplification is not so large.

Reflex Sets

The reflex principle has a certain application to sets for outdoor use when only the local station or Daventry is required, and provided a good design and first-class components are used, there is no reason why a reflex set should not be successful. Though you may not get exactly the equivalent of two ordinary stages of amplification, one valve is certainly saved, and this is a commendable feature, where portability is concerned.



A good example of a portable superheterodyne receiver which was described by Mr. G. P. Kendall in the May issue of "Modern Wireless."

HAVE YOU MADE YOUR PORTABLE SET?—*continued*

Superheterodyne Receivers

The superheterodyne has great possibilities for powerful semi-portable receivers, and, indeed, it is practically the only type of set which will adequately satisfy the requirements of those who want reception of distant stations with only a small aerial or frame aerial.

With six valves a very successful set may be made, and for a well-tried design the reader is referred to "A Superheterodyne for the Open Air," designed by Mr. G. P. Kendall, and described in the May issue of *Modern Wireless*.

This set employs an "aperiodic" stage of high-frequency amplification at signal frequency, a combined first detector and oscillator, two stages of intermediate frequency, second detector and one stage of low-frequency amplification.

Reflex Superheterodynes

Though not much work seems to have been done in this respect, there are great possibilities in reflex superheterodyne sets for portable uses—that is to say, superheterodynes in which one (or more) of the intermediate stages is reflexed, thus making this valve function as a low-frequency amplifier as well. A five-valve circuit was published some time ago in which the three intermediate stages were reflexed on the Grimes' Inverse Reflex principle, but it does not seem to have achieved the popularity which was apparently justified from the author's claims.

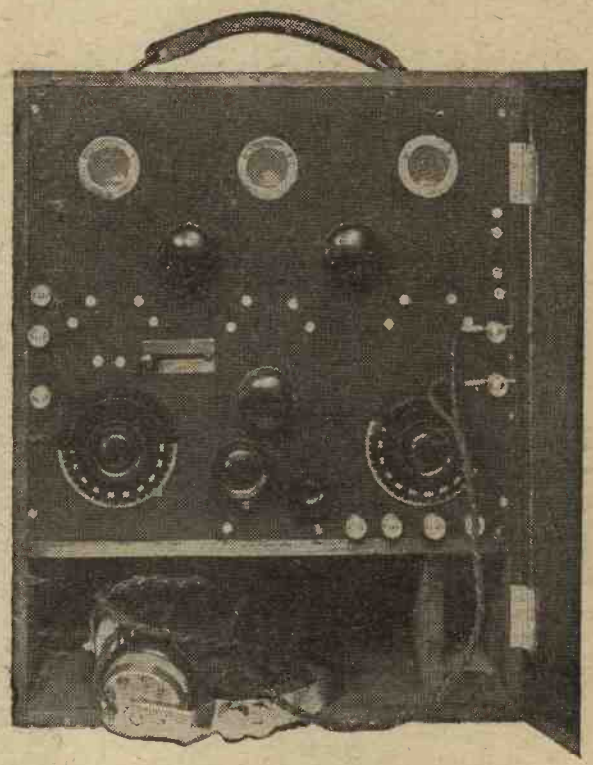
General Design

There are one or two points in the design of portable sets which call for special consideration. First, there is the choice of valves. Generally speaking, valves of the 3-volt, .06-ampere type will satisfy most requirements, while power valves taking .1 ampere at 4 volts seem to be the most suitable. It is, I think, generally agreed that a small four-volt accumulator of the "unspillable" type is to be preferred to the more cumbersome and weighty dry batteries, which have to be of large size to supply safely the current for three or four valves.

There is now on the market a two-volt valve taking .06 ampere filament current. Although I have not tried this valve, it would seem to be a useful type to incorporate in portable receivers.

Keep the Battery Sizes Small

High-tension batteries should be as small as possible consistent with not too large a load being taken from them. About 5 milliamps. is the safe maximum which can be taken from the ordinary small type of battery over any length of time, and if your total H.T. current exceeds this figure it will probably be more satisfactory to utilise two of this size of battery in preference to the heavier and more bulky type employing larger cells. In most medium-powered portable sets it is possible and more convenient to provide a separate compartment in the case to house the batteries, 'phones and aerial wire, together with any minor accessories which may be necessary.



In this type of portable receiver provision is made for carrying all the accessories in the case.

Good Joints Essential

No matter what type of set is employed, it is wiser to safeguard your valves against rough treatment by providing some good valve holders of the vibratory type.

Incidentally, special attention should be paid to the soldering of all connections, each one being carefully tested to see that it is both electrically and mechanically sound. A dry joint can quite easily occur, and may spoil your enjoyment of the programme or even render reception impossible.

I think I have discussed in sufficient detail all the considerations which will influence your choice of a portable set, and I trust these details will be of some assistance to those who are contemplating building a set for the enjoyment of radio in the open air this summer.

NEWS FROM ADVERTISEMENTS

SEVERAL noteworthy advances in valve design will be found mentioned in the advertisements in this issue. The Mullard Wireless Service Co. give details of the new PM-1, a 2-volt valve, and a valve working at a similar rating is the Cossor "Stentor Two," also described. The new Metrovick S.P.18/B (Blue Spot) valve is of the same type, but its filament consumption is only 0.09 amps, at 2 volts.

* * *

Messrs. Igranic Electric, Ltd., and also Messrs. Jackson Bros., are advertising dual condensers of a type suitable for incorporation in the "Elstree Six" and similar receivers.

A new precision condenser is also described by Messrs. W. G. Pye & Co. This is supplied with a 200-1 ratio vernier drive, complete freedom from backlash being claimed.

* * *

In connection with neutralising condensers, Messrs. Gambrell Bros., Ltd., point out that they are now marketing a direct-reading dial for their well-known "Neutrovernia" condenser, which will enable the user to make an instant return to settings previously logged. No alteration to the existing condenser is necessary.

NEWS FROM ABROAD

CRYSTAL RECEPTION IN AUSTRALIA

SIR,—Two years ago I and a fellow enthusiast "went in for wireless," and built a loose-coupled crystal set which was completed by the end of February. We connected up and started listening in from Goomen in the South Burnett district (100 odd miles north of Brisbane) and tried to pick up 2FC at Sydney. Plenty of spark came through but not 2FC. We persevered, and in May (our winter time) actually got them at good 'phone strength. Finances did not permit a condenser, and all the tuning was done directly from the loading coil, which was operated with two switches.

We listened in regularly after this with two pairs of telephones. Daytime reception was nil, and only when the sun had set for about 1½ hours could we get 2FC. Two other local people built similar sets and got the same results, although farmers are over 600 miles away.

The following particulars may be of interest to you and your readers. Coils — two cardboard cylindrical formers, diameter 3½ in. and 4 in., length 6 in. These were thoroughly shellaced and dried. *Primary* winding 125 turns of 24-s.w.g. enamelled copper wire (unspaced). *Secondary*, 165 turns 26-s.w.g. wire. The completed coils were then shellaced again and baked in an oven. The crystal cup was a valve cover from a car, and the crystal (just the ordinary eighteen-penny) sat on top. The aerial was of 3/20's aerial wire, 135 ft. long with lead-in, and of the inverted L type. The lead-in pointed west—2FC is south.

The catswhisker ranged from one strand of wire out of a flexible lead to a needle. Results were in all cases the same.

The surrounding country consists of high ironstone ridges heavily timbered, so that the aerial was fairly well screened. A variable condenser installed later made very little difference to the selectivity either in series or parallel. Trusting these particulars will be of interest to you.—Yours faithfully, G. S. HALL.

North Queensland, Australia.

THE 'POWERFUL THREE' AGAIN

SIR,—I am writing to let you know the results I have had with the "Powerful Three," described by Percy W. Harris, M.I.R.E., in the April, 1925, issue of THE WIRELESS CONSTRUCTOR.

I have received the following stations at good loud-speaker strength: London and Daventry (very loud),

Mr. S. L. Hogben's "Powerful Three" receiver has induced three friends to make a similar set.

Newcastle, Birmingham, Bournemouth, Brussels, Hamburg and Dublin.

I am enclosing a photo, which you may like to publish, and you will see I have altered the design somewhat. Also I have placed a Polar R.C.C. unit in the last stage of the L.F., as I do not require so much volume as I had when I first made it up. The valves employed are Mullard .06. The D.P.D.T. switch is for the purpose of having two pairs of 'phones on detector only. All battery leads are at the back of the cabinet, which is mounted on "Eddystone" shock absorbers, as this saved me buying special valve holders.

In conclusion, I may say that this set has been responsible for three people starting off with a three-valve set straight away.

Wishing THE CONSTRUCTOR a long and healthy life,—Yours faithfully,

S. L. HOGBEN.

Windlesham.

THE MIDGET AND SHORT-WAVE WORK

SIR,—I read with interest the letter from Mr. Chas. H. England appearing in your May issue of THE WIRELESS CONSTRUCTOR which has just come to hand. While Mr. England is to be congratulated on his achievement, he cannot claim to have established a record in the reception of KDKA.

Using this set (the Midget) without any form of amplification I logged that station at R4 on two consecutive mornings last January. This is our best season for receiving stations in the Northern Hemisphere.

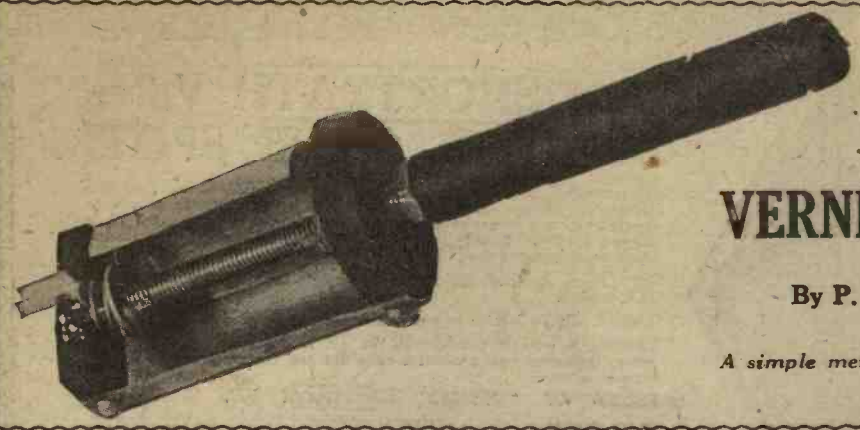
It may interest you to know that I have since mounted the panel on a baseboard with coil holder and .0005 variable condenser, the latter controlling reaction on the Grebe system. The set is now used exclusively for short-wave reception, and oscillates easily down to 25 metres. Using a 7 ft. indoor aerial I have already logged a large number of South African "Hams" as well as Bandoeng (Java), and several other commercial low-wave stations. Under separate cover I send you the only available copy of our "local mag." It is somewhat ancient, but you will get an idea of its nature. It caters almost exclusively for the amateur transmitter and the short-wave merchant. Couldn't you manage to introduce more of this stuff?

Yours faithfully,

ROBERT E. TAYLOR.

Germiston, Transvaal.

[We congratulate our correspondent on his achievement with the "Midget" receiver, and tender our thanks for the copy of his local magazine. In view of his remarks concerning short-wave work he will no doubt be especially interested in the two-valve receiver described on page 889.—ED.]



A HOME-MADE VERNIER CONDENSER

By P. H. WOOD, B.Sc., F.P.S.L.

A simple method of making a useful component.

AMONG the uses to which variable condensers of small capacity may be put, probably those most familiar to readers of THE WIRELESS CONSTRUCTOR are their employment for fine tuning and as neutralising condensers for controlling oscillation in H.F. amplification circuits.

Fine Tuning

When a small variable condenser is connected in parallel with the larger condenser normally used for tuning any particular circuit, the circuit may be coarsely tuned by the larger instrument in the usual manner, while fine adjustments can be carried out by means of the small condenser. Since the two condensers are in parallel their effective capacity is equal to the sum of their individual capacities, and hence the tuning range of the original arrangement remains practically unaltered by the addition of the auxiliary "vernier" condenser if the capacity of the last-named is small.

Hence the employment of a small variable condenser in conjunction with the usual tuning control provides a convenient means of carrying out the fine tuning adjustments associated with modern selective circuits, and obviates the replacement of existing condensers by new ones fitted with fine-control devices.

Preventing H.F. Oscillation

In the case of neutralised H.F. circuits a small "neutralising" condenser is connected between some point in the anode circuit of the H.F. valve and the grid of the valve, so that energy can be fed back to counterbalance the feedback due to the capacity of the valve. The neutralising condenser normally has to be so designed that it has a small minimum capacity, and many condensers fulfilling these conditions are advertised in this journal.

Such condensers are eminently suitable for the first purpose discussed above as well, so that the purchase of a good neutralising condenser should prove a good investment, as when not in use for its nominal purpose it can be incorporated in any existing set as a fine tuning device connected to one of the tuning condensers.

A Home-Made Component

Below is described a small condenser which is quite suitable for either of the purposes discussed above. It can be quite easily and cheaply made at home, and is so designed that it takes up little panel space and is mechanically sound. It consists of a metal plate bent in the shape of half a cylinder carrying an ebonite bearing at each end. A slightly smaller semi-cylindrical plate mounted on a spindle working in the ebonite bearings forms the moving vane of the condenser, the spindle being continued and fitted with a length of ebonite rod to form a handle for control purposes.

Materials Required

Most readers will find that the materials required for the construction of this condenser can be found in the scrap box, which seems to be associated with the activities of every wireless enthusiast. In any case an outlay of a few pence will be sufficient to satisfy the requirements, and a list of the necessary materials is appended:—

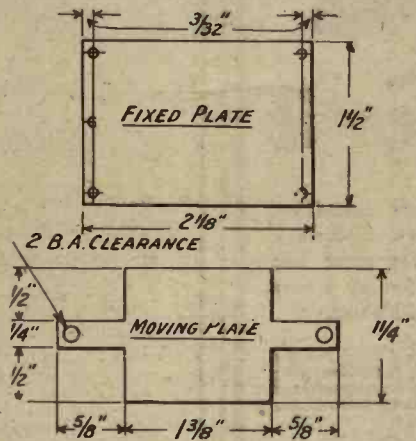


Fig. 1.—The details of the two plates can be obtained from this figure.

A few square inches of sheet metal, preferably brass.

A circular disc of ebonite 1 in. diameter, 3/16 or ¼ in. thick.

Strip of ebonite about 1⅛ in. long by ⅜ in. wide.

Two spring washers.

Length of 2 B.A. studding, 2¾ in. long.

Ebonite rod, 2½ in long by about ⅜ in. diameter.

Two 2 B.A. washers, one 2 B.A. nut, and a soldering tag.

Five small round-head wood screws.

Cutting the Plates

The sheet metal should be of fairly stout gauge, and must be flattened out before use if it is bent in any way. Details of the two plates to be cut from it are shown in Fig. 1, where it will be seen that the fixed plate consists merely of a rectangular piece of metal drilled with five small holes to take the wood screws which are used to fix it to the ebonite end-pieces.

The moving plate is slightly more elaborate, being cut with a projection at either end, these projections being used as fixing lugs and drilled with holes to take the spindle. The outlines of the plates should be scratched on the sheet metal with a scriber, or marked with a hard pencil, and tin snips or a pair of strong scissors used to cut round the outline. If the edges of the metal are bent up at all during the cutting process a wooden mallet should be used to flatten them down again.

Ebonite End-Pieces

One end-piece is in the form of a circular disc 1 in. in diameter, and must be drilled with a 2 B.A. clearance (3/16ths) hole at the centre, with a further hole for fixing purposes. The other end-piece is shaped so as to form part of a similar disc in its lower part, while its upper part extends by about 1/16th inch further at each side to form a sort of shoulder against which the fixed plate of the condenser can rest. At the centre of this second end-piece a 2 B.A. hole is drilled through about *half* the thickness of the material, this hole forming a resting place for the end of the spindle.

The fixed plate can be bent to shape to form half a cylinder of 1 in. diameter, a wooden mallet or similar handle forming a suitable mandrel for

A HOME-MADE VERNIER CONDENSER—*continued*

the purpose. When shaped the fixed plate may be screwed to the end-pieces, leading holes first being drilled for the wood screws.

Assembly

Next bend the moving plate to a similar shape, but let it be of slightly smaller diameter. Bend the metal extensions of this plate inwards, and place it in position resting inside the fixed plate.

Run the spindle through the hole in the larger end-piece and through the holes in the lugs on the moving plate, threading on spring washers, a tag,

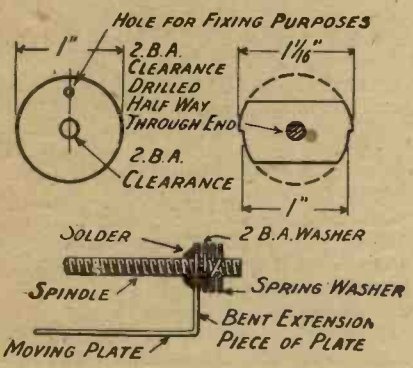


Fig. 2.—The construction of the end pieces and moving plate is clearly shown in this diagram.

and ordinary brass washers, as shown in Fig. 2. Allow the end of the spindle to rest in the hole provided for it in the smaller end-piece, and then carefully mark where the lugs of the moving plate rest. Solder the lugs to the spindle at these points, removing the small end-piece during the operation to release the pressure of the spring washers.

Final Adjustments

When this operation is concluded, re-assemble the condenser, seeing that the spring washers exert sufficient pressure to ensure a good electrical connection between the moving plate and the soldering tag. Connections to the fixed element may, of course, be made by soldering a lead directly on to the fixed plate, although a second soldering tag may be fitted to one of the wood screws if desired.

Now very carefully shape the moving plate so that it does not touch the fixed plate at any point during rotation, at the same time allowing the plates to be as close together as possible in the maximum capacity position. Tap a 2 B.A. hole in the ebonite rod, and screw the latter on to the projecting end of the spindle to form an extension handle, using a nut to lock it in position.

AN EFFICIENT INDOOR AERIAL

THE main problem of wireless from the point of view of a large number of would-be enthusiasts is the aerial. This applies particularly to those who live in flats, and who do not find it convenient to erect an outdoor aerial. Quite good results, however, are possible when using an indoor aerial erected in one of the rooms of the house, and this article describes how to make such an aerial with very little trouble and a small outlay. The writer has used such an aerial for reception with several different receivers, and has found it gives excellent results. The items enumerated below must first of all be procured.

Material

100-ft. roll of ¼ in. wide copper ribbon.

One dowel rod, 3 ft. 6 in. long by ⅝ in. diameter, or an ebonite tube or rod of similar dimensions.

One length of brass bar, 3 ft. 6 in. long by about 3/16 in. diameter.

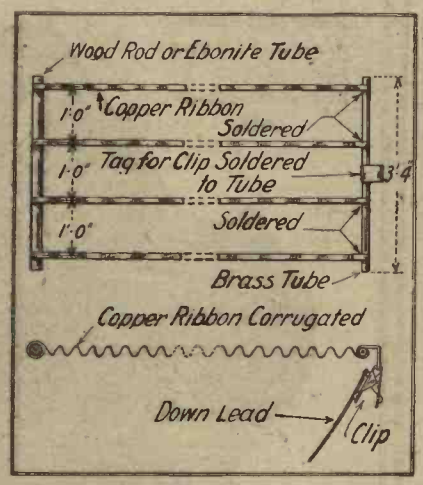
One spring clip.

A piece of brass strip about 2 in. long by ½ in. wide.

A length of insulated flex for the down lead.

Preparing the Copper Ribbon

The details of construction are extremely simple, as will be seen from the diagram, which shows the completed aerial. First measure the distance across the room where it is intended to erect the aerial. If this distance should be, say, 12 ft., double this figure and cut off four lengths of copper ribbon, each length thus being 24 ft.



An indoor aerial constructed from corrugated copper ribbon will prove quite satisfactory in practice.

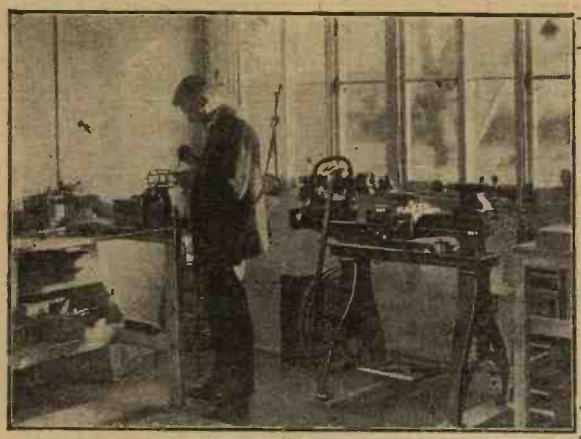
Now corrugate these lengths of ribbon, as shown in the lower portion of the drawing, simply by making bends in alternate directions at equal distances along each length. This process should be done with the fingers and not with pliers, as the bends must not be too sharp.

Now secure one end of each of the four strips to the dowel rod at distances of one foot apart as shown, a small pin nail driven through the copper strips at these points effectively holding them in position. The remaining ends of each of the four pieces are next soldered to the brass bar, also at distances of one foot apart. Finally, a small piece of brass strip is soldered to the brass bar in the position indicated.

Erection

All that now remains is to erect the aerial in the room chosen by securing a string across the dowel rod and the brass bar respectively. The string at each end may in turn be attached to insulators connected to hooks provided in the opposite walls of the room. A down lead should finally be made from a suitable length of insulated flex, one end of which should be equipped with a spade tag or terminal for the purpose of connecting to the receiver, while the other end should have joined to it a spring clip for connecting to the aerial via the brass strip tag provided. This arrangement enables one to completely disengage the down lead from the aerial itself when desired.

H. B.



WORKSHOP HINTS
FOR THE
HOME CONSTRUCTOR

Ebonite Mouldings—Another Threading Tip—Centring Round Rod—Rapid Tapping—A Handy Saw—Making a Straight Cut—Salving Terminals—Ill-Fitting Screws and Nuts.

EBONITE MOULDINGS

I WONDER how many readers have discovered the large variety of ebonite mouldings that is now available? So many kinds are made that an enormous amount of cutting and shaping work is saved by their use. Fig. 1 shows one type that I have found especially useful. This is 1 1/16 in. by 9/16 in. in section, and running through it are two quarter-inch holes spaced 9/16 in. apart. This moulding can be obtained in 36 in. (or shorter) lengths, and it enables coil mounts to be made with an absolute minimum of trouble. All that is necessary is to cut off about one inch and to insert into the holes a standard plug and socket; these are kept in position by a pair of screws or terminals that also form the contacts.

Fluted Rod

Another very handy kind of material to keep in stock is fluted ebonite rod, which can be obtained in all diameters from 7/16 in. to 1 1/16 in. When a supply of this is available the task of making small knobs for spindles, control levers, and so on, is immensely simplified, for all that need be done is to cut off a 1/4 or 3/8 in. length, to finish off the ends, and to make a tapped hole in the centre. If a lathe is available, really elegant knobs can be turned up from fluted rod.

ANOTHER THREADING TIP

I DESCRIBED recently in these notes a simple method of threading ebonite rod intended for use as the formers of fixed resistors by means of a split gas die. Lately I have been employing a method which is even more satisfactory and quite as easy to put into practice. It consists in the use of 3/8-in. ebonite rod, which is threaded by means of a standard Whitworth die. This makes a thread with sixteen turns to the inch and allows approximately one inch of wire to be wound on for each turn. For dull-emitter valves No. 30 Eureka wire, which has a safe current capacity of .59 amp., is quite suitable, and the resistance of this wire runs out to a little under six ohms per yard. It will be found quite an easy business to thread the rod if the die is "spread" as much as possible by means of the pointed adjusting screw in the middle of the holder.

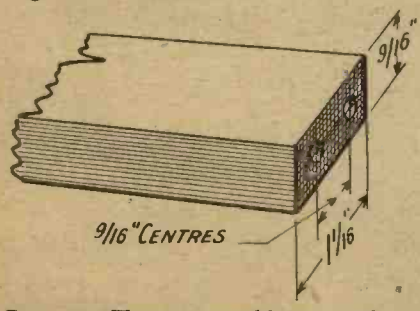


Fig. 1.—Ebonite mouldings such as that illustrated can be used for a variety of purposes.

A Cheap Outfit

Since ebonite is rather hard on steel tools I did not care about using my own best quality die for the purpose; instead, I bought a 3/8-in. die from Woolworth's for sixpence, which does the work very well indeed. As a holder can be purchased for the same price, the outfit is not an expensive one! These dies are simple to use since they are made with a fairly wide "let-in" at one side, which greatly facilitates the process of starting the threads straight. Fix the rod to be threaded in the vice, allowing about an inch to protrude above the jaws. Press the die firmly on to it, and, having seen that the holder is level, make half a turn forward. You will be able to see at once if you are going straight, for if you are not the holder will wobble as you turn it. Once you have got a proper start the die can be run on quite quickly.

Use Good Quality Ebonite

It is necessary, however, to take care that it does not become clogged. The best way of ensuring this is to prod out with the point of a scriber after every few turns the chips and the dust that collect in the clearing holes of the die. Be careful, too, to purchase ebonite rod of good quality, since poor stuff cannot be threaded satisfactorily owing to the way in which it chips or crumbles.

CENTRING ROUND ROD

WHEN ebonite rod is used for fixed resistors, for the handles of control rods and so on, holes have to be drilled in the ends, and it is most desirable that these should be central, for if they are not the job when finished is always rather an eyesore to the man who prides himself on the quality of his work.

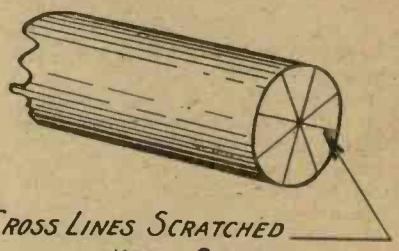


Fig. 2.—The suggested method for obtaining the centre of round rod.

It is extraordinary how difficult it is to guess by eye the centre of the end of a piece of rod. If a punch mark is made in this way it will usually be found that the hole when drilled is considerably out of position. One of the best tips that I know for finding the centre, when a lathe is not available, is that indicated in Fig. 2. Having filed the end of the rod flat, scratch in a few crossing diameter lines with the point of a scriber. With their help the exact centre can be located quite easily, as the reader will find if he gives this tip a trial.

RAPID TAPPING

I PREVIOUSLY recommended the use of the hand drill instead of the ordinary tap-holder when it is necessary to thread a number of holes in ebonite. With either standard second cut taps or with those of the home-made variety the work can be quickly and accurately done in this way after a very little practice. There is, however, one wrinkle about rapid tapping which is probably not known to the majority of readers. One's task is made much easier if the holes are made with a rather larger drill than that given as the correct

Workshop Hints—*continued*

tapping size in the tables. There need be no fear that the bigger drill will make for a slack fit or for threads too shallow to hold properly. As a matter of fact, it enables quite a full thread to be put on, whilst it is much easier to start the tap straight, since its point goes further into the hole before the first critical turn is made.

Larger Drills Suggested

The use of larger drills has also the advantage that taps do not clog up so badly owing to the slightly larger

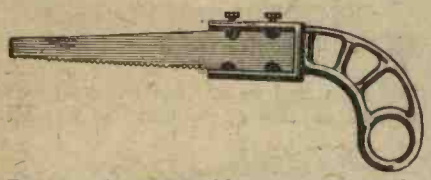


Fig. 3.—A useful addition to the workshop equipment is the keyhole hacksaw.

clearance space. For 4 B.A. the standard tapping drill is No. 34; for ebonite I always use No. 33, and the beginner who finds it difficult to go straight may find it better to use at first No. 32. A No. 42 drill instead of No. 44 is quite small enough for making 6 B.A. tapping holes, and for 2 B.A. a No. 25 may be used with advantage instead of No. 26. For threading brass or other metal it is desirable to use the tapping sizes given in the tables.

A HANDY SAW

ONE of the most useful tools that I have added for some time to my workshop equipment is the keyhole hacksaw seen in Fig. 3. This has a strong blade 5½ in. in length, which is ground almost to a point. With it the work of cutting the slots for lever switches and so on in ebonite panels is immensely facilitated, and there are many other small jobs for which it comes in very handy. The cost of these saws is only eighteenpence apiece, and extra blades are obtainable at eightpence each.

The pistol grip is very convenient, since it is a great help towards keeping the blade straight when cutting is in progress. I find this little saw much handier than the usual frame type for doing such jobs as cutting ebonite tube or rod as well as for trimming off unwanted portions of screws or studding.

MAKING A STRAIGHT CUT

A GOOD many hints have been given at one time and another on cutting ebonite with a hacksaw, but it still remains a feat which many find exceedingly difficult, for even if the blade of the saw is screwed up quite taut it shows a tendency to wander towards or away from the scribed line, largely, I believe, owing to the weight of the hacksaw frame, which makes it tend to lean to one side or the other. Here is a tip which I stumbled upon quite by accident the other day.

An Easier Process

I had drawn one scribed line, but just as cutting was about to be done it occurred to me that it might be better to reduce the length of the panel that I was cutting by ⅛ in. A second line was therefore drawn, and I began to cut between the two. To my surprise I found it much easier to keep straight with this kind of marking out than when only one line was used. One can see at once when the saw twists in one direction or the other and can correct this tendency before it reaches either of the lines. When the cut has been made it is a matter of a few minutes to trim away the unwanted material with a flat file. Some may object that this is a wasteful way of cutting up ebonite, since an eighth of an inch of the material is scrapped at every cut.

Not Wasteful

Actually it is economical rather than otherwise, for when a single line only is used, one concentrates one's endeavour in not allowing the saw to run into it; hence the blade may, and occasionally does, wander quite a long way into the main piece of the material from which the smaller panel is being cut, with the result that there

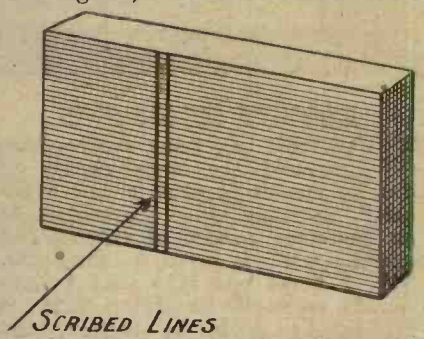


Fig. 4.—Double lines act as a guide when making hacksaw cuts.

is a good deal to be trimmed away as waste when another piece is required subsequently.

SALVING TERMINALS

EVERY experimenter's or constructor's scrapbox must contain quite a large number of old terminals which have been scrapped because their milled nuts have been lost. One of the greatest mysteries in the world is what happens to the millions of pins that are lost each year; milled nuts have an almost equally uncanny habit of disappearing in large quantities without leaving a trace. It is not generally known that these nuts can be bought from most good tool shops at very reasonable prices. Those with milled heads cost about five shillings a gross, and it is most useful to keep a supply of them in your workshop drawer.

Make Your Own

Another very useful type of terminal top is the wing-nut, which is easy to tighten down firmly and which allows connections to be made or unmade very quickly. These are obtainable in all the B.A. sizes from 0 to 5 at about double the price of milled nuts. Where terminals are needed which do not protrude below the under-

The type and size of aerial insulators used in constructing the Rugby station aerial is clearly demonstrated in this photograph.

WORKSHOP HINTS—*continued*

surface of the ebonite, as in valve holders and other small components for panel mounting, it is a good tip to make one's own, using screws with countersunk heads for the stems. Small round nuts in all the B.A. sizes can be purchased very cheaply from tool shops, and with these and either milled or wing-nuts for the tops neat terminals can be made.

ILL-FITTING SCREWS AND NUTS

HOW often, when one is forced by lack of time to obtain supplies of B.A. screws and nuts from "the little shop round the corner," does one find either that the nuts are a

Having had the pleasure of listening to John Henry and Blossom "over the wireless" we shall shortly be seeing them on the films.

trifle too small or the screws slightly too large? The nut goes on quite easily for the first two or three turns and then refuses to go any farther. And, unfortunately, it is not only the small shop whose owner dabbles in the sale of wireless fitments that plays this unkind trick upon the constructor.

Just the other day I obtained from a big wireless firm a dozen clips supplied with screws and nuts for fixing purposes. Only two of the nuts would go on the screws. I must say that the firm was most apologetic about it and sent a fresh supply directly I called their attention to the matter; but, as is usually the case, I tackled the job of mounting those clips at a time when no shops were open, so that it was impossible to obtain other screws and nuts; nor had I in my stock any of the required size that were of the proper length.

The First Thing to Do

When this kind of thing occurs the first thing to discover is whether it is the nuts that are too tight or the screws that are too big. This can be done by running one of the nuts on to a standard tap of the proper size. If the nut goes on quite easily, then the screws are at fault, but if force is required to put the nut on and if the tap is obviously cutting, the screws are not to blame. When the nuts are too tight it is not a long job to deal with a dozen or two of them. Fix the tap in the chuck of your hand drill and run the first nut to be tackled a little way on to it with the fingers. Then grip the nut in the jaws of the vice and run the tap through quite fast. Having withdrawn the tap, put the nut into an empty cigarette tin and go on with the next.

Quick Work

Working in this way one can easily deal with a dozen tight nuts in five minutes. If it is the screws that are slightly too big, fix a die of the proper size into the jaws of the vice and run the screws through it one by one. Should you possess a spiral ratchet screwdriver, the job is very easily and quickly done.

IT'S THE LITTLE THINGS THAT COUNT

MANY beginners at constructional work find it rather difficult to punch-mark a panel accurately as a preliminary to drilling. Even if the marking out has been done with considerable care and accuracy many of the centres do not lie, as they should, at the junction of the cross lines made with the scriber. One of the commonest causes of inexact centre punching is to be found in the use of a tool that is unsuitable for the purpose. For wireless work, where most of the holes are made with small drills, the best type of punch is one that tapers gently to a fine point. The more or less round-pointed punch with a steep taper is not at all what is wanted.

The Punch to Use

When the point is sharp one can feel the way into the scratches made by the scriber and arrive at the exact point of intersection of the cross lines. It is a good tip to keep your centre punches always sharply pointed. This can be done without difficulty by the use of a keen medium file. Even when you have to make a $\frac{1}{4}$-inch or $\frac{3}{8}$-inch hole in a panel, it is better to mark the drilling centre with a fine pointed centre punch.

AN ALL-PURPOSE VALVE UNIT

By L. H. THOMAS (6QB)

Constructional details of a useful addition to the experimenter's equipment

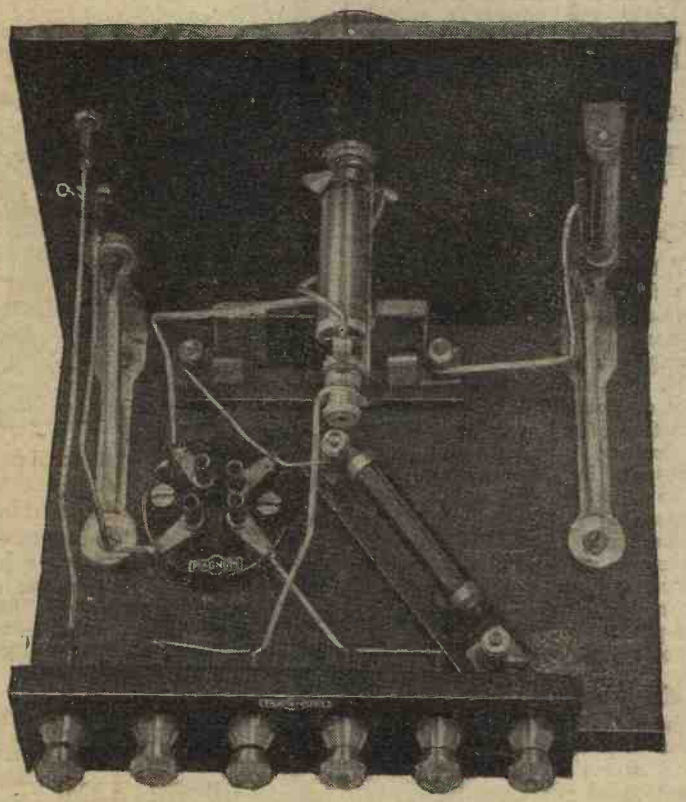
ALTHOUGH most of us agree that it is always preferable, in wireless, to keep one piece of apparatus for one particular job, and not to attempt to use it for anything else, it sometimes entails a considerable strain on the experimenter's pocket to follow this rule. It is, in many cases, quite practicable to construct a unit in such a manner that it may be used for a large number of different experiments without having to undergo any alteration itself, all the changes being made in the arrangement of the circuit *outside* the unit.

The writer has made the useful unit described in this article to show that one small and inexpensive instrument can be used for quite a number of purposes without undue clumsiness and complicated switching (the usual objection to "multi-purpose" gadgets), and at the same time without loss of efficiency.

Of Utilitarian Value

It was originally used as a low-frequency amplifier, employing the resistance-capacity method of coupling, and was employed in connection with some tests carried out on the lower wavelength broadcast bands. The writer then had occasion to repeat these tests upon wavelengths around that of Daventry, and the idea struck him that the same unit might then be used as a resistance-coupled H.F. amplifier, this method of coupling being, of course, quite efficient on wavelengths of that order.

In addition to these two purposes, it may also be used as a detector following a stage of resistance-coupled high-frequency amplification, or even as a straight single-valve receiver, if suitable coils and a variable condenser are brought into commission externally.



The anode resistance R3 is mounted directly behind the "input" terminals.

The Circuit Explained

The circuit of the unit itself is shown in Fig. 1, from which it will be seen that two terminals for grid bias are provided. Normally these are only used when the unit is employed as a low-frequency amplifier. Also, both the resistances and the condenser are of the "clip-in" variety, so that the flexibility of the instrument is further increased.

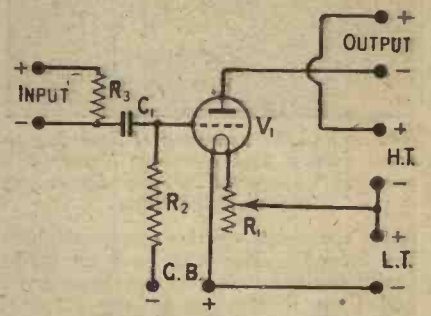


Fig. 1.—R2, R3 and C1 are all of the "clip-in" variety.

Only one high-tension positive terminal is provided, that being used for the potential applied to the anode of the valve in the unit itself. Since the "Input" terminals on the left of the panel are connected to the telephone terminals of the receiver to which it is being attached (all these remarks applying, of course, only when it is used as a low-frequency amplifier), the high-tension on the anode of the last valve in the receiver, whether it is the detector or a note magnifier, will not be interfered with. Care must be taken to connect the input terminals correctly. The positive (upper) one should be connected to the

AN ALL-PURPOSE VALVE UNIT—*continued.*

telephone terminal on the receiver which goes to the high-tension positive.

Construction of the Amplifier

As will be seen from the photographs and the back-of-panel diagram, both the initial construction and the wiring are very simple indeed. The only component mounted on the panel is the filament rheostat (the anode resistance being secured in clips attached directly to the input terminals). Behind, on the baseboard,

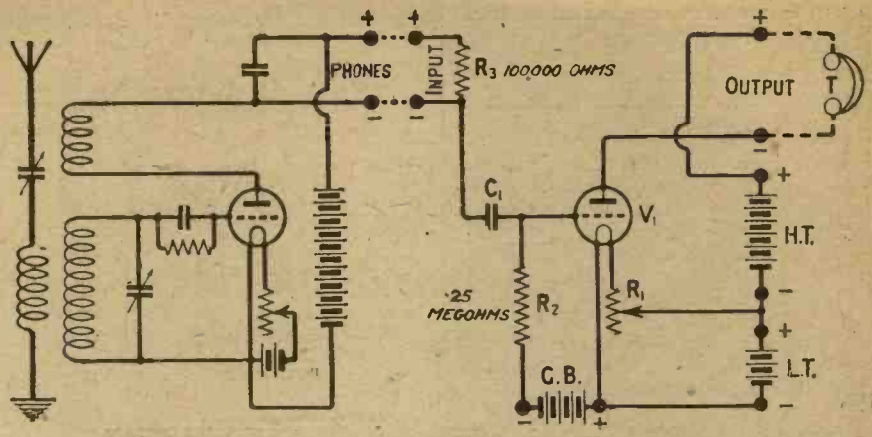
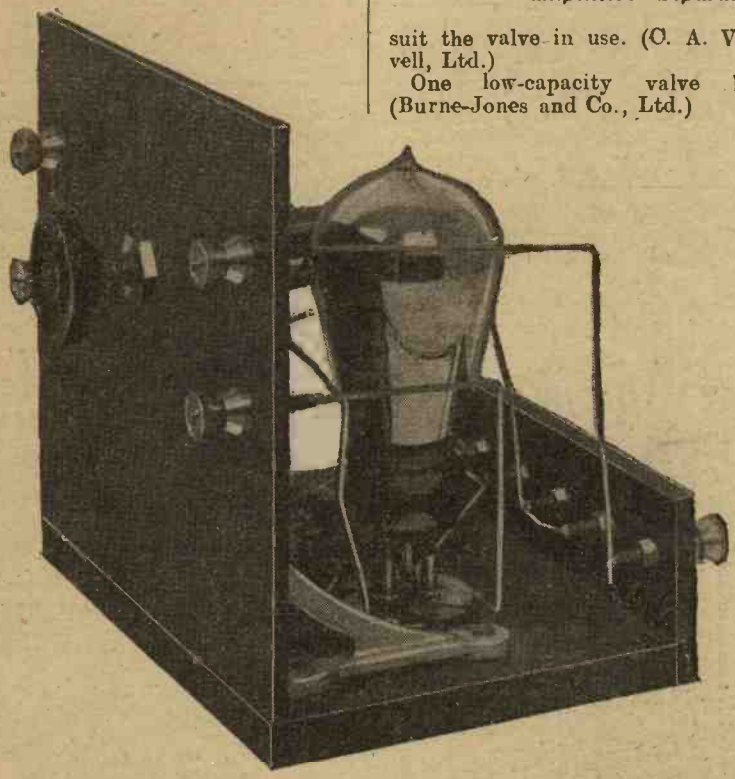


Fig. 2.—The necessary connections for using the unit as a low-frequency amplifier. Separate batteries are shown for clearness.



Only the input and output terminals and the filament rheostat are mounted on the panel.

are the valve-holder, the grid-leak and condenser, and the terminals for the three batteries. The wiring is extremely short throughout, and was carried out with square tinned copper wire.

The Components Used

For the guidance of readers who wish to construct an exact duplicate of the amplifier shown in the photographs, the following list of the components used is given. It will, of course, be understood that the actual makes need not be strictly adhered to, provided that the dimensions and values are not altered.

One Radion panel, 6 in. by 7 in. (American Hard Rubber Co.)

One baseboard, 7 in. by 4½ in. (Carrington Manufacturing Co., Ltd.)

One filament rheostat of resistance to suit the valve in use. (C. A. Vandervell, Ltd.)

One low-capacity valve holder. (Burne-Jones and Co., Ltd.)

One .0003 clip-in condenser.

One .01 clip-in condenser.

One .25-megohm grid-leak.

One 2-megohm grid-leak and one 100,000 ohm resistance, with necessary bases, and one condenser base (L. McMichael, Ltd.).

One ebonite strip, to take six terminals.

Ten brass terminals.

Two small panel brackets.

Sundry wood-screws, tinned copper wire, etc.

As a Low-Frequency Amplifier

A study of Fig. 2 will make quite clear the method of connecting this unit in circuit as a low-frequency amplifier. For this purpose the value of the anode resistance (across the input terminals) should be about 100,000 ohms; the grid condenser should have a capacity of .01, and the grid-leak should be .25 or .5 megohm. The necessary values must, of course, be modified in the list of components should the reader wish to depart from them. Since the leaks and condensers are easily interchangeable, this may be done without any trouble.

Suggested Voltage Values

The bottom end of the grid-leak, in the unit, is connected to the negative grid-bias terminal, and this should

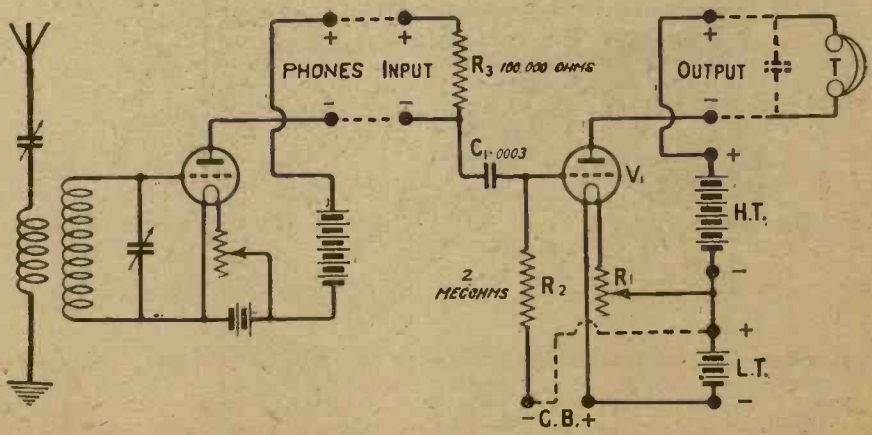


Fig. 3.—When the unit is employed as a detector, a by-pass condenser must be connected across the telephones.

AN ALL-PURPOSE VALVE UNIT—*continued.*

accordingly be connected to the negative end of the grid-bias battery. (This seemingly obvious fact is mentioned because when the unit is employed for other purposes this terminal is connected in quite a different manner). If the amplifier is being used directly after a detector, about 90-120 volts high-tension with 4½-7½ volts negative grid-bias are recommended. If, however, it is in use as a second stage of amplification about 9 or 12 volts grid-bias will be advisable, while the high-tension may be anything up to 180 volts.

Desirable Features

When used in this manner the chief feature lies in the very pleasing purity of reproduction, although the amount of amplification usually associated with a good transformer amplifier will not be obtained. Best results are secured when the valve in the anode circuit in which the 100,000 ohm resistance is inserted (*i.e.*, the detector or preceding note-magnifier to this unit) is one of the high-impedance type specially designed for resistance amplification (*e.g.*, the D.E. 5b type).

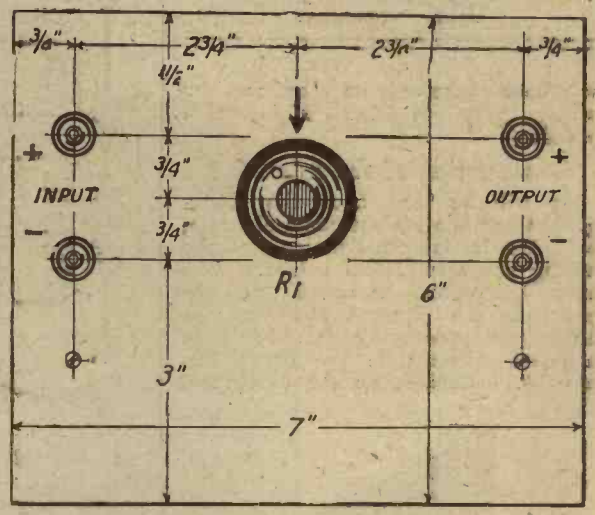


Fig. 4.—No difficulty will be experienced in the drilling of the panel. (Blueprint No. C 1053 a.)

The high-tension voltage on the preceding valve will also probably have to be increased somewhat to compensate for the voltage drop across this resistance. It is assumed that a by-pass condenser is always used across the 'phones, if the latter are directly in the anode-circuit of the detector; this condenser will then automatically be connected across the resistance, which takes the place of the 'phones.

Detector Modifications

Let us now consider the means of using this unit as a detector. In the first place the grid-leak and condenser will obviously need to be altered. A .0003 condenser and a 2-megohm leak, or components with similar values, should therefore be substituted for those in use. To ensure proper rectification the bottom end of the grid-leak must now be connected to the *positive* L.T. terminal, *i.e.*, the negative grid-bias plug should be removed from its battery and connected to the positive low-tension terminal. The unit may now be used after a stage of resistance-coupled high-frequency amplification without further alteration. Fig. 3 shows the complete arrangement, which will be found very suitable for the reception of 5XX and other long-wave stations. (The resistance-coupled H.F. arrangement is not, of course, very efficient below 1,000 or 1,200 metres.)

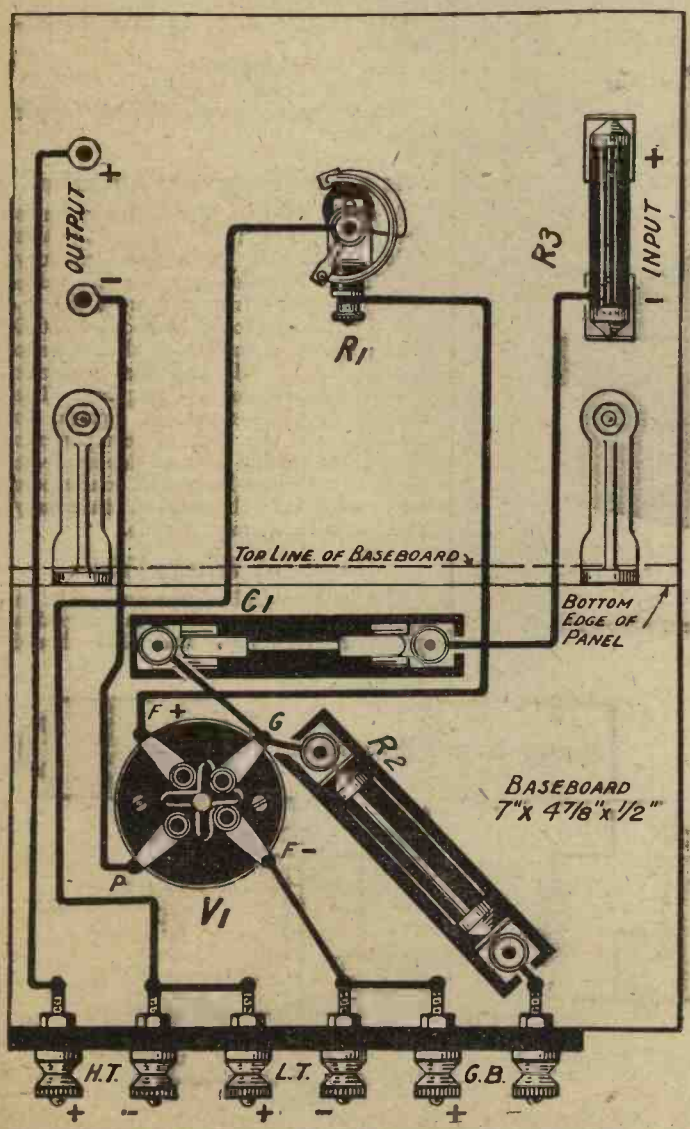


Fig. 5.—The small amount of wire used is apparent from this diagram. (Blueprint No. C 1053 b).

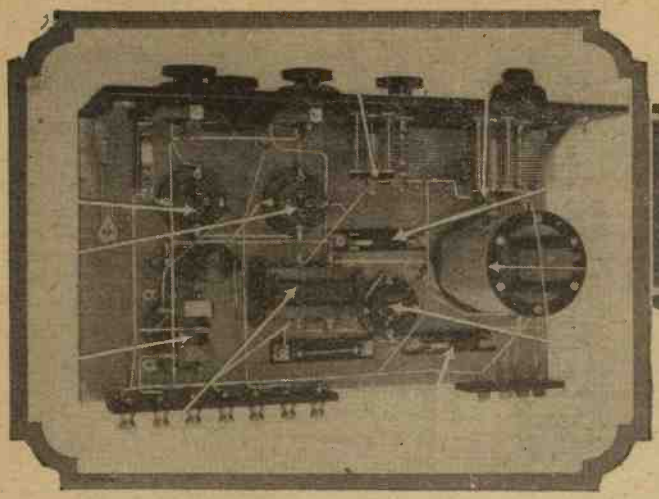
A Possible Refinement

The 'phones are now simply connected to the output terminals, the H.T. voltage applied to the anode of the valve in the unit (now the detector) being suitably modified. About 45 volts will probably give the best results. The high-tension on the H.F. amplifier will not need to be more than about 70 volts.

As a refinement, a variable grid-leak can easily be plugged into the holder for fixed resistances, if desired, but as the unit will probably not be used so often as a detector as for a note-magnifier, this was not done in the original instrument.

Further Applications

It will be seen from Fig. 3 that very little alteration is needed to convert the unit into a second stage of high-frequency amplification, *after* a resistance-coupled stage. The end of the grid-leak (*i.e.*, the G.B. − terminal) may be connected either to the L.T. − terminal or to the moving contact on a potentiometer, and in the anode circuit of the valve in the unit may be inserted either a tuned circuit or the primary of a high-frequency transformer, or, if desired, another anode resistance. It may be used for any of the well-known methods of H.F. coupling.



WHERE INSULATION MATTERS

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

Good insulation is vital in certain places, but is not so important in others. This article shows just where trouble must be taken.

A LARGE quantity of insulating material such as ebonite, bakelite, mica and sometimes porcelain or pyrex glass is used in the construction of a wireless receiver and its component parts, and one may be inclined to wonder at times whether this is all necessary. Might it not be possible to construct a set without taking all this meticulous care about the insulation, and yet not impair its efficiency?

The answer in nine cases out of ten is "No."

A Wooden Panel

There is certainly one part of the receiver where ebonite or bakelite can be eliminated, providing always that a suitable circuit is used, and that is the panel on which the controls are mounted. In such receivers as the "Elstree Six" (see *Modern Wireless*, June and July issues), where all metal parts coming in contact with the panel are at earth potential as regards H.F. currents, wood or some similar substance may be used for the panel.

In certain parts of the receiver, however, insulation is most vital. If only slightly impaired a marked loss in efficiency often results, and in certain cases, which will be dealt with in due course, not only may a reduction in signal strength be caused but the quality of reproduction is spoilt.

A Typical Circuit

Suppose we have a receiver employing a circuit such as that shown in Fig. 1. This consists of a detector valve, followed by three stages of resistance-capacity low-frequency amplification. Now, how will quality be affected by poor insulation, and at what points is this question of insulation likely to be critical?

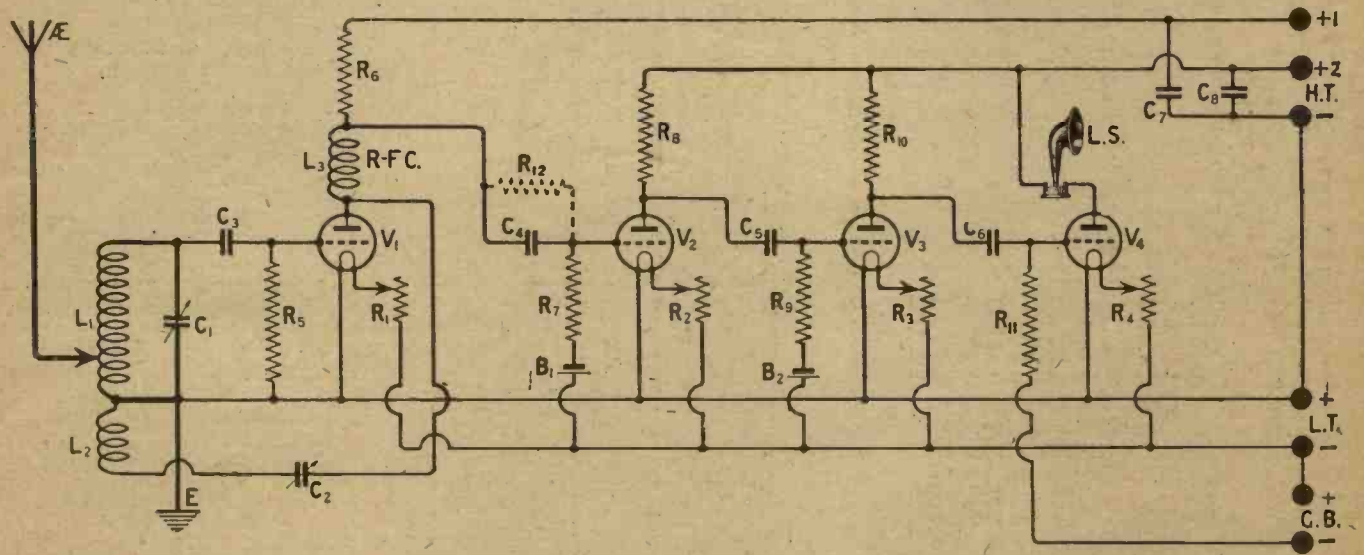


Fig. 1.—This circuit, which usually gives very pure reproduction, may be entirely spoilt if the condenser C4 is leaky.

It will be seen from the diagram that fixed condensers C_4, C_5, and C_6 are used to couple the anodes and grids of succeeding valves. Thus, C_4 couples the anode of V_1 to the grid of V_2 and so on.

As is no doubt known to most experimenters, a resistance-capacity coupled amplifier requires a rather high value of H.T. voltage, and even if valves specially designed for the purpose are used 100 volts is needed. Now, suppose that the insulation of the coupling condenser C_4 is faulty, the effect of this is equivalent to shunting it with a resistance which is shown dotted as R_{12}. It will be appreciated that this results in a positive potential being applied from the high-tension battery to the grid of V_2. This will result in grid current passing, in fact it will act similarly to grid-condenser rectification in the case of a detector valve. Distortion is therefore introduced, and the purity of tone generally associated with resistance-capacity amplification will be spoilt.

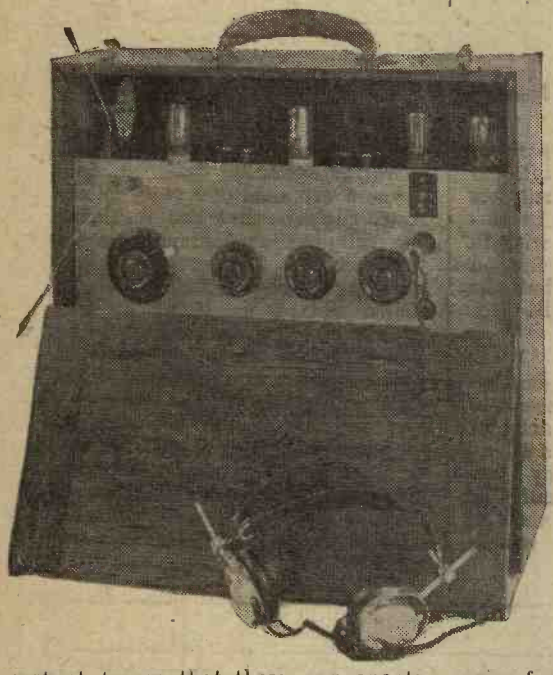
The Effects of Grid Bias

If a small biasing battery is used, as shown in the circuit at B_1, to apply a negative potential to the grid the effect will not be so serious; nevertheless it will be present. In the case where a D.E.5b type valve is employed only about 1½ volts negative

Where Insulation Matters—*continued*

bias should be used, as an examination of this valve's characteristic curve will show; therefore it will be difficult to compensate for the positive potential applied by the use of a faulty coupling condenser, and such distortion that is thereby introduced, though small, will undoubtedly be noticed by the critical ear.

The same arguments, of course, apply to the other coupling condensers C_5 and C_6. It is therefore important to see that these components are of the best quality, and inferior condensers, although cheaper in the first instance, will result in ultimate dissatisfaction.



A portable receiver employing a wooden panel was described by Mr. John Underdown in a recent issue of "Wireless."

Another aspect of the question is that if the grids of the L.F. valves are not kept at the correct negative potential, more anode current will be passed, with a resulting shortening in the life of the H.T. battery.

The Variable Condensers

There are other points, too, at which the insulation is important in the circuit shown. From the point of view of signal strength the tuning condenser C_1 should, of course, be above suspicion. Should this have a low insulation resistance the resultant signals will be reduced in magnitude.

We also have a variable condenser C_2, which is used for controlling reaction in a manner similar to that employed in the Reinartz circuit. This has to withstand the effective anode voltage, and the presence of poor insulating material will cause a partial short of the H.T. battery; while should dust accumulate between the plates the condenser will become exceedingly noisy in action, for dust is detrimental to insulation.

Preserving the H.T. Battery

The reservoir condensers C_7 and C_8 must not be forgotten. These are connected across the H.T. tappings and therefore have to stand up to the full H.T. voltage of each. The writer experienced a case where three H.T. tappings in a set each had a shunting condenser of the usual value of 2 microfarads connected between them and the common negative. With the set switched off a current of .25 milliamp. was found to be flowing in the H.T. negative lead. Though this is not a heavy current, yet it is sufficient to harm the H.T. battery, since it never gets a complete rest between the periods of working.

Another Circuit Analysed

Another circuit is shown in Fig. 2 in which certain points need to be watched. The remarks previously made about tuning condensers (which also apply to inductances), apply to the condensers C_1 and C_2 which tune the grid and anode circuits respectively of the valve V_1. The circuit, which is of the neutralised type, employs the centre-tap grid coil method of stabilisation, and it will be seen that the neutralising condenser shown as N.C. is connected between L.T. − and H.T. + 1 so that should the insulation be poor, a leakage of H.T. current will result.

Although the question of insulation of the grid condenser of the detector valve is always an important one, it becomes doubly so when a stage of tuned anode H.F. precedes the detector. Should the insulation not be perfect a positive potential is applied to the grid, causing not only excessive anode current to flow, but also a loss in rectification efficiency, and therefore a reduction in signal volume.

If a telephone shunting condenser is used as at C_4 its insulation should be perfect or a reduction in signal strength may result, since part of the signal will flow through the condenser instead of through the 'phones.

Transformer Details

In L.F. and H.F. transformers, of course, perfect insulation between windings and also windings and core is absolutely essential. With instruments of repute, however, such faults do not develop often, and although in the case of an L.F. transformer a winding may break down, the other faults seldom appear.

A Relative Matter

"This is all very interesting," I hear someone saying; "but what constitutes good and what bad insulation?"

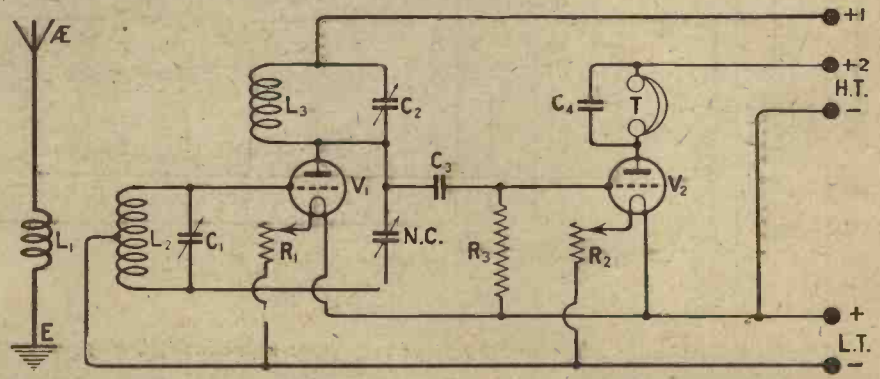


Fig. 2.—In this circuit a faulty neutralising condenser will cause the H.T. battery to run down.

Well, this is, to a certain extent, a relative matter, and although the ideal to aim at is perfect insulation in all instruments and components, or, as it is usually expressed, the insulation resistance should be infinity, it is not always easily attainable.

WHERE INSULATION MATTERS
—continued

It is obvious that in a component such as a filament resistance where the total resistance of the winding is only a matter of thirty ohms or so, the insulation resistance is good enough for general purposes if it is in the neighbourhood of ½ megohm; yet if a condenser showed an insulation resistance of this value it would be accounted as very bad. If the condenser were for shunting telephones, loud-speaker, or L.F. transformer primary it would not be so serious, but if used as a grid condenser it would be fatal.

The famous "Elstree Six" uses a wooden panel.

For a variable condenser, whether used for tuning, neutralising or reaction, the very lowest value permissible in the case of one of the cheaper instruments would be 20 megohms, but a good class component should certainly show not less than infinity.

Uncertain Operation

In the case of valve holders and valve bases again the resistance should not be less than infinity. It is obvious that any fault in the insulation of either of these is bound to result in a serious decrease in efficiency. Not only will the input be reduced by the presence of poor insulation, but the output will also be affected. Also if the insulation is faulty at such points the result may be to make the receiver noisy and uncertain in operation. Since bad insulation is in effect a high resistance, it is liable to vary not only from moment to moment, but also from day to day, a highly unsatisfactory state of affairs.

Testing Apparatus

The difficulty is, of course, for the average experimenter to determine where insulation is good and where bad. The only satisfactory method is to use a megger, but it is only a few who can afford a piece of apparatus of this description. Much can be done with a pair of 'phones and a battery, and their application to various forms of tests have been described from time to time in the pages of THE WIRELESS CONSTRUCTOR, and need not be dealt with again.

For extremely bad insulation a sensitive milliammeter may be used in conjunction with a high voltage battery, so that in such cases an actual deflection of the meter needle may be obtained.

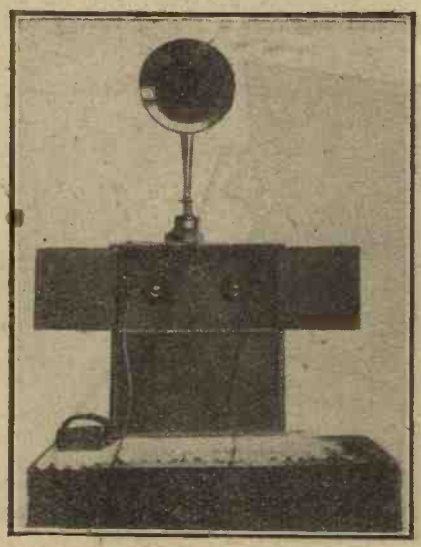
Clear Away All Dust

One of the chief enemies of good insulation is dust, and it is well worth while spending a little time every week dusting your receiver both inside and out. A round mop brush is a useful means of clearing out the dust, and particular attention should be paid to valve holders, fixed condensers and the like. Variable condensers may be cleaned out with a feather or one of those fluffy wire pipe cleaners.

It is incidentally just as well to keep the top of the H.T. battery free from dust, since otherwise quite considerable leakage may take place.

A THREE-VALVE LOUD-SPEAKER RECEIVER

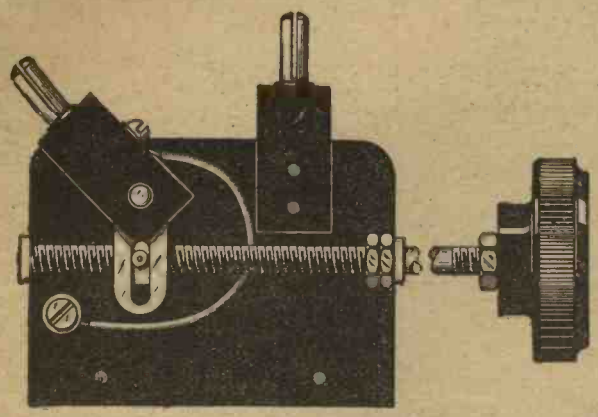
SIR,—I have constructed the Three-valve Loud-speaker Receiver as described by Mr. J. H. Reyner in the January, 1926, issue of THE WIRELESS CONSTRUCTOR under the heading of



Smooth Reaction Control, and am pleased to say that in every way it is splendid. I enclose a photograph of same, which may be of interest to you.

Yours faithfully,
W. H. PIERSON.

East Ham.



POINTS TO WATCH IN COIL HOLDERS

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

Some interesting points to be borne in mind when choosing a coil holder

IN order to ensure that a receiving set will function satisfactorily it is of prime importance to make sure that the individual components are of best quality and design. It will be quite obvious to all home constructors that since the market is crowded with apparatus of all descriptions the efficiency of the components will vary to a considerable degree.

Now the term efficiency should be considered in a very wide sense bearing in mind the two prime factors, *i.e.*, soundness both from the mechanical and electrical points of view.

Previous Discussions

Readers will have noticed that during the last month or so various components have been discussed in the columns of this journal, their merits and de-merits being indicated, so that when purchasing the components in question the potential customer is in a position to examine the apparatus with a critical eye.

Displaying Ingenuity

This month it is proposed to deal with coil holders, of which a large variety are available at the present time.

There are, of course, single, two-way and three-way coil holders, and in the last-named two types a great deal of ingenuity has been displayed by manufacturers in order to produce slow-motion effects.

Questions of Surface Leakage

Before particularising it will be apparent that certain qualities are essential to all the types. The quality of the insulating material employed in the manufacture must be of the highest. The surface of the material should be quite smooth, so as to minimise the possibility of globules of water or particles of dust readily adhering and thus causing surface leakage.

If the resistance between the pin and socket is not of the order of several megohms a loss of energy will take place which may prove very troublesome when weak signals are being received.

Loose Connections

The pin and socket should be accurately mounted, so that the standard makes of coils will fit tightly and securely in place. If a loose fit results then signals will be reduced. In addition, adequate connections must be provided between the pin and socket, and the terminals or screws used for joining to the wiring of the receiver. Faults have often been traced to the failure of the screws to make good electrical contact due, in many cases, to the screws being of insufficient length.

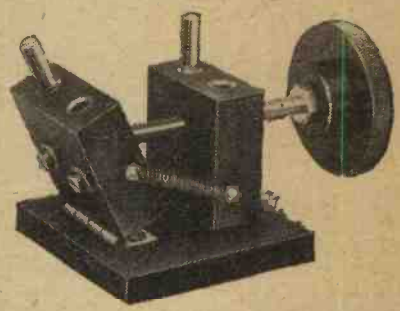


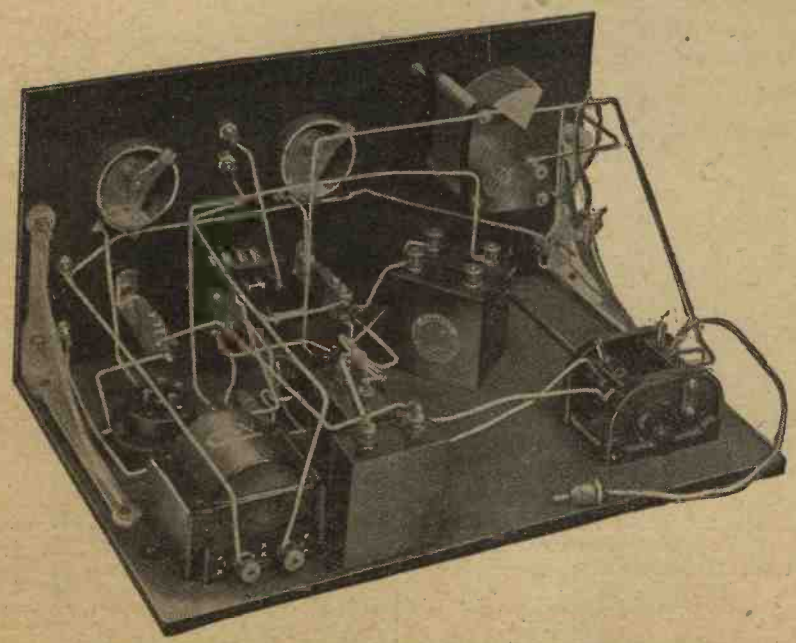
Fig. 1.—A simple but effective type of slow-motion arrangement.

The Addition of Terminal Nuts

The provision of terminal nuts, in addition to soldering tags, is a feature which has much to commend it, as it enables the constructor possessing little skill with the soldering iron to make a proper joint without damaging the holder through overheating with the soldering iron in the effort to make the necessary connections.

A Wide Application

Nothing need be added to the above points when considering the base-board - mounting single-coil holder and attention must now be turned to the two-way and three-way types which, of course, find their widest application in the variable-magnetic



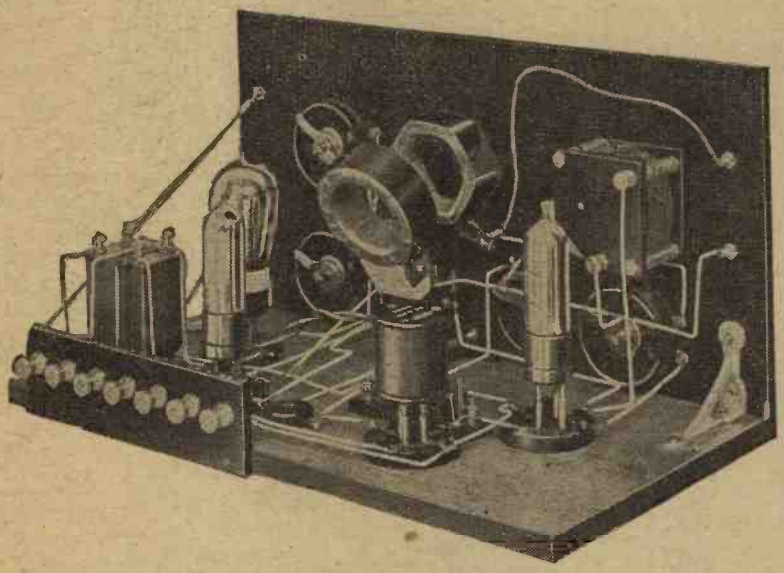
Long extension handles on coil holders are often useful.

Points to Watch in Coil holders—*continued*

reaction circuits that are still popular with a large number of constructors.

An Important Point

To generalise again it is essential that the moving coil block should be capable of remaining absolutely steady in any position between its limits of travel. The heaviest of plug-in coils should not be capable of causing the block to fall or, of course, the whole purpose of the coil holder is defeated.



This type of coil holder is often useful.

The Moving Block

Many spring devices have been incorporated into the holders in order to bring about this most desirable state of affairs, and the heading illustration shows one particular make which incorporates a moving block pivoted by means of a small pin.

Turning the knob makes a collar travel along a screwed thread, the collar engaging in an arm with a slot and moving the coil block against the tension of a spring. Figure 1 shows another arrangement, the moving block being hinged at its base, the forward travel of a screwed rod pushing the block round and altering the tension of a helical spring mounted at the side.

Avoiding Backlash

In many types special gearing is employed to give a slow motion effect as an aid to fine tuning, and in these cases a complete absence of backlash is desirable for smooth working. If backlash is present the operation of the receiver becomes erratic, and sudden bursts into oscillation take place which, of course, are particularly objectionable.

A Minimum of Metal

The minimum of metal should be present in the completed component so as to avoid the magnetic field produced by the coil linking this metal and causing losses. When extension handles are incorporated to enable the coil holder to be mounted on the baseboard, away from the other components, hand capacity effects are often present. This may prove troublesome in a very sensitive receiver, and should be guarded against wherever possible.

.....

Coil holders mounted in this manner are useful for experimental work.

.....

Conclusion

When designed for mounting at the back of the panel, as in the photograph above, ensure that the holding nuts are of sufficient size to support the holder when heavy coils are inserted.

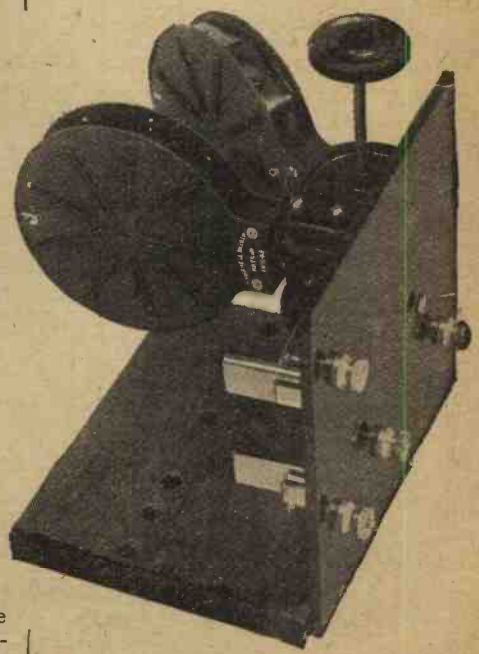
If these details are given their due attention little difficulty will be experienced by the wireless enthusiast in deciding on the make which most satisfactorily fulfils his requirements.

A READER'S EXPERIMENT

SIR,—I have read Mr. H. J. Barton-Chapple's interesting article entitled "Crystal or Valve Rectification" in the June, 1926, issue of THE WIRELESS CONSTRUCTOR, and note he welcomes experiences.

There is one disadvantage of anode current rectification which is often overlooked, and that is the effect of the high valve impedance when working on the bottom bend of the characteristic, and I find that a resistance-capacity amplifier is best after a valve working in this manner.

Some months ago, being pleased with the clarity and selectivity obtained with a single-valve set using the anode current method of rectification, I decided to convert my "Twin-valve Loudspeaker Receiver," described by Mr. John Scott-Taggart in the January, 1925, issue of THE WIRELESS CONSTRUCTOR, from the grid current method of rectification to the anode current, only to discover that, after I had readjusted the circuit to suit, the quality of reproduction was distinctly worse than when the grid leak and condenser method was employed! In spite, therefore, of a great gain in selectivity, I



am reconverting the set back to the leaky grid condenser method.

Incidentally, I am a great admirer of this particular circuit, and have tried one or two experiments of my own with the receiver I have made.

Yours faithfully,

Enstone. E. D. FORESTER.

For "The Wireless Constructor" at our Elstree Laboratories.

Combined Wavetrap and Filter

WE have received from Messrs. Claude Lyons, British Agents for the General Radio Co. of America, a combined wavetrap and filter.

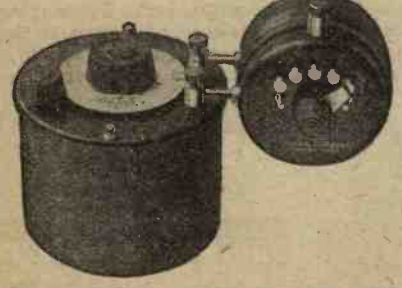
This instrument comprises a small geared condenser to the terminals of which a special coil is connected. This coil is provided with two windings, one of which is tuned by the condenser, and the other of which acts as a coupling winding and is tapped with a small switch. The aerial circuit is connected to the coupling winding, which may either be arranged as a series part coupled rejector, or as an acceptor circuit shunted across the receiver.

The condenser is calibrated in wavelengths when used with the appropriate coil, and on test this calibration was found to be accurate over the whole of the range. When employed as a wavetrap, it was found to assist the selectivity to a considerable extent, although it was not quite as good as the tapped auto-coupled arrangement which is very commonly employed. The instrument is very well constructed and attractively finished. The calibration of the condenser scale renders the device particularly suitable as an absorption wavemeter (one of the purposes for which it is intended), while the trapping action is quite up to standard. We can thoroughly recommend this component for use.

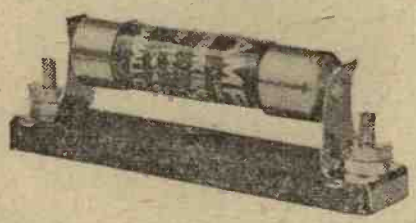
Automatic Rheostats

A COMPONENT received from Messrs. Rothermels is the "Amperite," described as the self-adjusting rheostat.

These components are similar to a gridleak or anode resistance in appearance, consisting of a cartridge surrounded with black paper and lettered in gold, with two metal cone ends which fit into clips, the whole being mounted on a small strip of ebonite; both nuts and soldering tags are included for making connections. They are neatly boxed in black and yellow cartons, but it would appear to be advantageous if these could be printed giving particulars of which "Amperite" is suitable for the English valves.



The combined wavetrap and filter submitted by Messrs. Claude Lyons, British Agents for the General Radio Co. of America.



The "Amperite" is similar to a grid leak or anode resistance in appearance.

The cartons are marked "For use with a U.V. 199 and C. 299," and so on, which are the symbols of the different types of American valves. These are not commonly known in England, therefore the English buyer would probably find difficulty in selecting the correct "Amperite" for his own use.

Grid Leak

MESSRS. EDISON SWAN ELECTRIC CO., LTD., have submitted to us for test and report two of their grid leaks.

These are of the cartridge type with metal end pieces, the leaks being of standard dimensions. Both leaks are rated at 1 megohm, and on test were found to give a value of 1.3 and 1.2 megohms each. The resistance element is contained in an opal glass tube which it is claimed is evacuated, while we understand that their resistance is independent of the applied voltage. When placed on test in a receiver they were found to be satisfactorily silent, and we can recommend these grid leaks for use.

Push Pull Switch

WE have received a "Trix" five-point push pull switch for test and report from Messrs. E. J. Lever.

This component is designed for one hole fixing, accomplished by means of a screwed metal bush. Through this passes a metal spindle carrying three ebonite and two metal bushes. Five spring contacts press against these, and as the spindle is pushed backwards and forwards they alternately make and break contact with the metal bushes, thus enabling various switching arrangements to be employed. The ends of these spring contacts are curved, while two of the ebonite bushes are grooved, thus giving a positive indication of the position of the switch. When placed on test the insulation resistance between adjacent contacts was found to be infinity, while the contact resistance was found to be negligible.

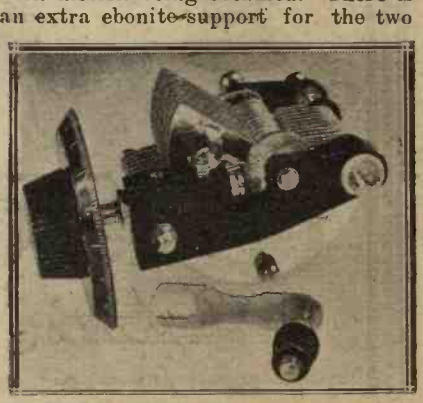
This component is well constructed and neatly finished, and can be recommended for use.

Devicon True Scale Friction Condenser

MESSRS. THE RADIO DEVICES CO., who specialise in the manufacture of condensers, have sent to our Laboratories one of their true scale friction condensers for examination.

The component is fitted with a neat ebonite knob and dial, the condenser being driven through a 2 to 1 gear, while a vernier attachment provides an additional slow motion. No end plate is employed at the top of the condenser, a supporting shoulder piece being utilised instead, thus making the instrument considerably stronger.

By means of the knob a friction disc is rotated, and this in turn rotates the friction wheel, a particularly fine even motion being obtained. There is an extra ebonite support for the two



A friction drive is incorporated in this condenser of Messrs. The Radio Devices Co.

Apparatus Tested—*continued*

terminals, while one hole fixing is provided for.

The rated capacity of the condenser is .0005, but on test it registered a shade under this value.

The introduction of this instrument will certainly meet with the favour of our readers, and we can recommend it for use.

Filament Rheostat

WE have received from King Quality Products, Inc., a sample of their filament rheostat and low-tension switch combined. So far as the resistance element is concerned this is of the conventional type.

The centre spindle carries a circular disc with two metal contacts, these contacts being connected to a centre concentric spindle, the other end of which is joined to a small knob concentric with the main knob. Bearing on this disc is a thin spring contact, which is joined to a third terminal on the body of the rheostat. The insulating disc previously mentioned has two depressions for "off" positions.

The contact arm is well shaped and tempered, and is stamped in such a way as to give it an inherent springiness. The whole component is of a very high degree of workmanship, both the construction and finish being exceptionally good. The movement of the contact finger of the resistance element is also noticeably smooth.

Balancing Condenser

MESSRS. THE IGRANIC ELECTRIC CO., LTD., have sent us one of their vernier balancing condensers for test and report. This component is intended for use where dual condensers are used to tune two separate circuits, in that it affords a method of compensating any inequality either in the two halves of the dual condenser or in the two inductances that are being used.

Showing the construction of the combined filament rheostat and L.T. switch received from King Quality Products, Inc.

The component consists of two sets of fixed plates mounted opposite to each other, while a set of moving vanes may be interleaved with either set of fixed vanes, a maximum capacity of 1¼ micro-microfarads being obtainable on either side.

On test the insulation resistance between the moving plates and the fixed, and the one set of fixed plates and the other set was found to be infinity in each case.

This instrument is well made, pleasing in finish, and can be recommended where a balancing condenser is required.

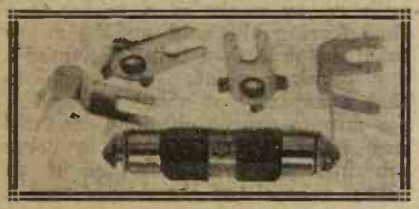
Cosmos Variable Condensers

MESSRS. METRO-VICK SUPPLIES, LTD., have sent us two of their variable condensers for test and report. Both condensers are of the square-law pattern, and are constructed on low-loss lines. The moving vanes are grounded to the end plates, and connection is made to them by means of a pigtail. The dial is 3½ in. in diameter, and is provided with a substantial knob, while a reduction gear of about 12 to 1 is

Apparatus Tested—*continued*

obtained by means of two pulleys and a spring belt.

When placed on test the condenser, which has the nominal capacity of .00025 microfarad, was found to have exactly this value, while the other, which was a .0005 microfarad capacity, had an actual value of .0043 microfarad. The insulation resistance of both instruments was found to be infinity, while both are to be recommended for their robust construction and sound design.



An ingenious spring device allows special clips to be used for mounting the Igranic grid leak.

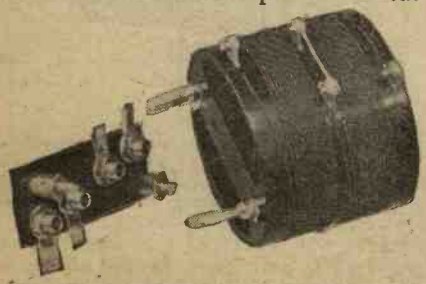
Grid Leak

A GRID leak has been forwarded to our laboratories by the Igranic Electric Co. for examination and report. This leak, which is of the fixed type, is particularly robust in construction, the resistance of the leak being plainly marked. Conical ends are provided, the leak itself being 2 in. in length, whilst an ingenious spring device under the conical ends allows a special clip to be employed for mounting it.

Two types of clips are provided with the component, one being for panel mounting and the other for soldering the leak in any position. The rated value was marked 2 megohms, and when placed on test it was found to be 2.3 megohms. This component certainly presents a novel and ingenious piece of apparatus, and can be recommended with confidence.

General Radio Low-Loss Coils

WE have received from Messrs. Claude Lyons, the agents for the General Radio Co., of America, a range of low-loss coils. These coils are wound on a 2¾-in. diameter Bakelite former, and are wound in two equal sections, the ends being brought out to four screw terminal plates. A bar



The General Radio low-loss coil submitted by Messrs. Claude Lyons.

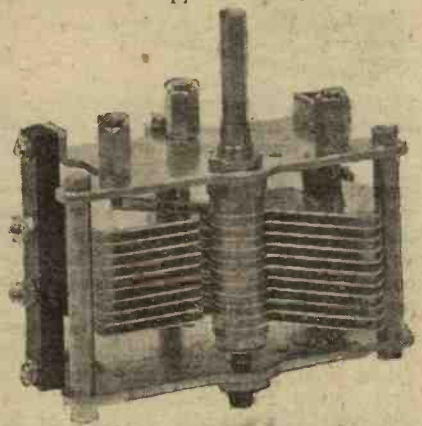
across the bottom of the moulding contains four holes, into which pins may be inserted and held by a small nut, and connections are made from these pins to the winding. The four pins fit into a special holder containing four sockets provided with soldering tags.

Since the coils are wound in two equal sections, which may be connected together in the middle by a short strap if so desired, the coils are particularly suitable for the various split coil circuits which have been used to a considerable extent recently. The coils are of reasonably low-loss construction, and gave very satisfactory results when used in a receiver.

"Apex" Crystal

MESSRS. C. O. CLARK have submitted to us one of their "Apex" crystals for test and report.

This crystal is packed in a small metal case, being wrapped in cotton-wool, instructions for use being enclosed. In appearance it is of fine



The neat and well-manufactured Cardwell variable condenser.

crystalline structure, of a bluish-grey colour. When placed on test the rectified current obtained from 2LO was found to be slightly below the average. A satisfactory number of spots was found, however, and this crystal can be recommended for general use.

Cardwell Variable Condenser

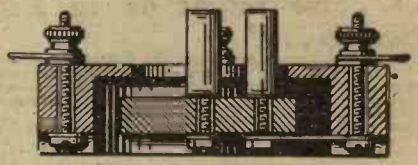
A NEAT and well-manufactured accessory is to be found in the Cardwell variable condenser which has been sent to our Elstree Laboratories by the Rothermell Radio Corporation of Great Britain.

The plates are manufactured from aluminium, while two ebonite strips insulate the metal frame from the fixed plates, connection being taken from terminal points which are made through the ebonite strip to the fixed and moving plates. The instrument has a very smooth motion, is rigidly constructed, three-hole fixing being provided for.

The rated capacity is .0005, and on test this reading was found to be correct, whilst the pleasing appearance of the component completes a series of excellent features.

Etherplus Anti-Vibro Valve Holder

THIS valve holder, which is constructed on low-loss principles, is designed for baseboard mounting. The insulating material is placed some distance away from the valve sockets, the sockets themselves being mounted through a rubber base, which is claimed by the manufacturers to be non-



In this Etherplus valve holder the sockets are mounted on a rubber base.

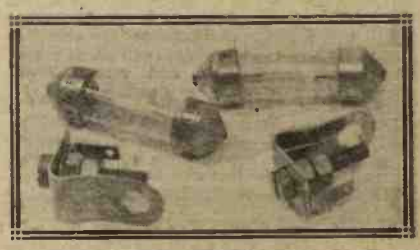
deteriorating. Connections from the sockets to the terminals are made by means of springy strips of metal, this springy action assisting in obtaining the necessary amount of anti-vibratory movement. Soldering tags and terminals are provided.

The component was tested in a receiver and was found to function quite satisfactorily, and damp out microphonic noises to a large extent. When a valve was inserted, it proved a good fit. The manufacturer of this holder is Mandaw, and we can recommend it as a well-designed and mechanically sound component.

Filament Fuse

THE device submitted by Messrs. Phillips is a small fuse for connection in the H.T. circuit where it limits the current to about 30 milliamps. It consists of a thin wire sealed into a small glass tube, with two terminals at the end. Under normal working conditions the drop of the H.T. voltage is very small. If the filament of one valve (or several valves) is accidentally caused to make connection with an H.T. battery, the momentary increase of current causes the wire to fuse before any damage is done to the filament.

We have tested this filament fuse and find that it carries out the claims of the manufacturer. We can recommend it, therefore, to all our readers.



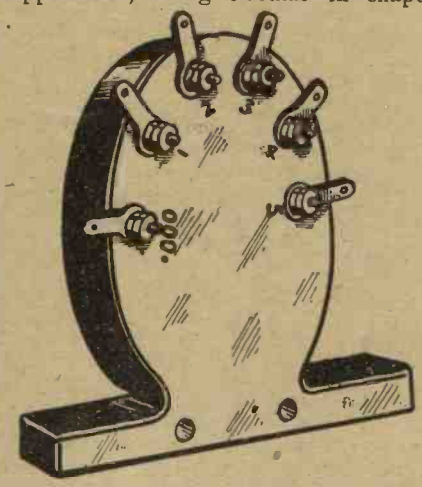
Damage to valve filaments is prevented with this Phillips fuse.

APPARATUS TESTED—*continued*

C.A.V. Multiple Fixed Condenser

A CONDENSER unit capable of giving 14 different values of capacities according to the method of connection has been forwarded to us for examination by Messrs. C. A. Vandervell and Co., Ltd.

The unit is exceedingly neat in appearance, being circular in shape



Fourteen different capacity values can be obtained with this C.A.V. multiple fixed condenser.

except for the fact that a base is provided so that the condenser may be screwed to a panel or baseboard either vertically or horizontally. The case containing the fixed condensers is manufactured from ebonite.

When using the component one terminal which is marked .000 always forms one connection, and the other connections may be taken to any of the points marked 1, 2, 3, 4 or 5, which will give a value of .0001, .0002, .0003, .0004 or .0005 respectively. If higher capacity values are required it is necessary to join the terminal No. 5 to any of the other terminals, and take the connection from either of the two so joined—thus 5 and 1 joined together will give a value of .0006. The sum of the numerals indicates the value. Both nuts and soldering tags are provided.

When tested at our Laboratories the capacities were found to be .0001, .00015, .0002, .0004 and .0005.

We should have liked to see the .0002 and .0003 condensers nearer to the rated value, but apart from this the component can be recommended for use.

Acfil Pumps

MESSRS. E. M. FRANCIS have submitted to us for test and report one of their Acfil pumps, which is specially designed for transferring acid from carboys direct to the accumulator.

It is claimed that this pump is fitted with a special expansion nozzle by means of which it may be fitted to carboys with large or small necks. When tried on a carboy with an exceptionally small neck the fitting was somewhat on the large size, and it had to be held in position by hand when using the pump.

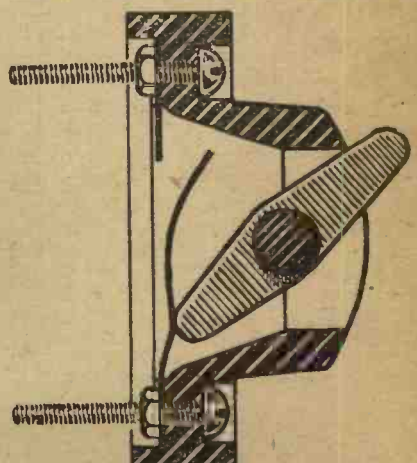
A rubber ball is fitted in the neck of the carboy and a knurled nut is screwed round on to it, expanding the rubber so as to grip tightly in the neck of the carboy. Through the centre of this rubber bulb passes a length of rubber tubing which goes to the bottom of the carboy. Pressure is built up by means of a rubber bulb, thus forcing the acid up the rubber tube, the acid then being delivered to any required point. It is claimed that a capacity of about two gallons per minute can be obtained, and this was found to be the case in actual practice. A clip on the end of the rubber tube allows the flow of acid to be started or stopped at will, and we can thoroughly recommend this pump for its particular purpose.

Toggle Switch

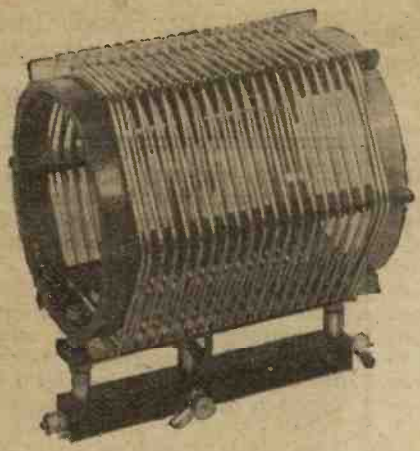
OUR Elstree Laboratories have examined one of the bakelite toggle switches forwarded by Messrs. The Rothermell Radio Corporation of Great Britain.

This switch is exceedingly neat and compact, consisting of a circular moulding of insulating material 1¼ in. in diameter. In the centre of this is a small cylindrical projection with a dome top to it which has a slot cut down its centre, and in this slot a small black insulated lever moves. The mechanism is neat and simple, and provides a quick break and a positive contact.

The actual resistance of the component was measured and found to be negligible, and when in the off position the insulation resistance was infinity.



Neatness and compactness characterise the toggle switch of The Rothermell Radio Corporation of Great Britain.



HOW TO WIND SPACED SINGLE-LAYER COILS

By W. H. FULLER

Several methods by which the constructor may space the turns on single-layer coils are described in this helpful constructional article.

FOR some considerable time plug-in coils have been universally used in every type of receiving set, but of late there has been a tendency to return to the single-layer type of inductance, which was very popular at the beginning of broadcasting, especially with crystal set designers. Hitherto the size of single-layer coils was due generally to the large gauge of wire used, but it has been found that by suitably spacing the turns of wire from each other and using a much finer gauge of wire, thus reducing the size of the complete inductance, equally efficient coils may be produced, and in many cases more efficient than the old-fashioned cardboard former type.

It does not necessarily mean that the finer the gauge of wire used the more efficient will be the inductance. This is not so, as various other considerations have an important bearing on the efficiency. Readers are referred to some of the articles by Mr. J. H. Reyner on coils which have appeared in Radio Press journals from time to time.

An Interesting Coil

Digressing for a moment, it may be of interest to readers to know that one of the most efficient inductances yet measured at the Elstree Laboratories

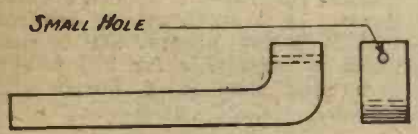


Fig. 1.—This simple tool is useful for winding spaced coils.

is wound with No. 22 d.s.c. wire, spaced 20 turns to the inch on a 6-in. Paxolin former. This coil was made by the writer for a Hartley oscillator, and has a resistance of .028 ohms per micro-henry.

Why the Turns are Spaced

The losses which may be overcome by spacing the turns of a coil are various, the most important being the reduction of self-capacity which exists between adjacent turns of the inductance. Another source of loss is the leakage from turn to turn due to faulty insulation, which may occur either in the covering of the wire or in the former upon which the wire is wound. This loss is more apparent when cotton-covered wires are used, and although this may be overcome by excluding moisture by doping with shellac, by so doing the dielectric loss is increased.

The ideal coil would be one wound with bare wire and supported by air, provided that the ratio of length to diameter was correct and none of the turns were short-circuited.

The Former to Use

The use of ordinary cardboard formers has now been practically dispensed with in favour of materials such as ebonite and Paxolin. The latter named material is, however, rather expensive, and is generally only used in very special cases, such as standard inductances. Thus perhaps the best thing the home constructor can use is ebonite, which can be obtained from many of the advertisers in this journal. Ebonite is not too expensive, and is not very difficult to work.

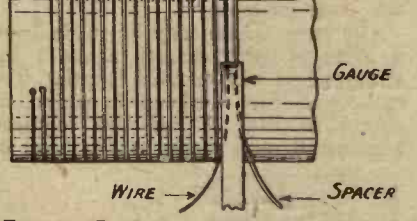


Fig. 2.—Both wire and spacer are fed through the small hole. For clearness the turns are shown well spaced, but actually they are wound close, the string being subsequently removed.

One of the most satisfactory methods of winding spaced coils is to have a threaded former, which can be purchased, or, in the case of lucky possessors of a lathe, made by cutting a thread on the ebonite tube mounted on a wooden mandril.

Suggested Winding Methods

When threaded formers are not available, the constructor may employ one of the following methods, the simplest being to use a spacer of string or wire. Both the wire and the spacer should be secured to a screw fixed in the tube or passed through holes

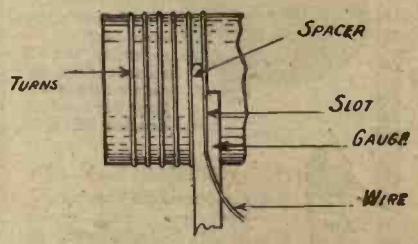
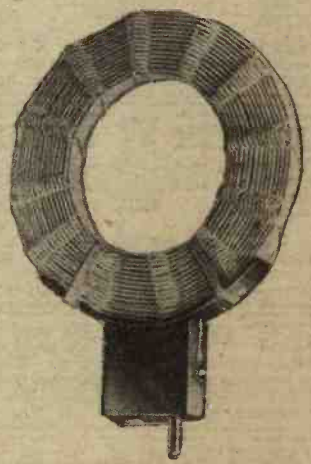


Fig. 3.—A gauge is suitable for winding spaced thick wire coils.

drilled in the tube. Both are then wound on the tube side by side as tightly as possible and close together to ensure uniformity of spacing.

A useful tool which may help in the winding of such a coil can be made from a piece of wood cut to the shape shown in Fig. 1. A small hole is drilled through the head of the tool, just large enough to pass both leads. With the help of this tool it is possible to pull the wire tight and to keep the spacing correct, and with the aid of Fig. 2, which shows how the gadget is used, no difficulty should be encountered in winding such a coil. When



Multi-layer plug-in coils still have many advantages which render their use popular.

the end of the coil has been secured the spacer may then be unwound.

HOW TO WIND SPACED SINGLE-LAYER COILS—*continued*

Using a Gauge

Another method which has been used by the writer with fairly stout conductors is to employ a gauge. The gauge is made from either wood or ebonite, and is cut to shape as shown in Fig. 3. The gauge is held in the hand and is pressed against the preceding turn, while the wire is fed over the small cut in the head of the gauge. This method can only be employed when large wires are used, owing to the fact that the pressure is liable to displace the turns already wound.

For Small Wires

This may be overcome when small wires are being wound by a device

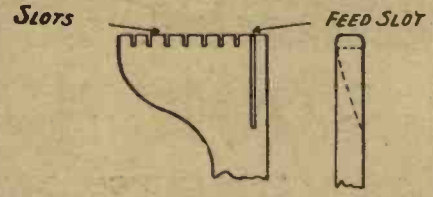


Fig. 4.—The "turn-chaser" referred to is very simply made.

which may be called a turn chaser. It is not unlike an ordinary thread chaser, consisting as it does of a number of small teeth of a fixed pitch, which engage in the turns already wound, and so advances the wire in the same manner.

The turn chaser may be made from a piece of ¼-in. ebonite about 1 in. wide and of any suitable length. The ebonite is first filed up to shape, as shown in Fig. 4, and the required number of slots made in the head of

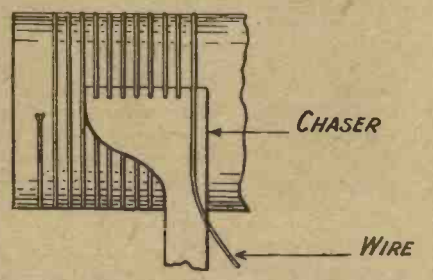


Fig. 5.—The employment of the chaser ensures even spacing throughout the length of the coil.

the tool with a fretsaw blade. The right-hand slot may be cut deeper than the others, as the wire is fed through this slot.

First secure the end of the wire to the former and make one complete turn round it and catch the wire in the right-hand slot. When this is done engage the beginning of the first turn in the second slot and make another turn. Continue winding, keeping all the slots in register, the tension of the wire being controlled by pressing the wire against the chaser with the thumb.

MAKING THE BEST USE OF YOUR ENVIRONMENT.

(*Concluded from page* 888.)

using an ordinary earth lead to a water pipe. This, however, will often provide only a very short aerial, even if the wire is run round the room away from the walls.

It is always advisable to keep the wire away from the walls, even if this means sacrificing a certain amount of length. The material of which walls are constructed does not form by any means a good di-electric, and appreciable losses may occur if the wire is fixed close to them. For the local station the aerial may prove all right, but for more distant work it will hardly be successful, unless a very sensitive receiver is used.

Further Examples

A long passage gives an admirable opportunity of putting up a good indoor aerial. Either one or two wires may be slung along the length of it, a foot or two below the ceiling and midway between the side walls. If the room where the receiver is situated is not at one end of the aerial, it will be necessary to determine by experiment the best point at which to attach the lead-in to the horizontal wire.

A staircase provides another "opening" for an aerial. The wire in this case may be stretched from top to bottom of the stairs, straight down in the "well" between the banisters. This will, of course, be most suitable when the receiver is in a room on the ground floor. The writer has also heard of excellent results being obtained by stretching a wire down the lift shaft of a high block of flats.

Suiting Your Own Conditions

It is obviously impossible to lay down definite rules for the disposition of aerial systems, simply because one or other of them has to be violated in almost every individual case to suit peculiar conditions or special requirements. It is worth noting, however, that it is not always the receiver which is responsible for bad results, even quite close to a broadcasting station.

The Deciding Factor

An error into which a number of people are prone to fall is that of supposing that it is worth while to make use of a highly sensitive receiver, without paying enough attention to the aerial system on which it is to be used. Possibly the receiver will give good results on a poor aerial system, but this is no argument for the use of such a system, so long as anything better can be arranged with the exercise of a little ingenuity.

INDEX TO ADVERTISERS.

Afternoon Reception of Cardiff and Manchester on a Frame

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Described by *J. H. Reyner. B.Sc. (Hons.) A.C.G.I., D.I.C., A.M.I.E.E.*
How British Broadcasting is Received on the Continent.
By Captain L. F. Plugge. B.Sc., F.R.Ae.S. F.R.Met.S.
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RADIO PRESS LTD., BUSH HOUSE, STRAND, LONDON, W.C.2

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 0911. 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., August, 1926.