The Wireless Constructor

6D MONTHLY

EDITED BY
PERCY W. HARRIS. M.I.R.E

Vol. II, No. 3 JANUARY 1926

Special Features:

How to make:

Five Complete Receiving Sets
An H.T. Accumulator
A Wireless Cabinet

SELECTIVITY AND THE CRYSTAL USER
By J. H. Reyner, B.Sc., A.C.G.I., D.I.C., A.M.I.E.E.

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The WIRELESS CONSTRUCTOR

— *Edited by Percy W. Harris* —

Vol. II No. 3 **CONTENTS** *JANUARY*

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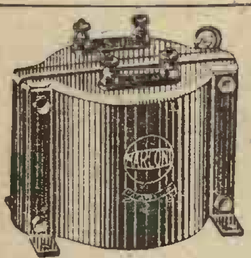

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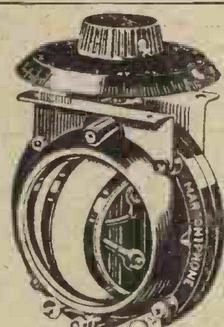

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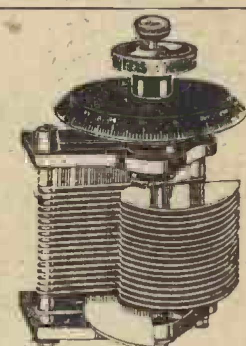

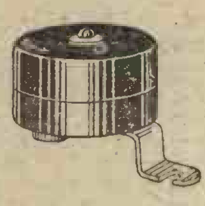

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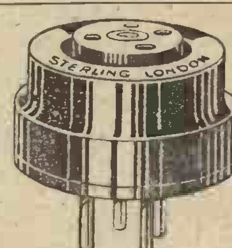

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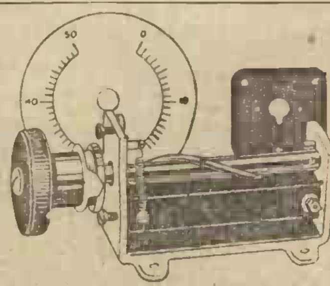

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The WIRELESS CONSTRUCTOR

Vol. II. JANUARY, 1926 No. 3.

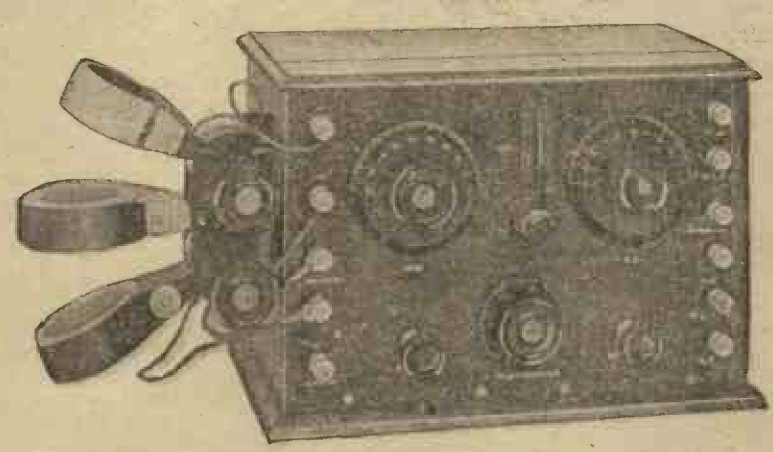
SELECTIVITY AND "RANGE"

A COMPACT TWO-VALVE RECEIVER

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

A headphone set which gives "range" both in distance and waveband covered

WHATEVER may be the result of international deliberations on the subject of the broadcasting stations of Europe, the present conditions demand that certain features receive special attention in a set designed for reception over even moderate distances. On the lower broadcast band the small wavelength separation between some stations calls for selectivity. This feature should be operative in more than one direction, not only to discriminate without undue difficulty between two stations at a distance, but also in particular localities to enable the listener to hear a distant programme without serious interference from the local station. On the higher wavelengths this same feature of selectivity is called for though at present there are not so many stations operating in the neighbourhood of Daventry's wave.



The completed receiver, showing the three-coil holder mounted on the side of the cabinet.

The Lower Frequencies

The programmes sent out by Daventry and Radio-Paris on the longer wavelengths may perhaps be at some time more attractive than those available at the moment on the lower band. It is often the case that quick change of wavelength is desired in these circumstances, and any time saved by avoiding the changing of coils is therefore well gained.

How Selectivity is Obtained

In the design of the receiver to be described here, selectivity and range have been studied, "range" in this case being intended to include both wavelength range and actual distance. Fig. 1 shows the circuit diagram. The aerial may be attached to the top of either L or L_1, the former position providing an "aperiodic" aerial circuit, with a consequent improvement in the sharpness of tuning of the circuit L_1, C_1, so long, that is, as the coupling between L and L_1 is not made too tight. Reaction effects and also a still further increase in selectivity owing to the reduced damping of L_1, C_1 are obtained by coupling to L_1 the coil L_2, which is included in the anode circuit of the detector valve V_2.

Switching Arrangements

In the anode circuit of the H.F. valve V_1 is a switch S_1 S_2. With this

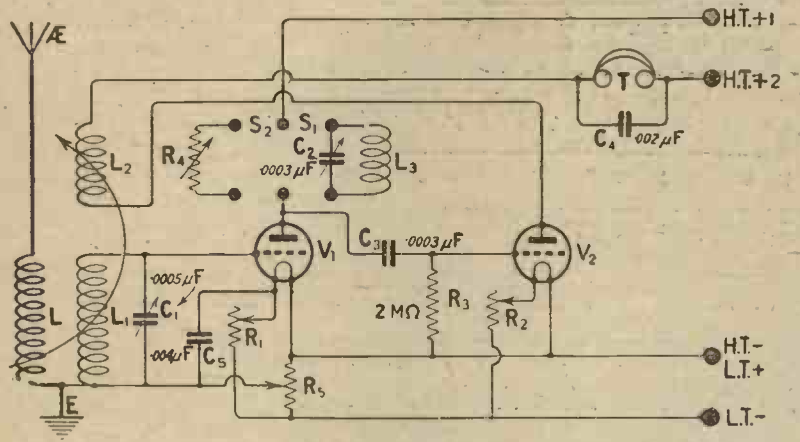


Fig. 1.—The circuit. The switch S1, S2, permits the change over from tuned anode to resistance coupling.

switch in the position S_2 the anode resistance R_4 is brought into circuit. This resistance is of the variable type, so that it can be adjusted to give the best results with the particular valve in use. When the switch is set thus, with suitable coils for L, L_1 and L_2, the receiver is suitable for use for 5XX and other long-wave stations.

For the Broadcast Band

On the lower broadcast band, however, resistance-capacity coupling fails to give the desired amplification. For the reception on this band, therefore, the switch is placed in the position S_1, bringing into circuit the tuned-anode coil and condenser L_3 and C_2. The anode coil is enclosed inside the cabinet of the receiver, since there will normally be no need to change it, once the best size has been ascertained. The coils L, L_1 and L_2, being mounted in a three-coil holder outside the cabinet, are readily changeable. It will be clear that it is not essential always to use the resistance-capacity method of coupling when receiving on the longer waves. A suitable coil for the anode circuit can readily be inserted. But normally any alterations *inside* the cabinet can be avoided if preferred, changing the coils in the three-coil holder and putting over the switch being all that is necessary.

Stabilising the H.F. Valve

When the anode resistance is in circuit, it will probably be found that the H.F. valve is little, if at all, inclined to instability. When the tuned-anode method of coupling is in operation, however, self-oscillation of V_1 is liable to occur when the circuits L_1C_1 and L_3C_2 are brought into resonance. In order to stabilise V_1 under such conditions, a potentiometer R_5 is provided; the condenser C_5 acts as an H.F. bypass across the winding of this potentiometer and also the filament rheostat R_1.

Separate H.T. Terminals

For the best results when receiving on the longer waves with the resistance-capacity coupling, it is necessary to have some means of raising the H.T. battery voltage, in order to compensate for the drop in voltage across the resistance. If only one H.T. terminal were provided, common to both valves in the receiver, such an increase in the H.T. value would tend to affect the detector valve V_2 adversely. It is therefore essential to provide separate H.T. terminals for each valve. When the tuned-anode system is in circuit, these may quite well be joined together and taken to a suitable tapping on the H.T. battery. When the resistance is in the anode circuit of V_1, this tapping will serve for V_2, while a higher one must be used for V_1.

Components

In view of the compactness of the receiver, a point which may be appreciated by some constructors whose space is limited, any wide divergence from the components specified should be made with caution, especially if the sizes of panel and baseboard are adhered to exactly. The list of the actual components used is as follows:—

Ebonite panel, $10'' \times 7'' \times \frac{3}{16}''$ (Radion; American Hard Rubber Co.).

Baseboard, $5\frac{1}{2}'' \times 10'' \times \frac{3}{8}''$ (Camco).

Cabinet (Camco).

One ·0005 μF variable square-law low-loss condenser (Ormond).

One ·0003 μF variable square-law low-loss condenser, one end plate only ("Utility," Wilkins & Wright).

One ·0003 μF fixed condenser (Watmel).

One ·002 μF fixed condenser (Watmel).

One ·004 μF fixed condenser ("Paragon," Peter Curtis).

Two Microstats (Wates Bros).

One 2MΩ gridleak (Dubilier).

One double-pole double-throw low-capacity switch ("Utility," Wilkins & Wright).

Eleven terminals.

Two valve-holders for board mounting (Burwood).

One three-coil holder ("Lotus," Garnett, Whiteley & Co.).

One variable anode resistance (Bretwood).

One board-mounting coil-plug (Burne-Jones).

One potentiometer (L. McMichael, Ltd.).

Two gridleak clips, piece of ebonite, $1'' \times 2\frac{3}{4}'' \times \frac{3}{16}''$.

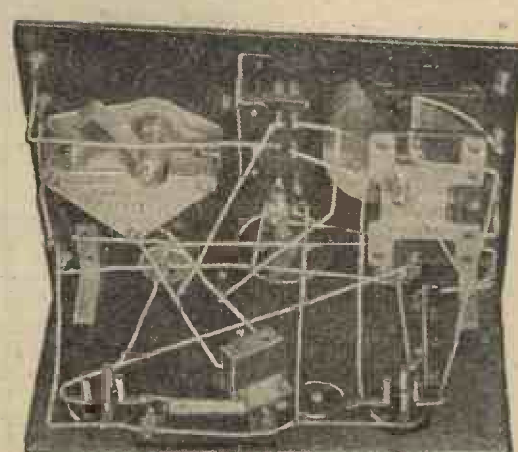
A pair of brackets to secure panel to baseboard.

Glazite for wiring up.

Radio Press panel transfers.

Constructional Details

The first operation in the construction of the receiver is to mark out the panel. This can be carried out quite easily by clamping the



The free blueprint is a complete guide to the panel and baseboard wiring shown in this photograph.

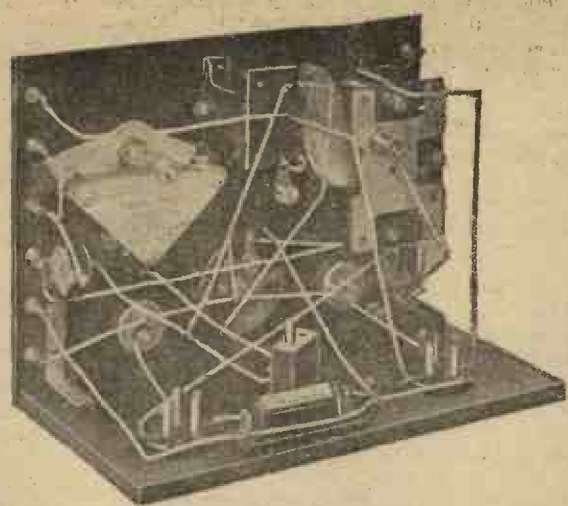
blueprint supplied firmly to the back of the panel and, with a sharp point, pricking through the centres of the holes to be drilled. It should be noted that the exact positions for the bolts securing the supporting brackets to the panels will depend on the type of bracket obtained. It will be best to mark the holes for these with aid of the brackets themselves.

Fixing the Switch

When the straight forward drilling has been completed, there is a slot to be cut for the change-over switch. First of all, drill the holes for the bolts which hold the switch on the panel. Now, bolt the brass plate which comes on the front of the panel in position and, with a sharp point, mark the panel round inside the slot cut in it. After removing the plate again, a chain of holes should be drilled inside the area marked, as close to each other as possible. With the aid of a small file, the holes may then be joined up and, with a thin flat file, the sides of the slot may be trimmed square up to the marked lines.

Baseboard Components

Before the panel is attached to the baseboard, the two valve-holders, the grid condenser and leak, the anode coil-holder and the ·004μF bypass condenser may be screwed down on the latter. This bypass condenser, at any rate, should be fixed in position first, since it will be no easy matter to reach it when other components have been assembled. The mounting of the components on the panel calls for no special comment, with the exception of the anode resistance. A short length (about 3 in.) of connecting wire should be soldered to the lug nearest to the panel before it is mounted. Otherwise it may be difficult to reach this point with the soldering iron.



Another interior view. Note the telephone condenser supported by wiring on the left.

Wiring

The wiring of the receiver shown is carried out with Glazite. The mounting of the switch should preferably be deferred until the connections to the filament rheostats and the potentiometer have been soldered. If the switch and the anode resistance are correctly mounted in the positions shown, it will be found that the outer soldering lug of the latter comes close enough to one of the lower switch tags to enable the two to be soldered together direct, without any connecting wire.

Grid Leak Connections

The connections to the grid leak are made via two small springy brass clips, which are mounted on a strip of ebonite screwed to the baseboard. One end of the grid condenser is soldered direct to the anode soldering tag of the H.F. valve-holder. Similarly, the condenser shunting the telephones has one of its lugs soldered direct to the shank of the appropriate terminal, a short length of wire being used for the other side.

(*Continued on page* 328.)

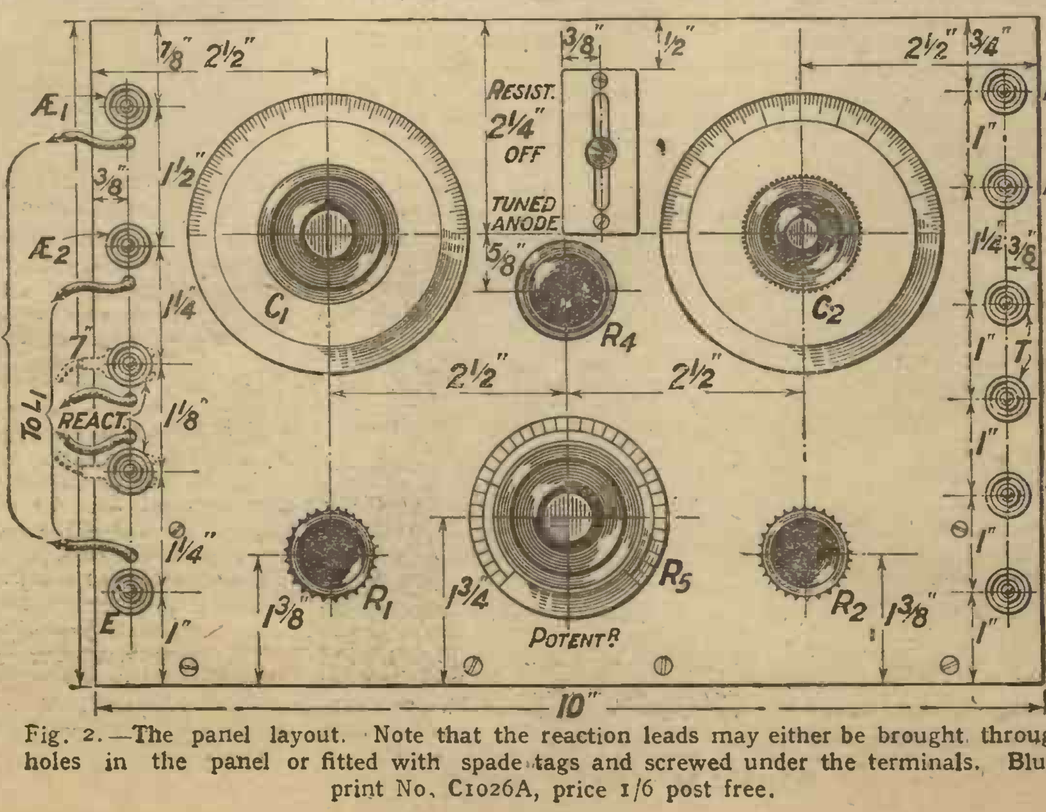


Fig. 2.—The panel layout. Note that the reaction leads may either be brought through holes in the panel or fitted with spade tags and screwed under the terminals. Blueprint No. C1026A, price 1/6 post free.

How to Make a Semi-Permanent Detector

By H. BRAMFORD

THE making of a semi-permanent detector is a comparatively simple matter, as this article explains. The cost of construction is quite low, the only materials required being as follows: Two crystal cups (screw grip type), a short length of ½ in. diameter ebonite tubing, some brass sheet, a few inches of hard drawn copper wire, a piece each of bornite and arzenite crystals, and the other small items as shown in Fig. 1.

The Diagrams

A detailed sectional drawing of the complete detector is shown in Fig. 2, which makes the assembly of the parts quite clear, while the various parts to be made or procured are shown in Fig. 1.

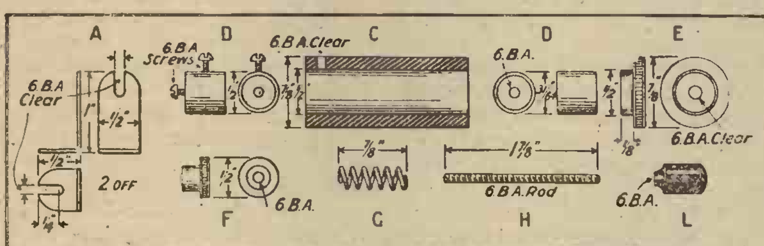


Fig. 1.—The component parts and their dimensions.

Components and Assembly

First prepare the two crystal cups which are intended to hold the bornite and arzenite crystals respectively. Cup B has two screws in use as shown. The screws should be temporarily removed, and the bornite crystal fixed in the cup with Wood's metal. The contact surface of the crystal should present as flat a face as possible. During this operation see that the screw holes are kept clear. Next prepare crystal cup D, which should be the same size as cup B. Reduce the external diameter of the cup slightly by filing, then fix the arzenite crystal in the cup by means of Wood's metal, as before. The surface contact of this crystal should be somewhat pointed if possible, and should be out of line with the centre of the cup. A length of ebonite tubing is next cut off about 2 ins. long and a 6 B.A. clearance hole drilled for the purpose of securing cup B by means of its contact screw. The piece of 6 B.A. threaded rod (H) is screwed into cup D, as shown in Fig. 2, a short length of spring (G) made from hard drawn copper wire being passed over the screwed rod. When the cup D thus equipped is placed in the ebonite tube it acts as a sliding plunger. Now force or screw the cap E into the open end of the ebonite tubing, first passing it over the screwed rod. Equip the rod with the 6 B.A. tension screw (F) and a small ebonite knob (L) tapped 6 B.A., and the detector is completed with the exception of the brackets A, which are made from strip brass to the dimensions given.

Mounting

The complete detector may be mounted on a small ebonite base by means of small terminals, or direct on the panel of the receiver, as desired. To operate, pull the plunger back and gently release it when the spring should cause suitable contact to be made between the two crystals. On no account turn the knob round when the crystals are in contact, as this will injure their surfaces. The tension of the spring may be altered by means of nut F, while the fact that the crystal in cup D is not fixed centrally allows the crystal in B to be extensively searched.

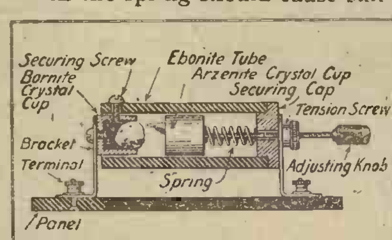
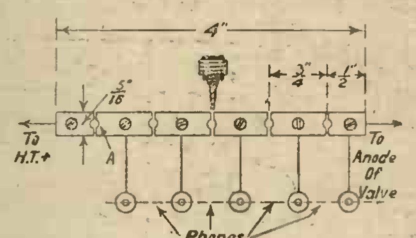


Fig. 2.—The completed Detector shown in section.

A Telephone Switchboard

WHEN it is required to provide for connecting a varying number of pairs of telephones in circuit, it is often inconvenient to be continually attaching and detaching the leads from the telephone terminals. If a telephone switchboard of the type shown in the accompanying sketch is employed, the telephones or loud-speaker not required for use at the moment may be left attached permanently to their terminals, without necessarily being connected in circuit. The assembly shown provides for four pairs of telephones, but of course the device may be extended. Five terminals are needed, a strip of brass 4 in. long, ⅛ in. thick, and about 5/16 in. wide, and five tapered metal plugs with ebonite bushes, such as "Clix" plugs. Holes are drilled in the strip as shown, those for the securing bolts being countersunk; the holes for the plugs should be of a size just to accommodate the type selected. The strip is bolted to the ebonite strip or receiver panel, and the terminals are mounted in the appropriate positions, the connections being soldered to the bolts and terminal shanks underneath the panel. Cuts are then made right through the strip across the centres of the holes.



The lay-out and connections.

Operation

The insertion of a plug in the hole marked A connects the switchboard in circuit, while by placing plugs in any of the other holes one or more pairs of telephones may be short-circuited and so cut out of circuit. In order to ensure a good contact and avoid "frying" noises a plug should be inserted with a screwing motion, using slight pressure, until it is felt to grip in the hole. The plugs may conveniently be attached to the switchboard by short pieces of stout thread.

A. V. D. H.

MAY NOTHING YOU DISMAY!!!

THE POWERFUL 3-VALVE SET

SIR,—Just a few lines to record my appreciation of the "Powerful Three-Valve Set" described by Mr. Percy W. Harris, M.I.R.E., in the April, 1925, number of THE WIRELESS CONSTRUCTOR. I have just built up the set, and I must say myself and friends are amazed at the results, being great believers in H.F., D. and L.F. for all-round loud-speaker results, but this set is far better. My results are as follows :—

Leeds, relay, 9 miles, too loud on loud-speaker.

Sheffield, relay, 26 miles, loud on loud-speaker.

Nottingham, relay, 60 miles, fair on loud-speaker.

Manchester, main, 40 miles, loud on loud-speaker.

Newcastle, main, 80 miles, loud on loud-speaker.

Glasgow, main, 180 miles, fair on loud-speaker.

Aberdeen, main, 220 miles, fair on loud-speaker.

Bournemouth, 260 miles, very fair on loud-speaker.

Daventry, 130 miles, too loud on loud-speaker.

Petit Parisien, fair on loud-speaker.

Madrid, fair on loud-speaker.

Brussels, loud on loud-speaker.

I have also had many other foreign stations on phones. My aerial is 30 ft. long and 4 ft. above the roof of the house, from a chimney stack to a 15 ft. pole. My earth consists of six tin plates 8 in. square, 2 ft. deep in clay, so I do not know what the set would do on a good aerial and earth.

Please accept my thanks for such a fine circuit and such an interesting magazine.—Yours faithfully,

ANDY THOMPSON.

Wakefield.

SELECTIVITY

SIR,—I have pleasure in stating that I have constructed the "Selective Three-Valve Receiver" described by Mr. A. V. D. Hort, B.A., in the September, 1925, issue of THE WIRELESS CONSTRUCTOR.

The results obtained will no doubt be of interest to those readers who are unfortunate to live within close range of a broadcasting station, as I reside within 200 yards of the Stoke relay station.

The components used in the construction of the set are of good manufacture, but all are not of the makes recommended by Mr. Hort, as I already possessed several parts. I first of all tried the aperiodic loose coupling—*i.e.*, the primary aerial coil untuned—and found I could eliminate the local station, but could not receive the distant stations with sufficient signal strength.

In consequence, I use a ·0005μF variable condenser to tune the primary coil, and the results are very satisfactory. During local transmissions I can receive Manchester, Birmingham, Newcastle, Belfast, London, Madrid and Hamburg. I have not yet tried to receive stations nearer the Stoke wavelength, but I think this could be accomplished with patience. I have logged numerous other stations (English and foreign) when the local station has closed down. I am particularly pleased with the results, more especially as I was advised by several well-known makers of radio components that it would be practically impossible to cut out a station (even a relay) at 200 yards.—Yours faithfully,

V. L. F. DAVIS, A.M.I.E.E.

Stoke-on-Trent.

THE "A.-A. SIX" AGAIN !

SIR,—I have been a reader of THE WIRELESS CONSTRUCTOR since it started, and have temporarily made up all the sets by Mr. Percy Harris, including the "Anglo-American Six," which was described in the January and February, 1925, issues. I must say how surprised I am at not having read more letters in THE WIRELESS CONSTRUCTOR from your readers regarding this set. This is the best set of all I have made, has given me more pleasure than any set I have worked, and is quite fascinating to use.

Wishing THE WIRELESS CONSTRUCTOR every success.

Yours faithfully,

F. HAYWARD.

Ipswich.

THE SELECTIVE SINGLE-VALVE RECEIVER

SIR,—I wish to thank Mr. G. P. Kendall, B.Sc., for the excellent Selective Single-Valve Receiver appearing in the September, 1925, WIRELESS CONSTRUCTOR. This set, coupled to a stage of power amplification, gives me all three South African stations on telephones—in fact, too loud to be comfortable ; Durban and Johannesburg, respectively 300 and 140 miles away, at night come in clearly at fairly good loud-speaker strength. Cape Town, 1,000 miles, at night also on loud-speaker. This is not all. On the night of September 29 I held a Spanish station for half an hour, from 11.25 p.m. African time, and a British station, presumably Bournemouth, from 12 to 12.50 p.m. Musical items were clearly heard. I am struck with the purity and wonderful selectivity. Tuning in my case is very sharp, and the reaction control is delightful. I also operate a five-valve tuned anode circuit and a special Reinartz type short-wave circuit. I have a very fine aerial system, the height at the lead-in end being 85 ft., with a stretch of 40 ft. across to a pole 95 ft. high. Earth: water pipe running immediately under the aerial. The set described by Mr. Kendall is certainly one of the best one-valvers I have yet come across.

I found the best valve to use with this set, in my case, was a B.T.H. Type B4 power valve—an excellent valve indeed. I use this type of valve for my short-wave receiver, with the greatest success. Many thanks again.

Yours faithfully,

G. W. SMITS.

P.S.—After nightfall all African stations excellent signal strength on one valve only.—G.W.S.

East Transvaal,
South Africa.

How to Make a Useful Accumulator H.T. Unit

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

WHEN employing a multi-valve set, it is often found that the high-tension batteries run down in a surprisingly short time, so that the experimenter is often obliged to see if he can find a substitute for the ordinary dry-cell unit. If the house is wired for electricity, recourse can be had to smoothing devices used in conjunction with the mains to supply the high-tension voltage, or an accumulator unit can be utilised. It is the purpose of this article to describe the construction of an accumulator high-tension battery which has a capacity of about 500 milliampere-hours, and which will give yeoman service if treated with normal care.

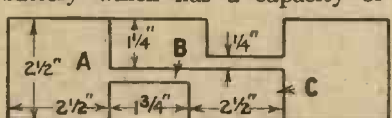


Fig. 1.—How the lead is marked out for two pairs of plates.

Battery Plates

It is well known that an ordinary accumulator has specially-formed plates immersed in a suitable electrolyte, the chemical reactions supplying the requisite electrical energy. For the plates of this battery good quality commercial sheet lead is employed, either $\frac{1}{16}$ in. or $\frac{3}{32}$ in. thick. As will be seen later, about 2½ square feet of lead will be required for each 60-volt unit, and by cutting up the plates in the manner to be described, only a small percentage of this quantity will be wasted. Fig. 1 shows the template, which may be made from any convenient material, A being the positive plate of one cell, C the negative plate of the adjoining cell, and B the connecting strip between the cells. By marking out the lead in the manner indicated in Fig. 1 for two pairs of plates, it is clear that a strip 9¼ in. by 2½ in. will be required, the waste pieces being the two portions 1¾ in. by 1 in. Thus the total area for the 30 pairs of plates will be 9¼ in. by 2½ in. by 15, equals 350 sq. in. (approximately), equals 2½ sq. ft. (approximately).

Increasing the Plate Surface

The portions A and C must be bent round mandrils to a cylindrical form, the diameter of the larger one being just over ¾ in. and of the smaller one just over ⅜ in. As it is essential to present the largest possible plate surface to the electrolyte, the writer has found it a distinct advantage to serrate the surfaces of the positive and negative plates. This can easily be accomplished if the A and C portions are separately gripped between the jaws of a bench vice. To provide adequate pressure between the vice jaws, a lever, such as a 3-ft. length of conduit or metal piping, should be slipped over the vice handle, and the lead can then be squeezed sufficiently to leave the jaw serrations on the lead surface. With the aid of a wooden mallet, the plates can now be bent round the mandrils, only light taps being given with the mallet, so as not to damage the previously prepared surface of the plates. The larger cylinder will become the positive plate of one cell and the smaller cylinder the negative plate of the adjoining cell, and the lead connecting strip B must now be bent in the form indicated in Fig. 2. The bend serves the purpose of supporting the two plates on the edge of the container, and gives the plates a ¼ in. clearance at the base of the container, and will prevent any sediment which may settle at the base from causing a short-circuit. (See Fig. 5.)

Cell Containers

The most convenient container for each cell unit is a glass "sample tube" 1 in. in diameter and 3 in. long, which can be purchased at any shop retailing chemical apparatus. Thirty of these will be required for each 60-volt unit, as each cell gives approximately 2 volts; and these should be thoroughly washed and dried before use.

The Battery Box

To accommodate the cells a box is required, the dimensions being shown in Fig 4. Wood ¼ in. thick should be employed, the best kind being teak; and in order to keep the glass containers in position, a top for the box must be made in the form indicated in Fig. 3. The rectangular piece of wood has the dimensions 8⅝ in. by 7¼ in. by ¼ in., so that it can just fit inside the box, being finally held in position by wood screws. The layout of the holes, which must be carefully drilled, gives the unit a symmetrical appearance. The diameter of the holes is given as 1 in., but this can be slightly

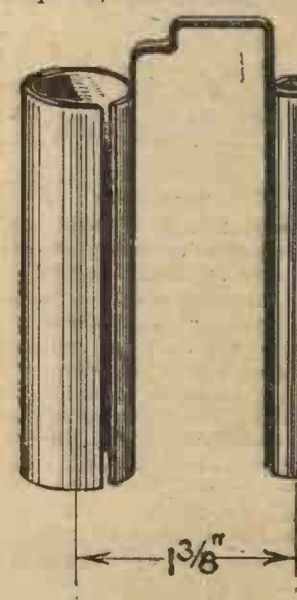


Fig. 2.—A pair of plates after bending to shape.

exceeded, so that the sample tubes will readily slip in to their places, even if just over the correct size, but the distance of $1\frac{3}{8}$ in. between centres should be kept constant, otherwise the external dimensions will be exceeded. To minimise the effects of any spilled acid, the box and perforated lid should be well soaked in oil for a few hours, and then allowed to dry; but this refinement is not essential.

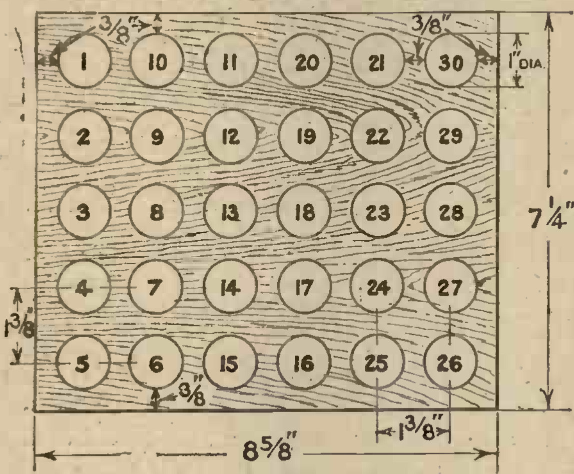


Fig. 3.—Details of the lid of a battery box for 30 cells are shown above.

Plate Separators

To prevent the positive and negative plates touching, it will be necessary to employ separators in the cells. These can be made from thin perforated ebonite sheet, each cell requiring a cylinder $2\frac{3}{4}$ in. long and $\frac{1}{2}$ in. diameter. To bend the ebonite, it should be immersed in hot water to soften, and a metal mandril $\frac{1}{2}$ in. in diameter should be obtained, when the ebonite will be found to bend readily round this. An alternative material for the separators is thin corrugated celluloid sheet, which has been perforated. If neither of these materials is available, a cheaper, and equally good substitute will be found in the prepared wood separators supplied for the ordinary low-tension accumulators. This material can be purchased at an accumulator repair shop, and can be new material or that which has been removed from a dismantled accumulator. The separator should be cut into strips to form a triangular prism $2\frac{3}{4}$ in. long, and when in position will give the appearance of Fig. 6, which shows a cross-section of one 2-volt unit.

Assembling the Components

Having made the wooden box and fixed the top, the thirty sample tubes should be inserted in position, and these will project $\frac{1}{4}$ in. above the surface of the wood. For the first positive plate the portion C should be cut down so as to form an extension of B—*i.e.*, a lead strip $4\frac{1}{2}$ in. by $\frac{1}{4}$ in. projecting from the top of the cylinder A. This strip will form a connection to the positive battery terminal on the outside of the box. The bend should still be made, and this plate with the lead strip extension can be inserted in the glass tube (1) (see Fig. 5). Now add the separator, and take one of the units which have been made to the form shown in Fig. 2, and insert the smaller cylinder in the centre of the separator, the larger cylinder then fitting into the glass tube in the position marked (2) (see Fig. 3).

How to Proceed

Repeat the same operation of adding separators and units similar to Fig. 2, following the numbers (1) to (30), as marked in Fig. 3. The negative plate of position (30) should be provided with a lead extension strip similar to the positive plate of position (1), by cutting away the A portion to add to the length B. Thus altogether 31 complete double units A, B, C will have to be provided for, but the estimated $2\frac{1}{2}$ sq. ft. for each 60-volt battery just allows for this provision.

Terminals, mounted on an ebonite strip, should now be fixed in place on the box side, so that the lead extension pieces from positions (1) and (30) can be fitted under the terminal shoulders to make good electrical contact.

Charging

A quantity of sulphuric acid of "1200" strength must now be poured in each sample tube so as just to cover the top ridges of the positive and negative plates. A

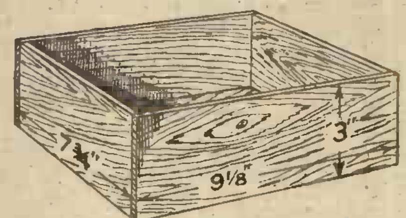
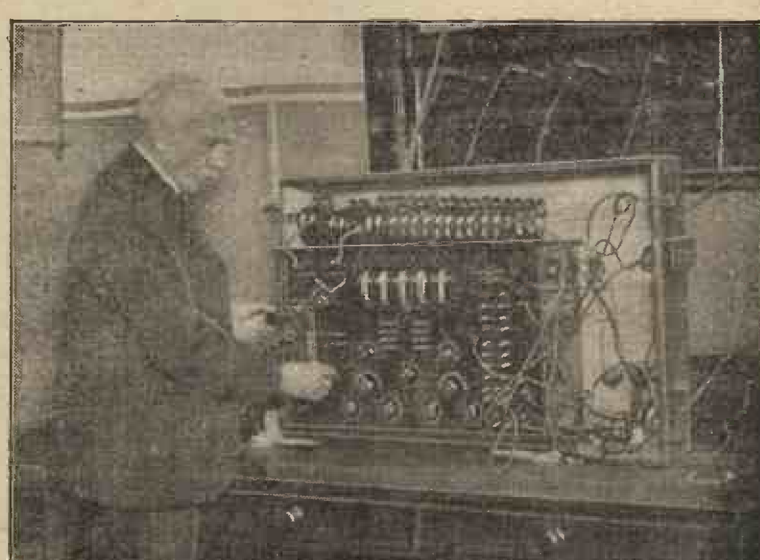


Fig. 4.—The battery box is made from $\frac{1}{4}$ inch wood.

thin layer of oil, such as Blancol oil, may then be added to the acid surface if desired, but this is not essential. The complete accumulator unit is now ready for charging, and initially periodic charges and discharges must be made in order to "form" the plates. A suitable charging current is 50 milliamperes, and 100-volt 8 candle-power lamps are convenient series resistances to employ for this purpose with 220-volt d.c. mains. Connect up the lamp and battery in series (use two lamps in series with the


The inventor of the thermionic valve, Prof. J. A. Fleming, D.Sc., F.R.S., with some radio apparatus in his laboratory.

battery if only one 60-volt unit is being charged across 220-volt mains), so that the positive main joins the positive plate of the battery. Allow current to pass for about 10 hours, and then reverse the connections and repeat

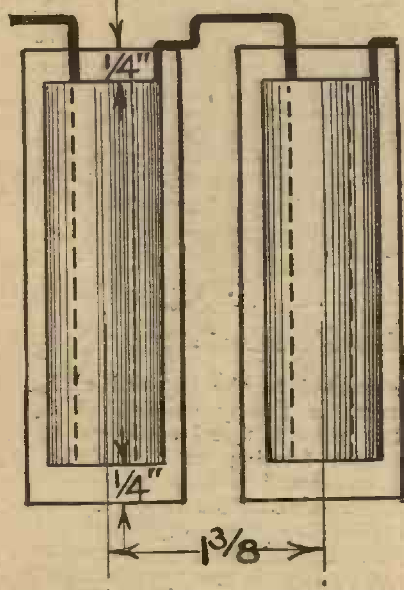


Fig. 5.—A sketch showing the plates arranged in the glass tubes.

for another 10 hours. This double charge and discharge should be performed three or four times, and then the plates should be found to be properly formed, the characteristic dark chocolate and grey colours being noticeable for the positive and negative plates respectively. The last charging current should, of course, be in the right direction—*i.e.*, positive main connected to positive battery plate, and then the battery will be ready for use.

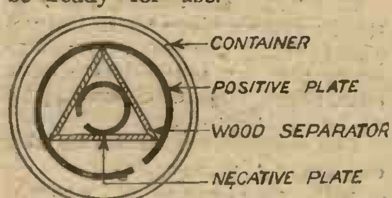


Fig. 6.—The plates are separated as shown by prepared wood strips.

The same care should be exercised with this unit as with all other accumulator units, especially for the first month or so, but after complete plate formation this source of high-tension voltage will be found to function quite well. If the house is not provided with D.C. mains, the charging and "forming" will have to be carried out by a battery-charging station, of course.

What Transformer Ratios Are You Using?

If you employ low frequency transformers you will be interested in this article

IN the majority of cases it is quite safe to say that transformers for audio-frequency amplification are not selected for the conditions under which they are to operate. Generally speaking, the influencing factors in the final choice of an instrument are an arresting advertisement, good appearance, attractive price, or the fact that so-and-so has one like it and says that it is very good.

Its Importance

When we consider the important part played by this instrument, and remember that upon its efficacy depends to a large extent the success of any set using low-frequency amplification, it seems strange that there is not a more general knowledge of the requirements of a transformer for functioning in a certain set. It is true that manufacturers do not state all the useful data concerning their products, but were there a greater demand for this information it would probably be forthcoming, and amateurs could then proceed to design their sets more intelligently, and with a greater degree of certainty that they would be doing the right thing in the given circumstances.

From the point of view of effective operation it is essential that the impedance (the resistance offered to the applied fluctuating impulses) of the primary winding of an audio-frequency transformer shall be greater than the plate to filament impedance of the preceding valve, both these values being taken under working conditions. On the other hand the efficiency of the transformer (using the term in its true scientific sense implying absence of losses) demands a low primary impedance. Here then are two conflicting desiderata.

The Question of Ratio

It may be said that little is to be gained by making the primary impedance more than three times that of the valve. If the latter value is high, this means that the primary will have a large number of turns. Now, since the transformer ratio is determined by the value of number of turns on secondary ($=T_2$) to the number of turns on primary ($=T_1$), it is seen that for a high-impedance valve, a high-ratio transformer would necessarily have a very large number of turns in the secondary, making the instrument bulky and expensive. Besides this, the capacity of the secondary would be higher than for one with fewer turns. It thus appears advantageous to use a low-ratio transformer having a primary winding of high impedance.

In the case of a low impedance power valve it is permissible to employ a higher ratio transformer, since the primary impedance, and therefore the number of primary turns, is low, and the ratio $\frac{T_2}{T_1}$ may be increased without using too much wire in the secondary.

The plate to filament impedance of the valve preceding a transformer may have a value ranging from 40,000 ohms for a detector or L.F. to 6,000 ohms for a power valve. It is obviously impossible for any one transformer to operate efficiently over this entire range, and yet that is what is expected of it when it is bought without any regard being had to the valve impedance.

Special Purpose Transformers

Some manufacturers produce transformers especially designed for different stages of low-frequency amplification. This is good practice worthy of support, and increases the advantages of using special purpose valves in their correct places. It is not improbable that general purpose valves and transformers will dwindle in popularity, giving place to special components designed to operate together in their allotted stages.

Why not Publish Data?

Meanwhile it would be a great improvement if the impedances of audio transformers were made known to the buying public in the same way as are the impedances of valves. Until this desirable state is reached it would appear, from the foregoing considerations, advisable to keep to low ratio transformers such as 1-2, or 1-3, except in the last stage where, if a power valve is employed, a higher ratio is permissible.

G. F.

The "ALL-PURPOSE" CRYSTAL SET

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

A neat enclosed receiver for 5XX and the local station giving a choice of two circuits

THAT the popularity of the crystal set is as great now as ever it was is not to be wondered at, since for purity of reproduction, ease of operation and negligible cost of upkeep this form of receiver remains unequalled. At the same time, however, modern developments require that the present-day crystal set should possess certain refinements. The most obvious is that there should be some provision for the reception of Daventry, and where a special coil for the ordinary broadcast band is incorporated within the set itself, as in the present case, a loading coil plug and socket is the only means of adding the extra inductance for 5XX.

Selectivity.

The question of selectivity is one which invites discussion, and Mr. J. H. Reyner, in an interesting article elsewhere in this issue, shows that selectivity is in many cases essential to the crystal user. As, however, increased selectivity is frequently accompanied by some loss of signal strength, many listeners who only occasionally experience interference hesitate to incorporate a selective device in their sets.

The Circuit used

In designing the receiver described below, I have borne these points in mind, and provided a means whereby direct or selective tuning may be employed at will, together with facilities for inserting a loading coil for the reception of the Daventry station.

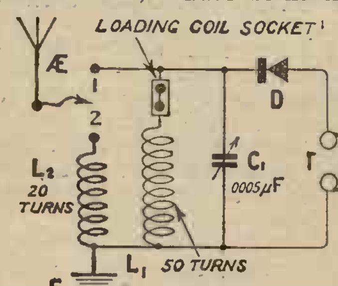
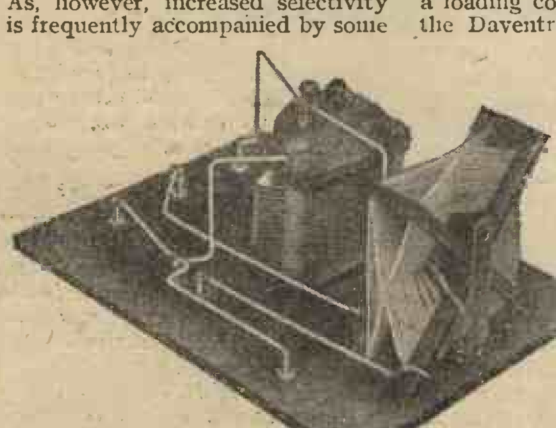


Fig. 1.—The two-circuit arrangement used.



The special X coil is supported by a small metal bracket as shown.

The Circuit

The circuit—or rather, circuits—employed are shown in Fig. 1, and will be familiar to all readers. By connecting the aerial to terminal 1 the usual straight circuit is employed, coil L_1 being connected direct to the aerial and tuned by the parallel condenser C_1. If terminal 2 is used, however, the aerial is connected to the top end of L_2, which is tightly coupled to L_1. The latter is tuned as before, the system forming an "aperiodic" aerial circuit wherein the energy is transferred from L_2 to L_1, and thence to the crystal. This arrangement gives greater selectivity but rather poorer signal strength.

Components

The receiver is totally enclosed when not in use, as the cabinet is provided with a hinged lid. The crystal detector is of the glass-enclosed type with micrometer adjustment. The special coil is wound on a cross-former, and will be described later.

The following components, none of which is expensive, were used in the set, and, to guide constructors, I give the names of the manufacturers :—

Ebonite panel, 8 by 6 by ¼ in., Paragon (Peter Curtis, Ltd.).

One "X" coil-former, made to the dimensions given later. (Burne-Jones & Co.) Readers who wish to make this for themselves should obtain two pieces of ebonite 4½ by 1½ by $\frac{3}{16}$ in.

One ·0005 μF. square-law variable condenser (Jackson Bros.).

N.P. panel-mounting enclosed crystal detector (Service Radio Co., Ltd.).

N.P. panel-mounting plug, socket and link for loading coil (Burne-Jones & Co.) (This must not exceed 1⅜ in. height above panel.)

Five N.P. 4B.A. terminals.

One N.P. 4B.A. countersunk-head screw.

Two oz. No. 22 s.w.g. D.C.C. wire.

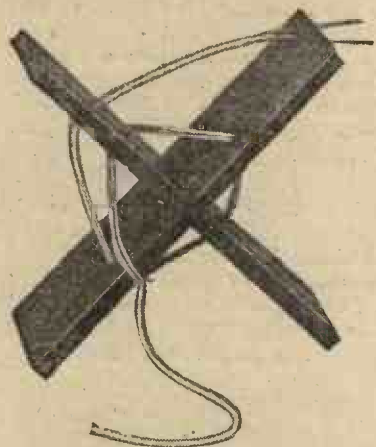
"Glazite" for wiring (London Electric Wire Co.).

"Camco" leatherette-covered cabinet, 4½ in. deep inside, to take

panel 8 by 6 in., with 1½ in. deep lid. (Carrington Manufacturing Co.).
Radio-Press Panel Transfers.

Panel Lay-out

The panel arrangements may be seen in Fig. 2, from which it is seen that the terminals on the left, reading from the top, are Aerial 1, Aerial 2, and Earth respectively. To the right of these is the condenser, behind which is the loading-coil link, plug and socket. The telephone terminals are in front on the right-hand side, while the crystal detector is mounted behind them, with its adjusting knob to the front. 4 B.A. clearance holes must be drilled for the five terminals and the detector-mounting screws, while two ¼ in. holes $\frac{9}{16}$ in. apart are necessary for the loading-coil sockets. The condenser requires a ⅜ in. hole, and a further 4 B.A. hole, countersunk, is wanted to the right of the detector to fix the coil-bracket to the underside of the panel, as explained later. After drilling, the panel should be rubbed clean, the components mounted, and terminals, etc., marked by means of panel transfers.



The double-wire winding is commenced as shown. The fifth quarter-turn seen on the extreme left is taken "straight" across from right-hand slot to right-hand slot, while the zig-zagging is recommenced with the sixth quarter-turn which is just being put on as shown at the top of the photograph.

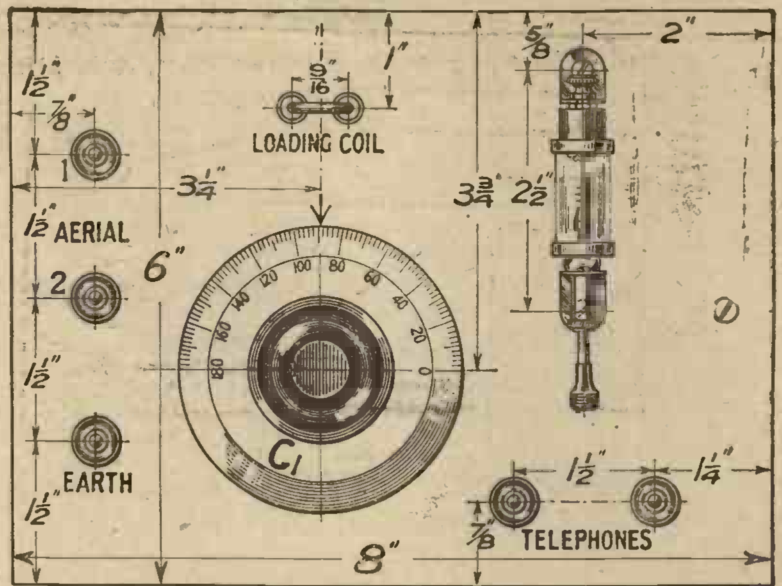


Fig. 2—The panel is drilled as shown above. The screw holding the bracket is seen on the right of the detector.

The Coil Former

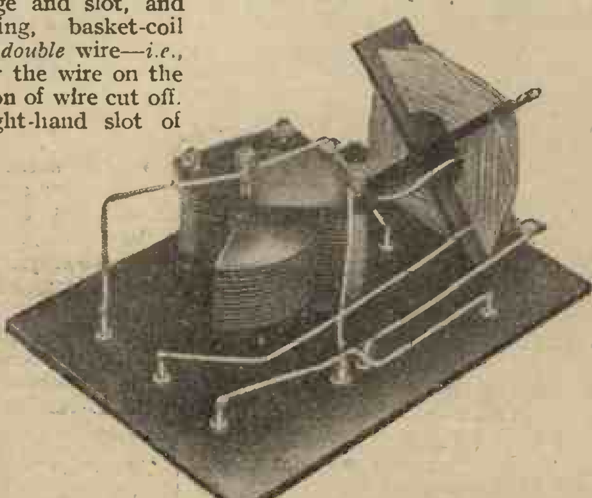
The coil used in this receiver aims at "low-loss" design combined with ease of construction. The coil-former is made of two pieces of ebonite slotted at their centres as shown in Fig. 4, so that they can be put together to form a rigid cross. Two cuts are also made with a hacksaw at each end of both pieces of ebonite, the slots thus formed being 1½ in. deep and placed $\frac{3}{16}$ in. away from the edges of the ebonite strips. It will be found that the average hacksaw blade will make a cut just wide enough to take the 22 S.W.G. wire.

Winding the Coil

Since close coupling between L_1 and L_2 is desirable, these two coils are wound on together as follows: First cut off about 10 ft. of the 22 S.W.G. d.c.c. wire, and twist one of the ends of this to the loose end of the wire on the reel. Suppose the "legs" of the "X" former to be numbered 1, 2, 3, 4. Starting with the right-hand slot in leg 1, leave about 6 in. of wire free, take a couple of turns round the ebonite strip between edge and slot, and commence winding, basket-coil fashion, with the *double* wire—*i.e.*, laying on together the wire on the reel and the portion of wire cut off. Go from the right-hand slot of leg 1 to the left slot of leg 2, then to the right of leg 3, the left of leg 4, and so on back to the right slot of leg 1, when, obviously, one complete turn has been made. In commencing the second turn, however, we do not wish to follow the previous turn, so, instead of taking the fifth quarter-turn to the left slot of leg 2 as before, take it to the right slot of leg 2, then to the left of leg 3, and so on, zigzagging as before, until another four quarter-turns have been made in addition to the fifth. This process is carried on with the double wire for 20 complete turns, every fifth quarter-turn being taken "straight across," as above, in order that consecutive turns cross one another instead of being parallel.

Continuing the Single Winding

After 20 turns it will be found the 10 ft. of wire which has been employed in conjunction with the wire on the reel is nearly all used up, and its free end should be pulled clear and cut down, so that a few inches only remains in excess of that wound on the former.



The "flat" appearance of this side of the coil is due to the "straight" quarter turns.

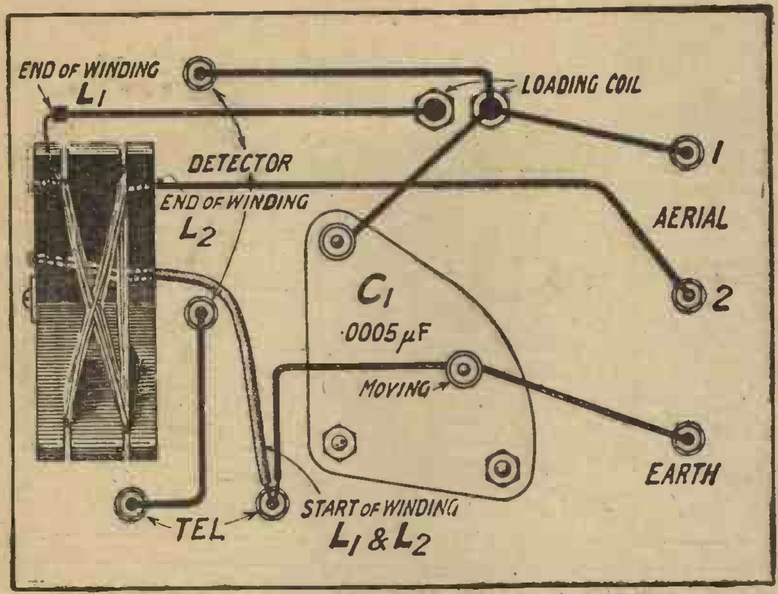


Fig. 3.—The wiring is simple, but the coil connections should be noted carefully.

Continue winding with the *single* wire from the reel until another 30 turns have been put on in the same fashion as before, then cut off with a few inches free.

Number of Turns Required

We now have two coils on the former—one of 20 turns (L_2) and one of 50 turns (L_1), the two having been wound on together for the first 20 turns. At this point it is well to note that the number of turns necessary on L_1 depends on the wavelength of the local station. I have used 50 turns, because that

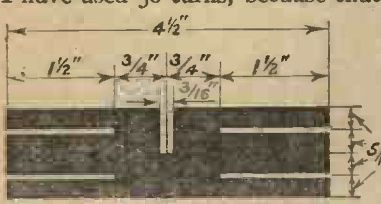


Fig. 4.—Two pieces of ebonite, each $4\frac{1}{2}$ in. $\times 1\frac{1}{4}$ in. $\times \frac{3}{16}$ in. must be slotted as shown above to make the coil former.

is about right for 2LO, but listeners at, say, Cardiff or Hull will probably find that 45 turns will be sufficient, while a Birmingham resident may require 60 turns for 5IT. The best plan is to wind on a few extra turns—they can be easily removed, if necessary, when testing-out, even if the coil has been mounted on the panel.

Mounting on the Panel

The coil is mounted on the back of the panel by means of a small bracket made of strip brass or "Meccano," as shown, the bracket being fixed to the centre of the "X" former by a small wood screw forced into a little hole drilled in the ebonite. The bracket is secured to the panel by the 4B.A. countersunk-head screw mentioned before.

Wiring

Twist together the inside ends of both coils (where the double winding commenced), cover with a short length of insulation sleeving, and solder to one of the telephone terminals, and thence to earth and the variable condenser, as shown in the wiring diagram, Fig. 3. The other phone terminal goes to the "whisker" end of the detector. "Aerial 1" goes to the fixed plates of C_1, the socket of the loading coil arrangement and to the crystal, the loading coil plug being connected to the outside end of the 50-turn coil L_1. "Aerial 2" is connected to the outside end of the 20-turn coil, L_2.

Operation

To receive the local station, short the loading coil plug and socket by means of the link, take the aerial to "Aerial 1" and connect up earth and phones. Adjustments of the variable condenser and catwhisker should bring in the station at good strength. The aperiodic arrangement can now be tried, the aerial now being taken to "Aerial 2" terminal. The condenser will have to be adjusted, and the receiver will be found to be very much more selective, although signal strength may not be as good as before.

For 5XX only the direct coupling method should be used, the shorting link being replaced by a suitable loading coil—say a No. 150.

Test Report

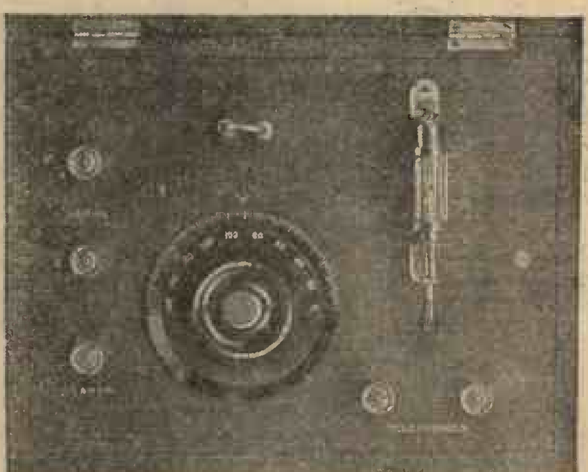
The set gave good crystal results 9 miles from 2LO in a very "crowded" wireless district. Selectivity was noticeably improved when the aperiodic circuit was used, but signal strength fell off by about 20 per cent.

The increased selectivity was evidenced by the faet that 2LO could be tuned out with a few degrees rotation of the condenser dial, while there was a definite "peak" point giving maximum signal strength.

5XX

Daventry was received at excellent strength with a No. 150 loading coil, using the direct circuit with aerial connected to "Aerial 1."

Those readers who desire to wind a suitable loading coil for 5XX for themselves should read Mr. Kelsey's article in "Wireless," Vol. I, No. 10, where the method of construction of a very efficient coil is explained.



A photograph of the panel. The loading coil plug and socket are seen above the condenser dial, shorted by a link.


MANSBRIDGE
CONDENSER

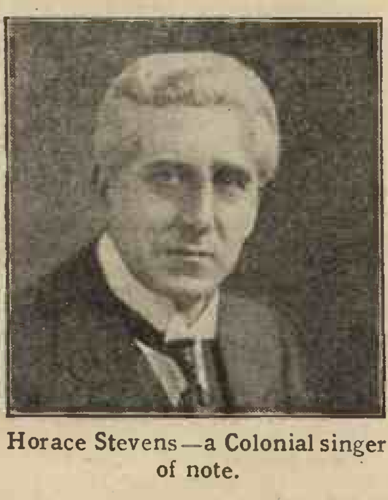
Famous Artists of 1925

By "CARRIER-WAVE."

Notes on well-known singers and instrumentalists who have broadcast during the past year

WITH the passing of another year of broadcast music, it is worth while calling a halt to give a glance back to the events which may be safely said to have made it a memorable one. In the first place, it has seen the freedom of the individual artists established, since most of the agents under whose contracts they were bound have yielded to the advancing spirit of the age. This has given the British Broadcasting Company opportunities of obtaining the great musicians of the world: a chance of which they have gladly availed themselves. Accordingly, the wireless public has been actually enabled to hear the artists who were hitherto but names, or only heard through the medium of the gramophone.

Thanks to the B.N.O.C., we have heard Robert Radford's fine bass singing.



Horace Stevens—a Colonial singer of note.

One can therefore divide the programmes into two sections, those in which the artists have appeared before the microphone in the broadcasting studios, others in which their performances have been relayed from hall or theatre. In both cases, however, world-famous musicians have been brought literally within our homes—singers, instrumentalists, chamber music players, artists of the stage, variety and revue, as well as celebrated military and dance bands.

The Vocal Art

In this, I suppose, Madame Tetrazzini may be said to have "led off," though following in the wake of Melba, heard from Covent Garden. At the same concert given early in the year, M. Dinh Gilly, the famous operatic tenor, appeared. He was first known here for his appearance in Puccini's opera, "Girl of the Golden West," at Covent Garden, in 1911.

Other great operatic stars have been Romano Ciaroff, creator of over forty different rôles on the Continent before he came over here to broadcast. Also Riccardo Stracciari, a chance performance of his being of particular wireless interest, for prior to his becoming one of the finest international baritones, he was for eight years interested in wireless work with Senatore Marconi. His chief rôle is in the "Barber of Seville" with its famous aria "Largo al Factotum," which he broadcast. Of operatic interest, too, have been the appearances of Ulysses Lappas, the Greek tenor, Vladimir Rosing, John Coates, Norman Allin, Frank Mullings, and possibly greatest of all, last month, Chaliapin himself. This great Russian artist had consistently refused to

The great Italian soprano—Madame Luisa Tetrazzini.

Chaliapin has taken many parts in well-known Russian operas.

Miriam Licette as Eva in "The Mastersingers."

broadcast in other countries, so naturally the B.B.C. considered his consent a signal triumph.

Other famous vocalists include Madame Clara Butt, Miss Carrie Tubb, and the Australian bass baritone Horace Stevens, who was heard last year at the Royal Albert Hall in the production of "Hiawatha."

The Catterall String Quartet includes two violins, a viola and violoncello.

Operatic Stars

Thanks to the British National Opera Company, during its various seasons, we have had opportunities of hearing its best artists, amongst them Miss Rosina Buckmann, of Beecham opera fame, and an ideal Isolde, Florence Austral, Miriam Licette, Maurice d'Oisly, and Robert Radford; the last-named justly acclaimed one of our finest bass singers since he first appeared at the Norwich Musical Festival in 1899 in Berlioz's "Faust." He has played leading rôles in French, Italian, German and English operas, and is also an able pianist and composer.

Norman Allin is a Wagnerian singer *par excellence*. Frank Mullings hails from Walsall, and, apart from his operatic rôles, chief of which is in "Othello," his hobby is conducting.

The Pianists

The "national instrument," as the piano has been called, has given us perhaps the greatest surprises of the year, beginning with Paderewski, and continuing with such "giants" of their art as Frederic Lamond, king of Beethoven players, Francesco Ticciati, Gieveking, the Belgian pianist, Sapellnikoff, Harold Samuel, the Bach player, Benno Moisewitsch, Leff Pouishnoff, Evlyn Howard Jones, William Murdoch, the Australian artist, Herbert Fryer, Miss Irene Scharrer and Madame Fanny Davies.

Instrumental Soloists

While the English public as a whole are great admirers of stringed instruments as well as the piano, and they admire the technical difficulties, and here again we have been privileged to hear many very famous artists, including Ysaye, the great Belgian; Zacharewitch, the Russian prodigy violinist, Miss Isolde Menges, Miss Daisy Kennedy and Mr. Albert Sammons. For the 'cello we have had Guilhermina Suggia, the greatest of women 'cellists, also Miss Beatrice Harrison, of "nightingale broadcast" fame. Cedric Sharpe, W. H. Squire and Charles Hambourg had also won fame before they came to broadcasting.

Benno Moisewitsch is a very well-known pianist.

Another instrumentalist of note is Isolde Menges, the violinist.

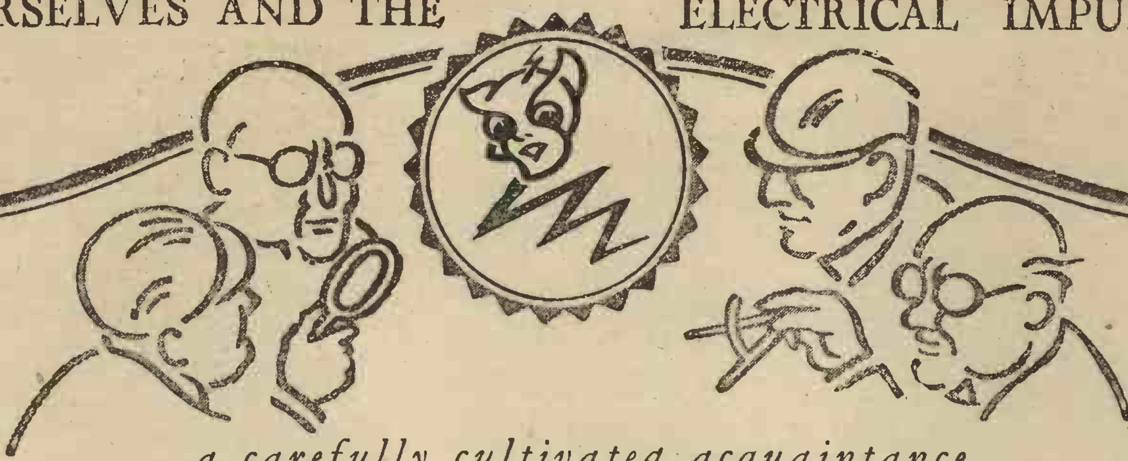
Chamber Music

Other interesting items in the programmes have been the performances of chamber compositions, thus reviving the almost forgotten 17th century style of music. We have heard the London String Quartet, now consisting of Mr. Jas. Levey, Thomas H. Petre, H. Waldo Warner and C. Warwick Evans; the Spencer Dyke Quartet, led by that well-known violinist; the Music Society String Quartet, led by Andre Mangeot; the Samuel Kutcher String Quartet; the Catterall Quartet, led by the famous leader of the Hallé Orchestra; the Snow String Quartet; and the Aeolian Players, led by Gordon Bryan; as well as the foreign Hungarian Quartet and the Modern Trio (Messrs. Manucci, Melzak and Krish).

The Funny Side

This year has seen a very great improvement on the humorous side of the programmes.

OURSELVES AND THE ELECTRICAL IMPULSE



—a carefully cultivated acquaintance

Certain of our technical experts, having foregathered in the sanctum of our chief-of-staff, did ponder with deliberation on the wisdom of his discourse. " Now gentlemen," he said, " you will have to exercise considerable mental brilliance and thoughtful friendliness in pursuit of the electrical impulse. We know that he is the electrical energy which quickens the radio receiver into pulsating life; our job is to tempt him just a little further without fraying his temper. That is, to transform him into voice and music with radio instruments having the correct scientific elements for a really natural transformation. Build, gentlemen," he added, " and remember, he is to be carefully cultivated." But that was long ago. After seventeen years' peaceful penetration in the Brandes laboratories, we are perfectly acquainted with the best methods of effectually harnessing the properties of this elusive spirit of radio sound. Get Brandes radio instruments, built by master craftsmen and scientists in the reproduction of radio sound.

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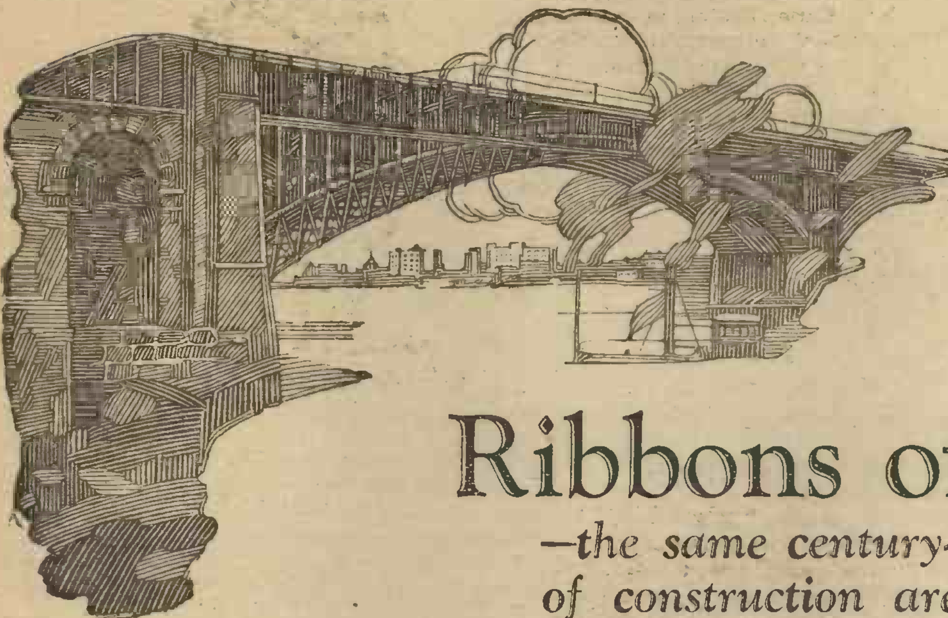

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Gilbert Ad. 3933

Eugene Ysaye and his violin.

Apart from what one might call the B.B.C.'s "stock" company, such as "John Henry," Helena Millais, Louis Hertel, Middleton Woods and Vivian Foster, the variety halls have yielded their quota. Amongst the names announced may be noted Charles Coborn, with that inevitable "Man of Monte Carlo," the Veterans of Variety, such as Arthur Roberts, with Nellie Wallace and Ella Shields, the male impersonator.

The "Legitimate" Stage

The stage has been equally well represented by Sir Johnston Forbes Robertson and Lady Forbes Robertson (Miss Gertrude Elliott), Lady Tree, Miss Lilian Braithwaite, Miss Ellaline Terriss, the Misses Esme and Vera Beringer, with Messrs. Aubrey Smith, actor and cricketer too, and Milton Rosmer.

Co-Optimists and Others.

On the lighter side we have heard Miss Marie Dainton, in some of her inimitable mimicry, George Graves of musical comedy fame, Jack Buchanan likewise, and Norman Williams. Dave Burnaby, Melville Gideon, Laddie Cliff and Phyllis Monkman, Morris Harvey of Pélissier days, with Dorothy Varick and Mdlle. Beatrice de Holthoir, two clever diseuses; also two more Follies, Muriel George and Mr. Ernest Butcher, have contributed to our pleasure.

Ballet and Dance

One must not forget the Russian Ballet at Covent Garden, with Pavlova to give us the sound of the dance; or the noted dance bands, such as Emilio Columba's, Jack Hylton's, Varaldi's Argentine, and Vincent Lopez's band at the Capitol Theatre, amongst many others. These, with the excerpts from such revues as "Dear Little Billie," "Charlot's Revue," and "The Co-Optimists," with the performances arranged by Mr. R. E. Jeffrey and his advisory board (which now includes Mr. Nigel Playfair and Mr. Donald Calthrop as well as George Grossmith, "G.G.") have all served to make the year's amusement as diverse as possible to satisfy high-brow and low-brow alike.

A noted exponent of the piano—especially Beethoven's music—is Frederic Lamond.

Musical comedy has included Jack Buchanan amongst its representatives.

The Anglo-American Six in India

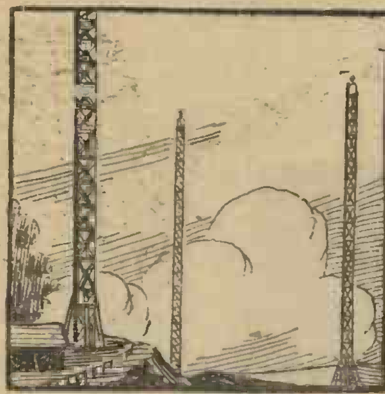
SIR,—Knowing you will be interested to hear of long-distance reception by a set published in THE WIRELESS CONSTRUCTOR, I have pleasure in forwarding the following short report. I have completed an Anglo-American Six to the specifications given by Percy W. Harris, M.I.R.E., in the January and February, 1925, issues, and when testing same on Calcutta Station one night about 10 p.m., not getting good results, I plugged in the coils and transformers suitable for 5XX and, much to my astonishment, immediately picked up a strong carrier wave. After a bit of tuning I found that I was listening to one of the B.B.C. Aunties, talking to the children, and from then onwards for quite two hours, I received the programme clear and distinct, except for the usual chorus of atmospherics. The voices and music were so strong that I missed very little for the first hour and half, but later the atmospherics became too bad. While working I had only the 3 H.F. and detector, as the addition of one stage of L.F., though it brought signals at good loud-speaker strength, also brought the atmospherics like a hot night in a front line trench. I have sent a full report of the programme received to the B.B.C. for confirmation. My aerial is not of the best, with a poor earth, surrounded by trees, and in the flat country. Looking at the map, more than three-quarters of the distance is over land, so it speaks well for the power of Daventry, and the appetite for distance of the set which received it. On the lower waves round 400 metres I have not been very successful, but I am placing the blame on the H.T. being too low, and will, perhaps, get better results on the arrival of fresh batteries. I added a reaction coil on the aerial, and succeeded in getting Calcutta on 420 metres, but not very clearly, so I will have a few more evenings practice with the set before reporting further. This past six or seven months I have tried various designs to bring in Calcutta, including one of the famous American Super sets, and all either bring in the carrier wave or weak fading telephony. Last year it was quite strong on two valves. Trusting this report may be of interest to you.

Yours faithfully,

W. FAIRWEATHER.

Muzufferpore,

Behar, India.



Of What Use is Selectivity to the Crystal User?

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

A GOOD deal of prominence has been given recently to the question of selectivity. Owners of multi-valve sets judge the capabilities of their receivers in terms of the possibility of receiving distant stations when the local station is working. There can be little doubt that the problem of eliminating the signals from the local station and still receiving signals from stations only 10 or 15 kilocycles away is one which forms a very fascinating study, and in the present overcrowded state of the aether a very necessary problem.

The question may be asked, however, "How does this question of selectivity affect the crystal user?" The average man possessed of a crystal set is interested solely in the local station, and by reason of the limitations of the apparatus he is unable to tune in to the more distant stations because the signal strength is too weak. The crystal user, therefore, is somewhat inclined to say, "Well, what use is this selectivity to me, anyhow? Why should I take the trouble to construct a low-loss receiver if I do not wish to receive the distant stations?"

Interference

This question is certainly a legitimate one, and the answer to it depends very much upon the local conditions under which the particular user has to work. There are many places in which the reception from the local station is good and strong, and no appreciable interference is experienced from any outside source.

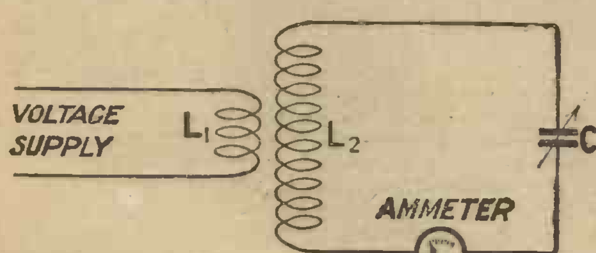


Fig. 1.—As the frequency of the supply in L_1 is varied, the current induced in the tuned circuit CL_2 falls away.

In such a case a very selective circuit is unnecessary. I shall discuss shortly one or two possible methods of obtaining selectivity, and it will be seen that with some of these methods the increase in selectivity is accompanied by an increase in the signal strength, while with other methods the resultant signal strength is the same as with an ordinary circuit, or possibly even somewhat less, although the actual selectivity is considerably improved. This latter type of circuit would possess no advantages for the crystal user who is favourably situated.

We have, however, to consider the crystal user in a locality where interference is troublesome. Such a case is that of the coastal dweller. Here interference is experienced from spark stations operating at frequencies comparatively near to the broadcasting band, and in some cases actually within the latter. In such a case a selective receiver is very helpful. This will readily be appreciated if the meaning of selectivity is investigated a little more closely.

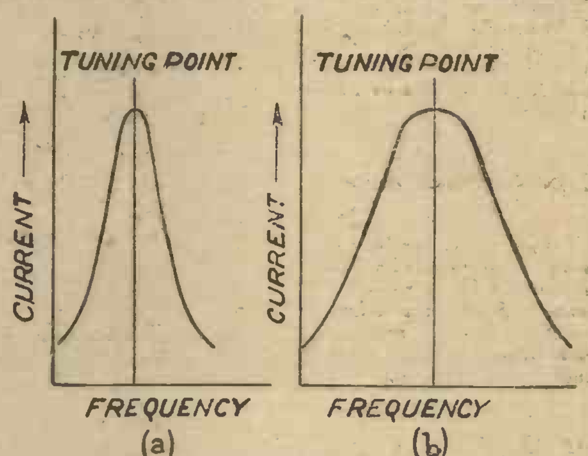
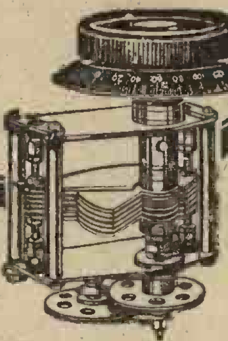


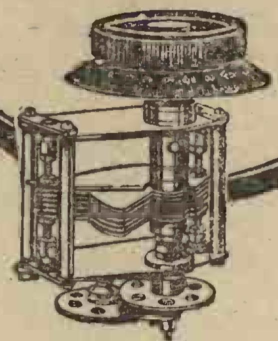
Fig. 2.—(a) shows a resonance curve for a selective circuit, but (b) represents one with flat tuning.

Resonance Curve

If a tuned circuit such as is shown in Fig. 1 is supplied with currents at varying frequencies, the current which will be produced in the circuit is a maximum when the circuit is in tune with the frequency of the voltage supplied. This is the ordinary principle of tuning. As the frequency is varied on either side of the tuning point, so the current falls away more or less rapidly until at a frequency considerably different from the tuning frequency the current in the tuned circuit is negligibly small.

Now the selectivity of the circuit is that property which governs the falling away of the current as the frequency is varied. Fig. 2 shows two of these resonance curves, as they are called, one for a selective circuit, and one for an unselective circuit. In the former case, shown in Fig. 2(a), it will be seen that falling away of the current as the frequency is varied is very rapid, so that at a frequency very little different from the tuning point the current has only a comparatively small value. This means that the tuning will be sharp. Referring to the second resonance





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Tewkesbury.
" You are too modest in your advertisements. I can tune in Continental stations as easily as Daventry, with good sharp tuning. If only your condenser had been invented earlier I should have saved pounds, for I have tried about 14 different kinds. You cannot miss a station on it."

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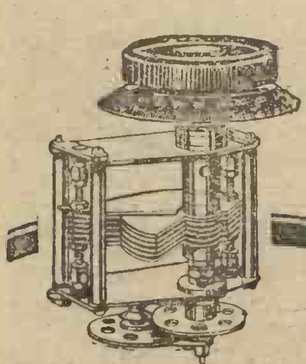

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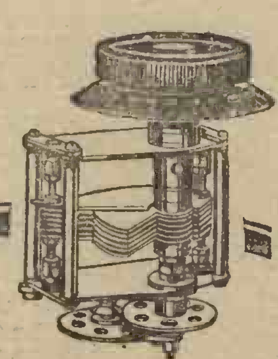

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curve, Fig. 2(b), it will be seen that in this case the falling away of the current is much more gradual, giving much flatter tuning. At a point differing in frequency by the same amount as in the first case, it will be seen that the current here is still large, and is not negligible as it was in the previous case.

Effect on the Receiver

Let us consider now the effect of such a circuit in a receiving set. We tune the circuit to the frequency of the local station and thus obtain the maximum

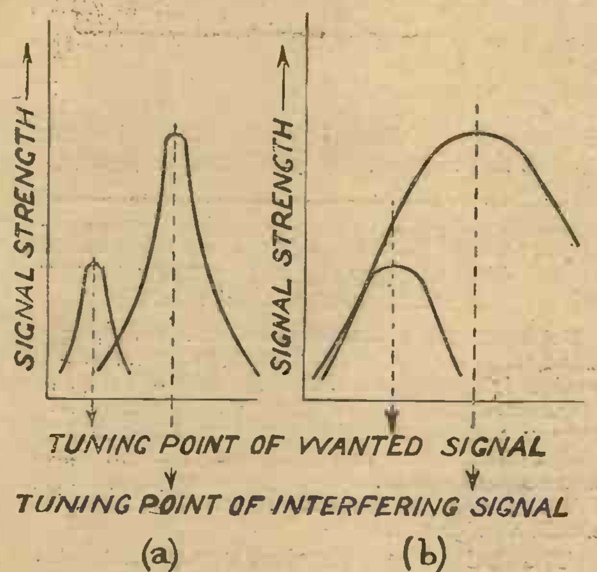

Fig. 3.—(a) With a selective circuit the interfering signal is negligible when the wanted station is tuned in, but in (b) the reverse is the case.

possible current. That is to say, we are working at the peak of the resonance curve. If there is now an interfering station at a frequency comparatively near to that of the local station, then, if the circuit is selective, the current produced by this interfering station will be very small, as shown in Fig. 3(a). If, on the other hand, the circuit is poor from the point of view of selectivity, then the interfering station will still be able to produce an appreciable current, although the circuit is not actually tuned to it. This, therefore, shows the benefit which is derived by employing a selective circuit in a locality where interference is experienced.

Relative Signal Strength

The problem is still more aggravated by the fact that the interfering signal is very often considerably stronger than that received from the broadcasting station. In this case it is more than ever necessary to have a selective circuit. If the two signals were both of equal strength when they were both tuned in, then if the set was tuned to the broadcasting station, the interfering station would be noticeably weaker, the actual reduction depending on the selectivity of the circuit as we have just seen.

If, however, the interfering signal when tuned in, is several times stronger than the broadcasting signal, then even when the set is tuned to the broadcasting frequency, the interfering signal may conceivably be stronger than the wanted signal. This point will be made quite clear from Fig. 3, which illustrates the current produced in the circuit both by the local station and the interfering signal. In Fig. 3(a) the circuit is selective, so that both the resonance curves are steep-sided, the current falling away very rapidly, and the current actually produced by the unwanted transmission in the receiver when the circuit is tuned to the broadcasting station is only comparatively small. In the case shown in Fig. 3(b), however, the circuit is unselective, and the resonance curves therefore are flatter. It will be seen in this case that even when the circuit is tuned to the local station, the current produced by the interfering station is stronger than that of the local station.

This is the trouble which is likely to be encountered in a locality where interference is experienced. There is little doubt that the use of a selective circuit is amply justified in such a case. We have seen that in the case of a good receiving area where interference is small, then the use of a highly selective circuit is not so essential.

Methods of Obtaining Selectivity

Let us consider some methods of obtaining selectivity. The first method is, of course, the reduction of the resistance in the circuit. The lower the resistance can be made, the sharper becomes the resonance curve for a particular circuit, and the more selective the circuit becomes. An advantage of this method of reducing the resistance lies in the fact that not only does the selectivity increase, but the current at the actual tuning point increases appreciably. This method of producing selectivity is one which is strongly to be recommended, wherever the receiver is situated. The coil employed should be of as low a resistance as it is possible to make it, consistent with reasonable size, and if this is done, not only will selectivity be increased, but the signal strength also.

This statement must not be construed into a recommendation to use abnormally thick wire, because there are certain secondary effects which have to be taken into consideration, and the design of a low-loss coil for a tuning circuit is one which requires considerable skill and knowledge. Designs of suitable

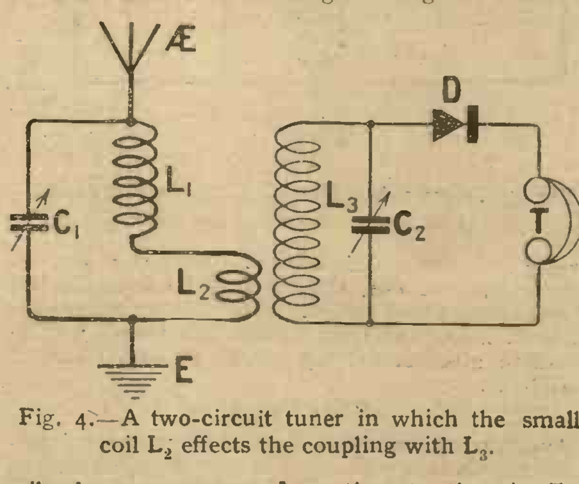

Fig. 4.—A two-circuit tuner in which the small coil L_2 effects the coupling with L_3.

coils, however, appear from time to time in THE WIRELESS CONSTRUCTOR, and our readers may rest assured that everything is being done to present the best possible designs of coils to their notice.

Use of Coupled Circuits

The only other method of improving the selectivity of the crystal set lies in the use of two or more tuned circuits. In practice it is found that the use of more than two circuits on a crystal set is accompanied by such a large decrease of signal strength and such difficulties of tuning that the arrangement becomes impracticable. A two-circuit tuner, however, is often employed. The aerial circuit is tuned, and loosely coupled to the tuned secondary circuit.

Two Useful Circuits

The coupling may be by means of a small coil, as in Fig. 4, or of a direct tapping (Fig. 5). Both of these methods are capable of giving an increased selectivity. It should be noted, however, that this method may not give rise to any increase in signal strength, though on a poor aerial a noticeable increase may result. With a properly designed circuit, the maximum signal strength with such an arrangement is quite as good as it would be with a good single circuit, while the selectivity is definitely improved. A circuit of this type is very suitable for a coastal area, where interference is heavy, and very selective circuits can be made by utilising this principle. These advantages, however, are not noticed in a locality where interference is not troublesome, and there is little reason for the additional complication.

Tapped Aerial

A third type of circuit, which is in reality a species of coupled circuit, is that shown in Fig. 6. Here the aerial, instead of being connected right across the coil, is only connected across a comparatively small portion of it. It is found that with a circuit of this type the signal strength obtained is not usually impaired, and may even be increased, while the selectivity is very

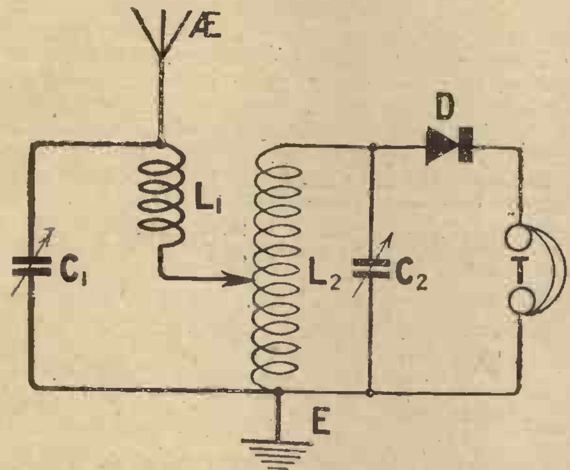

Fig. 5.—Here a direct tapping couples the aerial and tuned secondary circuits.

largely increased. This type of circuit is a particularly convenient one, since it only involves the use of one actual tuned circuit. If the tuning coil used is made of a low-loss construction, this circuit will be found to give satisfactory results under all normal conditions.

Wave Traps

Another very effective method of reducing interference is that in which a wave trap is employed. In this case a suitable circuit, tuned to the interfering station, is connected across the main circuit in such a position as to divert the interfering currents from the detector without appreciably affecting the wanted signals. One way in which a wave trap is employed was shown in Fig. 5 on p. 133 of last month's issue.

This method, however, I have not discussed here, because I have been confining my remarks principally to straightforward circuits actually tuned to the wanted station.

It will be seen from these remarks, therefore, that selectivity is a question which affects the crystal user under normal conditions, so that the extra trouble involved in the construction of low-loss sets does produce better results.

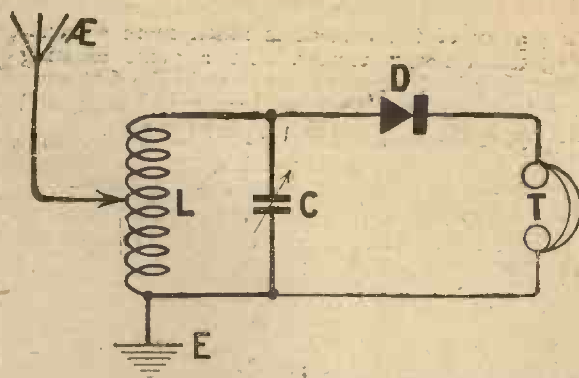

Fig. 6.—A tapped aerial circuit. The inductance L should preferably be of low-loss type.

OUR ELSTREE TEST DEPARTMENT

IMPORTANT NOTICE

Readers availing themselves of our Test Service are asked, when forwarding sets for test, to enclose with the receiver full particulars of the behaviour of the set and of the valves and batteries employed. Coils, H.F. Transformers and Neutrodyne Units should always be included with the set. Valves, if sent, should be forwarded under separate cover.

Where sets are despatched by rail or post, they should be addressed to:—

The Radio Press Service Department, Ltd. (Test Department), Shenley Road, Elstree, Herts.

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By carrying out these instructions, readers will facilitate the testing and return of their sets.

Mr. Donald Calthrop, the well-known revue artist, broadcasting from 2LO. He is a member of the B.B.C. advisory board which is concerned with studio productions.

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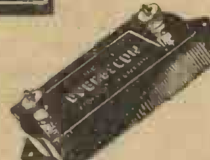

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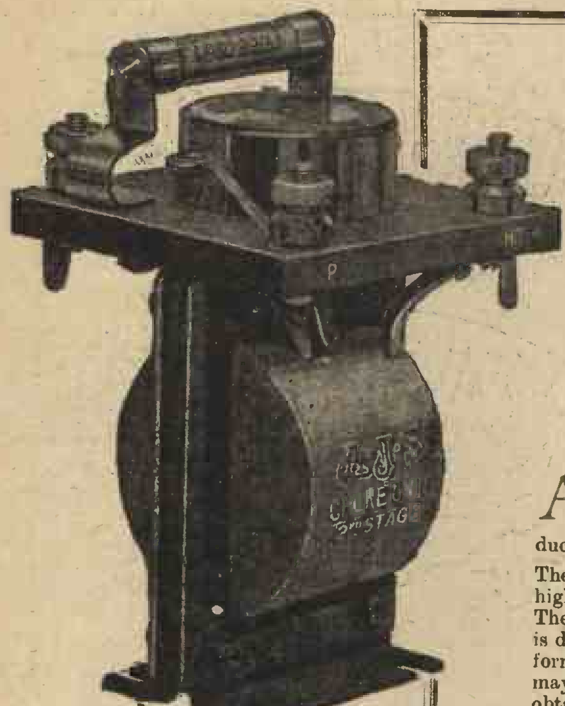

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Making a Cabinet for Your Set

A description of a useful cabinet with several novel points

AN important but unfortunately often neglected branch of work in connection with the construction of wireless receiving sets is the making of cabinets. A well-designed and thoroughly-made cabinet will always easily repay the time and trouble involved in its construction, since it forms a protection for the various components of the set.

Planning Out

In all cases the first consideration should be that of the space to be occupied by the various parts and their most advantageous disposition. The size of the panel or panels being given, the depth required for the parts should be calculated, allowing just sufficient accommodation without undue cramping. A good plan even when making the simplest of cabinets is first to make a full size drawing and to take all measurements from this. In this way one can not only calculate the exact sizes required but can also determine the best proportions in its design.

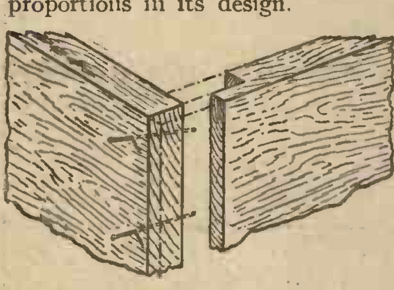


Fig. 1.—A lap joint, secured with glue and nails driven askew.

The Wood

Of the woods most suitable for the work, the hard woods such as mahogany and oak are the best, especially for all outside show work, although pine and deal if suitably treated form quite good substitutes. The latter woods are used by many experimenters, as they are more easily obtainable and are inexpensive. The most useful thicknesses of boards are ½ in. and ⅜ in., these being obtainable in widths varying from 6 in. up to 11 in. Prepared boards should be obtained, as these are already machine-planed and brought to an equal thickness and thus save

Fig. 2.—The finished cabinet. The set is completely enclosed.

the worker a good deal of labour. The thicknesses mentioned are quite optional, the thickness of wood being decided according to circumstances.

Simple Joints

The simplest type of cabinet is the plain box, the top being occupied by the panel of the set. There are various methods of joining the corners, from the simple nailed butt joint up to the more elaborate dovetailed joints. The latter are extremely strong and when well cut are very neat. A good alternative method is the lap joint, of which an example is shown in Fig. 1. Two of the sides are cut to the full outside size of the case, and a lap formed by cutting a rebate on the inner edges to a depth equal to the thickness of the wood. The remaining sides are less in length by the thickness of the lap allowed on the other sides. The joints are secured with glue and nails, the latter being driven askew as shown, to form a dovetail grip. A simple and effective method of securing the bottom is to screw it straight on underneath, hiding the consequent joints at the sides by mitreing a moulding round.

An unusual and useful cabinet is illustrated in Fig. 2, and involves in its construction most of the joints which occur in general cabinet construction. The panel is enclosed behind a sloping fall and is fixed to a separate case, which is free to move from back to front. The fall is connected to the inner case and when opened draws the latter forward, thus bringing the panel flush with the front so that the dials are easily operated. The fall when open rests upon a drawer, as in Fig. 3, in which headphones and any other small parts are kept. The mechanism of the movement can be seen in Fig. 3, fuller details being given in Fig. 8.

How to Make the Sides

The first step in making is to prepare the sides, which are of ½ in. material, and conform to the measurements indicated in Fig. 4. Both pieces should be first cut to the full size rectangular shape and carefully planed true. They are then clamped together and the

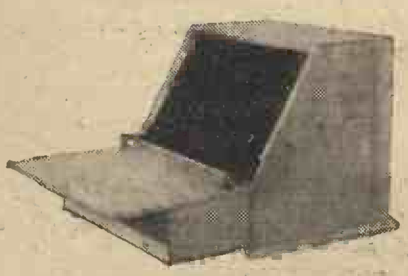


Fig. 3.—The wooden fall or "flap" when opened pulls forward the inner case and panel.

position of the slope marked on both edges. The waste portion is cut off and the edges planed square before the pieces are separated, thus ensuring their identity in size. The top and bottom are also prepared to size, allowing sufficient width in the former for the bevelled front-edge. The corners are lapped together in a similar way to that

shown in Fig. 1, except that a double lap is allowed at the top corners. The bottom will, therefore, be less in length by the thickness of both laps on the sides. Allowance must also be made in the latter for the laps at the top.

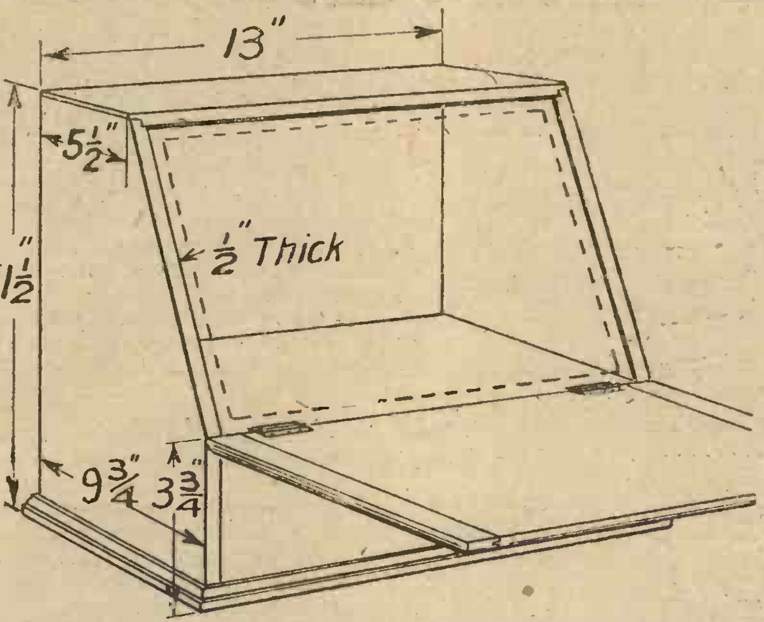


Fig. 4.—Dimensions of the cabinet. The inner case has a width of 12 ins. and a sloping height of about $8\frac{3}{8}$ ins. The panel fits over this, but has an allowance of $\frac{1}{8}$ in. off each edge, so that beading can be mitred on. The panel size is therefore about $11\frac{3}{4}$ ins. by 8 ins.

Cutting Grooves for the Shelf

Grooves are now cut across the inner faces of the sides to take the centre shelf. These grooves are stopped near to the front, so that the joint will not show at the front of the cabinet. The best method of cutting the grooves is first to mark out their position with a chisel, cutting deeply across the grain. The wood on the inner sides of these cuts is then eased

Fig. 5.—A central shelf is fitted into grooves cut in the sides.

away with a chisel, thus forming a small groove in which a saw may be worked. The groove may be made of equal depth by using a router. An extra allowance in the length of the centre shelf must be made for the portion fitting into the grooves. The top and sides are rebated at their back inner edges to take the back, which may be very suitably made from three-ply. It is unnecessary to rebate the bottom, as the back may fit right over this, the back edge being planed to fit level with the rebate on the sides.

Assembling

The whole is now ready for assembly. The bottom is first glued and nailed to the sides, driving in the nails askew from the underside, in the manner shown in Fig. 1. The shelf is next fitted in place with glue, sliding it into the grooves from the back, the top being fitted last of all. The nails for this should be driven in from the sides, after which the whole should be tested to see that it is square, and then put aside to set thoroughly.

The Drawer

The best method of making the drawer is to dovetail it. The front is first cut to size, and is carefully fitted into the space it will occupy, planing the edges slightly askew, so that it wedges in tightly. The sides are also cut off square to length, and fitted into the cabinet, being planed to fit just hand tight. The back will be made less in depth by the extent to which the bottom stands up, as it fits above the latter. The depth of the dovetails is gauged on all four pieces, making an allowance at the front for the lap, as the front dovetails should not run right through. The sides are cut first, and the front and back marked out from these.

Making the Inner Case

Fig. 6 shows the drawer being put together, and indicates clearly the lap at the front. Before glueing up the drawer, a groove to take a

Fig. 6.—The drawer is dovetailed, and grooved to take a three-ply bottom.

three-ply bottom must be worked on the front and two sides. The inside case is simply butted and nailed together, the exact size being taken directly from the outer cabinet. It should be carefully trimmed and levelled after being put together, so that it fits nicely in position. Small recesses are cut at the front corners as shown in Fig. 7. These are cut out to allow clearance for the brass stays which connect the inner case with the fall. The latter should be clamped at the sides to obviate any tendency to warping. The clamps are joined with a tongue and groove. After setting, it should be fitted in position, and a small moulding worked at the top and two sides. When hingeing it to the shelf the hinges should be let in half-and-half into both shelf and fall.

Fig. 7.—The inner case is cut to fit the main cabinet. Note the recesses at the front bottom corners for the brass stays.

The Stays and Brackets

The exact position at which to fix the stays and the brass angle-brackets is given in Fig. 8. The panel is cut with an allowance of ⅛ in. on each edge, so that a bead can be mitred round the edge. This not only gives a neat finish, but obviates the necessity of cutting away the panel to allow for the stays. A back view of the cabinet, showing the rebate to take the three-ply back is shown in Fig. 9. The base moulding is mitred round, and is fixed with glue and fine pins.

Applying Stain

The best finish for such a case as this made in deal is to first stain it, and finish off when dry with wax polish. The stain may be applied with a rag, rubbing it well into the corners, and finishing off with light strokes in the same direction as the grain of the wood.

Polishing the Cabinet

Oak may also be treated in a similar manner, or, if desired, may be fumed. Mahogany is best treated by french polishing. It should be first stained or darkened with a coating of bi-chromate of potash, and when dry the grain should be filled in with plaster of paris suitably coloured with powder colours.

Before polishing, a rag lightly soaked in linseed oil is passed over it, this having the effect of toning the plaster down, as the natural tendency of the plaster is to dry a light colour.

If the inner case is found to move tightly and is apt to bind or to squeak, a little candle grease should be rubbed over all working surfaces.

Fig. 9.—The cabinet from the back.

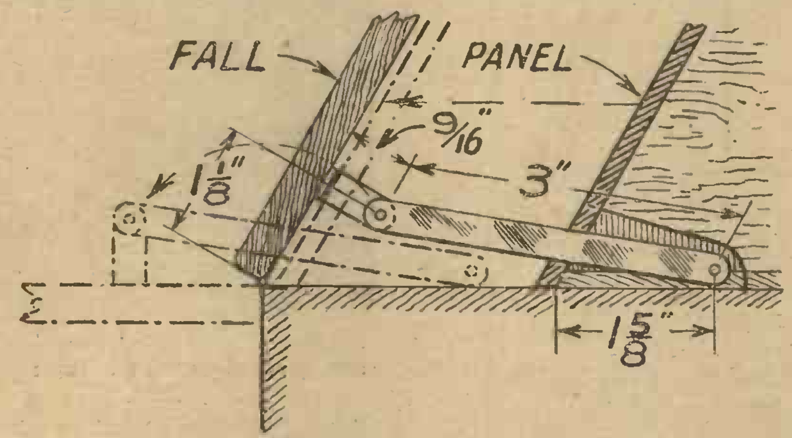


Fig. 8.—Details of the brass stays and their mode of attachment to the fall and inner case. The allowance of ⅛ in. on each edge of the panel leaves room for the stays and for ornamental beading.

The "Twin-Valve" Receiver

SIR,—Six months ago I had a plain one Det., one L.F. valve set, and felt fed-up because I could not get anything like good results. I could at times get Birmingham, Bournemouth and Cardiff, but at no great strength. Then reading the January, 1925, issue of THE WIRELESS CONSTRUCTOR, I noted the Twin-Valve Receiver, described by John Scott Taggart, F.Inst.P., A.M.I.E.E., comprised all my components except two fixed condensers. So I "rewired" my set to your circuit, and although the layout of components is somewhat different, results have really been excellent.

I can get all the B.B.C. stations at good phone strength (I have a very poor aerial and worse earth) Le Petit Parisien, P.T.T., Hamburg, Madrid (R.I.), Radio-Sud-Est, Brussels, Munich, Radio Toulouse, Radio-Paris, Hilversum, Stockholm, Dresden and WGY (U.S.A.) (twice).

Every station is clear, and I think that, given a better aerial and earth, the majority would work a loud-speaker (small type).

Later I intend to add the "Two-stage Choke Amplifier," by John W. Barber, described in the September, 1925, issue of THE WIRELESS CONSTRUCTOR.

Many thanks for the circuit.

Yours faithfully,

J. SHANN.

West Kensington.

SIR,—I made up the Twin-Valve set as described by John Scott-Taggart, F.Inst.P., A.M.I.E.E., in the January, 1925, issue of THE WIRELESS CONSTRUCTOR about six months ago, and am very pleased with results.

I have had all the main stations and several relays and continentals. Being situated about 25 miles from the nearest station (Cardiff), this comes in after dark rather too loud for phones (five pairs), while Daventry, much louder still, has worked a loud-speaker.

I do not, however, want to work a loud-speaker, but prefer the more distant stations, such as Bournemouth, Birmingham, Newcastle, etc., at excellent phone strength to accommodate the whole five pairs of phones.

Perhaps the following would be of interest. My aerial is of the "birdcage" type, 5 ft. across and 4 ft. above the roof (no room for any other type), and was erected by the trade, and seems quite efficient for Cardiff and Daventry.

My earth is a copper tube with a 15 ft. lead of five strands of No. 20 and 7/22, twisted together.

My coils are home made basket on card formers of nine slots, 22 gauge wire, and Cardiff requires 80 turns using C.A.T. and 15° condenser reading and 75 turns of 26 gauge for reaction.

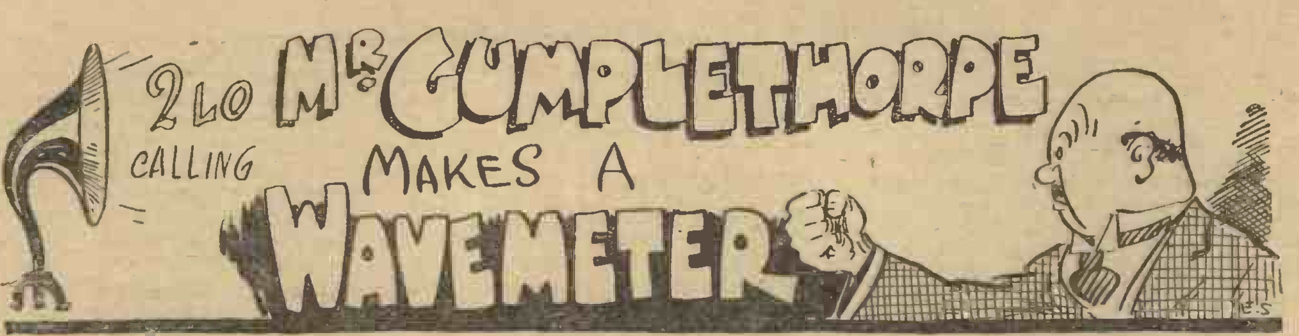
Daventry requires 260 turns of 26, same reaction, and comes in at 20° condenser.

I might say in closing that I made for a friend the "Powerful 3-Valve Receiver" by Percy W. Harris, M.I.R.E., described in the April, 1925, issue, and he was delighted. Cardiff 25 miles, Bournemouth 65, and Daventry coming in on an Amplion L.S. at full strength.

Yours faithfully,

A. L. MARTIN.

Bristol.



Mr. Gumplethorpe Makes a Wavemeter

ONCE his big set had been constructed there was, so to speak, only one fly in Mr. Gumplethorpe's ointment, though, if the insect in question was a single one, it made up in size for what it lacked in numbers. The trouble was that he simply could not run round the stations as he would have liked to do, because there were so many things to be twiddled all at once that, if he was trying to find Newcastle, he was never quite sure whether he was going up or down the scale when he turned the knobs.

Up or Down?

And it is obvious that if you are running up the scale in wavelengths, you are running down it in kilocycles and *vice versa*. Owing to his inexperience and to the difficulty he had in getting the old-fashioned wavelength idea out of his head, Mr. Gumplethorpe not infrequently went up the scale in wavelengths

.... conducted to the bicycle department....

with C1 and up the scale in kilocycles with C2 simultaneously. Such was the state of frenzy produced in him by his frantic, but unsuccessful efforts to give his friends a round-Europe programme that he very nearly went up the pole as well. Mr. Gumplethorpe always started by tuning in London. This was comparatively easy, since the distance from his desirable villa, messuage or demesne to 2LO's aerial was not great. Having found London, he then set himself the task of going down (or up, if you are old-fashioned) to Belfast. After a few careful movements of the knobs faint music would be heard from the loud-speaker. "Aha!" said Mr. Gumplethorpe. Further small twiddles brought the music up to splendid strength "Belfast," said Mr. Gumplethorpe. "2LO," said the announcer. Mr. Gumplethorpe then tried again, always with the same result. Whenever he tuned in Rome or Vienna or Oslo or Toulouse, his little sigh of satisfaction ever turned into a grunt of disgust or a scream of dismay, because, as soon as the music came to an end, the announcer told the world that 2LO was calling. At one time Mr. Gumplethorpe thought that there must be a world-wide conspiracy and that all stations were calling themselves 2LO. Several of his friends agreed with him when he told them about this, but others were quite rude about it.

2LO's Wavelength

Mr. Gumplethorpe was delighted to see the remarks that appeared in the publications of the Radio Press about 2LO's wavelength. He wrote a long letter to the Editor, saying that his own observations had proved that 2LO had no fixed wavelength or kilocyclage, but was transmitting upon all wavelengths between 300 and 500 metres or upon every frequency between one million and 600,000. He next consulted an expert friend, who, having heard his tale of woe, recommended him to purchase a wavemeter. Mr. Gumplethorpe disliked the name, but thought that the idea was a good one. On his next visit to London he entered a wireless shop and asked to be shown the latest thing in kilocyclometers.

Cyclometers

The salesman promptly conducted him to the bicycle department, where he was shown those funny little things that people fix to their front wheels for reasons best known to themselves. A friend of mine in the early days of cycling once fitted up one of these on the eve of a ride from London to York. Arriving at the northern city, he consulted the gadget to see how many miles he had done and found that it registered 9,802. As he had performed the ride in 12 hours, he claimed a world's record, but this was disallowed when the authorities found that he had clamped the ticker thing to the spoke in such a way that the instrument read backwards. Mr. Gumplethorpe, on being shown things of this sort, became livid with fury, and such was the torrent of speech that issued from his lips that it was some time before the man behind the counter could grasp what he was talking about. At length he was led back to the wireless department, where he demanded to see a frequency-meter. They were just taking him off to the gas department, when he flung his principles to the winds and explained that what he wanted was a wavemeter.

A Heterodyne Wavemeter

All was now comparatively plain sailing. The salesman having heard of Mr. Gumplethorpe's sad experience, and having been furnished with a lengthy description of his

.... found that it registered 9,802 miles....

super-set, prescribed a heterodyne wavemeter. "For ordinary, non-expert wireless men," he said, "we would recommend the buzzer article. But this does not give the accuracy that a person such as yourself would require. For you the heterodyne wavemeter is obviously the only suitable type." He demonstrated to Mr. Gumplethorpe how to find the silent point between squeaks and assured him that the whole thing was as easy as pie, if not easier. Mr. Gumplethorpe left the shop minus several Fishers and plus a parcel whose sharp corners he dug into the vulnerable spots of numerous fellow strap-hangers in the course of his journey on the Tube to the railway station, whence he was whirled home at the giddy speed of 10 miles per hour, perhaps, by a Southern Railway flier.

Silent Points

Having reached his little dovecot, he repaired to his radio den and prepared the heterodyne wavemeter for action. Now, at last, he thought, he would be able to go up in wavelengths or down in kilocycles just as he desired. He would make his first attempt, he decided, with Glasgow. He set the wavemeter at the appropriate reading and switched it on. Then he switched on the set. He gave C a slight clockwise twist. "Wheeeeeoooo—silence—ooowheee!" said the loud-speaker. There were the squeaks, and there was the silent

.... a parcel with sharp corners...

point. For the next half-hour Mr. Gumplethorpe chased that silent point round and round the dials of his condensers. Whenever he found silence as regards the wheees he found noise from 2LO. Not until the next morning did he learn that his next-door neighbour, Jones, one of the most renowned oscillators in the district, had been trying out a new set. The next night the wavemeter was all silent points, and all the silent points were 2LO.

The I.S.R.L. Again

Poor Mr. Gumplethorpe was in a terrible state. Every morning when he travelled up in the train his friends told him of the marvellous reception obtained on the previous evening from all kinds of stations. It was bad enough to have them telling him this kind of thing, but it was far worse when they asked him what stations he had got. Having been elected some time previously, as you may remember, a member of the Incorporated Society of Radio Liars, he gave quite a respectable list; but he felt all the time that the Recording Angel's self-filler was working pretty hard, and he had what the Americans call a hunch that, even with the handicap allowed to members of the Incorporated Society of Radio Liars, his card was well over bogey. He therefore pulled the heterodyne wavemeter to pieces, obtaining from it a valuable collection of components which went to join the members of the unemployed (without dole) upon the shelves of his wireless cupboard. He next decided to construct for himself one of the despised buzzer wavemeters.

Quite Simple!

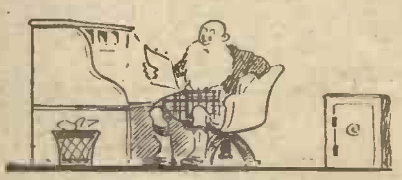
This, of course, is the easiest task in the world. The only materials required, to quote the words of those who tell us how to make things, are a buzzer, a condenser, a single cell, a coil, a switch, an ebonite panel and a neat cabinet. Anybody in one afternoon can make a buzzer wavemeter. I make this statement without the slightest fear that any reader will contradict it. But many afternoons and evenings and mornings may pass before he can make the buzzer buzz. I have told you that there was a fly in Mr. Gumplethorpe's ointment. But the fly apparently was not a bluebottle; certainly it was not a mosquito. The buzzer which he purchased was a small affair which appeared at first sight perfectly harmless. The instructions accompanying it said, "Adjust screw A and screw B until a high singing note is obtained." Mr. Gumplethorpe adjusted screw A until its threads were worn out and had to be replaced by screw A¹. He then adjusted the screw B until there was simply no nick left in it and screw B¹ had to take its place.

Getting it Calibrated

Mr. Gumplethorpe called them much worse things than A dash and B dash. The instructions referred, as I have mentioned, to a high singing note. It did not state whether the note was produced by a soprano, an alto, a tenor or a basso. All that Mr. Gumplethorpe could obtain even with screw A¹¹ and B¹¹ was a noise rather like the tearing of American cloth. Having got so far, Mr. Gumplethorpe completed his wavemeter and sent it round to a super-expert friend to be calibrated. After many days the friend returned it calibrated in wavelengths. Utterly disgusted, Mr. Gumplethorpe handed it over to a second friend, requesting him to calibrate it in kilocycles. The second friend returned it with a polite note, stating that the buzzer had apparently been struck by lightning. He then handed the instrument to yet another friend who promised to calibrate it for him in anything he liked. A week or two later the wavemeter was returned with a most beautifully drawn calibration chart. Mr. Gumplethorpe was in ecstasies.

The Buzzer Buzzes

That evening he switched on his set and switched on the wavemeter. The buzzer would not buzz. He tapped the instrument. The buzzer would not buzz. He rapped the instrument. The buzzer would not buzz. He banged the instrument. The buzzer would not buzz. He replaced screws X and Y with screws O and P. The rest of the evening he spent in making the buzzer buzz. Just before midnight it zizzed with a high super-soprano singing note. Mr. Gumplethorpe retired to bed, resolving to leave the final trial until the following evening. He came back to his little home prepared to have things all his own way. Did he find them so? He did not. The buzzer would not buzz. He fitted a new battery. The buzzer buzzed. Full of hope and enthusiasm he tuned in 2LO and set the meter at the appropriate reading. By exceedingly careful manipulation he advanced from a hoarse rending noise to the love song of a mosquito. This he found was perfectly possible with the condenser set at zero. If, however, he turned its knob ever so little in a clockwise direction things at once went wrong. Examination showed that C was suffering from touching plates. Having replaced C with C¹ he found that battery B was simply shouting to be relieved by B¹. And when a new battery had been installed and the buzzer was singing its shrillest not a sound could be heard from the loud-speaker even



.... a house agent in Aberdeen....

though the coil L of the wavemeter was held tightly against L1 of his super set.

Off to Bonnie Scotland?

Mr. Gumplethorpe is of an opinion that 2LO is not playing the game. For the moment he has given up the stations upon the broadcast waveband (or kilocycleband) and has taken to Daventry. This would be quite satisfactory but for the fact that 5XX now nearly always relays 2LO. Mr. Gumplethorpe when I last heard from him was in correspondence with a house agent in Aberdeen. Meantime, should you happen to meet him, I do not advise you to mention the subject of wavemeters.

A "Single Coil" Two-Valve Receiver

By E. J. MARRIOTT

This set will give loud-speaker reproduction on the local station and bring in one or two other B.B.C. transmissions on the headphones

WHAT type of receiver to make is very often a problem which some constructors find difficulty in solving. There are so many points to be reckoned with, and so many types of receivers, that it is really no wonder that a choice is somewhat difficult. One thing, however, must be realised, and that is unless you are prepared to spend a considerable sum of money it will not be easy to construct a set which will fulfil all needs. That is to say, if distant reception on the loud-speaker is required, local loud-speaker reception, and extreme selectivity, together with a simple control, then a receiver which will satisfy all these demands will not only be decidedly expensive, but will be no simple matter to construct.

What the Set will Do

In designing the receiver to be described in this article, the author had in mind certain requirements, and has attempted to attain these objectives, not forgetting at the same time to study economy to a certain extent. Generally speaking, two valves at least are necessary to obtain moderate loud-speaking on the local broadcast station, and are employed in this receiver. It was desired to be able to receive one or two of the other B.B.C. stations at good headphone strength, together with a possibility of hearing, under favourable conditions, some of the well-known Continental stations. How far success was attained will be seen later on by the test report at the end of this article.

As previously stated, the number of valves was limited to two, this number being economical, and as loud-speaking from the local station was desired, it was essential that the second valve should act as a low-frequency amplifier. The first valve then, is a detector, and reaction is incorporated in order that the strongest signals may be obtained from any station within range.

The Special Coil

A home-made coil is used in the set as a fixture, and a form of Reinartz reaction is employed, thus simplifying the tuning operation, which consists merely of adjusting two variable condensers. Again, for the sake of simplicity, no provision is made for receiving stations outside the normal 250-600 metre band.

In this way all moving coils are eliminated from the receiver, which consequently is comparatively small and, as may be seen in the photographs, presents a handsome appearance. Its general appearance is further enhanced by the absence of any terminals whatever on the front of the panel, all the terminals being on ebonite strips at the back of the set.

The Circuit

The actual circuit used may be seen in the theoretical diagram, Fig. 1, and many readers, no doubt, will be familiar with it. The same winding, L_1, acts both as the aerial coil and reaction coil, and it is coupled to the grid coil, L_2, which is tuned by a ·0005 μF. variable condenser. Except for the possible movement of the aerial connection to the centre tapping shown on L_1, the coupling between L_1 and L_2 is fixed.

A radio frequency choke, L_3, is connected in the anode circuit of V_1, and a variable condenser, C_2, is joined between the anode and the aerial lead. A variation of this condenser varies the reaction effect, an increase in capacity causing an increase in reaction and *vice versa*.

The low frequency rectified currents, however, find no obstacle in the R.F. choke L_3, and so pass through the primary winding T_1 of the low frequency transformer, T_1 T_2, being passed on to V_2 in the usual way, and appearing in the anode circuit of V_2 in a greatly amplified form.

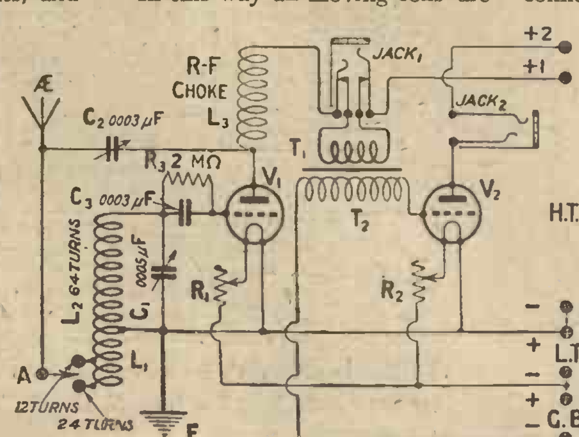


Fig. 1.—The circuit. Plugs and jacks are employed to allow the use of either one or two valves.

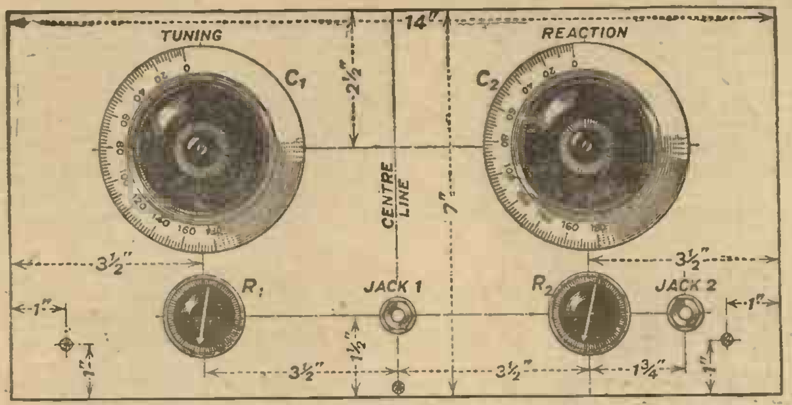


Fig. 2.—The panel is exceptionally neat. Vernier dials are employed on the condensers.

A double contact telephone jack has been made use of between V_1 and V_2, in order that headphones may be plugged in, in place of the winding T_1, when it is desired to listen on a single valve.

Components

In order to build this set exactly as described you will require the following components. The makes actually used are indicated, but other good quality makes may, of course, be substituted, any difference in size being allowed for when arranging the layout.

One Radion Mahoganite panel, 14 in. by 7 in. by 3/16 in. (American Hard Rubber Co., Ltd.).

One cabinet with baseboard, 8⅝ in. deep, to take above panel (Camco).

Two variable low-loss square-law condensers, one ·0005 μF. and one ·0003 μF. capacity (Jackson Bros.).

Two "Pelican Univernier" slow-motion dials (Cahill & Co., Ltd.).

Two 30 ohms filament rheostats (Yesly, Engineering Supplies Ltd.). (The resistance of these must be decided by the type of valves you intend using).

One 2 MΩ grid leak and ·0003 μF condenser, mounted (L. McMichael, Ltd.).

One single contact, and one double contact telephone jack (General Radio Co.).

One power L.F. transformer, type 84 (General Radio Co., Ltd.).

Two "Magnum" anti-microphonic valve holders (Burne-Jones & Co., Ltd.).

One radio frequency choke (Lissen, Ltd.).

One Kendall "X" former (Burne-Jones & Co., Ltd.).

Two strips of ebonite for terminals, one 7 in. by 2 in. by ¼ in., and the other 3 in. by 2 in. by ¼ in.

One spring clip (S. H. Collett).

Nine terminals.

Glazite for wiring up.

Half-pound of No. 24 d.c.c. copper wire for coil.

Short length of flex.

Radio Press panel transfers.

Two 3 in. angle brackets (R. Melhuish).

One small metal angle piece for holding coil.

Wood screws and usual sundries.

Constructional Work

With regard to the actual construction, much time and trouble will be saved if the following directions are carefully observed.

First of all wind the coil. To do this, take the "X" former, and make fast the end of the 24 d.c.c. wire through the hole provided near the centre of the former, leaving an inch or two free for connecting. Now commence the winding in the usual manner, until twelve turns have been wound in the first slot. A loop must now be twisted (this is the tapping indicated at Y in Fig. 3), and twelve more turns wound on in the next slot, after which another loop is twisted, this time about 2 in. or so in length. (This is the earth connection indicated at Z in Fig. 3.) Again continue winding in the same

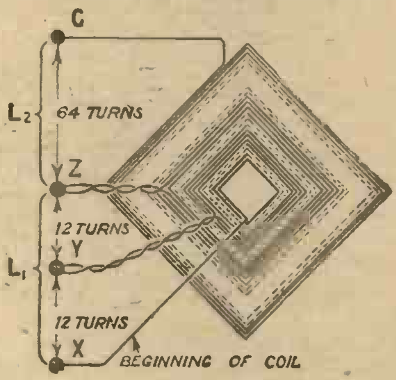


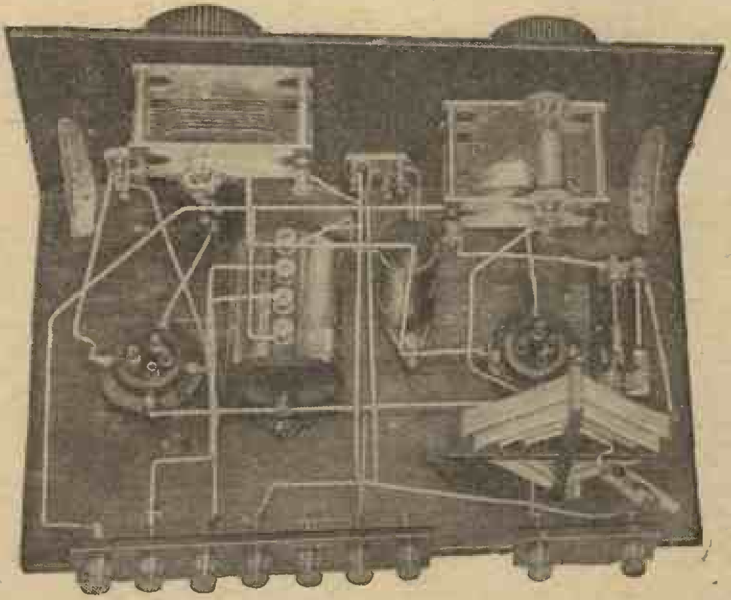
Fig. 3.—A diagrammatic representation of the coil and its connections.

direction, putting sixteen turns in each of the other four slots. Now make the end of the wire fast in the hole provided, leaving here also a few inches free for connecting. (This is the grid connection shown at G in Fig. 3.)

Having wound the coil, place it for the time being on one side, and proceed with the set.

Drilling

Drilling the panel will not be found a difficult matter, all the necessary measurements being given in the drilling diagram, Fig. 2,



The back of the cabinet must be cut away to give access to the terminal strips, seen at the lower edge of this photograph.

and when this is completed the various components may be mounted temporarily and the panel affixed to the baseboard by means of the angle brackets and the three wood screws, as shown in the diagrams.

The Baseboard Layout

Now place the various components on the baseboard in as nearly as possible the same positions as shown in the photographs and diagram, and screw them down. Take care that the positions of the valve-holders allow large valves to be plugged into them without fouling the condensers.

The method of fixing the coil to the baseboard is made quite clear by the diagram given in Fig. 5.

Wiring

Having got so far, the wiring up may be commenced. It will be found advantageous at this point to remove the variable condensers temporarily, in order to facilitate the soldering to the rheostats. When the connections to the components fixed near the condensers (*i.e.*, the telephone jacks and the rheostats) have been made the condensers may be re-mounted and the wiring-up completed. Be sure the connections to the coil are exactly as shown, and as far as possible bend the wires to take the same paths as those seen in the photographs.

If you use a different make of L.F. transformer the connections may be made as follows. From the bottom right-hand terminal on the jack No. 1 to OP; from the top left-hand terminal to IP; from OS to the grid of V_2 and from IS to G.B. negative terminal.

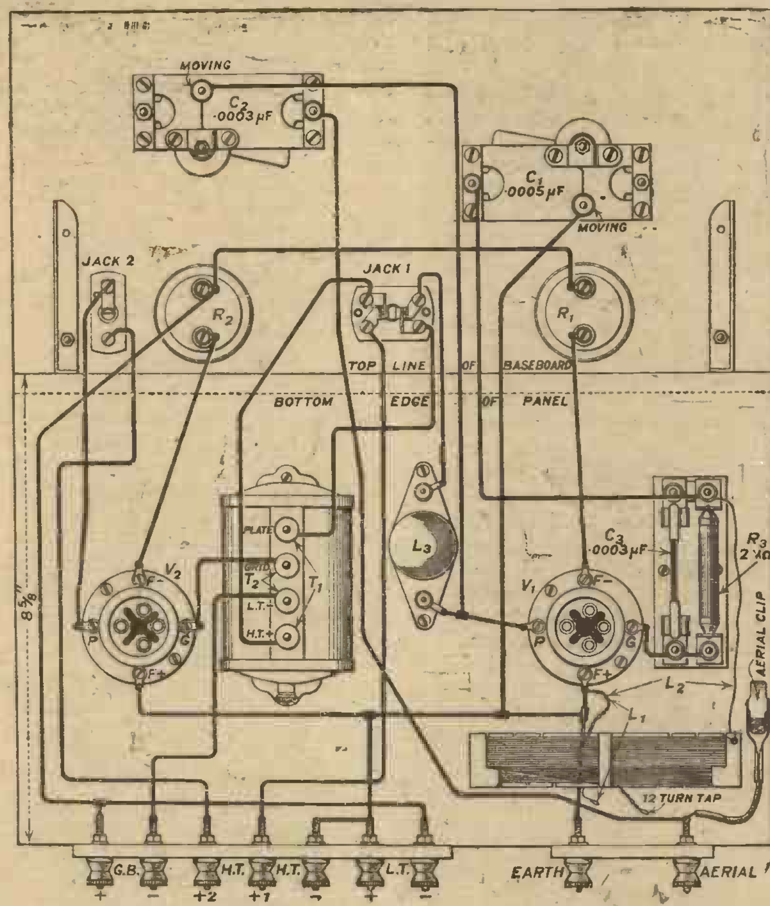


Fig. 4.—The wiring to the jacks needs care, but all connections can be followed easily from the above diagram.

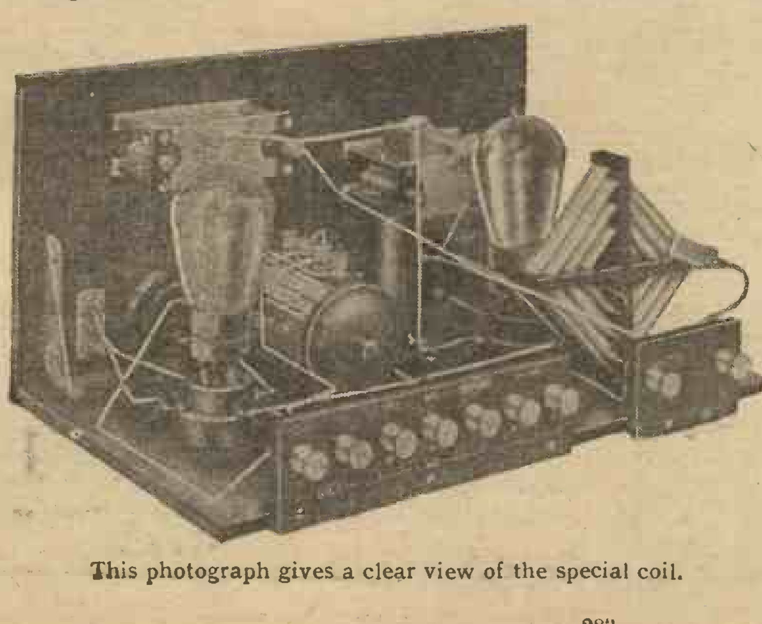
Before testing the set, check the connections very carefully once more against the wiring diagram. This may take a few minutes, but it is well worth while.

Instructions for fitting the "Univernier" dials are given with each one, and these may now be fixed on the condenser spindles.

Testing Out

The set is now ready for testing out. Connect up the aerial and earth leads and the various batteries, and plug in the telephones after the second valve. The aerial clip should be attached to the 24 turn tapping on the coil. Note the following regarding the telephone connections to the plug. The negative tag (the positive will probably have a red mark in the insulation) must go to the centre connection, in order that the steady anode current will pass through the phone windings in the correct direction.

Insert two valves in the sockets; two of the general purpose types will do for the time being, and slowly turn on the filament current by means of the rheostats. It is wise to have only three volts H.T. plugged in at first, until you are sure that all is O.K., and then the two H.T. tappings may be increased to about 30 to 40, and 60 to 80 volts respectively.



This photograph gives a clear view of the special coil.

Grid-Bias

Grid-bias may not be found necessary just yet, in which case the terminals marked G.B. should be joined together with a short piece of wire. The reaction condenser C_2 must be adjusted to zero (*i.e.*, all out), and the tuning condenser, C_1, turned *slowly* from the minimum to the maximum position.

Operation

Now, if the local station is working you will certainly hear it at some adjustment of this condenser, which should be carefully set to the position giving maximum signal strength. The reaction condenser may now be *gradually* increased, and it will be found that signal strength will also increase, until a point is reached where the set will oscillate and signals become distorted. Immediately this happens, turn the condenser back from this point until oscillation ceases, when a final adjustment can be made on the tuning condenser.

If you are near to a broadcast station you will find that the use of the reaction condenser is unnecessary for headphone reception, signals being, in most cases, too strong already.

The completed receiver. All front of panel connections are made by plugs and jacks.

Using One Valve

Should you desire to use only the first valve, merely turn the second valve out, and insert the telephone plug into jack No. 1. The same procedure regarding tuning, as just described, will still apply.

Valves to Employ

The above tests will show you whether every connection is correct and enable you to get the "feel" of the set, which in any case is not at all difficult to handle. To obtain the best results however, valves specially suited to their positions should be used in the receiver. In the first socket, any good detector valve, or one of the well-known small power valves will be found to give excellent results. Actually, the author has tried a general purpose type, a D.E.5 B., a D.E.4, and a D.E.5, and in each case commendable results were obtained. In the second stage, use a power valve, such as the B.4, B.6, D.E.4 or D.E.5, choosing the type according to the filament voltage rating, which should be somewhat similar to that of the detector valve used. The high-tension value on this last valve, when a loud-speaker is used, should be the maximum advocated by the manufacturer, the grid-bias also being adjusted according to the maker's instructions. If, however, telephones are being used after the second valve, a much lower H.T. value will be found satisfactory, the grid-bias being again adjusted accordingly. If the maximum value of H.T. is used on the low frequency valve whilst telephones are plugged in jack No. 2, the appreciable steady anode current flowing may possibly injure the phone windings.

H.T. Values

With regard to the H.T. value for the first valve, this will in most cases need to be fairly low if smooth reaction control is to be obtained. In fact, too high a value here, or running the filament of V_1 too brightly is almost certain to result in floppy control of reaction, and might in some cases cause a certain amount of backlash.

Further Points

Selectivity is not a strong point of this receiver, but several stations can be heard whilst 2LO is working, providing they are not on a frequency too near that of the London station.

The writer lives within four miles of 2LO, consequently it is a difficult matter to obtain selectivity in a degree sufficient to eliminate that station whilst working on a near-by wavelength.

The tuning range of the coil used, in conjunction with the ·0005 μF. condenser, is sufficiently wide to include the wavelength used commercially by ships—*i.e.*, 600 metres —and those who possess a workable knowledge of the Morse code will no doubt derive some pleasure from this.

Test Report

Tested on a mediocre aerial about 4 miles west of 2LO, that station was received at excellent loud-speaker strength, using the two valves. Using only the detector valve, 2LO came in loudly on the telephones. It was noticed that in order to obtain a smooth reaction adjustment a very low H.T. value was necessary on the detector valve, somewhere in the region of

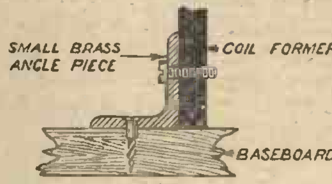


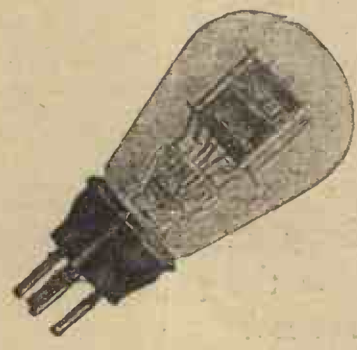
Fig. 5.—A bracket is used to mount the coil on the baseboard.

30-35 volts. This may vary, of course, with different valves, but every effort should be made to improve the reaction adjustment by varying both the H.T. value and the filament current, if the best results are to be obtained. Tested one Sunday evening before 2LO had commenced their evening service, ten stations were received by turning the tuning condenser *slowly* from the minimum to the maximum adjustment, whilst keeping the reaction condenser adjusted accordingly for the greatest sensitivity. The stations heard were mostly German and French by the language being used, but their call-signs were not given. Bournemouth and Birmingham both came in at good headphone strength.

Tested at Elstree

This receiver has also been tested at the Radio Press Elstree Laboratories with quite satisfactory results. Reports regarding results obtained with it in different localities would be both helpful and interesting.

Your Best Xmas Gift



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4-volt Accum.	D.E.3 D.E.4	16/6 22/6	D.E.3b D.E.3 D.E.4	16/6 16/6 22/6	D.E.3b D.E.3 D.E.3 D.E.4	16/6 16/6 16/6 22/6
6-volt Accum.	R.5v D.E.5	8/– 22/6	D.E.5b R.5v D.E.5	22/6 8/– 22/6	D.E.5b R.5v R.5v D.E.5	22/6 8/– 8/– 22/6

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How to Use a Power Valve

By G. P. KENDALL, B.Sc.

All loud-speaker users will find hints for their guidance in this article

I CAN imagine some readers upon seeing the title of this article asking themselves some such question as, "Why use a power valve, anyway?" Many people who do not actually use power valves will know that their friends have discovered for themselves that the use of such a valve does not in many cases increase the strength of signals, and it is natural to inquire why one should use these valves, since they are expensive and they do undoubtedly put a heavy load upon the high-tension battery.

Is it Worth While?

The answer to the question is that, properly used, a power valve is well worth the expense and the small amount of trouble involved; it gives one the power to obtain signals of greater purity for a given volume, and if a suitable type of valve is chosen for the particular conditions, loud-speaker, etc., there will be an increase of volume. In passing, it should be remarked that the correct type of power valve to use in any given case, apart from matters of convenience of filament supply, is a matter of suiting the valve to the strength of signal which is to be handled, and to what is known as the impedance of the loud-speaker.

The Question of Input

I mention this point merely in order that the reader may be warned that he will *not* improve matters by buying one of the large and expensive power valves, intended to handle quite large outputs, if his sole object is to produce such a strength of signals as will serve for domestic purposes. These large valves are intended merely to handle large powers without distortion, and do not in themselves result in a large power output when the input is small.

There are technical reasons for the points mentioned, but they do not concern us here, since we are concerned rather with the practical arrangements which must be made to achieve the desired improvement in reproduction, which, it must be emphasized, only occurs under proper conditions when a power valve is employed.

Requirements

It is to be realised that the main characteristics of a modern power valve (the dull emitting variety such as the DE 4, DE 5, B 4 and other types) are that they require 80 or, perhaps, 100 or more volts H.T., and a considerable amount of grid-bias. When these two conditions are fulfilled, the reproduction of speech and music will in practically every case be materially improved, and I think that anyone who has invested the necessary sum in a power valve will find that his investment has been a very sound one.

The Philips-Mullard PM4 is a small dull-emitter power valve taking ·1 amp. with 4 volts on the filament, which is N shaped.

A Warning

Since one of the main objects in using a power valve is to permit signals of full loud-speaker volume to be reproduced with the minimum of distortion, it is to be understood that it is not worth while to buy a power valve simply to use with a set which is never employed to work a loud-speaker, since when signals are only of telephone strength the advantage of a power valve is only very slight.

Where to Use the Valve

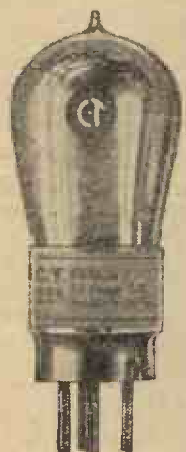
This brings us to the fact that the proper position for the power valve in a set is in the last socket—namely, the final stage of low frequency amplification, which works the loud-speaker itself. Thus, in a four-valve set with two L.F. stages, the power valve will be in the second low frequency stage; in a three-valve set consisting of a high-frequency valve, detector, and one low-frequency stage, the power valve will be the low-frequency valve, and so on.

High Tension Values

Having decided that the function of the power valve is to permit of the amplification of strong signals without distortion, and that it should occupy the last stage in the set, let us proceed to see how the necessary adjustments may be made in order that the valve may function properly. Take first the question of the adjustment of the high-tension voltage; most power valves require something like 80 volts to 120 volts to give the best results, and this value is, of course, too high to apply to the preceding valves, such as the high-frequency valve, and the detector, under most conditions, and it is when a valve of this type is used that we realise to the full the convenience of having separate high-tension terminals for the different valves in the set.

Sets with one H.T. Terminal

When these are present no difficulty arises, and one simply applies the extra H.T. to the particular terminal, and that is the end of the matter. However, quite a number of sets of a simple nature are built which have only one common high tension terminal for all valves, and



A Cleartron valve of the small power class.

it is, of course, something of a problem to see how the extra value should be applied to the last valve without structural alterations.

Adding Extra H.T.

As a matter of fact, however, it is not a very difficult matter. Decide upon a suitable value of high-tension voltage to apply to the main positive terminal of the set, say, 72 volts. Now obtain a 36-volt high tension unit, and connect this in series with the loud-speaker, and the result will be that this additional voltage is applied to the anode of the last valve only, giving a total of 108 volts, quite a suitable value. It is necessary that the additional unit should be connected the right way round, but this is quite easy to determine by trial and error. Simply reverse the connections to the additional unit, and notice which way round gives the loudest signals.

Importance of Grid-Bias

So much for the high-tension voltage adjustment. The provision of proper grid-bias is just as important from the point of view of quality of reproduction and economy of high-tension current. If too little grid-bias is used, not merely will an especially heavy drain of high-tension current take place, with consequent speedy running down of the battery, but the quality of the speech and music will be adversely affected. Most modern sets are provided with special terminals for the application of grid-bias to the separate low-tension valves and all that we have to do is to choose a suitable value. To ascertain the correct value for the particular valve which is being used, reference should be made to the box or packing in which the valve was received. It will be found that the instructions are something to the effect that the anode voltage should be from, say, 50 to 100 volts, while the values for the grid-bias will be from, perhaps, 3 to 6 volts. This means that when the maximum of 100 volts is being employed upon the plate, the grid bias should be 6 volts. Intermediate values should be estimated in proportion.

Saving the Battery

It pays to employ the maximum grid-bias possible without the introduction of the distortion which results from the use of an excessive value. The higher the grid-bias which is used the smaller the amount of high-tension current which is drawn from the battery, and the longer will the battery last.

A Problem

When a set is not provided with grid-bias terminals, the application of grid - bias (which must be made when a power valve is used) is not, unfortunately, as easy as the application of extra H.T. An alteration to the wiring must be made, and a further terminal added upon the panel, but this difficulty should not lead the constructor to dispense with the

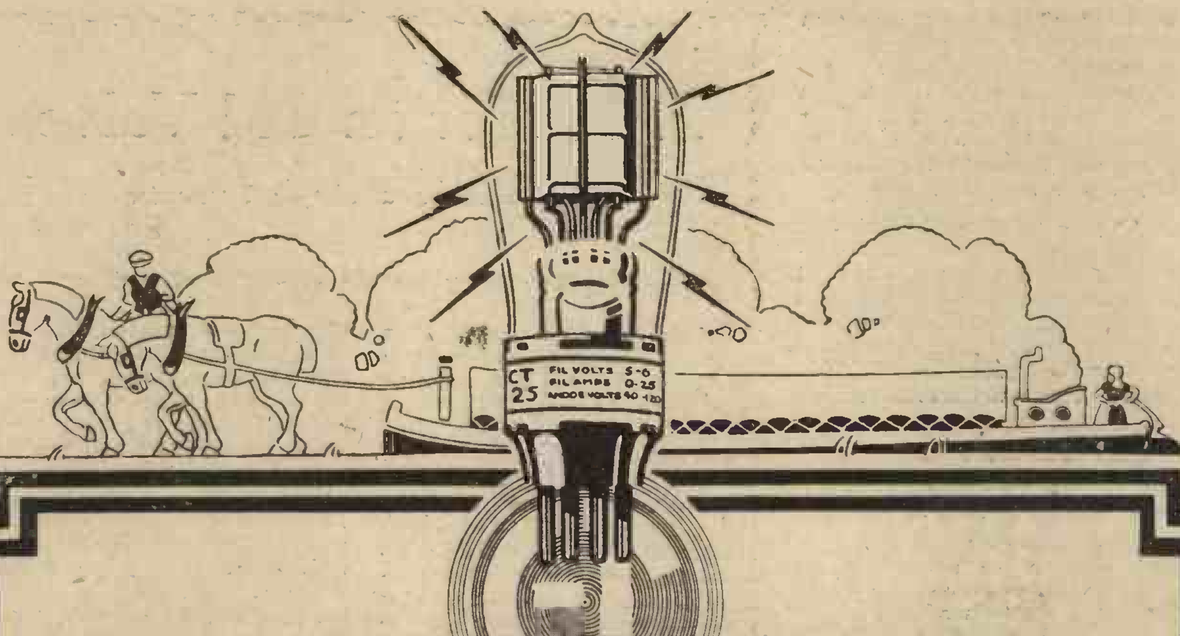
L.S.5 type valves are designed for power amplification.

very necessary item of a grid-bias battery.

G.B. Connections

The procedure is to investigate the inside of the set, and discover which is the L.F. transformer which supplies the valve socket in which the power valve is to be used. It

A resourceful refreshment vendor who has equipped his coffee-stall with a wireless receiver complete with headphones and loud-speaker.


CT
25

will be found that a wire runs from one end of the secondary of this transformer to the grid pin of the valve socket in question, while from the other secondary terminal of the same transformer a wire will be found which runs to the filament circuit at some point.

One New Terminal Wanted

The second wire should be removed, and a wire taken instead from the secondary terminal to a new terminal upon the panel, conveniently arranged somewhere near to the low-tension negative terminal. This new terminal becomes the grid-bias negative terminal, the positive terminal of the grid-bias battery being connected to low-tension minus. If desired, of course, an extra terminal can be provided also for grid-bias positive, and wired internally to low-tension negative.

The Ediswan P.V.5D.E. is a typical 5-volt dull-emitter power valve.

An Alternative Scheme

If it is not possible or desirable to add further terminals upon the panel, the grid-bias battery can, of course, be placed inside the set, and wires taken direct to each of its terminals.

Don't Forget to Answer the Questions on Page 316

A Use for an Old Valve

How to make a simple barometer

WILL it rain to-day? How often we ask this question when deciding whether some long-deferred visit shall be undertaken. Those who are possessed of a barometer can, within certain limits, answer this question for themselves. The barometer merely indicates the change in atmospheric pressure, and years of observation combined with meteorological theory have led weather forecasters to infer that as the pressure falls rain and storm may be expected, and when the pressure rises fine weather may be counted on.

Making the Instrument

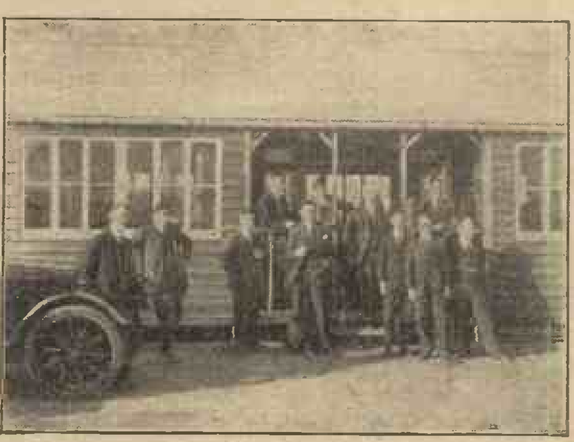
An old valve, which should be one of the type with a "pip," can be made into a very useful atmospheric pressure indicator, and a little daily observation will soon enable one to make a quite accurate estimate of the pressure changes. If it can be observed in conjunction with a good barometer for a week, it can even be calibrated. A valve is exhausted to a high degree of vacuum, and if the "pip" is broken air will rush in until the internal pressure equals the external pressure. If the valve be held under water and the pip snipped off with a pair of pliers, water will rush in (with a very pretty fountain effect) until the pressure of the small air residue in the valve is equal to the external pressure.

How it Works

The valve may then be taken out of the water. It will now be found to be almost filled with water with a small air bubble inside. If it is held upside down and slung with a piece of string, the water will not run out, but a small drop of water will be noticed almost ready to drip out of the hole where the pip was previously. This drop will exude further as the external pressure decreases and will recede as the external pressure increases. This is caused by the small air bubble inside the bulb expanding and contracting. The valve should be converted into a barometer preferably on a day when the barometer reading is low, thus ensuring that the drop of water is protruding as much as possible, and will not fall off when the pressure falls still further.

Calibration

In my own case the valve is slung up in a small cardboard box, open at the bottom. A small pinhole enables me to view the drop of water, and the opposite side of the box has lines drawn across to correspond with different pressures. This, of course, was calibrated against a good aneroid. It is not necessary to be so careful, as a period of observation, as previously suggested, will enable one to get a quite accurate estimate of the pressure. Another refinement is to colour the water before breaking the pip with some such substance as red ink or methyl orange, which defines the edge of the drop of water much more clearly. I have had one of these in use for a long time now, and can obtain almost as accurate readings as with a barometer, and its cost—nil. E.H.B.



Some of the staff outside one of the Radio Press laboratories at Elstree. Dr. Robinson is in the centre of the porch.

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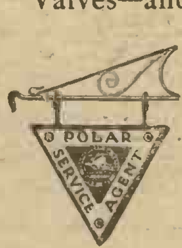

A clear and complete diagram of a resistance coupled 4-valve receiver is enclosed in each carton.

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The Problems of Short-Wave Reception

By C. P. ALLINSON

Above the broadcast frequencies special precautions have to be taken to ensure satisfactory reception

THE amazing developments of the last two years have shown the possibilities of the very high wireless frequencies (or ultra-short waves) for long-distance work to be remarkable. KDKA's telephony on 65 metres and thereabouts is a long established fact; Nauen has conducted experiments on 73 metres both on telephony and Morse, and 30 metre Morse only; various Continental transmissions are also to be found in the neighbourhood of 70 metres, while WGY has even worked as low as 15 metres on telephony, and is now working on about 42 metres every night except Sunday. Senatore Marconi's short wave work is now too well known to need detailed mention, for the erection of long distance high-frequency transmitters is already more or less an accomplished fact. These use the "beam" system, to which these very short waves are particularly suited, and it is claimed that this system allows far greater distances to be covered with the same power.

Communicating with Australia

More recent developments are those with regard to the wavelengths of 20 metres on which such good work has been done during the summer. Not only has the Atlantic been spanned in daylight, but two-way communication with Australia during daylight has been successfully accomplished — an achievement of no mean order in view of the low power used. The latest news received from Senatore Marconi with regard to short-wave work deals with the 17-metre wavelength. Numerous experiments, we learn, have proved that this wavelength, which is excellent for use in daylight, is absolutely useless at night, as it appears to be absorbed rapidly. Work of this description is one more feather in the cap of the amateur who has done so much in the furtherance of the wireless science. Especially must it be remembered that only comparatively low powers in the region of about ¼ kw. have been used.

150,000 Kilocycles!

Further researches are being carried out on the 4 and 5 metre and the 2 and 3-metre wavebands, and already one article of absorbing interest has been available from John L. Reinartz, who is one of the pioneers of short-wave work.

Long-Wave Congestion

Everywhere we see the headlong fall going on which first commenced some two years ago when the 200-metre band was opened up in face of "expert technical" advice to the effect that the short waves were no good. Amateur transatlantic work on low power speedily disproved this statement, and soon after the 100-metre band was being worked. And so the drop in wavelength went on, and there is no doubt that the great strides that have already been made will make these ultra-short waves of the greatest value. If we examine the higher wave bands we find a state of congestion that is fast becoming a serious problem. Let us consider the question rather from the angle of frequency and we find that the wavelengths between 5,000 and 29,000 metres (the latter is the longest wavelength at present in use) represent a total difference in frequency of roughly 50,000 cycles. Yet a frequency difference of 50,000 cycles is found between the small band between 50 and 50·42 metres. Already several commercial stations are carrying on work on these short wavelengths where there is plenty of room without congestion resulting, with its accompanying problems. Some of these are in the region of 100 metres, such as WGH and WGG, the stations of the U.S. Government at Tuckerton, and also IHU and IDO, belonging to the Italian Government at Rome, and others such as WIZ, WQN, WIR on wavelengths between 70 and 30 metres.

The "Super-Het."

Naturally the problems of transmission on the ultra-short waves are of no mean order, but it is the purpose of this article rather to consider the problems accompanying reception on these wave bands, especially as applied to the higher frequencies. Of the systems in use, first and foremost is the well-known Supersonic Heterodyne. This is as yet undoubtedly the best method, and has been successfully used down to 18 metres, by Mr. W. K. Alford, for one. Further work on it will no doubt show it to be suitable for even shorter wave work than this.

H.F. Amplification

Second, one or more stages of H.F. amplification, a detector valve, and then stages of L.F. amplification may be used. Although this may be suited to commercial work, it is not so for the amateur who wishes to search quickly. In any case it is considered highly doubtful if any real measure of effective H.F. amplification is obtained even with low capacity valves at these higher frequencies.

The Popular Arrangement

Last, but not least, is the detector with reaction followed by one or more stages of L.F. This is by far the most popular arrangement with amateurs, one stage of L.F. only being preferred in general.

A Novel Receiver

A method that has been used successfully for long-wave reception is the Einthoven galvanometer, in which a wire is deflected by the signal current, thereby allowing a light beam to shine on a sensitized film, thus recording the signal photographically. Nothing as yet seems to have appeared as to whether it can be used for the high frequencies, and it is rather doubtful whether it would be of use, for though the mass and therefore the inertia of the quartz fibre used may be negligible for low frequencies corresponding to wavelengths of the order of 30,000 metres, they may be sufficiently great at the high frequencies to render the instrument inoperative.

Problems of Design

Considerations of design then that affect the experimenter most widely are those applying to the popular "detector and note-mag" combination which has been used with great success by amateurs all over the world.

The first question is probably that of layout. This requires careful attention. First of all the inductances must be placed so that their fields are as free as possible. Metallic objects in particular, such as variable condensers, L.F. transformers, filament resistances, heavy metal brackets, etc., must not be placed so as to lie in the magnetic fields of the tuning inductances. Otherwise eddy current losses may be great, and in some cases sufficient to prevent the receiver from oscillating. It has frequently occurred that a short-wave receiver that stubbornly refused to oscillate merely required a slight rearrangement of the components to overcome the trouble.

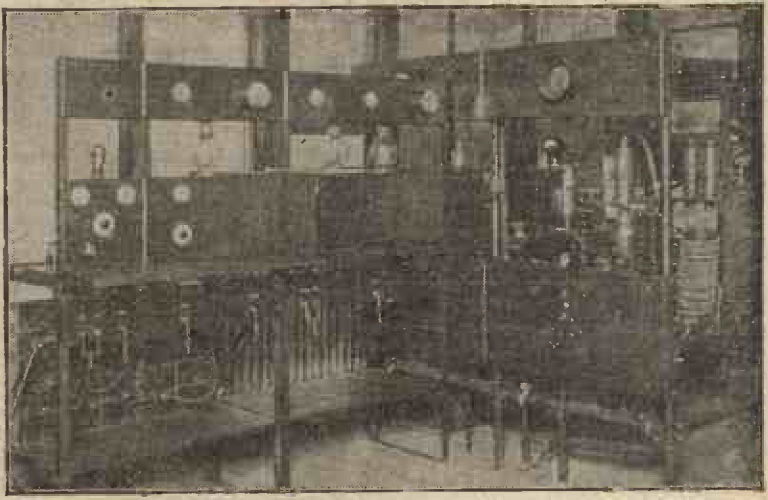
Choke Coils

R.F. choke coils. where used, should be placed with their fields at right angles to the field of tuning coils, and should preferably have the lowest possible self-capacity, although in some cases plug-in coils have been used successfully, as, for instance. in the short wave receiver described by Mr. G. P. Kendall in *Wireless Weekly* of August 26, 1925.

Low-loss Inductances

The second consideration is, the construction of the tuning inductances. For maximum efficiency these should be as nearly self-supporting as possible, yet they should be fairly rigid, as a shaky coil may cause signals to swing in and out when the coil is subjected to vibration. One method is to use a low-loss former such as is being produced by several firms at the moment, another is to use strips of ebonite with small holes drilled through them through which the wire is threaded (a rather tedious process), a third is used and described by the writer in a short wave receiver in *Wireless Weekly* for October 7, 1925, and other methods if suitable, may, of course, be used.

As the H.F. resistance of an inductance rises rapidly with the frequency, this resistance must be kept down as low as possible by using a suitable gauge of wire, such as 12 or 14. Above this size little advantage may be gained; in fact, various authorities state that the increased eddy current losses within the wire more than offset the gain due to the larger surface. Also, when working at frequencies such as those corresponding to a wavelength of 5 metres (60,000 kilocycles), it may even be found necessary to keep the wire or strip with which the inductance is wound brightly polished, for the increase in H.F. resistance, due to even the slightest film of oxide, may prevent the receiver from working.



The transmitting equipment at KDKA, the famous American short-wave station.

Other Components

The mountings and holders for the coils in a short wave set must have a low capacity, for every little added capacity will limit the lowest wavelength which the set will receive, as well as limiting the tuning range of the receiver. This was dealt with in some detail by Mr. D. J. S. Hartt in the August 19, 1925, issue of *Wireless Weekly*.

It is, therefore, necessary to use very small tuning condensers with a low minimum capacity and to space all wiring out as far as possible.

Only the best ebonite should be used in a short wave receiver, and as little of that as is practicable. Poor ebonite or some of its substitutes may cause extremely high losses.

A Note on Valves

It may be necessary to remove the valve cap. The additional capacity of this may be quite high, and when dealing with the very high frequencies may have detrimental effects in limiting the tuning range.

Another point is, that it appears to be preferable to use a detector valve having a low amplification factor (m) in order to get down to the lowest wavelengths; for the effective additional capacity placed across the tuning condenser is the value of the grid-filament capacity plus (m + 1) times the grid-anode capacity. This may amount to as much as 100 μμF, in some cases making the reception of certain wavelengths nearly impossible.

Obtaining Smooth Reaction Control

A variable grid-leak will probably be found a necessity if smooth control of reaction is to be obtained, while a grid condenser smaller than that used on the B.B.C. wavelength may be employed with advantage. A suitable value is from ·00005 to ·0001 μF, although in some cases the capacity of the grid condenser may be as small as ·00001 μF.

Use of Capacity Reaction

Capacity reaction should be employed if possible, as then the variation in tuning arising from an alteration of the reaction setting

will not be found to be nearly so great as with magnetic reaction. Down to 40 metres it may be found that the setting of the reaction condenser hardly affects the tuning at all. Two circuits are shown herewith employing capacity control of reaction that may be tried.

Condenser Control

Some form of gearing or vernier dead spots, which, however, may be overcome by the use of a very small series condenser or a detuning coil of about 50 turns on a 3 in. former. Some form of loose coupling is certainly desirable, and the aerial coil will preferably be untuned while the aerial needs to be a very small one: at 5 metres a couple of 3 ft. rods for aerial and counterpoise are suitable.

stant resetting of the reaction control that is usually necessary at present ? If this can be done, searching will be greatly simplified, as well as actual tuning. It is most troublesome to find a signal on the edge of a partial dead spot so that a slight decrease, say, of the tuning condenser requires a large increase of reaction. This then sends the wavelength up, requiring

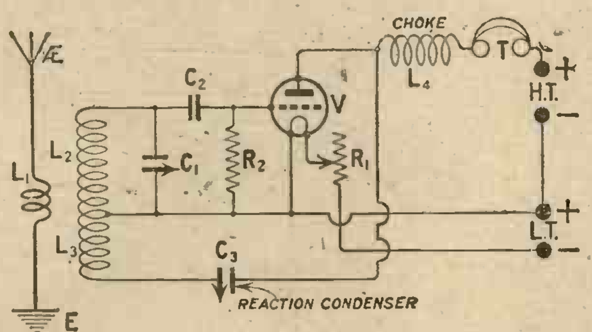


Fig. 1.—The coils L_2 and L_3 are here shown wound as one, but may be separated and the reaction condenser C_3 placed between them.

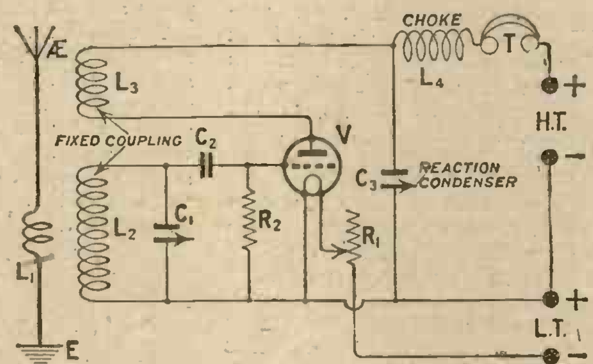


Fig. 2.—Another useful circuit which, like Fig. 1, has capacity controlled reaction.

control on the tuning condenser will be found imperative below about 40 metres, and even at this wavelength a considerable delicacy of touch is required if such gearing or vernier control is not employed. Below about 15 metres extension handles become the order of the day, increasing in length with the frequency. At seven metres a movement of the body of about 6 in., 2 ft. away from the receiver is sufficient to start or stop it oscillating. Chokes may be required in the L.T. leads as well as the phone leads, and perhaps even in the grid-leak to L.T. lead. A circuit suitable for five-metre work is shown in Fig. 3, and it should be noted that the chokes all consist of about 30 turns of 20 S.W.G. on a ¾ in. former. Lorenz winding is employed so as to make the chokes self-supporting. Shields for tuning condensers may be used and other steps taken to avoid capacity effects. In one case where unsuitable reaction control was in use a movement of a foot on the floor would tune a signal in or out.

Loose Coupling

Next we have to consider the method used of coupling the receiver to the aerial and the correct aerial to use. With even a small indoor aerial the receiver may have many

Effect of a Large Aerial

Having considered the chief points dealing with the design of the receiver a few problems may be mentioned which await a satisfactory solution.

Firstly, is it best to use an aerial having a wavelength above that to be received or below it ? The tendency with a large aerial seems to be for the receiver to find dead spots at settings corresponding to harmonics of the fundamental wavelength of the aerial. Is it better under these circumstances to use the detuning coil or the series condenser ?

Constancy of Reaction

Secondly, can the control of reaction be made so constant that the reaction coil or condenser can be set for large ranges of wavelength so as to eliminate the con-

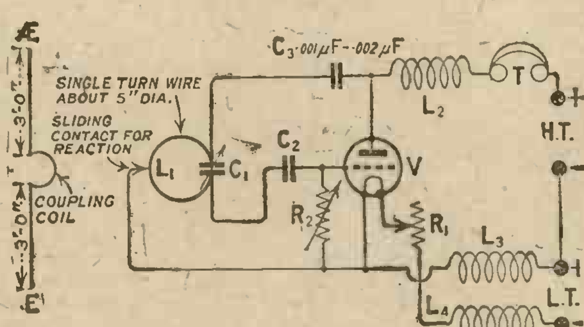


Fig. 3.—A five-metre receiver. The valve should have the cap removed. Values of components given will serve as a guide and C_1 may consist of 2 brass plates about 2 in. square and ¼ in. apart.

a further decrease of the tuning capacity and so on, *ad lib.* Under these circumstances it may become exceedingly difficult to tune in the signal at all.

Thirdly, is the use of shielding, so as to reduce hand capacity effects, advisable, or is it liable to introduce extra stray capacity into the receiver, thus limiting the lowest wavelength receivable ?

Metallic Objects

And again, how far does the presence of metallic objects within 2 ft. or 3 ft. of the receiver affect its efficiency ? A case has been heard of in which an amateur, experimenting on 5-metre transmissions, burnt out an expensive milliammeter which was not connected to anything but was lying on the bench about 3 ft. from the transmitter.

Other questions may arise, and most of these are well worth having a little time in experimental work devoted to them.

A Fascinating Hobby

The fascination of short-wave reception is very great, as many difficulties have to be overcome, and it presents a comparatively new field for experiment in many directions. These short notes will, it is hoped, be of use to those just entering this new field of reception.

A Novel Switch

By W. H. FULLER

THE hanging of a pair of telephones on a hook protruding through the front of a panel may be made to switch off the filaments of the valves of a receiving set by means of the simple switch described here.

The Principle Employed

On reference to Fig. 1 it will be seen that the switch consists of a brass arm, so shaped that a pair of telephones may be hung on it at one end, and pivoted on a screw at the other. The pivot screw is fixed to a brass bracket, which is

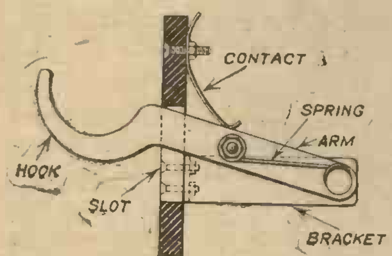


Fig. 1.—This diagram shows the method of assembly.

secured to the panel. A small wire spring keeps the arm against a springy brass contact until a pair of telephones is hung on the hook, when disconnection between the arm and the contact takes place. The switch may be arranged in the filament circuit of the valves, so that when the telephones are hung up the circuit is broken, and the current switched off.

Component Parts

The bracket and the arm are cut from 16 S.W.G. brass, and the dimensions may be obtained from

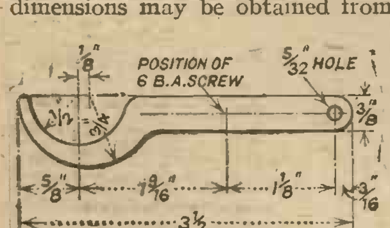


Fig. 2.—Dimensions of the hook-shaped arm.

Figs. 2 and 3. The brass may be cut first with a hack saw or a pair of snips, and then finished with a file. The contact is made from a piece of springy brass, and bent to shape with the aid of a pair of pliers and the fingers.

The tension spring of the arm is made from a piece of steel wire, and after being bent to the shape shown in Fig. 3, is soldered in the slot of a $\frac{1}{2}$ in. 4B.A. screw. The end of a spring engages on a 6B.A. screw soldered to the arm, and a nut is fitted to prevent the spring jumping off.

The finished switch mounted on ebonite.

The screw is passed through the $\frac{5}{32}$ in. hole drilled in the arm, and a washer placed behind it, and then secured to the bracket, and locked in position with two 4B.A. nuts, with sufficient room to allow the arm to move freely.

The Slot in the Panel

A slot 1 in. long and $\frac{1}{16}$ in. wide is then cut in the face of the panel, the arm passed through, and the fixing holes marked through the holes in the bracket. The bracket may then be secured by two $\frac{1}{2}$ in. 6B.A. screws. The pivot screw is then adjusted, so that the spring forces the arm to the top of the slot.

The contact spring is secured to the panel by a $\frac{1}{2}$ in. 6B.A. screw

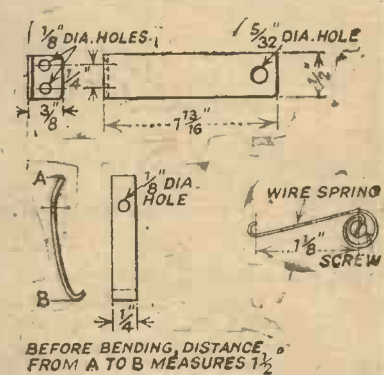


Fig. 3.—Details of the smaller metal parts.

and nut in such a position that good contact is made with the arm when the latter is released.

Battery Connections

One battery connection is soldered to the bracket and the other to the brass contact.

This type of switch offers many opportunities to the constructor, and it would be quite an easy matter by a suitable arrangement of contacts to disconnect the H.T. as well as the L.T. or to disconnect the aerial from the set, and automatically earth it at the same time.

Sir Henry Thornton inspecting a wireless set made by the boys of St. John's School, Ealing.

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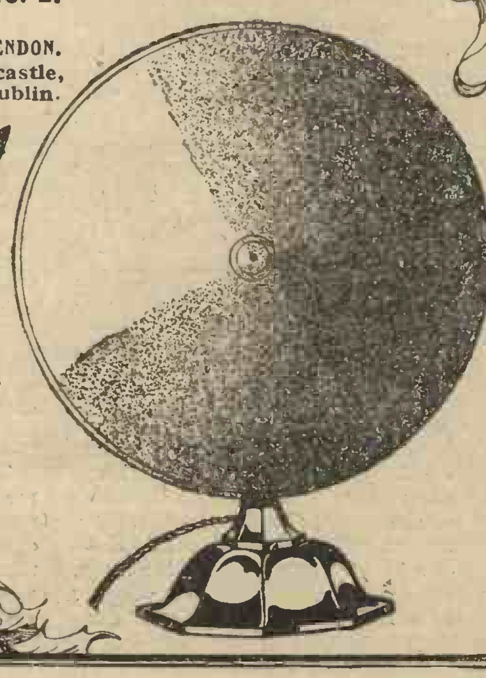

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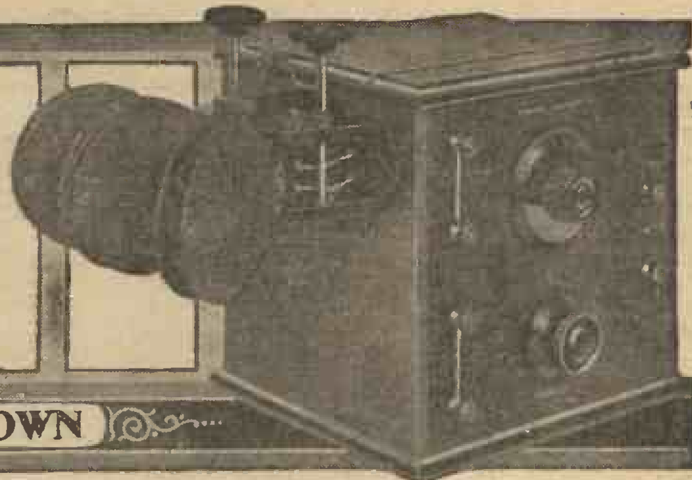
A Single Valve 3-Circuit Receiver

By JOHN UNDERDOWN



ALTHOUGH a good crystal receiver is an excellent piece of apparatus for listening on headphones to the local station, there usually comes a time when the listener either wishes to hear other stations or wants stronger signals to work a loud-speaker. In the former case the question at once arises, "What set shall I build?" Where the question of cost has to be borne in mind the choice is generally narrowed down to the building of a high frequency amplifier to add to the existing set or the construction of a single valve reaction instrument. To the beginner graduating from a crystal to a valve user I personally should advise the latter course.

Progress by Steps

Until a certain amount of skill has been acquired a direct-coupled circuit, with reaction on to the aerial coil is to be preferred. Later, a higher degree of selectivity than can be obtained with this arrangement may be considered desirable if the experimenter lives within, for example, 12 or 15 miles' radius of a main station, or near the coast, where interference from shipping or a shore station is troublesome. A receiver, therefore, which is flexible within limits, that will allow progressive experiments with several circuits to be carried out, should prove a boon to the single-valve man who wishes to try several of the popular straight types, in order to see which best suits his particular requirements. Bearing these points in mind, the receiver about to be described was designed.

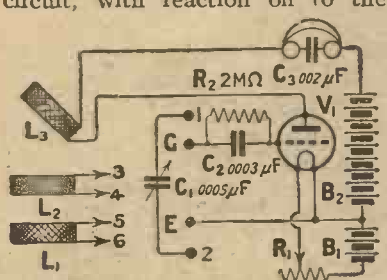


Fig. 1.—The general circuit diagram of the set.

Three Circuits

Without making the set unduly complicated, it was found quite an easy matter to arrange that three circuits could be obtained with little difficulty. This was effected by the employment of flex leads with spring clips, allowing connections to be changed with a minimum amount of trouble, and by means of four terminals.

The General Scheme

The general scheme is outlined in Fig. 1, from which it will be seen that three plug-in coils are mounted in a three-coil holder, and the leads from two of them, L_1 and L_2, are terminated by spring clips (shown as arrow heads), and are numbered. A tuning condenser, C_1, of ·0005 μF, is connected between the two terminals 1 and 2, the moving vanes going to 2. G and Earth are the other two terminals, the former being connected to one side of the usual grid condenser of ·0003 μF, and leak of 2MΩ, and the latter to L.T. positive and one filament leg of the valve.

Permanent Connections

The remainder of the connections are permanent, and call for little comment. L_3 is the reaction coil, connected in the plate circuit of the valve and reacting on to L_2, which is placed in the centre or fixed socket of the three-coil-holder. To facilitate smooth reaction control a by-pass condenser C_3 of ·002 μF is placed across the telephones.

The Direct Coupled Circuit

Fig. 2 shows the direct coupled or single circuit arrangement, which is the most simple and obviously the first to try. L_1 is not used here. L_2 serves as the aerial coil, and may be tuned by the condenser in parallel, as shown, or else in series. Direct magnetic reaction is here obtained, as it is throughout, by coupling L_3 to L_2.

A Form of Loose Coupling

In Fig. 3, the second circuit, and one which is more selective than that of Fig. 1, is given. Here L_1, coupled to L_2, which acts as a tuned secondary coil, is used as an untuned aerial coil, and by varying the coupling and the size of the former coil, tuning may be considerably sharpened, with but very slight loss of signal strength. On my aerial, which is a fairly large one, 12 miles from London, Bournemouth can be received without interference from 2LO.

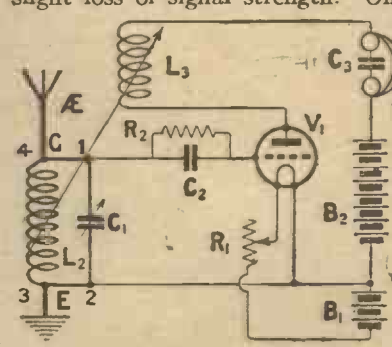


Fig. 2.—The direct coupled circuit.

A Trap Circuit

A circuit which should prove of value to listeners in coastal areas, where interference from ships mars reception, will be seen in Fig. 4.

An interior view of the receiver. The phone condenser is in the foreground.

This circuit is rather tricky to work, and on my particular aerial and earth system gave a certain drop in signal strength, but was found to be particularly selective. For the explanation of its working the reader is referred to "Trap Circuits," by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., in the February, 1925, issue of *Modern Wireless*, to whom the circuit is due. L_1 is the trap coil tuned by the condenser C_1. L_2, connected across the grid and filament of the valve, should be small in size, and is untuned. Reaction is obtained

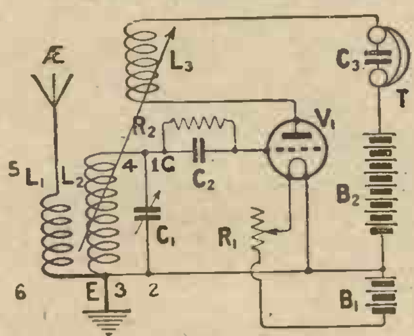


Fig. 3.—A selective circuit in which L_1 is untuned.

by coupling L_3 to it, and, in my particular case, had to be somewhat larger than usual.

General Layout

From the photographs the neat and symmetrical appearance of the receiver will be appreciated. An American type cabinet has been used, so that the valve is placed out of harm's way. Constructional work is also reduced to a minimum by this method of building. The three-coil holder, of vernier type, is mounted on the side of the case, and the leads from it taken through six small holes drilled in the woodwork before it is fixed in position.

The Panel

On the panel itself are mounted the tuning condenser, the filament resistance and six terminals. Four of the latter, on the left-hand side, are marked 1, G, Earth and 2 respectively, from top to bottom, and correspond to these markings in Fig. 1. The two on the right are the telephone terminals, the positive one being at the top.

The Baseboard

On the baseboard, which is 8 in. by 7 in., the shock-absorbing valve holder and the two fixed condensers C_2 and C_3 are mounted by means of suitable wood screws. To simplify construction, the usual terminal strip has been omitted, and leads are taken direct to the batteries, thus effecting a saving of both time and expense.

Components

For the convenience of the constructor, a list of the components employed, and also of the makers' names, is given. Provided, however, that good-quality material is used, a large number of other types will prove equally suitable if to hand.

One ebonite panel, 8 by 8 by ¼ in. thick ("Paragon," Peter Curtis, Ltd.).

One mahogany case for above, with lift-up lid and sub-base 8 by 7 in. (W. H. Agar).

One vernier three-coil holder (Peto-Scott Co., Ltd.).

One filament rheostat (L. McMichael, Ltd.). (I have used a dual type, but one suited to the particular valve to be employed may be substituted.)

One shock-absorbing valve holder (Burne-Jones & Co., Ltd.).

One type 610 ·0003 μF grid condenser.

One type 620 ·002 μF fixed condenser.

One 2MΩ grid leak (all three by Dubilier Condenser Co.).

One ·0005 μF low-loss variable condenser ("Utility," Wilkins & Wright).

Six terminals.

Four spring clips (Peto-Scott Co., Ltd.).

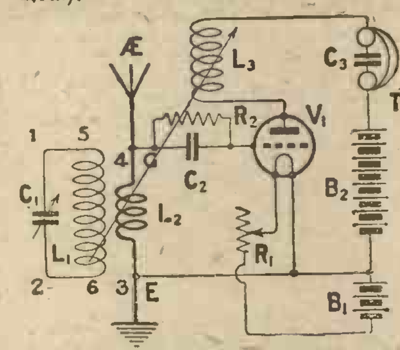


Fig. 4.—The most selective of the three circuits employs "trap" tuning.

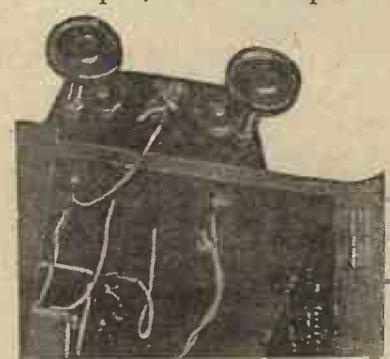
Quantity of "Glazite," V.I.R. flex and heavy twin flex.

Construction

The constructional work is extremely simple, and little need be said here. Both the filament rheostat and the condenser are of single-hole fixing type, so that they are very easy to mount. To drill the large holes required, I find a carpenter's brace and bits very handy. Small holes should first be drilled to form a centre for the bit. Having mounted the components on the panel, affix the valve holders and fixed condensers to the wooden baseboard At this stage also the coil holder should be secured to the left-hand side of the case, after the six holes to take the leads therefrom have been drilled.

Wiring

Simplicity is the keynote struck by the wiring. As far as possible, whilst apart, wire the components



This view shows how leads are taken to the coil holder.

on the panel and on the baseboard by leads shaped as shown in the photographs. Finally attach the panel to the sub-base by two or three ¾-in. No. 4 wood screws, and complete this part of the wiring. Certain leads, which can be distinguished in the photographs and

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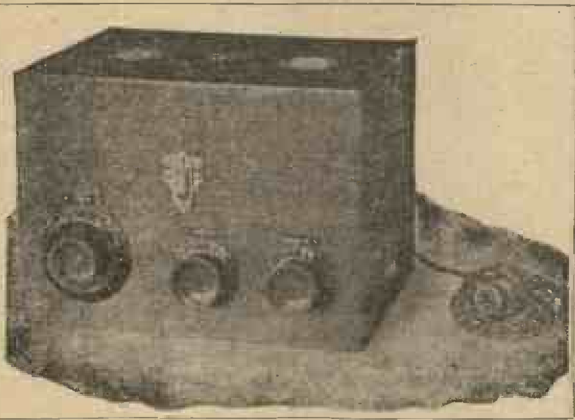

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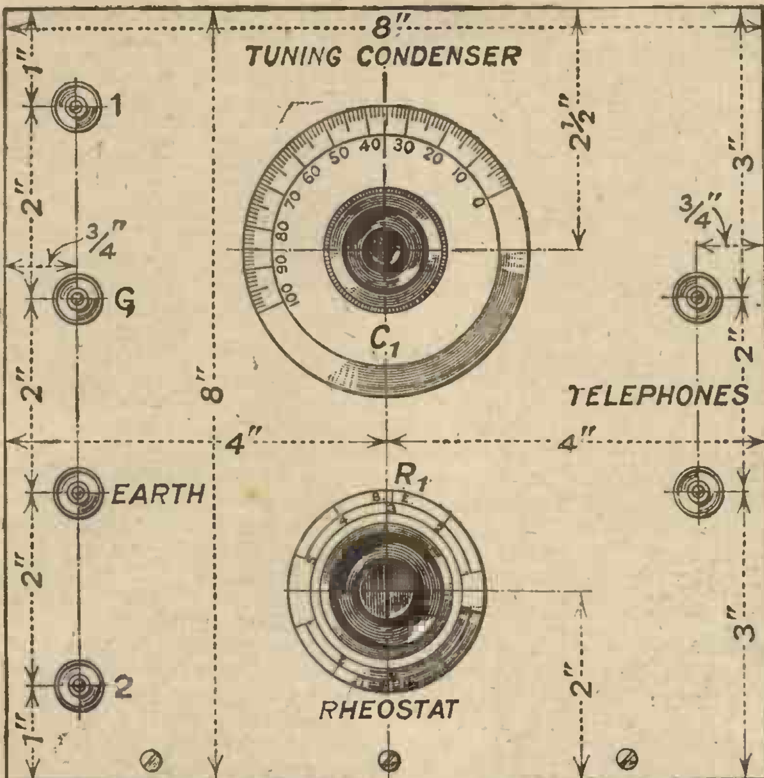


Fig. 5.—Extreme simplicity characterises the panel layout.

drawings, are carried out in rubber-covered flex, and sufficient length should be allowed for those which go to the reaction-coil block (shown twisted together) and to the H.T. battery. These two latter leads are, together with the twin flex L.T. leads, secured to the baseboard by a strip of fibre or wood and two tacks. Certain wires connected to 1, G, Earth and 2 are bared in convenient positions, as seen in the photographs, so that the spring clips for the coil holder leads make good connection.

Completion

Having wired so far, drill a ½-in. diameter hole in the back of the cabinet and take the battery leads through when inserting the panel and baseboard into the cabinet. Secure the panel in position by two wood screws at the sides, and then prepare four rubber-covered leads about 8 in. long, and solder one spring clip to an end of each. Take the flex lead from the plate of the valve to the socket of the coil block nearest the back of the case. The other lead from the lower telephone terminal should be connected to the plug of the same block.

The Flex Leads

It now remains to wire from the other two coil blocks. That nearest the panel takes the coil L_1, and the fixed block takes L_2. The socket of L_1 corresponds to 5 in the diagram and the plug to 6. With L_2, 4 and 3 correspond to the plug and socket respectively. Connect the four leads terminated by the clips to the points 5, 6, 3 and 4.

Circuit Connections

A tabular list of the connections necessary for the three circuits follows. For convenience throughout, the terminal marked Earth is shown as E. All aerial and earth connections are made externally to the terminals mentioned below, except with the Fig. 3 arrangement. In this latter case clip 5 is joined to the aerial externally, the flex lead 5 being taken outside the cabinet. The other connections made by the spring clips are effected inside the case, either to terminal shanks or to the bared parts of leads from them. For safety when changing circuits, remove the valve and disconnect the H.T. battery.

Table

Fig. 2.—Direct-coupled Arrangement with Parallel Tuning.		
Aerial to G	1 to G	4 to G
Earth to E	2 to E	3 to E
With Series Tuning.		
Aerial to 1	2 to G	4 to G
Earth to E		3 to E
Fig. 3.—Loosely-coupled Arrangement.		
Aerial to 5	1 to G	4 to G
Earth to E	2, 3 and 6 to E	
Fig. 4.—Trap Arrangement.		
Aerial to G	5 to 1	4 to G
Earth to E	6 to 2	3 to E

Testing

As a preliminary test, connect the L.T. battery only and insert a valve into the socket. Turn the filament resistance and note whether the valve lights correctly. Next remove the valve and connect as for the Fig. 2 circuit, employing, say, parallel tuning. The two pairs of terminals to the left will be joined by two short lengths of wire. The aerial is taken to G and the earth to Earth. Within the case 4 is clipped to the shank of terminal G and 3 in a similar manner to the earth terminal. A No. 25, 35 or 50 coil should be inserted into L_2 coil socket and a 50 or 75 into L_3. No coil is placed in L_1, and the clip leads 5 and 6 remain disconnected and left clear of the other wiring.

Tuning

Insert any general purpose type valve in the valve holder and apply a suitable valve of H.T. With the two coils well apart tune on C_1. The

Another back of panel view. Note the flexible leads on the left which go to the batteries.

local station should be heard, and by bringing L_3 towards L_2 whilst re-tuning slightly on C_1, its strength should improve.

Coils to Use

With series tuning a No. 50 or 75 should be employed for L_2. When receiving 5XX, connect for parallel tuning, and use a No. 150 for L_2 and a 200 or 250 for L_3.

With the Fig. 3 circuit L_1 should be a No. 25 or 35, L_2 a 50 or 75, and L_3 a No. 50. For 5XX the order should be a No. 100, 250 and 200 respectively.

Employing the trap circuit of Fig. 4 I find a Gambrell "a" most suitable for L_2, a B or C for L_1, and a C or D for L_3. L_1 and L_2 gave best results when tightly coupled together. For 5XX, L_1 may be an F coil, L_2 a D and L_3 an E. Probably on other aerial and earth systems some experiment may be required to find the best combination of coils to use.

Test Report

Tested on a good aerial 12 miles S.E. of 2LO, that station gave uncomfortably loud signals with all three circuits, and with the Fig. 3 and 4 arrangements Bournemouth was quite free from interference from 2LO. The Fig. 4 circuit was extremely critical to tune, and proved effective in minimising Morse interference. A large number of other British and Continental stations were logged at good phone strength, among them Toulouse, Madrid and Münster; but it is not proposed to take further space in giving a detailed list, since I would prefer the reader to judge the set on its own merits. I have no hesitation, however, in saying that the receiver functions in a very satisfactory manner, and should render yeoman service to the constructor.

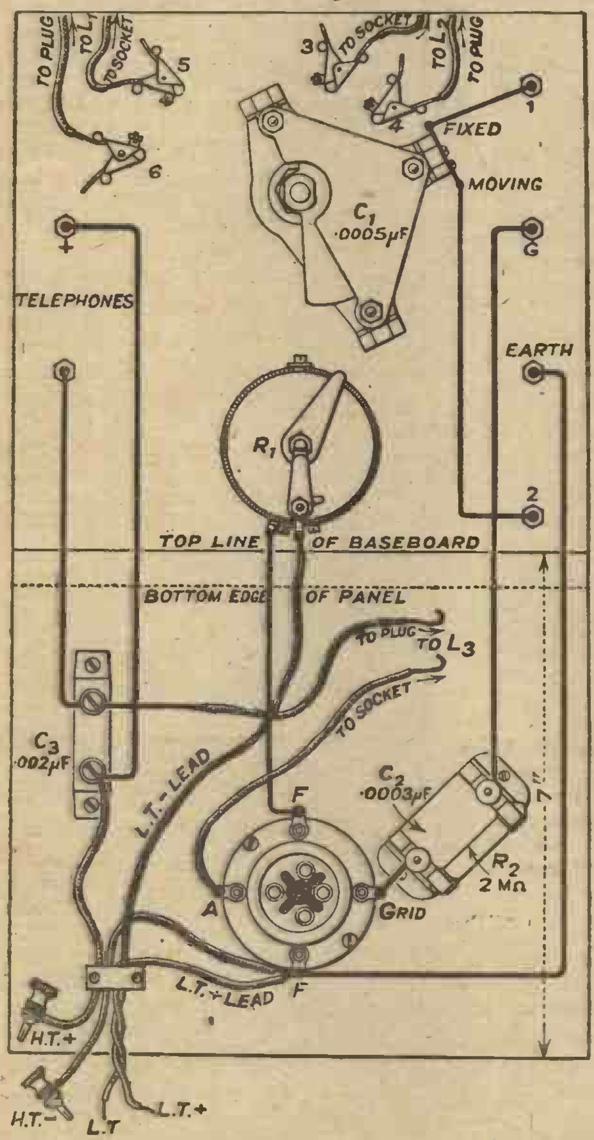


Fig. 6.—The wiring diagram. The uses of the flexible leads are marked, and the clips numbered in accordance with Figs. 1, 2, 3 and 4.

Conclusion

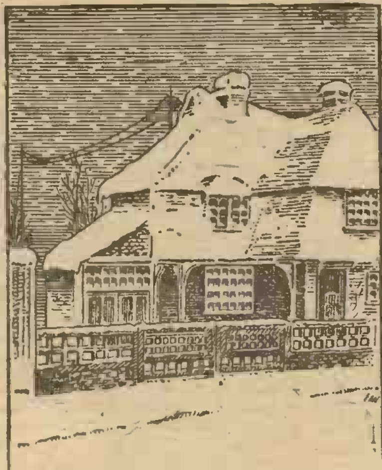
In conclusion, it should be pointed out to the constructor that for loud-speaker work note magnifying valves may be added as circumstances demand. Transformer, choke or resistance coupling may be used, and the reader will find many suitable designs in back numbers of this journal. It should be noted, however, that a high-frequency valve cannot be added in a simple manner.

The Midget Single-Valve Receiver

SIR,—In reading your most interesting publication THE WIRELESS CONSTRUCTOR, I came across some of your readers' experiences with the Midget Single-Valve Receiver. I have been a reader of your paper for some time, but many of the sets which were described in it were beyond my pocket. So I waited and then I saw the Midget Single-Valve Receiver, by Mr. A. S. Clark, in the May, 1925, issue, which was very neat and very easy to wire up. Being the first time I had attempted to make a valve set, I thought that I would make this one. I was not only surprised but amazed at the result. I am sure it is quite as good as any two-valver—there is not a bit of harshness—absolutely a clear background when working. The only alteration I made was to use a larger piece of ebonite and a different condenser. I first made it up on an old piece of ebonite just to see what it would do, and I can tell you I was extremely pleased with it. Then I built a cabinet for it with a glass panel door. I use a 4-volt bright-emitter power valve. These are the stations I have heard up to now: 2LO, 5XX (too loud), 6BM (good), 2ZY, 5IT, 5WA, 5NG, 2BE, 2DE, 5NO, EAJ6, EAJ1, EAJ13, and also Oslo, and a number of French and German stations yet to be identified. All were heard on two pairs of phones loudly, some with the receiver tuned down. The climax came the other night. I made up my mind to try for something big, and about 2.25 (after hearing Madrid and a few more stations close down) I picked up a carrier wave. I heard speech which came in well and then seemed to fade, but came back again as quietly as it went. I moved the condenser dial round a few more points and picked up another station which was transmitting music. I continued the experiments till past 4 o'clock in the morning, and I was still getting them. It is the best little one-valver that is round about here, I am sure, and I thank Mr. Clark for his most helpful guidance and also the way THE WIRELESS CONSTRUCTOR prints it so clearly for the novice.

Yours faithfully,

Ely. A. E. A. NORMAN.



Radio Games for Christmas

How to get your family interested in wireless!

H. G. WELLS has invented a game, so that I am in good company if I do it, too. It is the right spirit for Christmas. Mr. Harris's Centodyne really suggested it, and for the wireless man it is just as good as a crossword puzzle. It also enables the married man to spend a little time with his wife, and perhaps get her interested in wireless. No more wireless widows, in fact. You can play the games, too, without any apparatus, on paper, but it will not be half so lively. The set of rules I give are only suggestions, and better ones can, no doubt, be established.

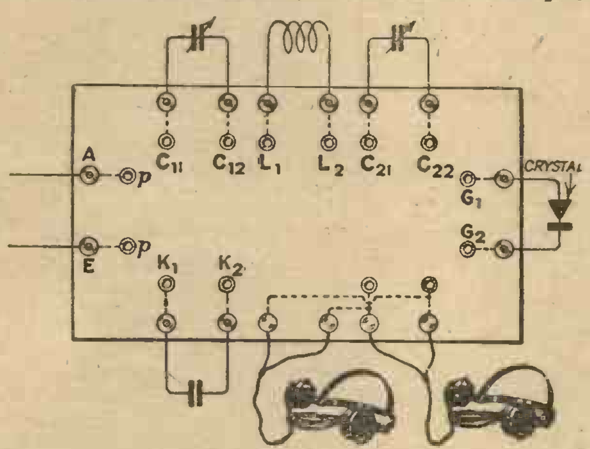


Fig. 1.—The layout for the Chequerphone. The wiring between terminals and sockets is below the panel.

CHEQUERPHONE

This is a simple form for crystal users.

Requirements :—

An ebonite panel (quite small).
A number of plugs, sockets and terminals.
Two pairs of phones.
Aerial and earth.
A No. 50 coil.
Two variable ·0005μF condensers.
One fixed condenser, ·001μF.
Crystal detector.

The arrangement of the panel is as in Fig. 1, each terminal being connected to a socket (*pp*) of the "Clix" type. Across the terminals are put the various instruments shown. The two players each put on a pair of headphones, and each is provided with a set of leads with plugs at the ends. Preferably one set of cords is white and the other black. Toss for first move. Winner takes white cord. Then White makes first connection. The winner is the one who gets 2LO first.

Rules :—

1. Any connections can be made, and, if the opponent wishes to change, he pulls cord out, but that counts as one move.

2. No repetition of the same connection is permitted by the same player. (For instance, if Black shorts G_1 G_2, White will then remove the connection as his move, but Black must not again make that move.)

3. Adjustment is permitted on variable condensers as part of a move.

CHESSOPHONE

Chessophone is similar, but played with a valve set.

Requirements :—

Three loud-speakers.
Three variable condensers (say, each ·0005μF).
One 2MΩ grid leak.
Three fixed condensers.
One L.T. battery and variable rheostat.
One H.T. battery.
Three coils (two No. 50, one No. 25, say).
Valve sockets and valve.

Rules :—

1. Same as Chequerphone.
2. Same as Chequerphone.
3. Same as Chequerphone.
4. Any move which shorts battery, mover removes the short and gives two moves to the opponent.
5. Burning out valve filament loses game.
6. Oscillation by either player loses one move.

Chessophone gives all sorts of possibilities of freak circuits and, of course, to make it more difficult, the local station may be barred. The great point will be to try and deceive the other man as to the circuit you are after.

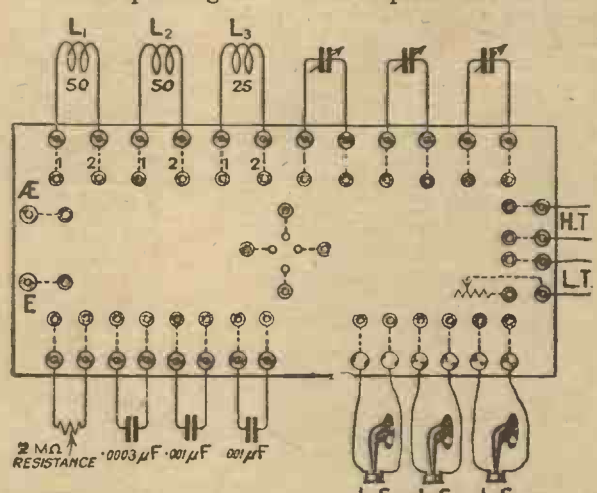
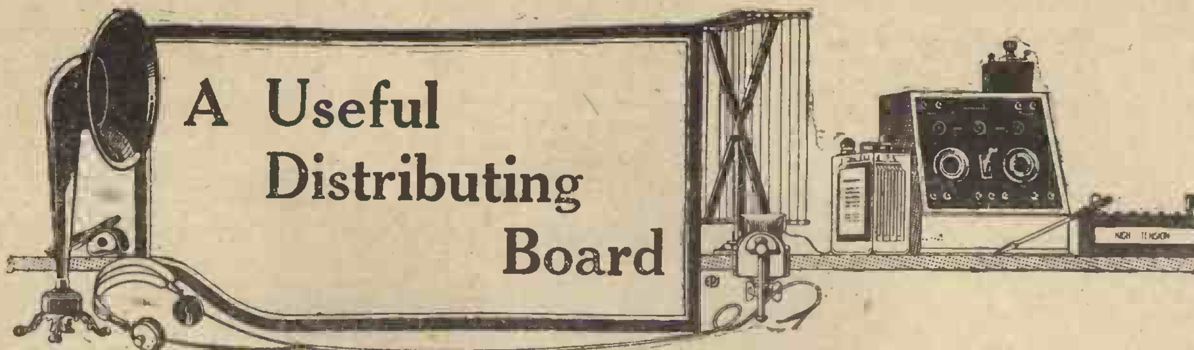


Fig. 2.—The Chessophone board.



A Useful Distributing Board

A device of interest to accumulator owners who have occasion to use different filament voltages

IN these days when valves vary considerably in their filament requirements the experimenter needs some handy device upon his wireless table which will

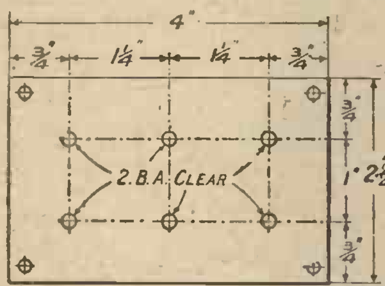


Fig. 1.—How to mark and drill the ebonite panel.

enable him to obtain a maximum low-tension potential of 2, 4 or 6 volts at will, without having to use a rheostat containing a high resistance winding. One of the simplest and most convenient ways of doing this is described in this note.

Making the Board

Cut out first of all a piece of ¼ in. ebonite 4 in. in length by 2½ in. width, marking it out and drilling as shown in Fig. 1. The holes arranged in two rows of three each are made 2B.A. clearance (No. 12 drill), whilst those at the corners are of suitable size for the wood screws which fix the panel to a shallow box or to a small block of

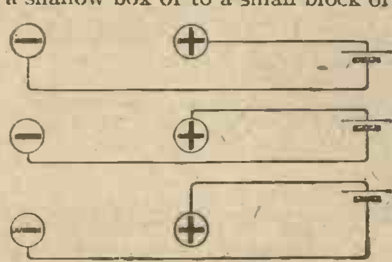


Fig. 2.—The accumulator cells are wired to the sockets as above.

wood in which hollows are made to clear the shanks of the Clix sockets mounted in the 2B.A. holes. We require here plain Clix, each with a single bush, three red and three green. Place all the reds in one row to mark the positives and the greens in the other. It is next necessary to "split" the cells of the accumulator in order that they may be wired to the terminals, as shown in Fig. 2.

Wiring-up to the Accumulators

This is made a very easy matter with Exide and other accumulators, in which screwed-down lead strips are used as inter-cell connections by simply removing the strips.

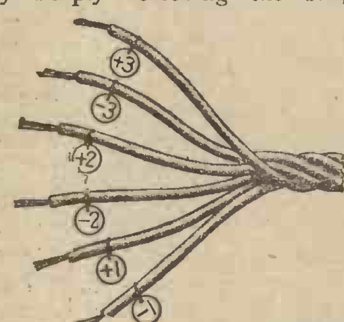


Fig. 3.—The six accumulator leads are marked and twisted together.

Should the connections be made with fixed rods of lead, cut a gap in each about an inch wide with a hacksaw, drill a 4B.A. clearance hole close to each end, and fit terminals, taking care either to coat them with anti-acid paint or to cover them with grease, so that they may not corrode. Between the battery and the "Clix Board" we require six leads made into a cable. One end of each should be soldered to its Clix socket, and to the other is fixed a very small ivorine key tag marked, as shown in Fig. 3, with the sign of the terminal and the number of the cell to which it belongs.

Connecting Links and Leads

We next require some short lengths of good flex to each end of which is fixed a Clix connector

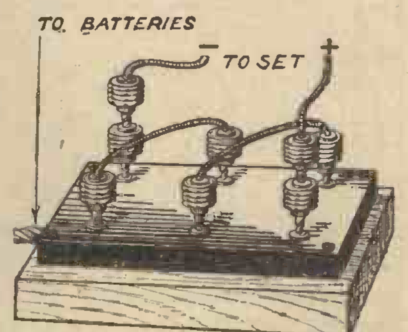


Fig. 4.—The board will look like this in use.

complete with insulator. The leads which are to run from the distributing board to the set will also require to have Clix terminals at their ends. The colour of the insulators used on the small connecting pieces does not matter—it makes a neat job to use black ones throughout—but those at the ends of the leads on the set should be red and green to denote positive and negative respectively. Fig. 4 shows the distributing board in use. It will be seen that in this case the three cells of the battery are connected in series, so that the total E.M.F. delivered is 6 volts.

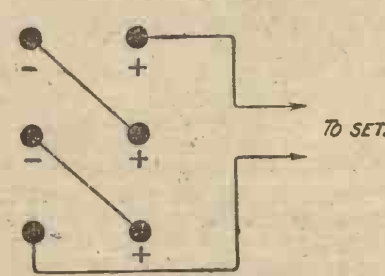


Fig. 5.—A 6-volt output results from these connections.

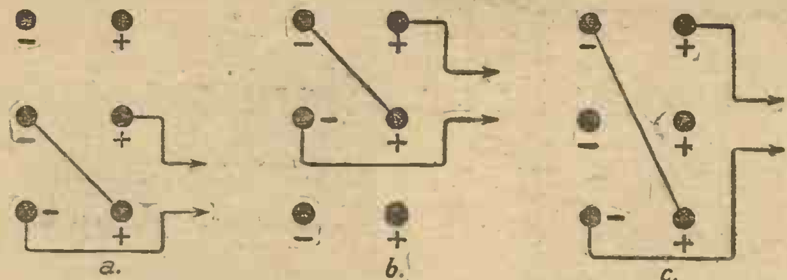


Fig. 6.—All three arrangements shown here give 4 volts, and each should be used in turn.

Getting Different Voltages

In Figs. 5, 6 and 7 are seen combinations which give respectively 6, 4 and 2 volts. An examination of Fig. 6 will show that by means of the Clix connections *any* two cells can be used in series to give 4 volts, the third being cut out. Most distributing boards use only one pair of cells to obtain the 4-volt E.M.F. This is a bad practice for it means that if much work is done with a 4-volt supply two of the cells are badly run down, whilst the third is hardly touched. The device described enables one to work all cells evenly by making occasional changes in the connections.

A Precaution

The distributing board will be found most satisfactory to use since connections can be made in a moment. There is only one thing to be careful of, and that is on no account must any metal object be laid on the board, for if this were done a short circuit would occur.

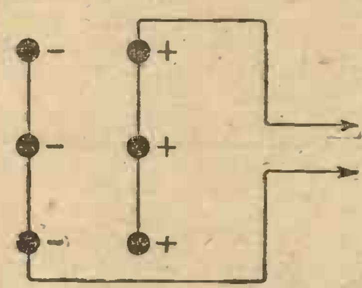


Fig. 7.—In the 2-volt arrangement all three cells are used.

The All-Enclosed Local or Daventry Receiver

SIR,—I have just completed the Local-Daventry receiver described by F. English in the September issue of THE WIRELESS CONSTRUCTOR, and I think it is the most wonderful crystal set I have ever possessed. I have had several sets (ready made), but I've not had one that can be placed in comparison with this, and I feel that I must sincerely thank the author for furnishing us with the details or such a perfect little model.

Yours faithfully,

ALBERT BERESFORD.

Derby.

Selectivity or Simplicity?

IN view of the rapid spread of the "itch for distance," selectivity is becoming more and more desirable in the ordinary broadcast receiver. It is, however, well known that a really selective receiver is much more difficult to operate than one merely intended for reception of the local station. The most popular method of combining a reasonable amount of selectivity with ease of operation is to use the well-known "untuned" or "aperiodic" aerial circuit. The question frequently arises, however, whether this method of coupling is really as efficient and selective as it should be. All readers interested in this question will derive great help from the series of articles commencing in *Wireless Weekly* for November 25, by Mr. G. P. Kendall, B.Sc., on "Selectivity and the Tight-Coupled Aerial."

Wave-Traps

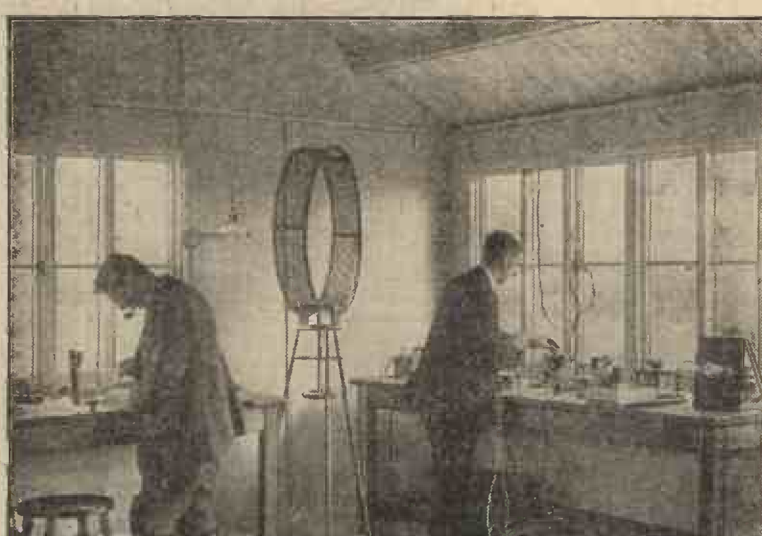
There are some, however, who feel competent to operate a really complicated receiver, and rather than use this method of obtaining good selectivity prefer to use a wave-trap. These will find their needs catered for, and also may receive some slight surprise, in the very comprehensive series of curves in the article entitled, "What is the Best Wave-Trap to Use?" by Mr. C. P. Allinson, in the Nov. 18 issue of the same publication.

The Oscillation Nuisance

Mr. Percy W. Harris has written an article of great importance to all users of valve sets, in "Chasing the Oscillator," which appears in the November 14 issue of *Wireless*, the one-word weekly. He also continues to give new circuits for use on the "Centodyne" receiver each week in the same paper.

A Three-Valve Super-Het.

Few readers know that, although the super-heterodyne is frequently called the best of all receivers, still it may not necessarily be the most expensive and difficult to construct. It will come as a decided encouragement to these to know that a perfectly efficient "super-het." may be constructed which needs only three valves. Several variations of this, all the result of practical experiments, are dealt with in "Super-heterodyne Development," an article by the staff of the Radio Press Laboratories, in the Double Christmas Number of *Modern Wireless*. For those who already possess one of these receivers,



A corner of one of the Elstree Research Laboratories at present devoted to Super-heterodyne work.

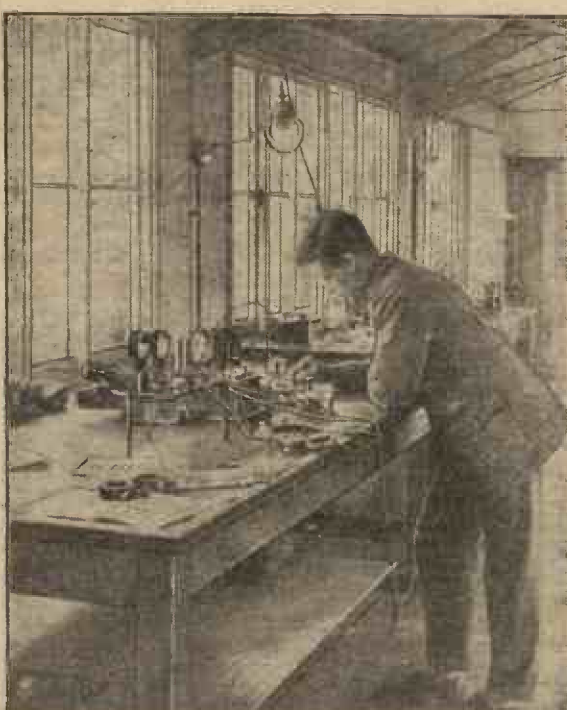
Can they be combined in one receiver?

there is a short treatise on "Faults in Super-heterodyne Receivers," by Mr. John Underdown, who is already noted for his knowledge of "faults." Of equal interest is Mr. A. Johnson-Randall's article entitled, "How to Get the Best from Your Set," in the same number.

Tuning Coil Resistance

For the constructor looking for fresh worlds to conquer, there is a five-valve receiver, embodying two stages of radio-frequency amplification using a novel method of coupling, described by Mr. Hartt under the title of the "DX Five." There is also an interesting article on "Wireless Tricks for the Christmas Party," by Mr. A. V. D. Hort, which offers ample opportunities for the budding inventor and constructor to show his skill.

For the more mature readers, however, who prefer to find out what there is in their present receivers that might be improved from the theoretical point of view, Mr. Reyner's discourse on "What is the Resistance of Your Tuning Coil?" will open fresh fields. Major J. Robinson describes a method of using valve-filaments in series, showing how much more economical this is than the usual method, especially when D.C. mains are available.



A member of the Elstree Research Staff engaged in experiments for obtaining resonance curves of tuned circuits.

Special-Purpose Valves

Many owners of receivers are guilty of the fault of expecting one particular valve to do any work which may be required of it. Mr. Hartt shows how fallacious this is in his comprehensive articles on "Choosing Valves to Suit Your Circuit," which appear in *Wireless Weekly* for November 18, and the December number of *Modern Wireless.*

Amateur Transmitters

Those interested in transmission generally suffer from lack of practical information on the subject. They will, however, have no difficulty in following the articles entitled "Some Problems of Radio Transmission," by the Radio Press Laboratory Staff, now appearing in *Wireless Weekly*. These articles commenced in the December 2 number. Matters of general interest to short-wave enthusiasts also appear in "Short-Wave Notes and News" each week in the same paper.

Equally interesting articles, of a more specialised nature, are "How the Valve Works," by Major James Robinson, and "Wireless Under the Sea," by Lt.-Commander J. M. Kenworthy, R.N., M.P. These both appear in the December 12 issue of *Wireless*, the One-Word Weekly.

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AERIAL WIRE (100 feet).—Heavy, 7/22, 2/6; Ribbon (Tape), 2/9.

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COIL STANDS—2-way Standard, 2/9. Cam. V. 4/6; Geared, 5/6, 6/-; 3-way Standard, 5/-; Cam., 6/6; Geared, 7/11.

COIL PLUGS (Ebonite).—Fitted Fibre, 1/6 pair. Shaped. Brass sides, 1/8 pair. Standard, 1/- pair.

PHONE CORDS, etc.—6 ft. Rubber Insulated, 1/11; 7 feet do., 2/6. Loud Speaker, do., 12 ft., 2/6.

"PEERLESS"—6 ohm, 15 ohm or 30 ohm Rheostat, 2/6; Dual Rheostat, 3/9.

COSMOS VALVES (Met.-Vickers)—A.45 7/6; SP.18 12/6; DE.11 12/6. Old Valve allowed for.

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DUBILIER CONDENSERS.—·0001 to ·0005, each, 2/6; ·001 to ·006, 3/- each. Grid Leaks, 2/6 each. Type, 610, fixed, 3/-, 3/6, 4/-, 4/6. Anode, 70, 80, 100,000, each, 5/6 on stand. Mansbridge Variometer, 30/1,800, 12/6.

DORWOOD FIXED.—·001 to ·006, 3/- each; ·0003 (with grid leak clip), 2/6.

EUREKA TRANSFORMERS—Concert Grand, 25/-. 2nd Stage, 21/-. Baby Grand, 15/-; Gravity Detector, 5/6

ENERGO H.F. TRANSFORMERS.—B.B.C., 3/11; Daventry, 4/6. Other sizes stocked. L.F. Transformer, 15/-.

EDISON BELL PARTS.—Ser. Par. Variometer, or B.B.C. or 5XX, 16/6; Old Model, 10/-. Fixed Condenser. ·001, ·0001 to ·0005, each, 1/3; ·002 to ·006, each, 2/-; ·0003, with grid leak, 2/6. Shaped Plug, 2 for 2/-. Loud Speaker, 42/-. Dulcevox, 42/-.

GOSWELL (QUALITY RADIO).—Coils, mounted 25, 1/6; 35, 1/9; 50, 2/-; 75, 2/3; 100, 2/9; 150, 3/-; 175, 3/6; 200, 3/9; 250, 5/3; 300, 6/-. Valve Holders, Legless, 1/3. Sub-Panel, 1/3. 4-Valve Sockets, 1/-. Coil Stands Panel—2-way, 3/-; 3-way, 5/-. Cam operated—2-way, 9/-; 3-way, 12/6; Low Loss Coil Former, 3/9

GAMBRELL PARTS.—L.F., 1st or 2nd Stage, 27/6 each. 2-way Anti Cap Switch, 7/-; 4-way, 9/6. Neutrodyne Condenser, 5/6 Coils all sizes.

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HEADPHONES, BRITISH 4,000 OHMS.—B. T. H., Browns, Brandes, 20/- pair; Sterling, English Ericsson 22/6 pair. Bowerman's Super 'Phones, 12/6 pair.

HEADPHONES, GENUINE 4,000 ohms.—Dr. Nesper Adjustable, 12/11; Telefunken Adjustable, 16/3; N and K Stamped on back, 14/11; Brunet, new model, 14/11.

IGRANIC PARTS.—L.F., 1st Stage, 21/-; 2nd Stage, 19/6. Coils, Ultrinic, 9/- Unitune Major, 9/-; Minor, 7/6. Honeycomb, 25, 35, 4/3; 50, 4/6; 75, 4/10; 100, 6/3; 150, 7/-; 200, 8/-; 250, 8/6; 300, 9/-; 400, 10/-; 500, 10/3; 600, 11/-; 750, 12/6; 1,250, 15/6; 1,500, 17/6; Rheostats, 3/6, 5/6. Variometers, 10/-, 12/6. Potentiometer, 5/6. H.R. Variometer, 8/6. Variable Grid Leak, 8/6. New Square Law Variable Condensers, ·001, 27/6; ·0005, 24/-; ·0003, 21/-.

BURNDEPT PARTS.—Rheostats, 5/-. Dual, 7/6. Detector, 4/-. L.F., 24/-. Potentiometer, 7/6. Anti-Phonic, 5/-. Coils from 3/-.

CRYSTALS (Best)—Neutron 1/6. Listron, 1/6. Uralium, 1/3. Shaw's Genuine Hertzite (Sealed), 1/-. Silverex, 2/6.

"KAY RAY" DETECTORS.—Enclosed nickel fittings, trigger movement, 2/6; Permanent, 2/-. Do., one-hole fixing, 2/6.

LOUD SPEAKERS (Various).—Sterling "Baby," 50/-, 55/-; Dinkie, 30/-; Primax, 155/-; Amplions Dragon Fly, 25/-; Junior 27/6; A.R. 111, 50/-; A.R. 114, 65/-; A.R. 19, 105/-. Browns, all models. Ultra, 27/6; C.A.V., 27/6. 30/-. And all new models makers' prices.

LISSEN PARTS.—Anode or Variable Grid Leak, 2/6 ea.; L.F. or H.F. Choke, 10/-. Switches, D.P.D.T., 5 point Reversing, 4/- each. 2-way series Par., 2/9 each. Minor, 3/6; Major, 7/6. Universal, 10/6. Potentiometer or Wire Rheostat, 4/- each. Neutrodyne Condenser, 4/6. Coils 25, 35, 4/10 each; 50, 5/-; 60, 75, 5/4 each; 100, 6/9; 150, 7/-; 200, 8/5; Lissen X 50, 6/-; 60, 6/4; 75, 6/5; 250, 9/9. Tuner, 22/6. Mark III. Var., 17/6.

MARCONIPHONE.—Potentiometer, 11/-. Ideal L.F. Transformers, 6-1, 4-1, 2·7-1, 30/- each. Automatic Detector, 8/-.

McMICHAEL PARTS.—Rheostat, 5/6; D.E., 6/6; Dual, 7/6; Triple, 22/6; Potentiometer, 7/6; H.F. Transformers, 10/- each. Supersonic A7 12/6. Fixed and clips, ·0001 to ·001. 2/6 each; ·002 to ·01, 3/- each. Grid Leaks, 2/6 Anode, 70, 80, 100,000 ohms, 2/6. L.F.T., 21/-.

MAGNUM (BURNE-JONES).—H.F. Transformers, 7/- each. Coil Holders, 2-way, 9/6; 3-way, 12/6. Valve Holders, 2/6. Vibro, 5/-. T.A.T. Tapp. Coil, 8/6. Neut. Cond., 4/6. All parts stocked.

POLAR (RADIO COMM. CO.)—R.C.R. Unit, 15/-. Condensers, Micro, 5/6; Neut., 5/6. Variable, ·001, ·0005, ·0003, 1/6 each. Coil Stands, Cam. V., 2-way, 6/-; 3-way, 9/6. Polar Sets stocked. Polar Junior Variable ·0005, ·0003, 5/6 each

LOTUS (GEARED)—2-way, 7/-; 3-way, 10/6

R. I. (RADIO INSTRUMENTS).—L.F. in sealed box, 25/-. Anode Choke, 10/-. Permanent Detectors, 6/-, 7/6. New Var. Air Condensers and V. ·0003, 22/6; ·0005, 24/-.

REFLEX RADIO COILS (Made under Burndept Licence).—35, 8d.; 50, 9d.; 75, 1/-; 100, 1/2; 150, 1/8; 200, 2/9; 250, 3/3. Post 2d. each. Mounts, 1/- each extra.

STERLING PARTS.—·00025 Square Law and V., 23/6; ·0005, 25/6. Non Pong Valve Holder, 4/3.

T.C.C. (MANSBRIDGE).—2 Mfd., 4/8; 1 Mfd., 3/10; ·25, 3/-.

SUCCESS (BEARD & FITCH).—L.F., all black Super, 21/-. Choke, 10/6. Var. Condensers. No Loss. List Prices.

SHIPTON.—Rheostats, 7, 30, 60 ohms, 3/- each. Potentiometer, 600 ohms, 4/6.

PANEL SWITCHES. Nickel SPDT, 1/- DPDT, 1/3.

TRANSFORMERS (L.F.)—Feranti, 17/6; Pye, 22/6; Silvertown, 21/-; Ormond, 14/-; Royal, 20/-; Lissen, T1, 21/-; T2, 15/-; T3, 12/6. Powquip, 14/6; Formo Shrouded, 10/6; Ormond Latest Shrouded Model, 18/6; Croix, 9/6; Wates Supra, 12/6.

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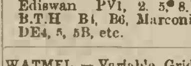
VALVES.—Bright, 8/- each Mullard Ora, Red or Green Ring. Marconi, R4, R5 B.T.H. "R," Ediswan AR. Cossor P1., P2. 14/- each; Mullard D3 Cossor W1, W2, Ediswan ARDE, B.T.H. B3, Marconi DER. 16/6 each: Mullard ·06, DE3, Cossor WR1, WR2, Ediswan 60, B.T.H. B5, Marconi DE3 18/6 each: Cossor W3, Marconi DE6. 22/6: Mullard DF, "AO," "A1" Ediswan PV1, 2, 5, 8. B.T.H. B4, B6, Marconi DE4, 5, 5B, etc.

WATMEL.—Variable Grid Leak, 2/6. Anode, 3/6. Green Knob, 3/6. Fixed Condensers, 2/6, 3/6 (all sizes).

WOODHALL PARTS.—L.F. Transformer, 23/6. Vernier Rheostat, 7 ohms, 2/6; 30, 3/6; 2 way, 10/6.

ACCUMULATORS.—
2 v. 40 amps., 9/6, 10/6;
4 v. 40 amps., 15/11, 17/6;
4 v. 60 amps., 22/6, 23/11;
4 v. 80 amps., 25/-, 26/-;
6 v. 60 amps., 30/-, 33/-;
6 v. 80 amps., 37/6, 38/6;
6 v. 100 amps., 45/-. Radio-cell, Rotax, etc., etc.

BENJAMIN—Valve Holder, 2/9



R.I. Permanent Detector 6/- R.I. One-hole Fixing 7/6. "Kay Ray" Permanent One-hole Fixing 2/6.

RADIO MICRO VALVES
·06 SPECIAL
F.V. 3 to 3·5
A.V. 40 to 80
10/6

RADIO PRESS ENVELOPES

SETS OF PARTS
All Less
Box, Valves and Panel.

2 Valve Amplifier De Luxe (No 7) £4 16s. 6d.

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Efficient Single Valve £1 16s. 10d.

9 Valve Supersonic £18 5s. 0d.

4 Valve Family (No. 2) £6 15s. 0d.

Twin-Valve Loud-Speaker Receiver by J. Scott-Taggart £4 12s. 0d.

Above are prices for AUTHOR'S Specification of parts. Reliable substitutes quoted for. High quality, very moderate prices.

QUOTATIONS given for Sets of Parts where it is possible to do so and give Early Delivery.

WITH DIAL 2/3
Without 1/9
6 ohms

HEADPHONES

ERICSSON (E. v.) CONTINENTAL
STILL UNBEATABLE 4,000 ohms. Sample pair, 10/6.

"BRUNET"
The old original phones, a little lighter in weight, very fine value, 4,000 ohms
Post free, 12/11 pair

TELEFUNKEN
In sealed boxes. Genuine 'Phones, 4,000 ohms (adjustable magners), in sealed boxes. Many thousands sold without a complaint. Light as a feather. Post free. 16/- pair.

BURNT-OUT VALVES
1 Burnt-out Valve accepted in part exchange for each new British Valve bought. Usable Valves purchased or exchanged.

SECOND HAND
Parts bought (callers can bring goods, but am under no obligation to purchase). U.K. only.

Any offers made liable to withdrawal without notice or liability.

No second-hand goods to be sent by post except by request.

N. and K.
Guaranteed genuine Stamped N. and K. on Cases.

NEW LIGHTWEIGHT MODEL, with all the old characteristics

4,000 ohms, **13/6** post free

BOWERMAN'S
(B.B.C.) Uniquely light in weight, 4,000 ohms, 12/6 pair.

Dr. NESPER HEADPHONES
Genuine and adjustable. 4,000 ohms. Comfortable Leather Bands. Post free, 12/11 pair.

BRETWOOD
Valve Holders 1/9
Grid Leak - 3/-
Anode Res. - 3/-
Grid Leak and Condenser, 50,000 ohms to 15 meg. 4/6

BROWN'S A 2 HEAD-PHONES
4,000 ohms
30/-

SIEMEN'S EBONITE—
Special sizes, 3/16 in. ½d. per sq. in. ¼ in. ¾d. per sq. in.
Post extra

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4,000 ohms
20/- pair

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VALVE WINDOWS, Nickel 6d.
KEYSWITCH 2/9
PUSH-PULL 1/6
Post 2d. under 2/-

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Please write plainly

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(5-PIN)
Complete with Ebonite 5-Pin Valve Holder
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PLEASE WRITE PLAINLY AND REGISTER CASH.

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Re-Echo Pattern Crystal Set

Handsome Present. Fitted permanent Detector. Variometer Tuning. Complete with Headphones, aerial wire insulators, lead-in wire. The LOT post free **21/9**

Cheaper to Callers

COILS (Mounted)

All highest quality, post 2d.

FINSTON—25, 1/3; 35, 1/6; 50, 1/3; 75, 2/-; 100, 2/6; 150, 2/9; 200, 3/6 250, 3/9; 300, 4/-.

STAR—25, 1/3; 35, 1/6; 50, 1/9; 75, 2/-; 100, 2/3; 150, 2/6; 175, 2/9; 250, 3/-; 300, 3/3.

GRAM (Patent)—25, 1/6; 35, 1/6; 50, 1/8; 75, 1/11; 100, 2/3; 150, 2/5; 200, 2/11; 250; 3/3; 300, 3/6.

ORMOND

Shrouded L.F.	18/6
Standard L.F.	14/-
6 ohm Rheostat	2/-
New Model Rheostat ..	2/6

30 or 6 ohms.

One Valve Amplifiers

ready to assemble.

Drilled Panel, L.F. Transformer, valve-holder, terminals, etc. Screws, wire, sloping box, high-class set, only wants fixing up.
POST FREE, NETT **14/11**

MULLARD'S VALVES

Highly recommended. P.M.4 Loud-Speaker Valve. 4v. accu. or 3 dry cells. **22/6**

All Mullard's Stocked

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Each 2s. 6d.

"Service" Crystal Set

Very handsome design.
SOLID POLISHED BOX (enclosed)
Complete with Siemen's Phones (4,000 ohms.) lead in, insulators, etc.
POST FREE
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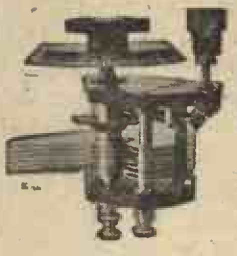


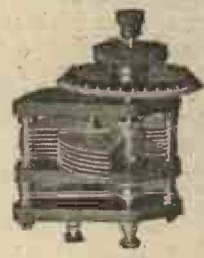
Prov. Pat.

80-1 Worm reduction gear. Impossible to equal such fine tuning.
·0003, **13/6** ·0005, **15/-**

KAY RAY

"DE LUXE" LOW-LOSS MODEL SQUARE LAW

High-grade Ebonite ends, one-hole fixing, **knob and dial**



With Vernier	
·001	8/11
·0005	7/11
·0003	7/6
Without Vernier	
·001	7/6
·0005	5/11
·0003	5/3

With or Without Bottom Ebonite Plate. Accurate, narrow spacing, splendid workmanship, high-class article. Clean cut signals. Many Testimonials.

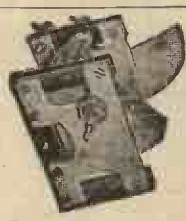
G. Robinson, Esq., says; — 4, Gladstone Street, DERBY. 21/10/25

"Have tested your Condensers and they are the best money's-worth I have ever had. The workmanship is supreme and gives entire satisfaction."

IGRANIC

Last word in Condensers,
·0005 .. 24/-
·0003 .. 21/-
Square Law with Vernier.

ORMOND



American Type Low-Loss, skeleton ends, perfectly rigid, moving vanes and end plates are at earth potential. Each complete with dial and knobs.

·001	10/6
·0005	9/6
·0003	9/-

Above with vernier. Deduct 1/3 each if no vernier required. Also with Ebonite Ends. same price.

R.I. variable

·0005 ..	24/-
·0003 ..	22/6
Tuner ..	39/6

JACKSON BROS. (JB)

Square Law with Vernier

·001	14/-
·0005	12/6
·0003	11/6

	Geared	Low-Loss
·001 ..	17/6	13/-
·0005 ..	15/-	10/6
·0003 ..	13/-	9/-

	Square Law	Standard
·001 ..	9/6	8/-
·0005 ..	8/-	7/-
·0003 ..	6/9	6/9

Apex V.H. Anti-Capacity
Baseboard Type, Nickel Screws. Soldering Tags, 1/6, post 2d.

CROIX L.F.

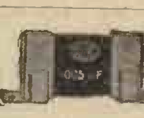
In new boxes 9/-
5-1 or 3-1.

Star Variometer

DUPLEX
for B.B.C. and 5XX
Prov. Patent
9/6

RADION PANELS

1d. per sq. inch.
Not under 3/6 in value.
Post extra.



1/9 2/3
2/6 3/.

Brownie Set, No. 2 new model complete with coils, phones, aerial and insulators, post free, 22/6.

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SEE THE NAME "RAYMOND"

Retail purchasers of **£5** worth of our own goods—offered as an advertisement **one pair of 4,000 ohms Headphones FREE**

Select from SIEMEN'S, BRUNET Genuine N & K, or BOWERMAN'S

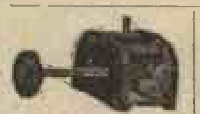
BATTERY BOXES With 14 Batteries. Clips fitted in Box.
Post free, **10s.** 63 volts.

Bowyer-Lowe Ossitator Coupler, 20/-

Dorwood Precision Condensers
The only grid condenser having a three-point connection. ·0005, with Grid-Leak Clip, 2/6.

Cam Vernier Coil Stands

2-way - 3/6
3-way - - 5/6



Lotus 2-way geared, 7/-
Lotus 3-way geared, 10/6

BUY MULLARD VALVES

Harmony Four By Mr. Percy W. Harris
ALL PARTS SOLD.

ACCUMULATORS.
2 v. 40 amp., 8/6, 9/6, 10/6.
4 v. 40 amp., 13/11, 15/11, 16/11
2 v. 60 amp., 10/6, 11/6, 12/6.
4 v. 60 amp., 17/11, 18/11, 19/11
4 v. 80 amp., 23/6, 25/-.
6 v. 60 amp., 25/11, 27/6, 30/-.
6 v. 80 amp., 33/-, 35/6.
ALL BEST MAKERS.

HIGH-TENSION BATTERIES.
B.B.C. 60 volts, 6/11
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B.B.C. 36 volts, 5/6.
Crown Long Life, 60 v., 6/11.
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Flash Lamp, "Neutron," 4½d.
Battery Boxes, 63 v., 4/3.
Battery Clips (best), 2 a 1d.
Wander Plugs, screw, 2½d. pair.
Wander Plugs (best), 4½d. pair.

AERIALS, etc.
7/22 Heavy, 100 ft., 2/3.
7/22 Good Value, 100 ft., 1/11.
Phosphor-Bronze, 49 Strands—100 ft., 1/8.
"Wonder," do., 110 ft., 3/-.
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Min. Silk, 6 yards, 6d.
Coil Former, 46 Spokes (wood handle), 1/6.
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Complete, with Nut and Washer W.O. or Pillar (large), 1d.
Small Pillar, 4 for 3d.
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Telephone, 1d. each, 10½d. doz.
Nickel W.O., 3 for 4d.
Nickel Pillar, 3 for 4d.
Nickel Phone, 3 for 4d.
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" " (Nickel), 2 for 1½d.
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" " " (Nickel), 2 10d.
Brass Spade Screws, 2 for 1½d.
Nickel " " 1d. each.
Pin, ditto, same price.
Red or Black Spades, 1½d.
Lead-in Tubes, 8d., 9d., 10d.
Copper Earth Tubes, 3/3.
Wate's Microstat, 2/9.
Enclosed Detectors, 9d.
Large ditto, 1/-, 1/3, 1/6.
Micrometer, Enclosed, 1/6, 1/9.
Brass Spade Tags, 6 a 1d.
Nickel Soldering Tags, 4 a 1d.
Ormond Screws and Nuts, 4 or 6 B.A., 2 a 1d.
Push and Pull Switch, 1/3.
On and Off Switch, 1/-.
D.P.D.T. Panel Switch, 1/-.
S.P.D.T. Panel Switch, 10½d.
8 Twist Drills, 1/2.

D.C.C. WIRE.
Per ¼ lb. Reel—20 g., 9d. 22 g., 10d.; 24 g., 11d.; 26 g., 1/-; 28 g., 1/2.
Switch Arm, 12 Studs, 10½d.
Nickel, ditto. 1/2.
Flush Panel Sockets, 3 for 2½d.
Shorting Plug & Socket, 3½d.

L.F. TRANSFORMERS.

Portland	8/11
Formo Type	8/11
Supra Pattern	8/11
Shrouded "Kay Ray" ..	12/6

HEADPHONES.

Adjustable 'Phones ..	8/11
Telefunken, genuine ..	14/11
Ericsson, Continental ..	10/6
Brunet	11/9
French Thomson-Houston	11/9

All 4,000 ohms.

VARIABLE CONDENSERS.
Sq. Law, Ebonite Ends, Knob and Dial, .0003, 5/-; .0005, 5/6.
CUSTOMERS requiring these Special Lines must please ask for same. No Post Orders from this column.

EBONITE PANELS, 3/16 in.
6 by 6 or 7 by 5, 1/2; 8 by 6, 1/6; 9 by 6, 1/9; 10 by 8, 2/6; 12 by 6, 2/6; 12 by 9, 3/11, etc., etc. MATT.

SIEMEN'S.
Cut to size, ½d. per sq. in. 3/16 in.
Cut to size, ½d. " " ¼ in.
RADION PANELS CUT.

CRYSTALS.
Shaw's genuine Hertzite, 8d.
Neutron, Listron, Gilray, Silverex, Zincite, Bornite.
AT LOWEST PRICES

Three Simple Joints

By R. W. HALLOWS, M.A.

When wiring up a set, we often have to join two wires together. Read how to do it

WHEN wiring up a receiving set or a smaller piece of apparatus one frequently has to make joints between leads. There are several ways of doing this, and the constructor must choose that which he finds the most convenient for his purpose. In Fig. 1 is seen a joint which may be made with round wire of not very heavy gauge. In this case the end of the lead to be connected up is twisted round the other two or three times with the pliers and solder is run into the joint with a hot iron. This kind of joint is very strong, and though it does not look particularly neat it may be relied upon not to come adrift provided that the soldering is properly done. Wire of heavy gauge or square tinned rod cannot be treated in this way owing to the difficulty of twisting either.

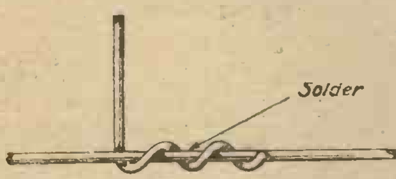


Fig. 1.—A simple joint with round wire.

Joining Square Wire

Square tinned rod is liable to break if subjected to much bending, and it is very difficult indeed to make anything like a good-looking job in this way with such wire as No. 16 or No. 18 S.W.G. For these materials use either of the joints shown in Figs. 2 and 3. The "T" joint if well made is the neatest of all, and it can be relied upon if properly done. It is not, however, an easy joint to make well unless one has a certain amount of skill with the soldering iron. When making a "T" joint the wire A should be cut to such a length that it just touches the proper point in B. At the point at which A is cut the copper will be exposed; it is therefore advisable to tin the end. When this has been done lay the two together in the proper position, apply a little flux and run in a good blob of solder with a very hot iron. When the solder has cooled make sure that your joint really has stuck by giving the lead A a good pull with the pliers. Another joint, much easier to make and quite reliable is the "L" joint shown in Fig. 3. As the portion of the lead A bent round at right angles need not be more than a ¼ in. in length a joint of this type looks quite well. To make the "L" joint cut the wire A so that it is slightly more than a ¼ in. longer than is required. Bend the end round at right angles with the pliers and lay it against B. Hold the two in position with the pliers, apply a little flux and run solder well in with a hot iron. Test the joint as before by giving it a good pull when cool.

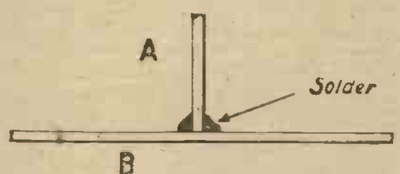


Fig. 2.—How to make a "T" or butt joint.

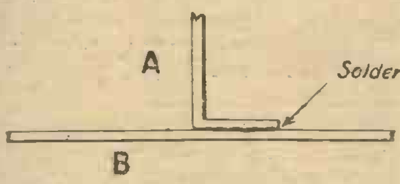
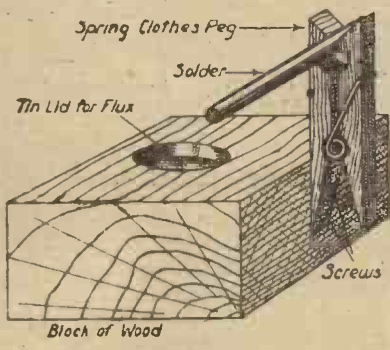


Fig. 3.—The "L" joint is very strong.

A Useful "Third Hand" for Soldering

"I wish I had been born with three hands!" Here's one to fill the deficiency!

MOST of us have felt the need when doing soldering work, and particularly when making the connections necessary during the wiring up of a set, of a third hand. The right hand is occupied with the soldering iron, whilst the left is needed to hold together the pieces that are to be joined. How is one to pick up the stick of solder? If one abandons one's hold of the portions about to be joined, and uses the left hand to pick up the stick of solder, it is quite probable that by the time the parts of the joint have been arranged once more the iron is too cold to do its work properly. I have found most useful for soldering work the "third hand," illustrated in the drawing. This is the simplest thing in the world to construct, and its cost is trifling. All that is required is a single-spring clothes-peg, which can be bought anywhere for a halfpenny, and a small block of wood from one's workshop scrap. The peg is fixed to the block of wood by means of a couple of small screws. There is no difficulty in doing this, since its two halves can be twisted apart quite easily, and replaced when the work is done. Solder in thin sticks can be held as shown in the drawing, whilst thicker stuff fits nicely into the hollow jaws of the peg. When one is making joints the solder is held conveniently by the peg, and one can take the required blob on to the bit of one's iron without letting go one's hold of whatever is being joined. Many other uses for this handy little contrivance will suggest themselves to the man who makes a hobby of constructing wireless apparatus. A further refinement easily carried out is to make a hollow in the top of the wood block to receive a small tin containing liquid or solid flux. One then has everything at hand, and need never experience the bother of making a frenzied search for solder or flux when the critical moment arrives. Both of these things have in the ordinary way a knack of hiding themselves, but when a third hand is used they are always to be found when they are required.



How the "third hand" is made.

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Complete kit of components......	£1	16	0
Engraved panel drilled complete		5	6
Cabinet to fit..........................		10	6

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Complete kit of components......	4	17	6
Cabinet to fit		7	6

The "P.W." 2-Valve

	£	s.	d.
Complete kit of components.. ...	1	18	0
Engraved panel drilled complete		8	6
Polished cabinet to fit	1	1	0

The P.S. 1-Valve Reflex

	£	s.	d.
Complete kit of components......	2	13	0
Engraved panel drilled complete		6	6
Polished cabinet to fit		4	6

The Twin-Valve

	£	s.	d.
Complete kit of components... ..	3	6	3
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Engraved panel drilled complete	1	3	0
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When all parts are bought with panel a Marconi Royalty of 12/6 per valve holder must be remitted with order

Jim Vesey builds the Modern Wireless Special Five—

A few days ago I ran into Jim Vesey in the Strand. "I want you," he said, "to come over to Golders Green one evening next week to see my new set." "What, another new one?" I asked, for Jim has made so many that I lost count. "Yes," said he, "but this one is a winner. Bournemouth on the Loud Speaker without a trace of 2 L O—how's that for selectivity?" "Easy," I said, with a chuckle, "when London has closed down." "No, don't be silly—I have really built a selective set at last, and if you come along I'll show you how it's done."

Of course, with my curiosity thus whetted I couldn't resist going over to Golders Green to see this wonderful set. "Here you are," said Jim, pointing to an imposing-looking five-valve set. "Yes," I replied, but I came to see the one you built." "That is the one," he said, indignantly. "Except for the cabinet, which cost three guineas, I built up the whole set." I hastened to congratulate him and smooth his ruffled feelings. "Splendid," I said, "it is a better-looking set than my neighbour, Alec Hurley, paid £43 for last month." "And I'll bet it gives better results," cut in Jim, as he lifted up the lid and exposed the rear of the panel.

"What peculiar-looking coils!" I remarked. "Yes," he replied, "they are the little fellows that enable me to cut out 2 L O, and get Bournemouth on the Loud Speaker. Pass me that H.T. Battery and we'll see what's on." He connected up, adjusted the rheostats and plugged in the Loud Speaker. "London calling," said the voice, "Mr. Walter Hyde will now sing 'Vagabond' by John Ireland." The song began, "Now listen," said Jim, as he rotated the three dials a few degrees to the left. "In three minutes the Bournemouth Orchestra will play 'La Berceuse,'" came a voice from the Loud Speaker. "There," said Jim, "now be convinced."

"Well," I had to admit, "it is a good job I heard it myself as I should not have believed it possible to cut out 2 L O as close as this. Tell me, how long did it take you to build this set?" "Two evenings only," he said, "one to assemble the components and one to wire up." "But what about the drilling and cutting of the panel?" I asked. "Oh, you don't need to worry about that—do as I did—send to Peto-Scott's for a complete kit. It comes already for assembly with panel drilled and engraved—everything down to the last screw. All the lot cost me only a ten-pound note." "Good heavens! that's cheap," I said. "Yes," he replied, with a twinkle in his eye, "and if you make a mess of it they'll put you right for a few shillings! Just send for a copy of their Pilot Manual * and read all about it."

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   1. Sets for Telephone Use.
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   (NOTE.—For the same number of valves, the telephone set will give longer range, while the loud-speaker set will give louder signals, but the range will be shorter.)

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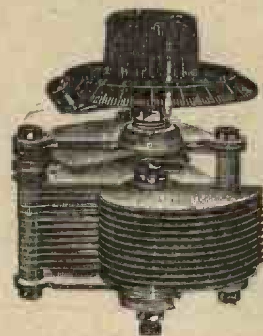

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W.C.130/5	7/-	W.C.147/5	10/-
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Smooth Reaction Control

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

WHEN constructing a set having three valves only, there are several types of circuit which may be employed. Of these the principal classes are:

(1) Detector and 2 L.F.
(2) H.F., detector, and L.F.
(3) Circuits employing a crystal for rectification, the valves being arranged partly as H.F. amplifiers and partly for L.F. purposes. This class includes
(4) Reflex circuits.

The third class, however, cannot really be considered a three-valve circuit owing to the introduction of the crystal. Thus, unless we adopt a reflex arrangement of the three valves themselves, in which case the circuit requires careful design to obtain satisfaction, we are reduced to a choice of the first two classes.

High Frequency Amplification

The second class has become popular lately owing to the large number of European stations which have recently commenced to broadcast. High-frequency amplification, however, is not very efficient (although present-day developments are causing great improvements in this direction), and it has the further disadvantage that two tuning circuits are generally required.

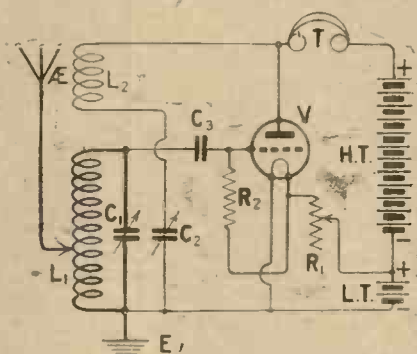


Fig. 1.—A popular type of condenser-controlled reaction circuit.

The disadvantage of having no high-frequency amplification lies in the fact that the reaction adjustment is much more critical if the more distant stations are required, and with a poor reaction adjustment a set employing no high-frequency amplification would probably give very disappointing results.

Reaction Control

The desirable features in a reaction circuit are threefold.

(1) The increase of signal strength as the reaction is increased must be smooth and progressive—*i.e.*, the set should not suddenly start oscillating with a "plonk."

(2) There should be no backlash. This means that if the reaction is inadvertently increased to such a point that the set oscillates, then the slightest movement in the reverse direction should cause the oscillation to cease.

(3) The variation of the reaction control should not affect the tuning of the set to any appreciable extent.

Unruly Oscillation

The first two of these features are very important, not only from

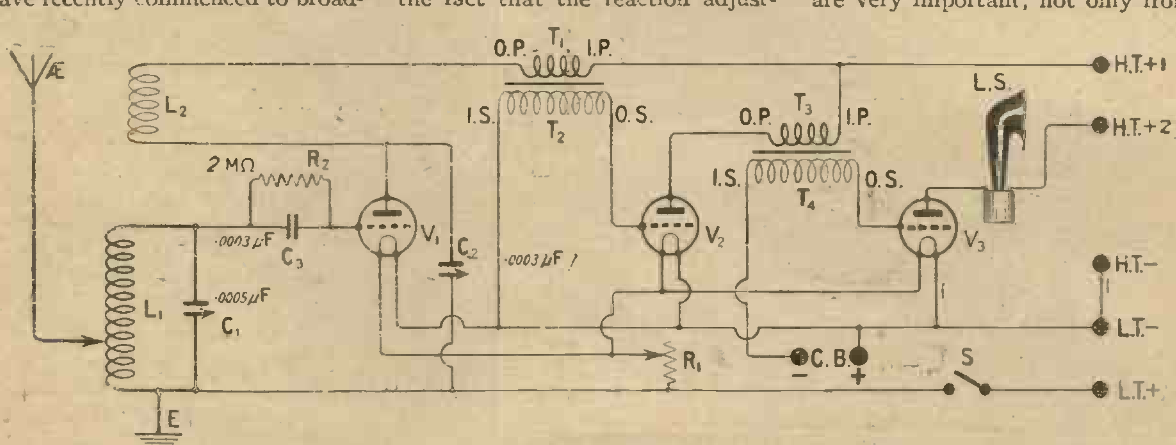
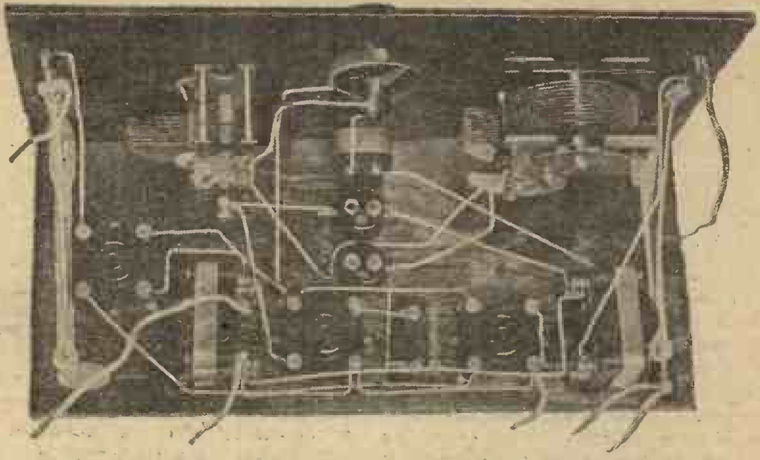


Fig. 2.—The circuit employed in the three-valve receiver, in which C_2 controls the amount of current flowing through the reaction coil L_2.

A Three-Valve Loud-Speaker Receiver

Using Plug-in Coils.



A photograph of the interior showing the wiring and flexible leads

the point of view of one's own satisfaction, but also from regard to one's neighbour. A set which slips in and out of oscillation in a wild and unruly manner causes all sorts of interference to the other listeners in the vicinity, whereas a set which is smooth in control only oscillates very feebly when it does commence to do so, so that the interference caused by inadvertent oscillation is minimised.

Effect on Tuning

These two points can be controlled almost entirely by a suitable adjustment of the filament brilliancy and H.T. voltage of the valve in question. This was explained in an article on Reaction Control Circuits in the November, 1925, issue of *Modern Wireless*.

The question of alteration of tuning is not so simple, however. The simple method of obtaining reaction by means of a coil in the anode circuit which is moved relative to the grid coil, causes variations of tune, because the effective inductance of the grid coil is altered by the presence of the other coil, the extent of this variation depending on the position of the reaction coil.

Thus the movement of the reaction coil causes variations in the tune of the grid circuit.

Condenser Control

This defect led to a type of circuit which has become very popular, in which the reaction coil is fixed relative to the grid coil, but the current through it is controlled by a suitable means. Such a circuit is shown in Fig. 1.

Here some of the high-frequency current in the anode circuit flows through the reaction coil, and then through the condenser C_2 back to the filament. The amount of such current, which will, of course, produce reaction if the coil L_2 is in the right direction, depends on the value of the condenser C_2. If this is small, its "impedance" to the high-frequency currents is large, and little current flows. As the condenser is increased the current increases, and with it the reaction effect, until finally oscillation is produced if the coil L_2 is large enough.

This circuit will give very good results if suitable precautions are taken. The coil L_2, however, must not be too large, or very large variations of tune will occur. In fact, unless correctly proportioned values are used throughout the circuit, it is possible to obtain quite disappointing results.

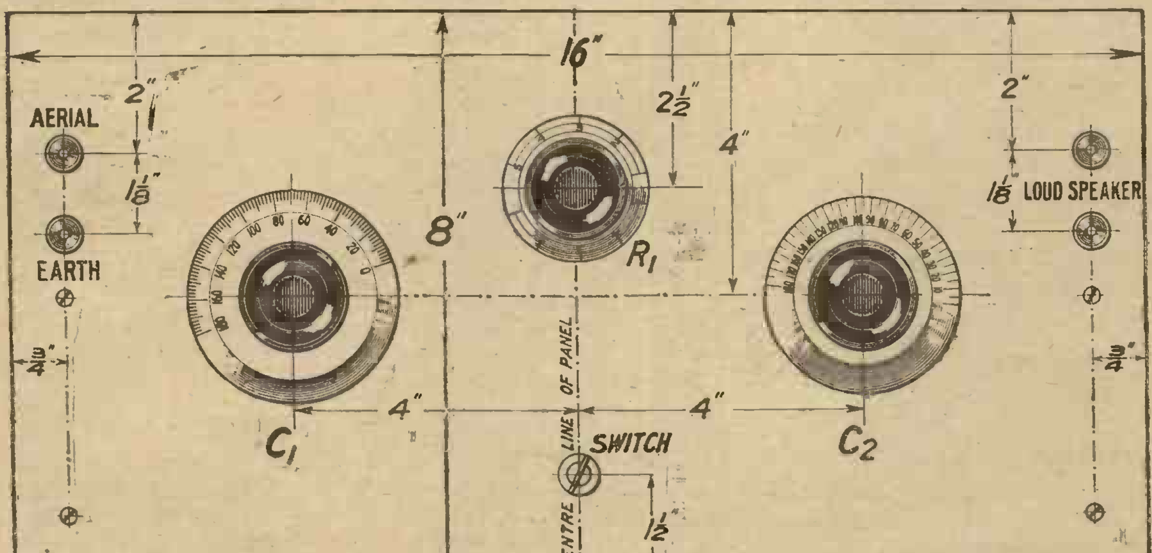


Fig. 3.—The panel layout. A full-size drilling blueprint No. C 1027A, may be obtained, price 1/6 post free.

Another Method

A modification of this form of control is shown in Fig. 2, which is the circuit finally adopted. Here the reaction coil, as before, is fixed, the current flowing through it being controlled by a by-pass condenser C_2 connected across the anode and filament of the valve. Such a condenser forms an easier path for the high-frequency currents than the route through the coil L_2 and the transformer, the larger the condenser the greater being the by-passing action.

There are other methods of condenser control, one of these being the shunting of the condenser across the primary of the intervalve transformer T_1 T_2, and the particular set described here is capable of being readily modified from one type of circuit to another.

High Tension Battery

There are one or two other features about the set in question. In order to simplify controls, only one filament resistance has been provided. The instrument is designed to operate with dull-emitter valves so that such a step is practicable.

Arrangements are made to house the grid-bias batteries inside the case, and also the H.T. battery if not too large, while the L.T. leads are taken through the back.

It should also be noted that the negative of the high-tension battery is connected to the negative of the low-tension battery, and not to the positive as has become the general practice. The connection to the positive is satisfactory when bright-emitters are employed, and in such there is a definite gain, owing to the slight extra anode voltage so obtained.

With dull-emitter valves, however, more particularly of the 60 milliampere class, there are definite disadvantages. The anode current of the valve flows between the anode and the negative of the filament. If the H.T. battery is connected to the positive of the L.T., then this anode current will flow through the filament, and this will cause slight variations in the filament current, which give rise to instability in working.

Panel Layout

The layout of the apparatus on the panel is very simple. All four components are of the one-hole fixing type, so that this portion of the work is quickly accomplished. The components required for the complete set are:—

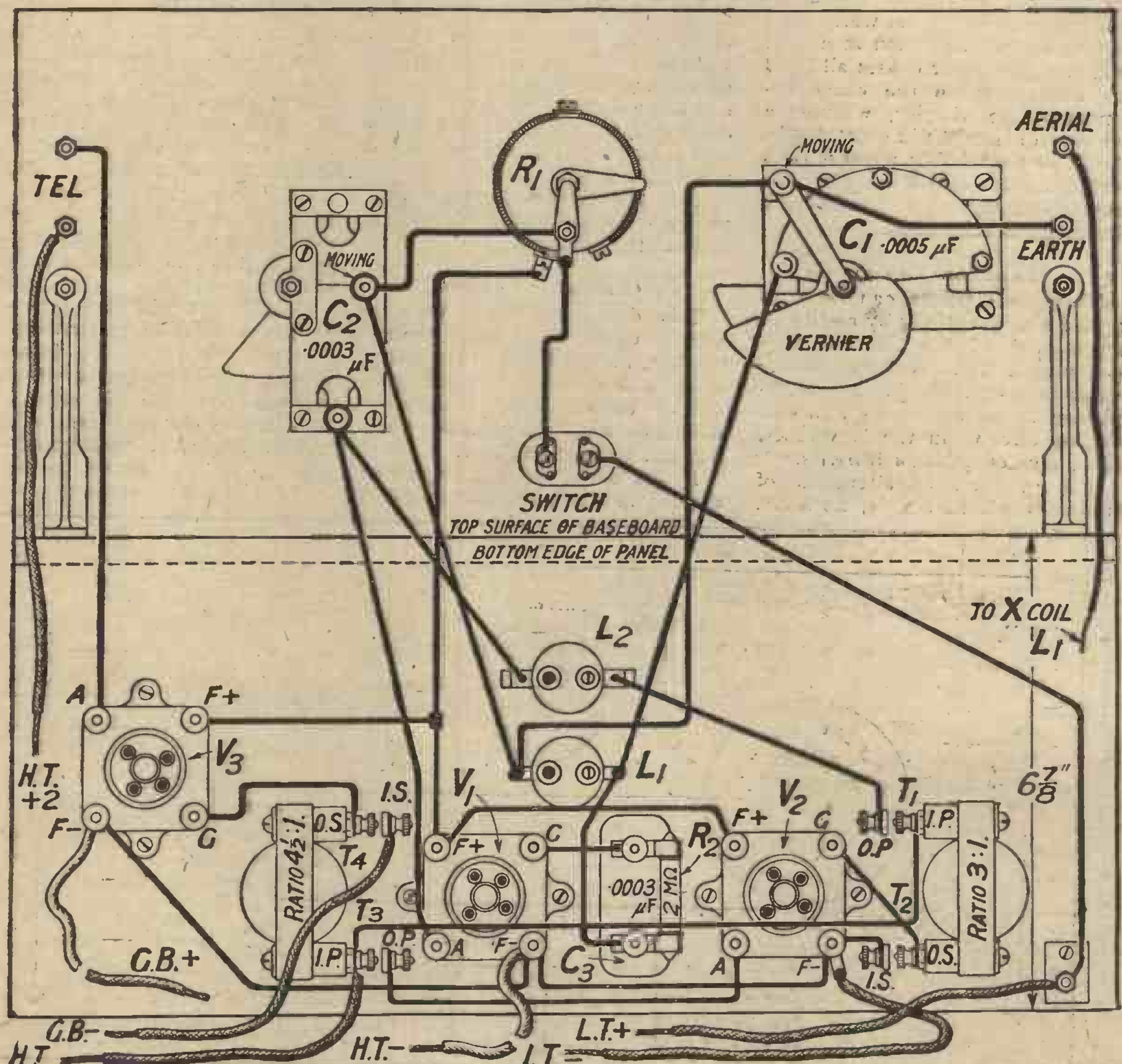
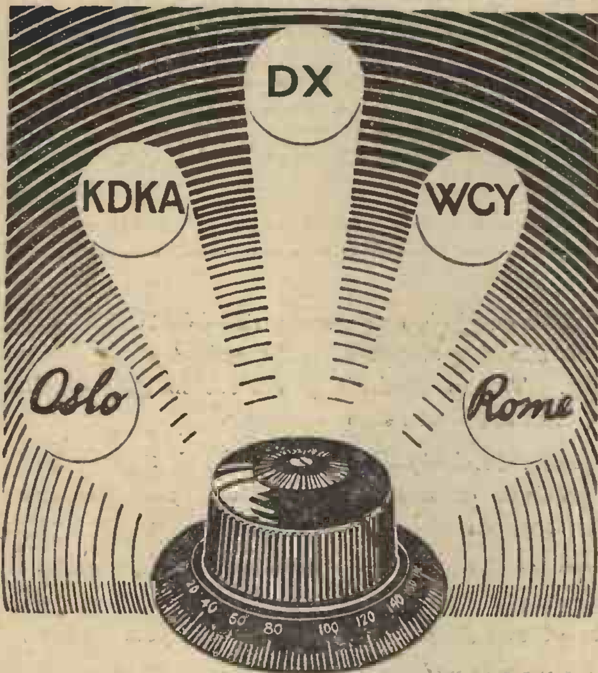


Fig. 4.—The wiring is not very complicated, but for the benefit of readers Blueprint No. C1027B can be supplied for 1/6 post free.



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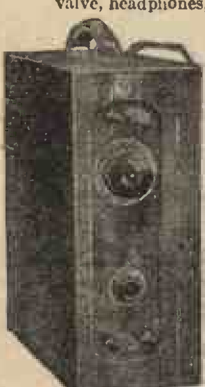

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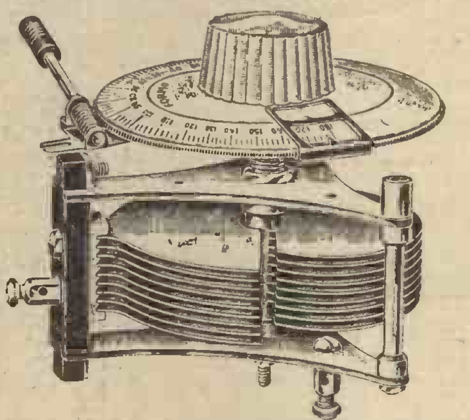

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One panel 16 by 8 by $\frac{3}{16}$ in. ("Radion" black, American Hard Rubber Co.).

One baseboard 16 by 7 in. (W. H. Agar).

One cabinet to suit panel, 10 ins. deep (W. H. Agar).

One ·0005 μF. variable condenser with vernier (Ormond).

One ·0003 μF. variable condenser (Jackson Brothers).

One dual rheostat (McMichael).

One "Radioloc" switch (Igranic).

Two "Royal" intervalve transformers (see text for ratios) (R. A. Rothermel).

Three vibratory valve-holders (Benjamin Electric).

Two board-mounting coil-holders (L. McMichael, Ltd.).

Two panel brackets (Burne-Jones & Co.).

One grid condenser (·0003 μF.) and leak (2MΩ) (Dubilier Condenser Co.).

Four terminals.

Quantity of "Glazite," flexible wire and tags.

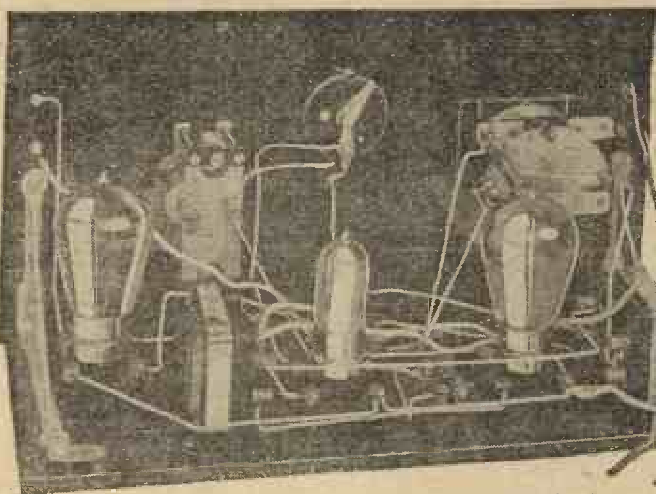
One packet Radio Press panel transfers.

Baseboard Layout

The next step is to lay the requisite components out in position on the baseboard. This can be done quite readily from the drawing given in Fig. 4, the only point to note being that the rectifier is the centre valve of the three. This was done in order to keep the high-frequency leads short. It will be seen that with this arrangement the tuning and reaction coils are next to the appropriate valve, the tuning condenser is on the left of the panel and the reaction condenser on the right. This construction also keeps the low-frequency transformers well apart.

Intervalve Transformers

The actual make of transformers employed is relatively unimportant if suitable ratios are obtained, but I have found the ones used in this set quite good. If the detector valve is one having a high impedance and a high amplification factor, as is usually the case, then the first transformer should have a ratio of about 3 to 1, while for the second



The disposition of the various components is well shown in this back-of-panel view.

stage using ordinary G.P. or, better still, L.F. valves having a lower impedance, a ratio of 4 or 5 to 1 will be suitable.

I actually used a 3 to 1 in the first stage and a 4½ to 1 in the second stage.

Wiring Up

On the panel the filament circuit may be wired in part, and on the baseboard all the filament circuits and the L.F. circuits may be wired almost completely.

The panel may now be mounted in position relative to the baseboard and the wiring completed. The only points to note are that the moving plates of the variable condensers both go to the filament side of the circuit. There will be no difficulty if the wiring diagram is followed exactly.

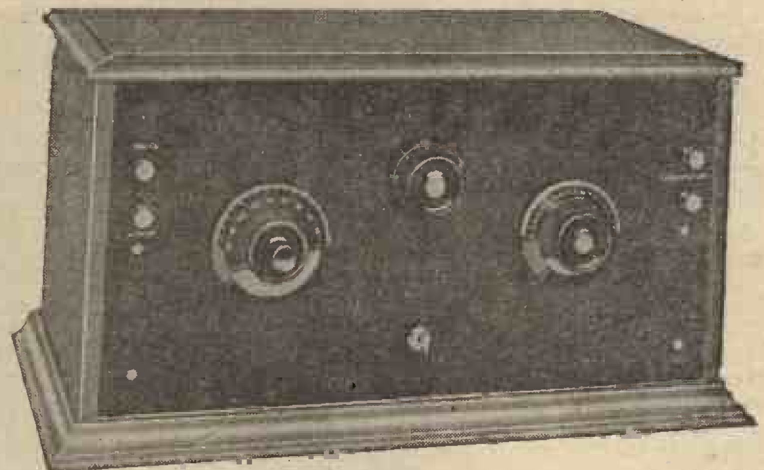
Operation of Set

The operation of the set is comparatively simple. First of all connect up the L.T. leads, insert the valves, and test out the filament circuits. Then connect up the H.T. and plug in suitable coils for the reception of the particular station desired. Suitable sizes are given in the accompanying test report. The set may then be tuned in to the local station, and the reaction control tested. It will be found that decreasing the condenser increases the reaction, and the filament brilliancy should be suitably adjusted at this stage until the control is smooth and free from backlash and plonking. Care should be taken not to let the set oscillate during testing, and it is preferably when carrying out these preliminary adjustments to mistune from the local station so as to cause as little interference as possible in the event of a "howl."

Use of Aerial Series Condenser

In many cases, particularly if a large aerial is employed, an improvement is obtained by connecting a small fixed condenser in the aerial circuit before connecting to the X coil. A value of ·0001 μF to ·0003 μF is satisfactory, the actual size depending on the aerial.

For higher frequencies I used 50X coil for the grid circuit and 60 for the reaction. A slightly larger reaction coil is required in some circumstances. The coils for 5XX were 250X and 200 respectively.



The completed set is very handsome. The key switch can be seen below the rheostat.

On test, 2LO, 6BM, 5SC, 5IT and 2BD were all obtained on the loud-speaker, as also were Radio-Toulouse, Ecole Superieure, Hamburg and other unidentified stations. 5XX and Radio-Paris were tuned in at good strength.

An interesting point is that, when the filament current is correctly adjusted, the reaction adjustment remains "put" over a wide range of frequency.

FREE! and full of wiring diagrams

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SELECTIVE AND SILENT

Fulstop
VARIABLE CONDENSER

J. H. NAYLOR, LTD., WIGAN

Do You Know—?

By C. P. ALLINSON

That a soldered joint may often look all right on the surface, and yet be faulty. This may be due to what is known as a dry joint. In order to obviate any risk of a dry joint resulting when soldering connections to terminal shanks (where these faults most frequently occur) the shank should be carefully cleaned with a file before tinning.

* * *

That nickelled metal is particularly likely to be the cause of a dry joint, as nickel does not take solder well. The nickel plating should, therefore, be removed with a file before commencing work.

* * *

That copper wire at the temperature of boiling water has a resistance which is 30 per cent. greater than its resistance at ordinary temperatures. A rise in resistance as great as 10 per cent. may be experienced on a very hot day, as compared to a cold day.

* * *

That the letters S.O.S., popularly supposed to represent the words "Save Our Souls," actually have no such significance, but have been arbitrarily assumed as the distress signal, being selected by the International Radio Telegraphic Conference, which was held in 1908 in Berlin.

* * *

That valves occasionally go "soft." When this occurs they are useless for amplifying, and a high plate voltage will produce a blue glow inside the bulb. They are, however, excellent as detectors when used with a low plate voltage in the region of 20 to 30 volts.

* * *

That leads going to a set from batteries should be disconnected at the battery end first. If this is not done, should the bare ends of the leads touch, the battery will be short-circuited, thus possibly damaging it.

* * *

That angle-brackets can, in an emergency, be made from old strips of ebonite. Place a piece of ebonite in boiling water, and it will become quite soft, so that it can easily be bent to the desired angle. It should be fixed in some way till cold, when it will be found to have set quite hard again.

That it is well worth while to clean valve pins and legs occasionally to ensure that a perfect contact is being made. This may be done with a little fine glass paper. The same procedure should be followed with plug-in coils and coil-holders.

* * *

That records show that severe atmospheric disturbances are experienced whenever an earthquake occurs. No theory has as yet been advanced to explain this fact.

* * *

That high frequency currents are used in furnaces for producing very high temperatures. Temperatures exceeding those produced in arc furnaces have resulted. The metal to be melted is placed in a crucible or furnace, round which is placed an inductance carrying a very heavy high frequency current. This results in eddy currents being induced in the metal, which are great enough to heat and melt it at an exceedingly high temperature. This form of furnace has the added advantage of heating the metal only, no energy being wasted on heating the furnace first.

* * *

That it is better to use a master filament resistance than a snap on-off switch, as it is better for the life of the filaments. With the switch the current is suddenly turned on, thus causing sudden expansion of the filament, and similarly sudden contraction when switched off, while the resistance turns the valves on and off gradually, eliminating sudden stresses and so preserving them.

* * *

That one of the best double crystal detectors is the zincite-tellurium combination. Not only is this a very sensitive detector, but it is also quite stable, as a fair amount of pressure may be used.

* * *

That a small single wire aerial is far more selective than a "big twin," and that in actual practice only a slight drop in signal strength from distant stations may be observed.

* * *

That a reliable variable grid leak is of very real assistance in long-distance reception, not only in obtaining maximum signal strength, but also smooth reaction control.

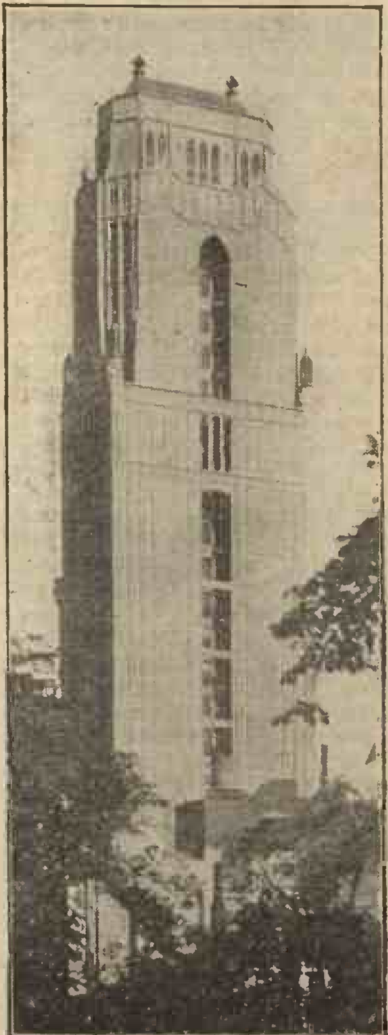
That an emergency grid leak may be made from a match stick cut in half lengthwise (so as to make it thinner), and dipped in Indian ink. When dry it may have a resistance of about one megohm.

* * *

That if accumulator acid is spilt on cloth some ammonia should be poured over it at once to neutralise the acid. If no ammonia is handy, bi-carbonate of soda will do. It should be sprinkled on, and then moistened with a little water. Keep adding fresh bi-carbonate till the fizzing stops.

* * *

That if ammonia is used the cloth should be thoroughly washed as soon as possible, for sulphuric acid is a strong acid and ammonia only a weak alkali. Otherwise the material will be corroded in time by the action of the acid.



The Bush Building in New York, where the American offices of Radio Press, Ltd., are situated.

Selectivity and "Range"

(*Continued from page 245*)

The Coil Holder

For making connections to the three-coil holder, flexible leads are soldered to the shanks of the aerial and earth terminals, and brought out through holes in the panel. The earth-terminal lead goes to one side of both the fixed-coil and one of the moving-coil holders. The other side of the fixed coil is connected to A_2, while the lead from A_1 is taken to the remaining point on the moving holder. Flexible leads are permanently attached to the second moving holder, which is for the reaction coil. The other ends of these are to be connected to the two reaction terminals. These reaction-coil leads must be reversed when the change-over is made from resistance-capacity to tuned-anode coupling or *vice versa*.

Alternative Arrangements

An alternative method of connecting the leads to the reaction coil is that shown on the blueprint and Fig. 2. There two bolts are inserted in place of the terminals for the reaction connections, and the stiff wire leads inside the cabinet are soldered to the ends of these bolts. To the same points are soldered the ends of two flexible leads, and these leads are brought out through holes in the panel. Spade tags may be fitted on their free ends for insertion under the connecting bolts on the coil-holder.

A Precaution

When terminals are used, as shown in the photograph of the receiver, it will be found a wise precaution to disconnect the H.T. battery from the receiver when the reaction coil is to be reversed. If this is not done, accidental contact between the spade tag removed from the terminal connected to the detector valve anode and the earth terminal, the other spade tag being still in position, will cause a short-circuit of the high-tension battery.

Test Report

The receiver was tested on two separate aerials, the same valves being used in each case—namely, a Cossor red top bright emitter and a Marconi R5V, the latter for detector. The first test was carried out on a short indoor aerial in N.W. London, about one and a half miles from the London station. In this situation it is with direct aerial coupling practically impossible to eliminate 2LO's transmission altogether and to receive more distant stations. With the help of the untuned aerial circuit, it was found possible to reduce the signals from 2LO sufficiently to receive Bournemouth, though of course signals were not strong on such an aerial system. After the London station had closed down, Edinburgh was picked up at quiet telephone strength.

A Test in Hampshire

A subsequent test was carried out on a moderate outdoor aerial, 60 ft. long, about 15 ft. high, in a valley of the Hampshire Downs. With direct coupling of the aerial, Bournemouth (about 40 miles) was heard at good full telephone strength, sufficient to drown any spark signals from coastal and ship stations. Loose coupling gave a slight reduction in the strength of signals from 6BM, with a marked decrease in spark mush and similar interference. Other British stations heard were London, Cardiff, Manchester and Newcastle, all at readable strength. The Ecole Superieure (Paris) was excellent, and the programme from EAJ7 in Madrid was received at good strength, the announcer's voice being particularly clear. On the longer wavelengths, using resistance coupling, Daventry and Radio-Paris were both received at good telephone strength. As both these stations were at some distance from the locality where reception was carried out, no great advantage was gained by using the untuned aerial circuit. In situations close to Daventry, this arrangement would no doubt be of some advantage.

Direct Coupling

When direct aerial coupling was in use, the circuit appeared quite stable without the use of stabilising potentials on the grid of the H.F. valve. Some adjustments with the potentiometer were necessary when the aerial was connected to A_1 instead of A_2, owing to the decreased damping of the grid circuit of the H.F. valve.

The First Low-Loss H.F. Transformer

This H.F. Transformer (patent applied for) represents an entire departure from all other designs. In selectivity and amplification it is far ahead of the ordinary barrel type of Transformer. Its primary is aperiodic and its exclusive design and shape make it the last word in low-loss and efficiency. The secondary is air spaced on a grooved ebonite former, and each one is made to an exact standard, resulting in the condenser scale reading being practically identical in each successive stage of H.F. amplification. The main feature of this new Peto-Scott production is that the capacity coupling has been reduced to an absolute minimum resulting in an exceptional degree of selectivity.

No. 1. 250 to 550 metres, with base 15/-
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As chosen by Mr. P. W. Harris for the "Modern Wireless" Special Five

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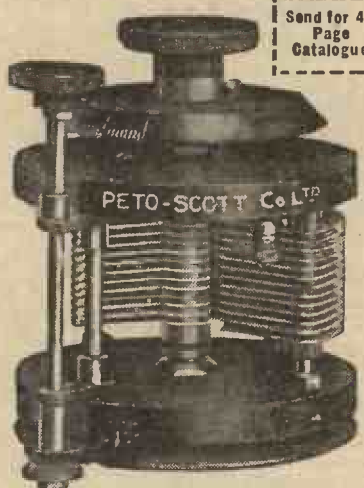

No backlash—no gear wheels but a delightful smooth vernier movement always

This new Peto-Scott de luxe is the ideal condenser—built by a man who knows how imperative it is to use a **slow motion for all the plates** and not to use a separate vernier plate. Its slow movement is obtained by means of a smooth 8 to 1 **rubber** friction gearing. Only solid ebonite is used—no cheap substitutes.

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Just now experts are debating this serious question of low loss. When dealing with weak signals you cannot afford to take risks with your panel. Indeed the panel can be said to exert a greater influence over your set than any other part. Radion is recognised as being the highest grade of panel in the world.

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Where the Listener Scores

By

CAPTAIN A. G. D. WEST, M.A., B.Sc.

IN aiming at perfect broadcasting, which means perfection in the whole chain throughout from the microphone in the studio or hall to the loud-speaker or head telephones at the receiving end, the B.B.C. is trying to give listeners an opportunity of hearing concerts and speakers exactly as if they were situated in the position of the microphone. That is to say, in most cases, if receiving sets were designed to be practically distortionless and quite faithful in reproduction, the results should be exactly as though the listener himself were placed exactly where the microphone is, thus having the opportunity of enjoying the programmes in a privileged manner. In the other cases the listener is even better off, because steps are taken sometimes to improve even on what the microphone itself alone would pick up.

To go into this in further detail, I will mention a few examples.

After-Dinner Speeches

The first case to which I refer is when certain speeches are broadcast from a dinner. If the listener himself were at the dinner, he might be one of the privileged few sitting at the head table or fairly close to the speakers taking part. But this privilege is confined to only a few, and the others who are present at the dinner often have difficulty in hearing what the speakers say on account of the general noises in the hall and the clatter of dishes and the clinking of glasses; half of them usually have to occupy a strained position in turning round to watch the speaker and straining their ears so as not to miss any of his words. On the other hand, the microphones present at the dinner are placed in very close proximity to the speaker. The listener in his home at Balham, or in his cottage in the north of Scotland, can sit in his armchair in front of the fire with phones on or listening to his loud-speaker, and thus hear the speech with just as much effect as if he were actually a few feet away from the speaker at the banquet itself.

What an advantage it is to the listener to hear speeches in this manner! The broadcast engineer, wherever he goes, takes his microphones and places them in a privileged position, and thus brings the nation of listeners into the closest possible contact with events of this nature that may be taking place.

Two Striking Examples

It has often been brought to my notice how striking this result may be. For instance, when broadcasting a military service from York Minster several months ago it was remarked that, although the preacher's sermon could not be understood at a distance of more than about twenty feet from the pulpit, every word was heard in detail by those who cared to listen in to the broadcasting of this event. Knowing the bad acoustics of this cathedral as far as listening to sermons is concerned, a local enthusiast even installed a receiver and loud-speaker in one of the smaller York churches, and by picking up Daventry on his set gave to the congregation of that church a much clearer conception of the military service than if they had been in the cathedral itself. In fact, they had heard better at a distance of two hundred miles (via Daventry) than if they had been actually inside the cathedral.

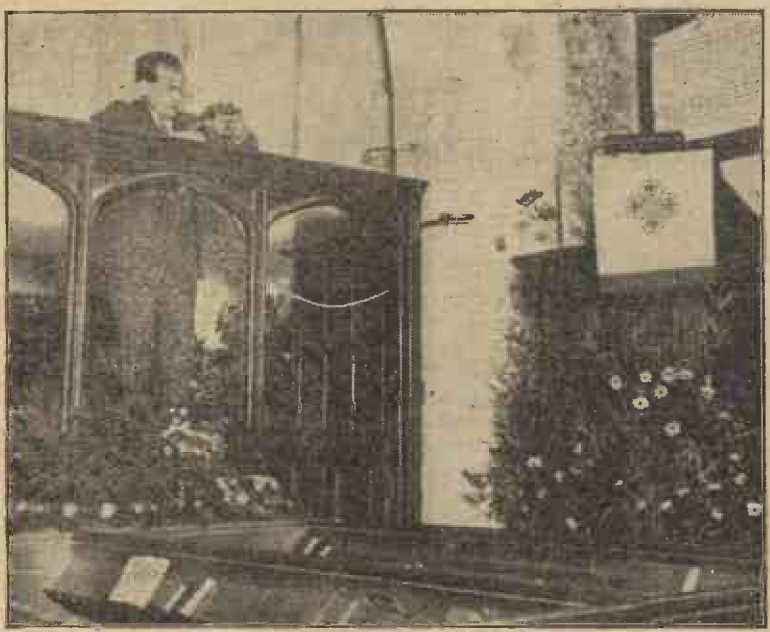
Another similar thing happened when a resident in Canterbury said he had been living in Canterbury for forty years, and had attended cathedral services, and had never heard a sermon so clearly as when he listened in to the Archbishop's

The Author and Canon Larken at Crowland Abbey on the occasion when the famous bells were broadcast.

address from the pulpit. This aspect of broadcasting has perhaps not been so much appreciated as it should have been.

Unsatisfactory Acoustic Properties of Halls

Now, turning to another view of this matter, there have been cases when certain concerts have not been musically satisfactory to members of the audience in certain parts of the concert hall or the theatre, on account of the unsatisfactory acoustical properties of these places. For instance, the hall itself may be very echoey, or the concert-goer, in buying his ticket at the last moment, may find that the only seats left are those near the drums or double basses. In these cases, if the concert is being broadcast, and the broadcast engineer has an opportunity at rehearsals of finding the best places to put his microphones, the late concert goer would be much more happy musically if he went home, and tuned in on his receiving set, provided that the latter were capable of giving good reproduction.



With the microphone so close to the pulpit, not a word of the sermon is missed by the home listener.

A Balanced Performance

The problem of transmitting satisfactorily musical concerts from halls or theatre transmissions is continuously being attacked by the broadcast engineer. In time, perfection (according to our present ideas, at any rate) should be obtained in every transmission of this type. The aim is to give every listener, if he provides himself with a receiver and reproducing apparatus capable of giving faithful quality, a musical performance so well balanced and so acoustically perfect that he will in every case listen to it with pleasure.

Some Acoustic Effects Desirable

It is well known, and it has been more or less proved by practical tests, in which well-known musicians have taken part, that for any given type of musical transmission, there is a certain very definite amount of acoustic effect required to give the most desirable and the most pleasant result.

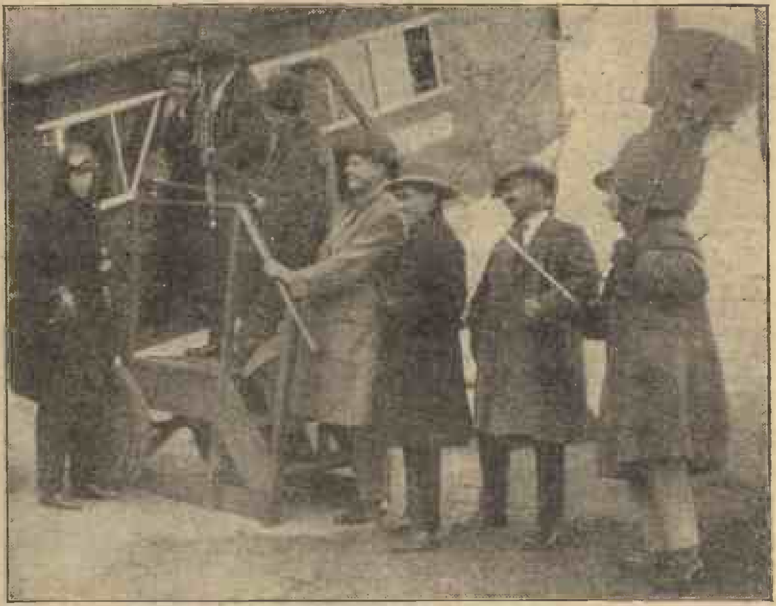
Pure Echo

Considering the latter first, this effect depends entirely upon the construction of the halls or studios where the transmission takes place. The effect has two distinct forms. First of all pure echo, that is to say, every sound is heard by anybody in the room where the transmission is taking place first of all direct, and, secondly, by a direct reflection from one or more of the walls. This rarely occurs to an objectionable extent in halls in general use, because to be really serious and distinct the reflecting surfaces require to be large and flat, and usually the decorations in the halls do not satisfy this condition.

Reverberation

The second effect is that which is called reverberation, and this is due to a general mingling together of the sound, as it is reflected from all the various walls in large or small proportions, the result being that any definite impulse of sound is heard followed by a prolongation of sound.

Music in a perfectly dead room and music in a hall where reverberation is large can be compared respectively with piano playing without and with the loud pedal on. It is, of course, obvious that no direct echoes are necessary, in fact, they must be avoided.

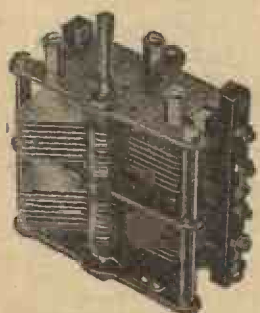


Serious problems in acoustics arise when an orchestra broadcasts in a confined space, such as the cabin of an aeroplane.

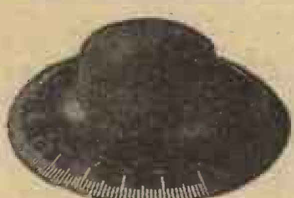
The Type of Music

As regards reverberation, it has been found, as mentioned before,

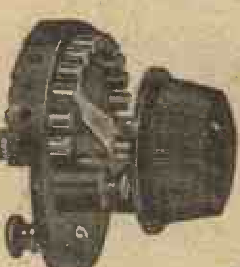
KING IN RADIO



King-Cardwell Condensers manufactured under licence from the A. D. Cardwell Manufacturing Corporation



Dials in black bakelite



Inductance and "B" battery control switch

King Components Are Carefully Made

THE success of radio reception depends largely upon the quality of the components—if one is faulty, the whole receiver is at fault.

"King in Radio" Components are made with the utmost care from the very best materials obtainable. The designs are the best—when the best is made by some other manufacturer, as in the case of Cardwell Condensers, we manufacture it under licence from the original manufacturer.

All the facilities of an eight-acre plant equipped with the most modern machines for the making of radio components help to maintain the "King in Radio" high quality standards. Each component goes through a thorough system of inspection before it leaves the plant.

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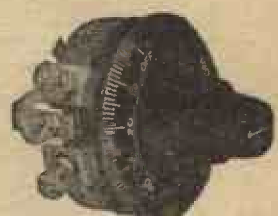
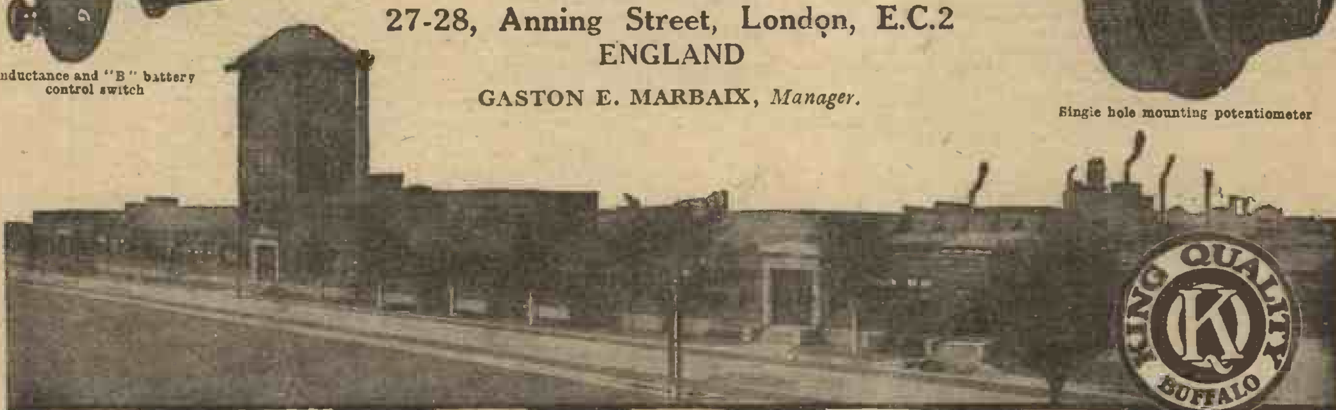


Single hole mounting rheoswitch

Single hole mounting potentiometer



What's holding you down?

Just one thing is holding you down. It isn't that you "never had a chance," or that somebody else "has all the luck," or that your employer "doesn't like you."

No—it is none of these. It is lack of training. Deep down in your heart

YOU KNOW

that the reason why others are getting ahead is that they can do things you can't. They know more because they have been trained.

Why don't you study some one thing and get ready for a real job at a real salary? Think what that would mean to your family as well as yourself! The I.C.S. can prepare you in your own home and in your own time for something much better than you now have.

The I.C.S. originated spare-time technical training by post 34 years ago, and is by far the largest institution of its kind in the world. It has teaching centres in eleven countries, and students in fifty.

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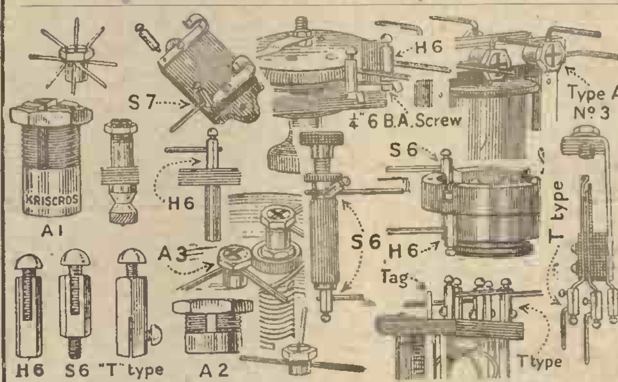

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The Vokes-McLaughlin One Control

Every station within range comes in by turning one dial

This set is giving splendid results all over the British Isles—results which were unobtainable with other types of Superheterodyne.
Mr. W. of Edinburgh has 50 stations logged on his dial.
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Messrs. M., London—We are getting 29 stations within a mile of 2LO.

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As easy to build as the average 4-Valve Set. Only one main tuning Control. Reproduction is excellent and selectivity all that could be desired.

Price complete kit of parts one Control ...	£19 1 9
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Set complete in mahogany cabinet with all necessary accessories, One-Control ...	£45 0 0
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This set incorporates the famous Precise Super-Multiformer. One instrument which does the work of four. It replaces all long wave transformer in any type or modification of the Superheterodyne circuit. It cuts in half the time and eliminates all trouble in building the Superheterodyne and assures the builder of successful results due to the short connections which are required from the instrument to the respective valve sockets,

thus preventing the experimenter from unconsciously causing undesirable coupling between circuits.
Price £4 17 6

If you are seriously interested in broadcast reception or short wave experiments use the Wade Grounded Frame Variable Condenser. It eliminates Body Capacity. For the ·0005 mfd. type the minimum capacity is the extremely low value of 3·66 mmf, and the dielectric absorption losses at 1,000 cycles with the condenser set at maximum were equivalent to a series resistance of 10 ohms. This gives an extremely low radio frequency phase difference angle showing that the Wade Condenser is a step ahead in low loss design.

Short Wave ·000125	37/6
Tuned Radio Frequency ·00025 ...	40/-
Superheterodynes or Aerial tuning...	42/-

All sizes complete with 4-in. Vernier dial.

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KORACH E-Z-TOON FOOTE MONOSMITH BRANSTON METRO ERLA AJAX MICAMOLD PRECISE WADE KELFORD BARRETT PADEN that a certain definite value of this reverberation is desirable in all music, the amount of the effect depending entirely on the type of

When "Tess of the D'Urbervilles" was broadcast from the Barnes Theatre, one microphone was placed in the fireplace on the stage.

music that is under consideration. I strongly believe that if every musical transmission can be broadcast with just the right amount of effect in every case listeners will be inclined to keep listening to transmissions of a type that they did not previously enjoy.

A Comparison

Music in this respect can be compared with painting. The dull painting where colours are not artistically blended does not appeal to the eye, neither will people look a second time at some of the uncouth masses of brilliant colour which characterize certain of the posters we see in the streets. The two cases are similar to music from the heavily draped studio and the very echoey hall; but people do look again at that combination of light and shade or of colours which has just that right balance that is particularly pleasant to the eye, and which represents a good picture. This corresponds to the acoustically perfect musical transmission.

There is no scientific criterion in either case. The decision rests with the general conception and feeling as expressed by artistic taste.

Progress in Technique

There is a good deal to learn in all this, but I feel sure that in time the whole problem will be solved,

The microphone used at the footlights at the Barnes Theatre.

and the ideal at which broadcast engineers are aiming will be fulfilled, and that full satisfaction and pleasure will be obtained from every musical transmission. Technique is so far developed in this way that there should be no doubt that the broadcast listener will have a very great advantage, from a musical point of view, over the concert-goer, and it is this point of view that I have tried to bring forward, that even now in many cases the listener is at a greater advantage in this respect and will be increasingly so as broadcast technique progresses.

The Low-Loss Reinartz Set

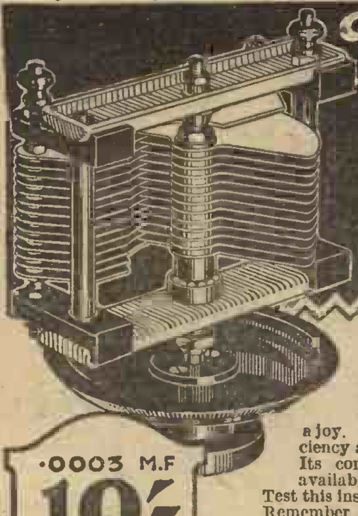
SIR,—So far, I have seen no comments from readers on the low-loss Reinartz one-valve set described by G. P. Kendall, B.Sc., in the September WIRELESS CONSTRUCTOR. It looked so simple in construction that I made it the subject of my first essay in the making of a set—in fact, it is the only valve set I have worked with, which confirms how much of a novice I am—and I thought you would be interested in the results achieved. First of all, on a fairly good aerial, 30 miles from London, it gives excellent tone to a fair-sized loud-speaker, using 78 volts H.T., and 2LO comes through splendidly. On the phones one evening I had Hamburg, Rome, Toulouse, Paris, and, with the loading coil, of course, Daventry and Radio-Paris, these latter stations being particularly easy to separate.

Strangely enough, I have not received any other B.B.C. stations, but I hope to be more successful when I have had more opportunity of studying Mr. Kendall's article in the October CONSTRUCTOR, and have become more accustomed to the tuning of a valve set.

I must congratulate Mr. Kendall on the design of a simple set, which to me seems ideal for the beginner.

Yours faithfully,
GEO. W. BAKER.
Chelmsford.

Waiting for Father Xmas! These tiny tots while away the time by listening-in.



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See also Advt. on page 276.

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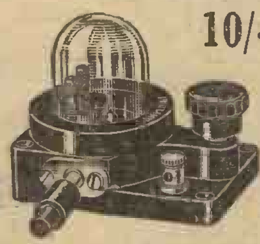

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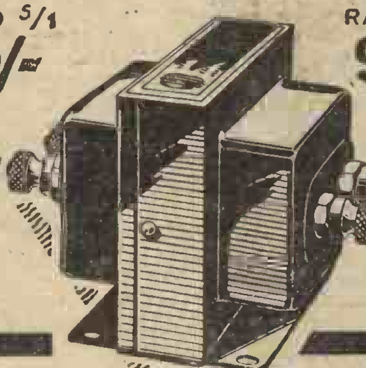

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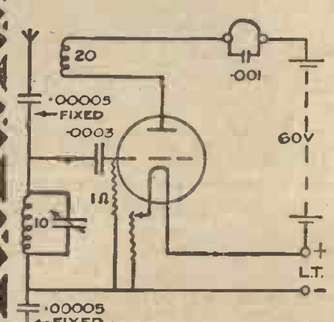

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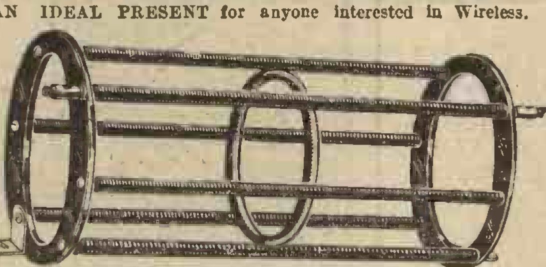

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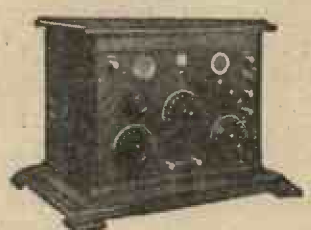

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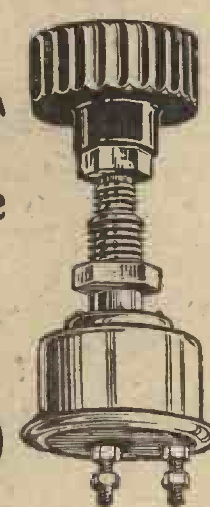

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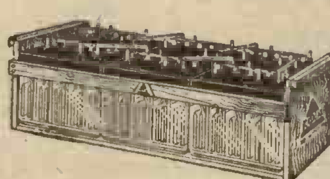

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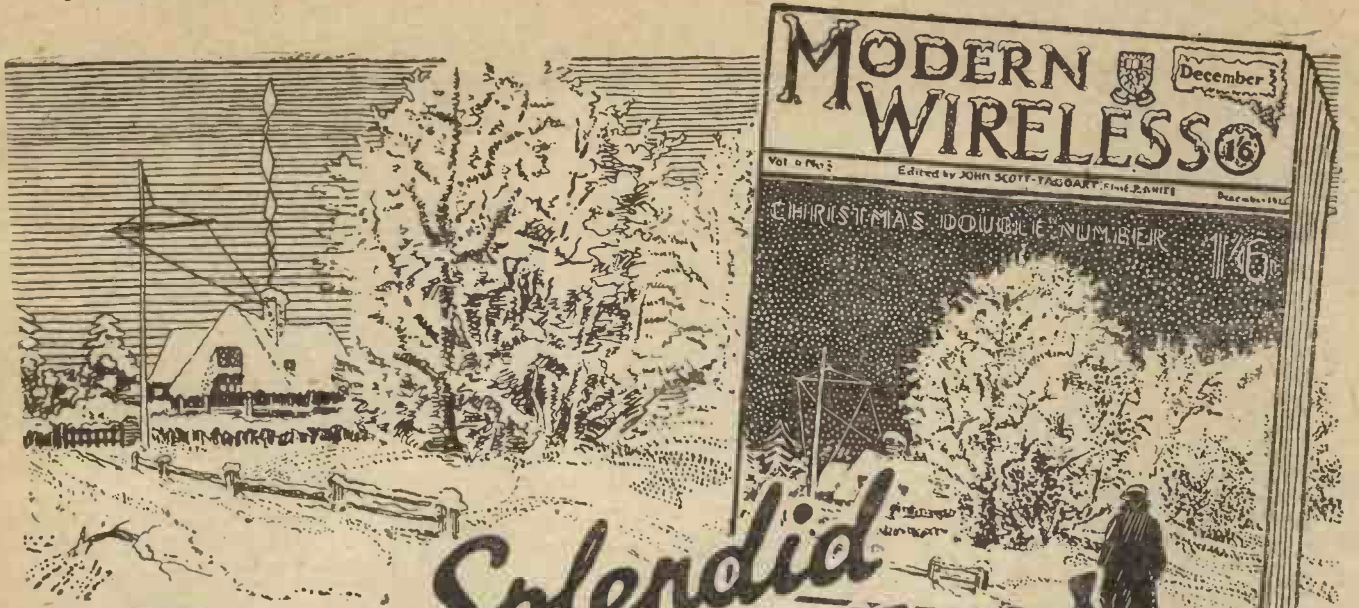

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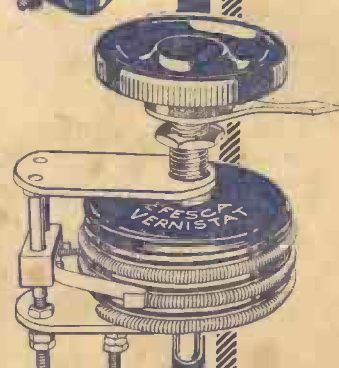

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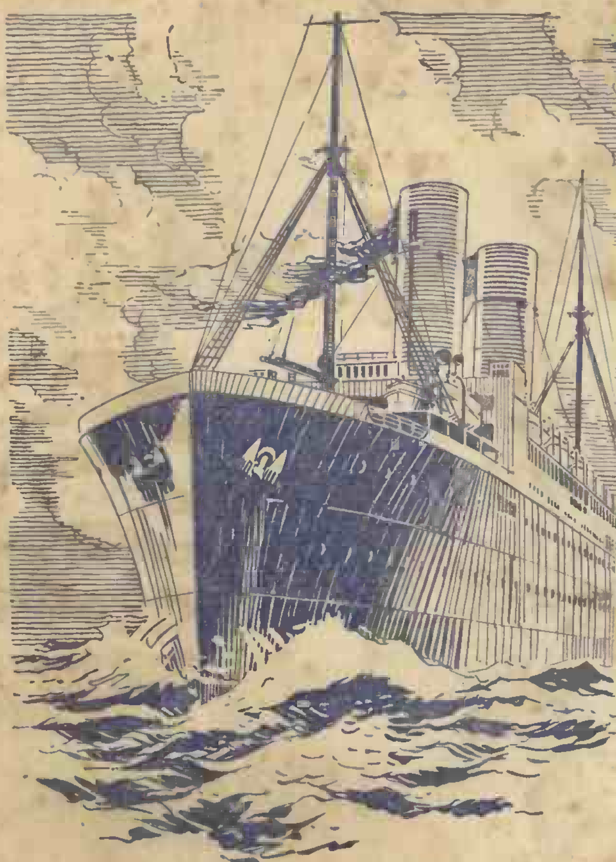

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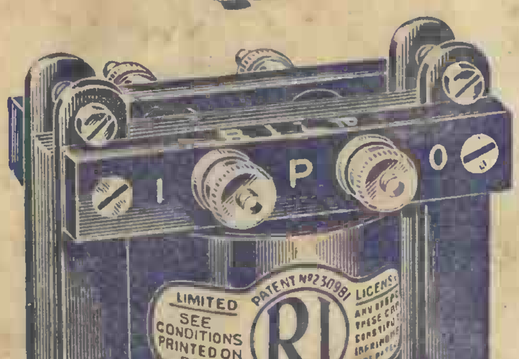

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