MODERN WIRELESS

April

1/-

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HOW TO MAKE: A FIVE-VALVE RECEIVER FOR ALL STATIONS. *By the Radio Press Laboratories.*
A USEFUL THREE-VALVE SET. *By John Underdown.*
A COMPACT TWO-VALVE RECEIVER. *By E. H. Berry.*
A BIJOU CRYSTAL SET. *By the Radio Press Laboratories.*

SHIELDED COILS: A NEW DEVELOPMENT. *By J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*
HOW INTERFERENCE HELPS. *By Capt. H. L Crowther, M.Sc.*
WORKING VALVES FROM D.C. MAINS. *By Capt. H. J. Round, M.C., A.M.I.E.E.*
EXPERIMENTS WITH USEFUL CIRCUITS. *By G. P. Kendall, B.Sc.*
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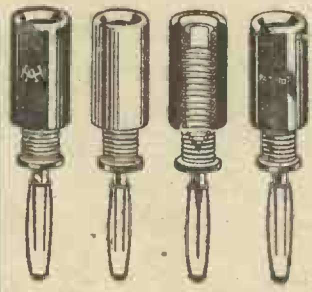

THE ANTI-VIBRATION
SPRING IS HERE

Fig. 975
Code Word
"WOBBLERS"
Per 1/6 Set of four
(3 black, 1 red).

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IT'S SO EASY.

NO TROUBLE.
JUST PLUG THEM IN.
No Soldering.
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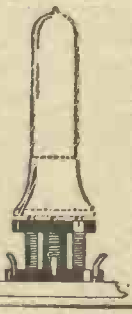

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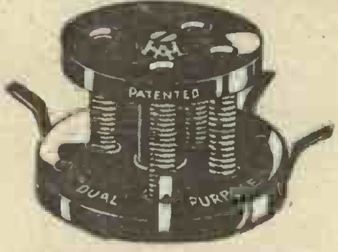
FOR BASE OR PANEL FITTING OR IN ANY OTHER POSITION.

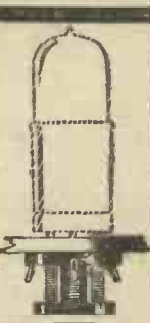
The smallest and neatest combined holder on the market.
No joints, because the soldering tag is the same piece of wire as the spring.
Show cards and display cards free.



THE THREE LARGE ILLUSTRATIONS ARE FULL SIZE.

Fig. 976.
Code "DUAL" Word
PURPOSE.
DOUBLE-ENDED.
PRICE ... 1/9 each.

THE FOOL PROOF HOLDER.



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For the genuine experimenter who must have a holder without capacity, and perfectly sprung, Hunt's "WOBBLY" is ideal. It is impossible to have fewer parts, or to better insulate, separate or spring them. Separately, sprung legs are far more effective than a closed-in solid sprung top.

Fig. 974.
Code Word "WOBBLY."
PRICE ... 2/3 each.

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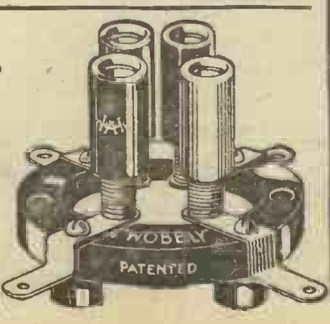
TOO SIMPLE TO IMPROVE.



Made by A. H. HUNT, Ltd. (Dept. 5), Croydon, Surrey.

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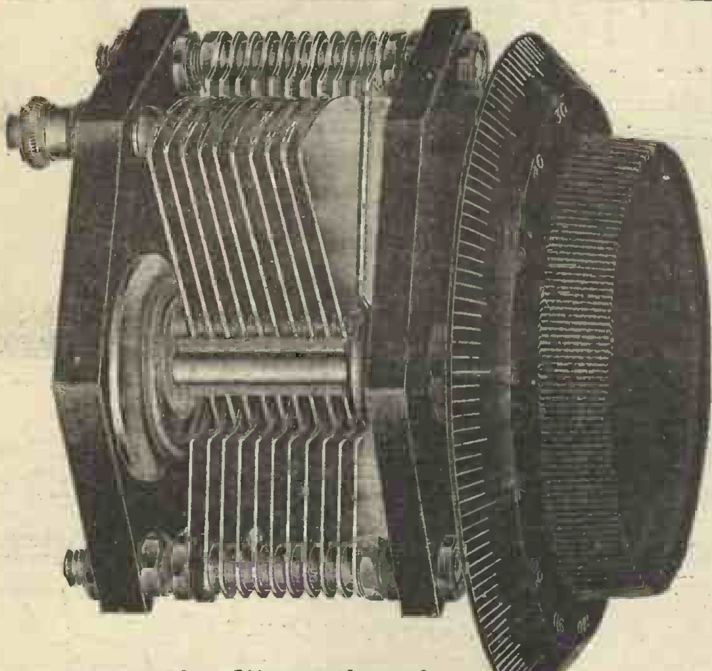

Actual Size Illustration of "Polar" Cam-Vernier Ball-Bearing Condenser.

If you would be sure of the greatest help in tuning, fit "Polar" Cam-Vernier Condensers. The special features listed below get better results from your Set because they achieve successfully the aim of every enthusiast, namely, high selectivity and *easy* tuning control. Smooth, silent operation is assured by a Pigtail connection to moving plates, and special BALL-BEARINGS.

Square Law. The "Polar" Cam-Vernier Condenser gives a true square-law characteristic when actually in your set; the vanes are specially shaped to compensate for the parallel capacity of the circuit. Only the "Polar" Cam-Vernier Condenser allows a square-law reading *under working conditions*.

Vernier Control. The Patent Cam-Vernier device is embodied in the "Polar" Condenser, providing a reduction of 10 to 1 over any portion of the dial; THE VERNIER READING IS REGISTERED DIRECTLY ON THE SCALE. The smoothly-working Cam-Vernier affords great selectivity, and makes the tuning-in of distant transmissions a real pleasure. Gears are entirely avoided, so that the "Polar" Condenser gives you a *precise* vernier control *with complete* absence of backlash.

Low Loss. The moving plates of the "Polar" Condenser are joined to the terminal by a PIGTAIL CONNECTION, and this, combined with end-plates of best quality Ebonite, results in extremely low dielectric loss. The vanes are very robust, well-spaced and carefully-balanced. All danger of shorting is eliminated.

Smooth Silent Operation. Motion is smooth and precise even with coarse tuning, while the Cam-Vernier device, *operated by the same knob*, gives infinite delicacy of control.

Unique Dial-Engraving. Note that the scale reading of the Polar Cam-Vernier Condenser covers from 26 to 100 degrees, recognising that no tuning system can have a zero capacity. The wave-length range is always proportionate to 26–100, whatever inductance value is in circuit.

The many advantages of "Polar" Cam-Vernier Condensers are available to you at a cost well below that of other high-class Condensers. Do not judge Condensers by their price—judge by reputation and results and specify "POLAR."

.001... 14/- .0005...13/- .0003...12/-

Complete with new large Knob and Dial.

Square Law—Vernier Control—Ball Bearings—and a comfortable Knob that makes for easier tuning

OF all Components governing the possibilities of a circuit, the Variable Condenser is, perhaps, the *most* important.

Correct scientific design; robust construction; perfect finish—delicacy of control; noiseless operation—these qualities make a vast difference to the operation of your Set and the results obtainable.

Only when you buy *reputable* Condensers can you be sure of results. Every "Polar" Condenser carries *a hard-and-fast Guarantee of perfect performance* over a period of 12 months, against original defects and breakdown in ordinary use. It is a guarantee you should have with every Condenser you buy.

Obtainable from all reputable Dealers. If any difficulty is experienced write direct.

Polar Components *for Sound Design*

Free Booklet

Write to-day for the "Polar" Condenser Booklet. This contains information on Condensers which no amateur should be without, and is sent gratis on receipt of a postcard to the manufacturers.

E.W.B.

Wireless Operators still Wanted

There are now vacancies on our Sea-going Staff for Junior Wireless Operators, trained on our apparatus. Youths of good education, preferably between 17 and 25 years of age, wishing to enter the Wireless Profession, should communicate with the Managing Director, London Radio College, 82–83, High Street, Brentford, Middlesex, who will be pleased to furnish particulars of the training course necessary to qualify for our Service.

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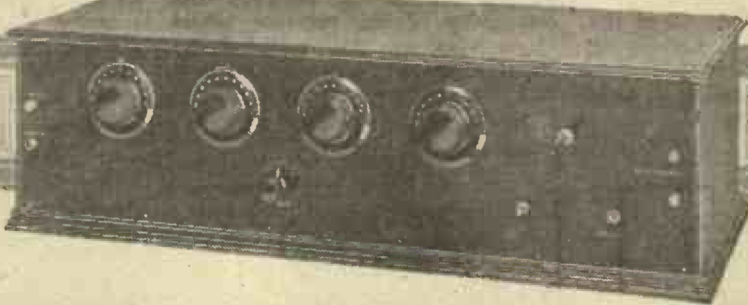
REMARKABLE FIVE VALVE RECEIVER

By THE RADIO PRESS LABORATORIES



The receiver described here was employed at the recent Press visit to our laboratories when the main B.B.C. stations and relay stations, together with Continental ones, were tuned in at will.

WHEN the B.B.C. closed down their stations for a quarter of an hour recently in order to determine what Continental stations were causing interference with the British transmissions, independent tests were carried out at our Elstree Laboratories on this point. It will be remembered that these tests were made in the presence of representatives of the leading London newspapers and Press agencies.

Notwithstanding the fact that a couple of superheterodyne receivers were available for use, if necessary, it was decided to use a five-valve set, in preference, for receiving the stations. This receiver incorporates several novel points in design, giving not only excellent ease of handling, selectivity and sensitivity, but also simplicity of control, and we are sure that our readers will welcome a description of the set, together with full constructional details.

Primary Object

The set, which consists of three stages of high-frequency amplification, a detector and one stage of low-frequency amplification, was primarily designed with a view to demonstrating the fact that a set employing three stages of H.F. amplification could be as easily controlled as a receiver employing only one stage.

Its success may be gauged from the fact that it is possible under favourable conditions to tune in not only all the B.B.C. main stations and a number of Continental stations, but also many of the relay stations on a loud-speaker, notwithstanding the fact that only one stage of low-frequency amplification is employed. It is interesting to note that the relay stations could not be picked up on supersonic receivers owing to bad mush. This receiver, however, cut through this and brought the relays in without difficulty.

External Appearance

As will be seen from one of the photographs, the well-balanced layout of the controls on the panel gives the receiver a pleasing appearance. These controls have been reduced to a minimum by the use of amperites to maintain the temperature of the filaments at the correct values. The only components which appear on the panel are the four tuning condensers, the potentiometer for the detector valve, the reaction condenser, the telephone jack, the on and off switch and four terminals. The two terminals on the left-hand end are for the aerial and earth connections, while the two on the right are for the loud-speaker. All connections to the batteries are made to a special terminal strip placed at the back of the baseboard. The controls will be found conveniently placed for their manipulation, and the absence of filament resistances which may require adjustment will be found a great boon.

> You *must* construct this set if you want one that will receive all the B.B.C. and Continental Broadcasting Stations. The receiver incorporates selectivity and sensitivity with ease of handling and simplicity of control.

The Basic Circuit

After a considerable amount of experiment, the basic circuit to be employed was decided upon, and is indicated in Fig. 1. This is shown without aerial or earth connections as it is merely intended for a diagrammatic representation of the scheme employed. It will be seen to consist of a grid coil L_1 which is tuned by a variable condenser C_1, one end of this coil being connected to the grid, while the centre point is connected to low tension and filament. The coil L_2 is the primary of an H.F. transformer which is connected in the anode circuit of the valve, while a small variable condenser, nominally a neutrodyne condenser, is placed between the anode and the other end of the grid coil L_1. L_3 is the secondary of the H.F. transformer and may go either to a further stage of H.F. or to the detector valve.

This circuit comprises a true neutrodyning scheme, since it will be found stable at one setting only of the condenser C_2, and above or below this setting the circuit will oscillate.

A Modification

The first modification made to this circuit is indicated in the theoretical diagram, Fig. 2. Here the D.C. and H.F. components of the current in the anode circuit of the valve V_1 have been separated by a choke L_2, the H.F. current being passed to the primary of the H.F. transformer L_3 through a D.C. stopping condenser C_3. The value of this condenser is by no means critical, any value above ·001 being satisfactory. Since the next valve is an H.F. amplifying valve the grid circuit is similar to that of the valve preceding it, as is shown in the diagram.

Obtaining Increased Selectivity

The aerial coil L_1 and the three primaries of the H.F. transformers, L_5, L_9 and L_{13}, are plug-in coils. This enables selectivity to be controlled, as the smaller the size of these coils the sharper will be the tuning. This enables the experimenter who resides close to a main B.B.C. station to improve the selectivity of the receiver, while those who are not troubled by interference may use larger coils and thus obtain greater signal strength.

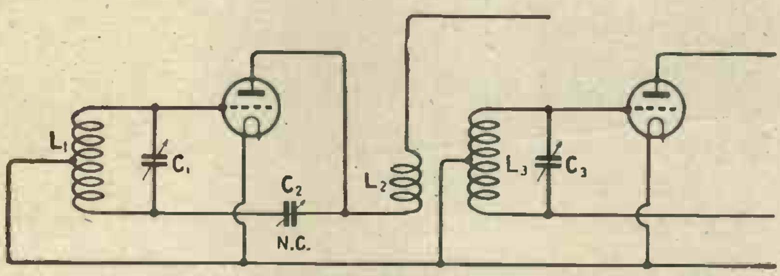


Fig. 1.—The circuit used for the initial experiments.

The Final Circuit

The receiver as constructed is only suitable for use on the ordinary broadcast frequencies on account of certain difficulties which are now being investigated. The theoretical circuit of the receiver as finally constructed is shown in Fig. 3. One of the first points noticed in connection with this diagram is the fact that in the anode circuit of the H.F. amplifying valves we find that two chokes have been used. The three chokes L_4, L_8 and L_{12} are special short-wave chokes. To go back to Fig. 1 it will be found, when employing a multi-stage H.F. amplifier using this type of circuit, that half of the coil L_1 would attempt to oscillate at its natural frequency, which is in the neighbourhood of 5 million cycles per second. These oscillations are then transferred to the next valve in an amplified form, and amplified again. When this occurs the receiver goes absolutely dead, and it is impossible to receive anything. This point was referred to in an article entitled, "Developments in Neutrodyne Reception," in last month's Modern Wireless.

Chokes were therefore connected as shown in Fig. 3 between the anodes and the by-pass condenser, so as to prevent any of the parasitic oscillations (should they occur) being passed on from one stage to the next. The other three chokes, L_3, L_7 and L_{11}, are of the usual type, as used for the broadcast band, their functions merely being to separate the H.F. and D.C. components in the anode circuit of the H.F. amplifying valves.

The four grid coils, L_2, L_6, L_{10} and L_{14} are Dimic coils, which not only provide a centre tap, but also a low high-frequency resistance, an important point in the design of a sensitive or selective receiver.

Since the set is stabilised it is possible to use a negative bias on the grids of the H.F. amplifying valves, and a small 1½- or 3-volt battery can be used as shown at G.B.$_1$. An idea of the receiver's stability can be gauged from the fact that it is possible to apply 140 volts or more to the anodes of the three H.F. valves without causing self-oscillation or rendering the receiver any more critical or difficult to control.

Anode Current Rectification

In order further to improve the selectivity and also to help obtain faithful reproduction, anode current rectification has been used for the detector valve. In actual practice it was found that this resulted in an increase in signal strength, as compared with the grid leak and condenser rectification method. This further enables three of the tuning condensers to match up and give the same reading, which does not occur when grid leak and condenser rectification is used. This is an exceedingly important point to note, while it has further frequently been stated that anode current rectification does not give such great signal strength as the grid leak and condenser rectification method.

The Reaction Control

Reaction is obtained in the detector valve circuit by means of a small condenser C_{11} which is actually a neutrodyne condenser, a choke L_{15} in the anode circuit of this valve being connected as shown, thus giving Reinartz reaction.

The circuit for the stage of low-frequency amplification is straight forward, while a fixed condenser C_{12} of ·5 microfarad is shunted across the grid-bias battery G.B.$_3$.

In the receiver itself a jack is connected in the anode circuit of the last valve V_5 by means of which telephones may be inserted in circuit. Two terminals are provided for the loud-speaker, which are so arranged that when the telephone plug is removed the loud-speaker is put into circuit.

Components Required

The following components were used in the construction of this receiver, and although it is not essential that these stated makes be employed, it is advisable to adhere as far as possible to the specification, if it is intended to obtain the same results. This applies particularly to the grid coils, as if other makes of inductances are used here it will be necessary considerably to modify the design and layout of the receiver, and it is quite possible that the functioning of the set would be seriously affected. The maker's

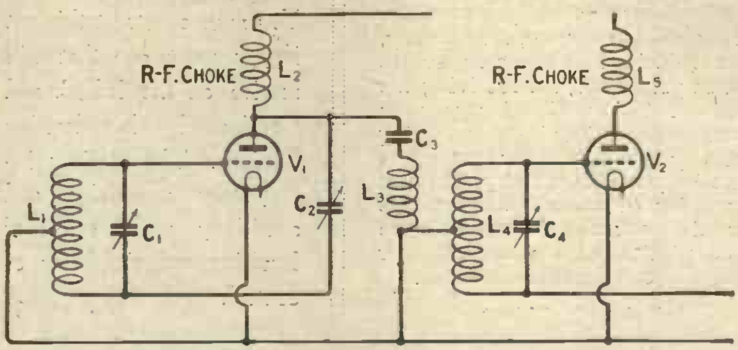


Fig. 2.—The modifications shown in this figure produced a vast improvement.

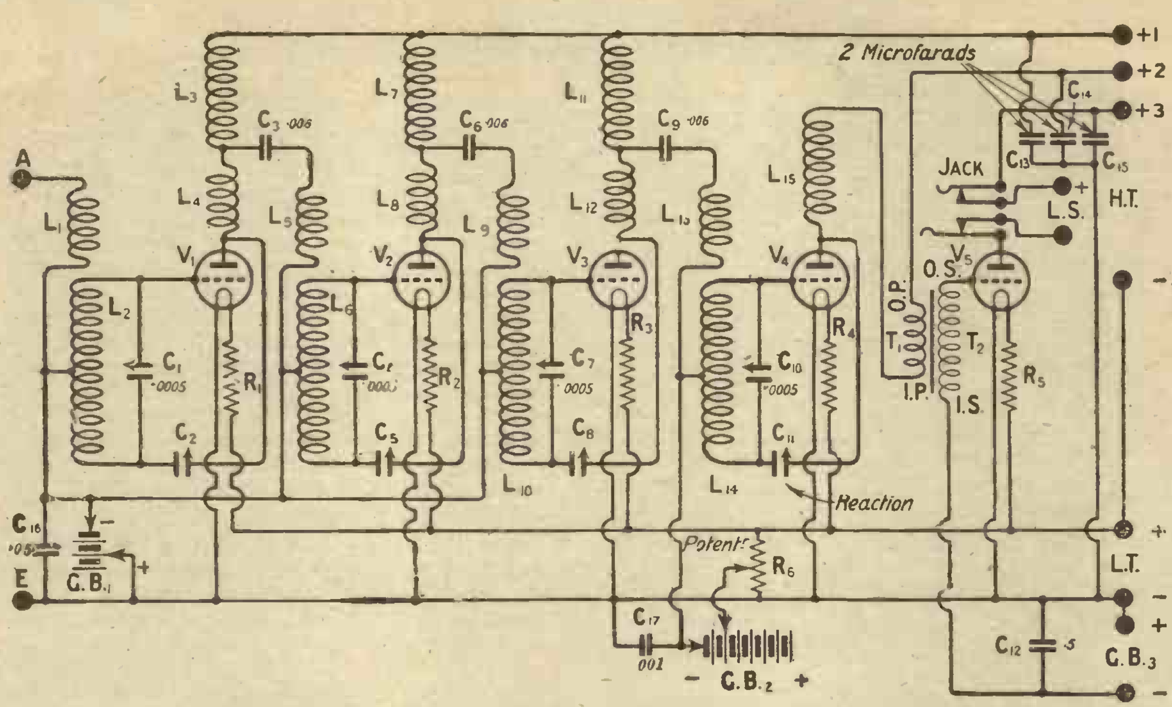


Fig. 3.—All the features shown in this final theoretical circuit have been well thought out.

name is given in every case for the benefit of those who wish to duplicate this receiver in every respect. The components required are :—

One ebonite panel, 36 ins. by 9 ins. by ¼ in. (British Ebonite Co., Ltd.)

One cabinet for same. (Carrington Mfg. Co., Ltd.)

Four Cyldon variable condensers, ·0005 capacity. (Sydney S. Bird.)

Four Magnum single-coil holders, baseboard mounting type. (Burne-Jones & Co., Ltd.)

Three fixed condensers, ·006, clip-in type, with mounting. (L. McMichael, Ltd.)

One Ideal transformer, 6 to 1 ratio. (Marconiphone Co., Ltd.)

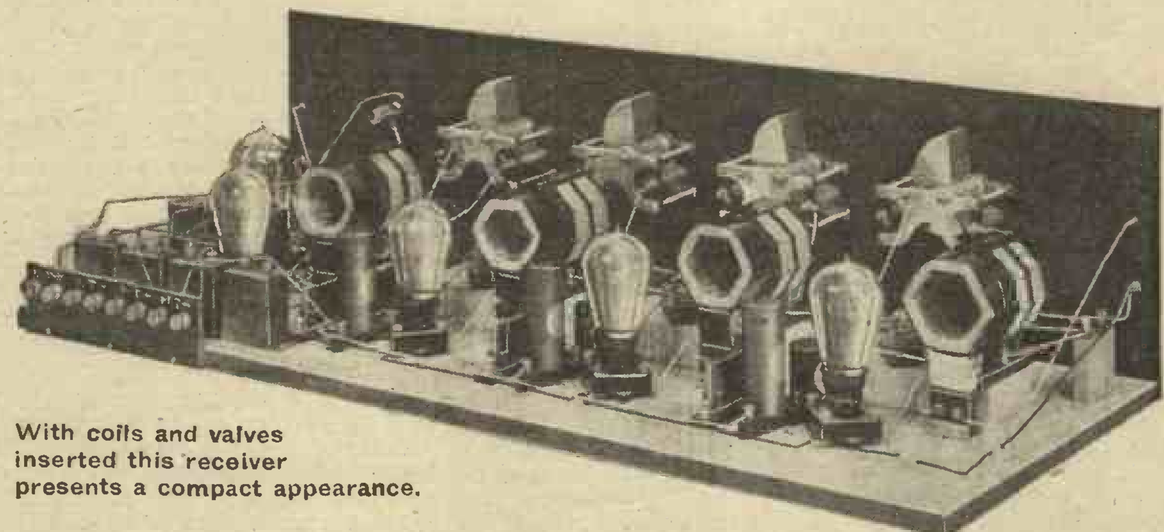
Three Neutrodyne condensers, (Rothermel Radio Corporation of Great Britain, Ltd.)

One double-circuit jack.

One R.I. fixed condenser, ·05 capacity. (Radio Instruments, Ltd.)

One fixed condenser, ·5 capacity. (Telegraph Condenser Co., Ltd.)

Three fixed condensers, 2 microfarads capacity. (Telegraph Condenser Co., Ltd.)



With coils and valves inserted this receiver presents a compact appearance.

Four No. 1 Dimic inductances, with bases. (L. McMichael, Ltd.)

Four standard Lissen H.F. chokes. (Lissen, Ltd.)

Three special H.F. chokes, short-wave. (Lissen, Ltd.)

Five Clearertone valve-holders. (Benjamin Electric, Ltd.) baseboard mounting. (Peto-Scott Co., Ltd.)

One Polar neutrodyne condenser. (Radio Communication Co., Ltd.)

One potentiometer. (Radio Instruments, Ltd.)

Five amperites, 1 amp. type. (Rothermel Radio Corporation of Great Britain, Ltd.)

One push-pull on and off switch.

One fixed condenser, ·001. (Dubilier Condenser Co., Ltd.)

One 9-volt tapped grid-bias battery.

One 4½-volt tapped grid-bias battery.

Twelve 4B.A. terminals.

Twenty lengths of Glazite for making connections.

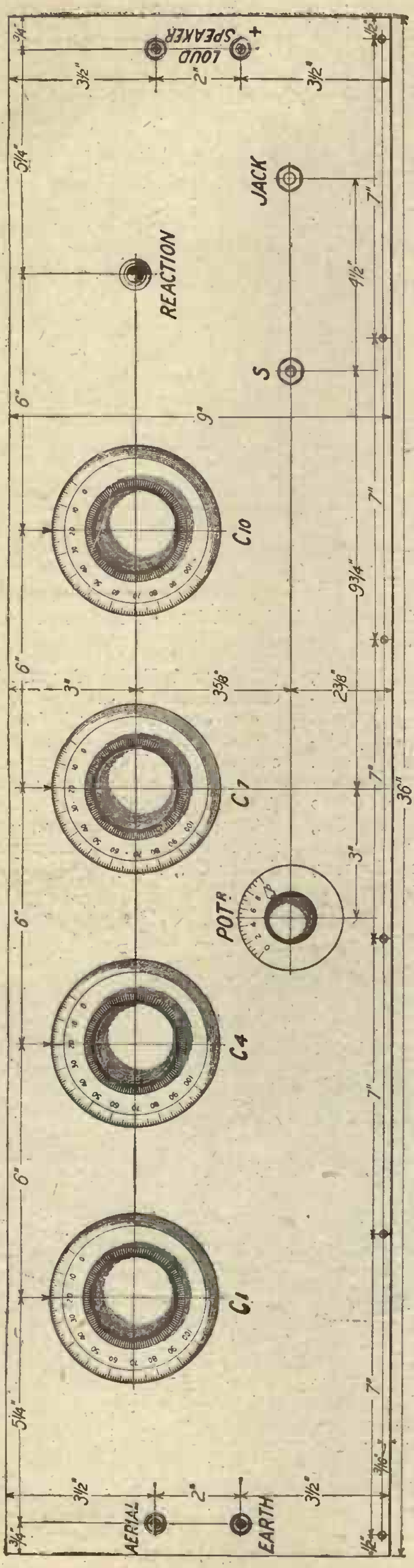


Fig. 4.—Marking out the panel will become straightforward if reference is made to this diagram. Blueprint No. 154a, 1/6 post free.

One strip of ebonite, 8 ins. by 2¼ ins. by ¼ in. for terminal panel.
One wooden baseboard, 36 ins. by 13½ ins. by ⅝ in.
One strip of wood, 26 ins. by 2¾ ins. by 1¼ in.
One set of Radio Press panel transfers.

Marking out the Panel

The construction of this receiver is a perfectly straightforward matter, and the first point is to prepare the panel if this is not of guaranteed ebonite. This should be done by rubbing it down on both sides with some fine glass paper, No. 0 being a suitable grade. Afterwards it may be marked out in accordance with the panel layout shown in Fig. 4. The makers of the condensers used in this set supply a template which will be found of assistance in mounting the condensers on the panel. It should be noted that since the dials supplied are recessed there is no need to countersink the panel for fixing screws.

The Wooden Shelf

The four Dimic coils, three baseboard mounting neutrodyne condensers and three amperites are fixed on the short length of thick wood given in the list of components. This piece of wood is required in order that the centres of the coils may be on a level with the centres of the plug-in coils used for the primaries of the H.F. transformers. The position of this piece of wood will be seen not only from the photographs, but also from the wiring diagram. It should be noted that this wiring diagram is exactly drawn to scale, and it will therefore serve as a guide for placing the various components on the baseboard.

Having mounted the components on the panel, this should be fixed to the baseboard and the components which are placed thereon put in position.

Simple Wiring

The next step in the construction of the receiver is to carry out the wiring, and since all the components are well spaced out, no difficulty will be experienced in getting the various leads into position, the back of panel wiring diagram being shown in Fig. 5. Connections from the high-frequency side should be well spaced out, at the same time being made as short as possible.

Two short flexible leads are required for making connection to the tapped grid-bias battery, which is used in order to give anode current rectification for the detector valve. One of these goes to the slider of the potentiometer, while the other goes to the centre tapping on the last Dimic coil. The negative end of the battery is connected to this point, while the positive tapping is taken to the slider of the potentiometer.

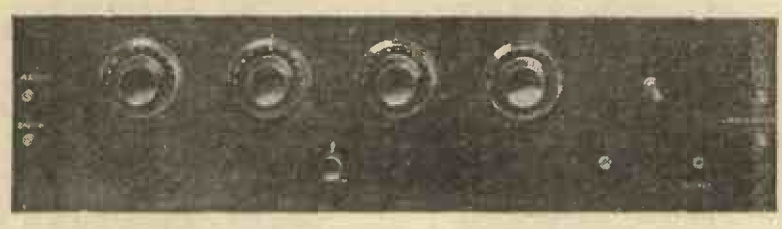
Preliminary Tests

Having completed the wiring, care should be taken to test the receiver to see that all is in order. First connect a 6-volt battery to the two L.T. terminals, the polarity being as indicated. See that the amperites are inserted in their clips, the former being 1 amp. type, suitable for use with valves of the D.E.5, D.E.8 and D.E.5b type. Insert five of these valves, and see that they light correctly, and that they are controlled by the on and off switch. Suitable valves are D.E.5b or D.E.8 H.F. type for the first four valves and a D.E.5, D.E.8 or B.4 type valve for the L.F. amplifier.

Next test the H.T. circuits. For the purpose of preliminary tests the three H.T. positive terminals may be strapped together. First apply a potential of 6 volts only, and notice whether the brilliancy of the filaments is altered in any way. If all is in order the set can now be tested on the aerial.

Preliminary Adjustments

Steps must be taken to adjust the neutrodyne condensers so as to stabilise the set, which should preferably be done out of broadcasting hours, so that should oscillation occur, listeners will not be disturbed. Insert the four Dimic coils into the holders, plug a No. 60 coil into the aerial position, L_1. The three coils, L_5, L_9 and L_{13}, may be No. 50 or 60 coils or their equivalents. In the case of the experimenter residing near a main B.B.C. station the smaller size coils should be used, as this will give enhanced selectivity. The correct values of H.T. should be connected, suitable values being from 80 to 120 volts for the H.F., 60 volts for the detector and 120 volts for the L.F. For preliminary adjustment it would be advisable to use a lower voltage on the H.F. valves, and it will then be found that if the set has been correctly stabilised any increase in the H.T. potential will in no way effect the stability of the receiver. The correct grid bias to use on the detector valve with the H.T. voltage given will be 3 volts, fine adjustment being made with the potentiometer. The slider will be approximately in the centre of the winding.



The controls on the front of the panel are easily manipulated.

The reaction condenser should be set at zero, and the procedure adopted to stabilise the set will be as follows.

The Procedure to Follow

Set the four tuning condensers at about 40 degrees, plug in a pair of telephones in the anode circuit of the last valve, and with the set switched on, and the H.T. connected, tap the grid side of the first tuning condenser C_1 with a moistened finger. If this valve is oscillating it will be found that a click is heard both on touching and removing the finger from the condenser. The neutrodyne condenser C_2 should now be turned slowly, and it will be found that at a certain point the click will disappear. If this point is passed, it will reappear again. This therefore shows that the circuit is oscillating on both sides of the setting, and that is the correct setting at which the condenser should be left. It will probably be noticed that on one side of this setting the oscillations are perfectly silent, no sound being heard in the phones, while on the other there will be a slight hissing or crackling noise, and it is for this reason that this test has to be applied. The next neutrodyne condenser C_5 is adjusted in a similar manner, and C_8, the third neutrodyne condenser, is also adjusted in this way.

Tuning In

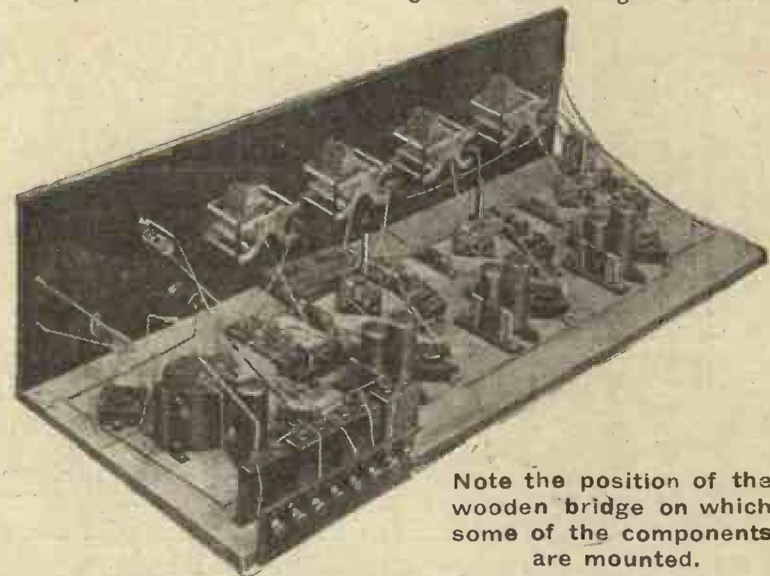
The set is now ready for testing out during broadcast hours. It will be found that the dials of the three tuning condensers, C_4, C_7 and C_{10}, will read to all intents and purposes exactly the same, while the reading of the tuning condenser C_1 will only be slightly different from these. The local station may now be tuned in and as a guide to the condenser settings at which this will be received a list is given further on of a number of the stations received, and the dial readings for them. Having tuned in the local station, the potentiometer should be adjusted to the point of maximum signal strength consistent with good quality of reproduction, and should this point not be found to be within the range of the potentiometer one of the wander plugs of the grid bias battery will need to be moved to the next tapping, and the potentiometer readjusted until the best point is found.

The effect of varying the bias applied to the H.F. valves should also be tried and as high a value as possible used in order to reduce plate current.

Should these tests be carried out in the locality of the main B.B.C. stations it will of course be desirable to connect the loud-speaker to the set, and the grid bias to the L.F. valve may then be adjusted to obtain maximum purity of reproduction. This is rather an important point since it assists in the economy of high-tension current consumption.

DX Work

Distant stations may now be searched for, and it will be found that the tuning is exceedingly sharp and critical. The three H.F. Condensers should be removed together about a degree at a time, keeping the readings all approximately the same, the aerial-tuning condenser being adjusted as required afterwards. The use of the reaction condenser C_{11} will now be of assistance. Since all the H.F. circuits in this receiver are very lightly damped, it will be found that only a small value of this condenser is required to obtain oscillation, but since the preceding stages of H.F. are neutralised the detector valve may be made to oscillate without fear of causing disturbance, a feature of great value when searching for weak transmissions.



Note the position of the wooden bridge on which some of the components are mounted.

Having picked up a distant station, slight adjustments of the tuning condensers will bring it in at good strength, and if only a small

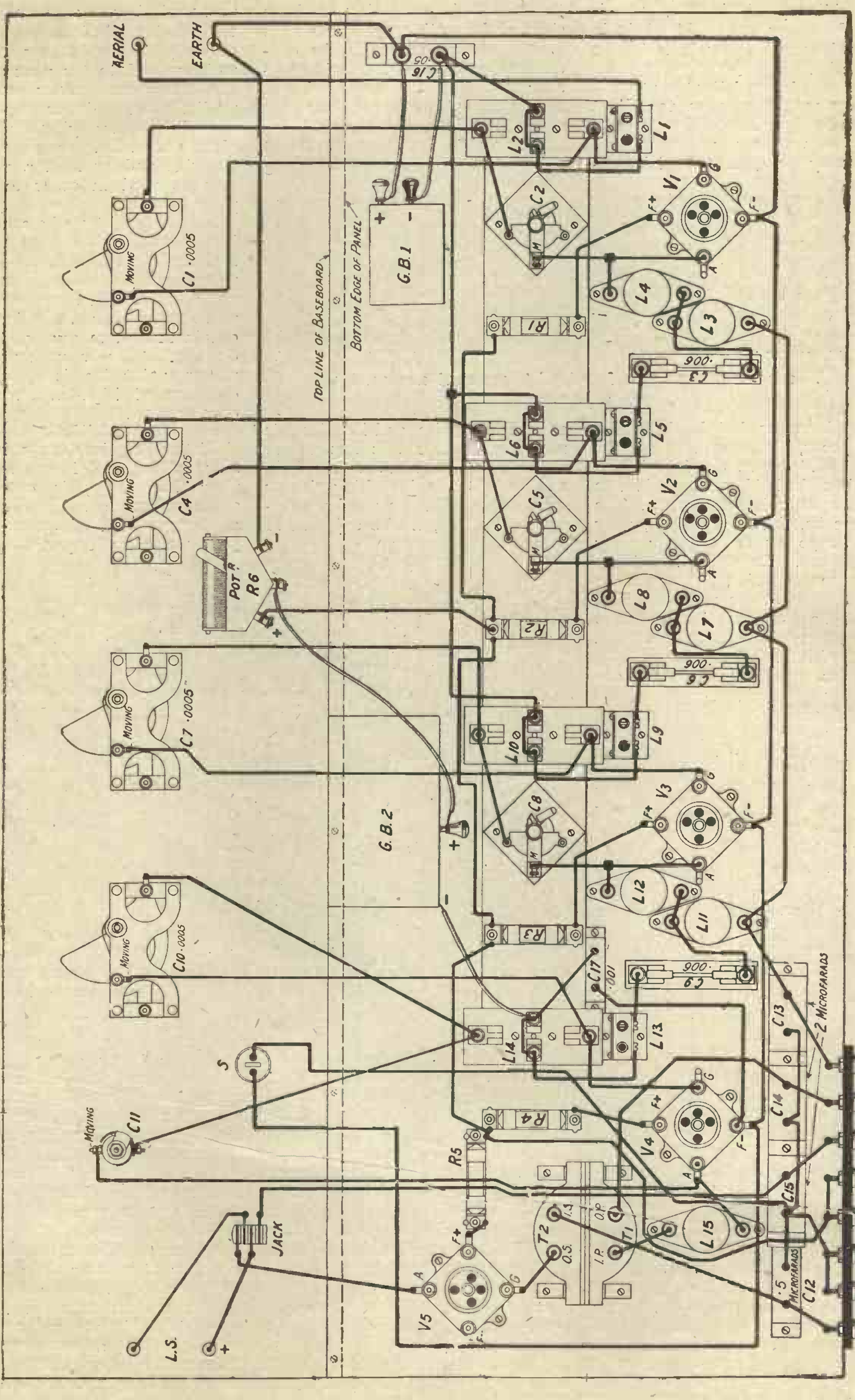


Fig. 5.—Special care should be taken when wiring this receiver. A full-size Blue-print, No. 154b, is available at 1s. 6d., post free.

amount of reaction is used, this may be increased to bring the station up in strength.

Loud-speaker Reception Possible

Although this set is primarily intended for long distance work on the telephones, it will nevertheless, under favourable conditions, bring in a considerable number of stations on the loud-speaker, and the jack and terminal arrangement provided will be found of great convenience in transferring the output to the telephones or loud-speaker as desired.

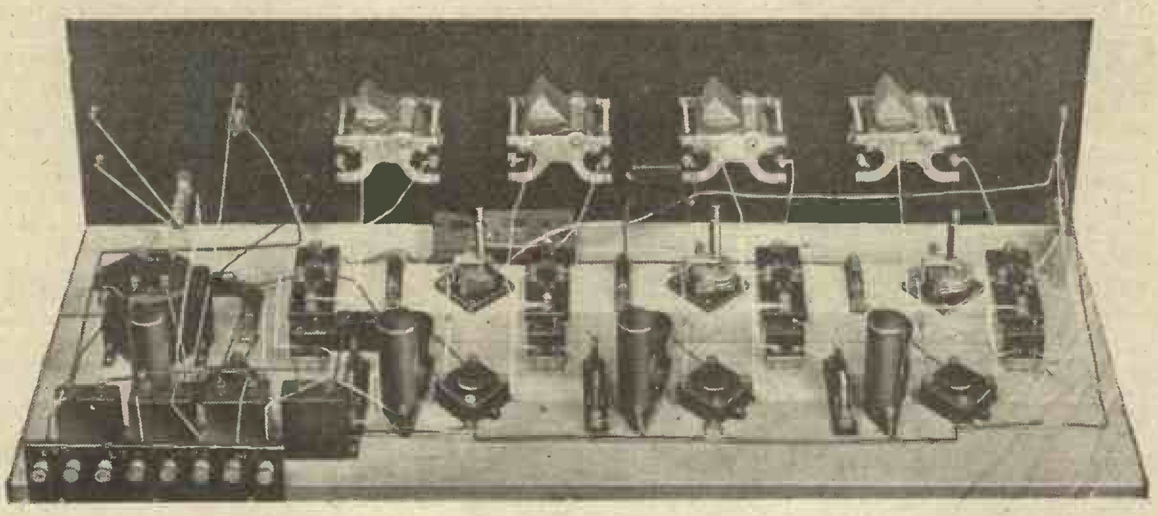
A fair amount of care is necessary in handling this receiver. Not only are the tuning controls exceedingly sharp, but unless all four dials are correctly set nothing will be heard. Care must therefore be taken in searching for distant stations to adjust all the dials in turn.

Changing the Aerial Coil

A point to note is that when the aerial coil L_1 brings the aerial-earth system into tune with the wavelength being received, the tuning of the condenser C_1 will be exceedingly flat, and when this occurs a different aerial coil should be used in place of the one employed. This was found to occur on the aerial on which it was tested at about 420 metres, and though a No. 60 coil had been in use it was preferable to use a No. 50 coil for wavelengths between this and 476 metres. Above this wavelength the No. 60 coil was again employed. For wavelengths below the Plymouth station the best size aerial coil was found to be a No. 35. This change of coil only applies to L_1, the other plug-in coils being left at the same value.

A Selectivity Test

An idea of the selectivity of this receiver will be gained from a test which was carried out at Elstree one afternoon during daylight hours, Cardiff was received with only a very slight background of 2LO at a time when the wavelength difference between these two stations was barely 7 metres.



The fixed condenser in the top right-hand corner of the baseboard has a 4½ volt grid-bias battery connected across its terminals when the receiver is in use.

Table of Stations Received.

Name of Station.	Wavelength in Metres.	Setting of Condenser Dials, C_4, C_7, C_{10}.
Sheffield	303	41
Bradford	313	43
Liverpool	315	44
Leeds	322·5	45
Edinburgh	325·5	45
Nottingham	328·5	45·5
Dundee	331	46
Hull	334	47
Plymouth	348·6	49·5
Cardiff	353·5	50
London	361	51·5
Manchester	377·8	54
Bournemouth...	383·9	55
Newcastle	404·5	58·8
Glasgow	422	62
Belfast	439·5	65
Birmingham	476	71
Swansea	493	74
Aberdeen	496	74·5

Increased H.F. Amplification

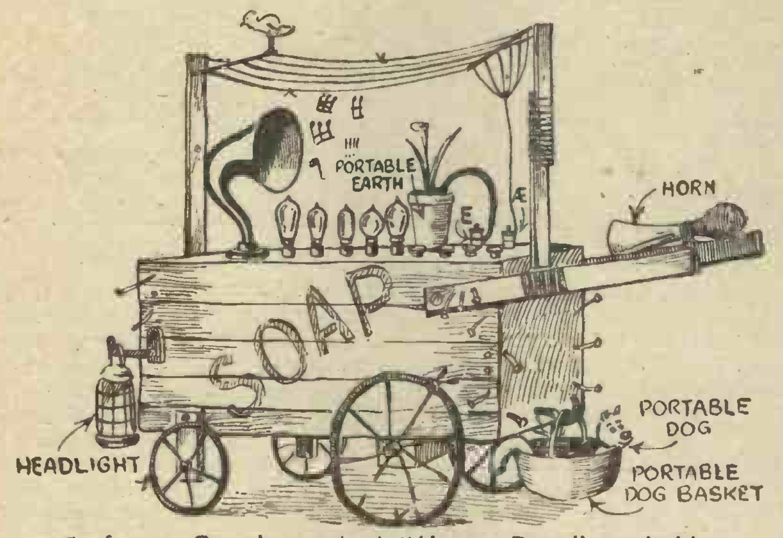
Having made all the necessary adjustments the effect may now be tried of increasing the high-tension voltage on the H.F. valves, and should the receiver be functioning correctly it will be found that this will in no way impair the efficiency of the set. On the other hand it is most probable that increased amplification on the H.F. side will be obtained.

As an aid to searching for distant stations a list of some of those received on this set is given here with the dial settings on the H.F. condensers. This refers only to the three right-hand condensers, as the left-hand condenser, which tunes the grid circuit of the first valve, will alter in setting according to the aerial coil used.

Among the Continental stations not given in this list which, however, were received were Elberfeld, Brussels, Hanover, Hamburg, Munster and Ecole Superieure. In addition, when conditions are favourable, no difficulty should be experienced in receiving the American broadcasting stations on the frequency band covered by this receiver.

In Passing

AT this time of the year everyone's thoughts turn to portable receiving sets. Why this should be so must always remain a mystery to me, but it is nevertheless a fact that they do. Personally, as the days grow hotter the thing that I most feel need of is a really portable accumulator. It is a well-known fact that owing to the expansion caused by heat the rails upon the line from London to Edinburgh are a mile longer in the height of summer than they are in the depth of winter. I have observed the same phenomenon in a much more striking way on the stretch of road which lies between my abode and the local accumulator-wrecking station. In winter it is a mere step; but as the warmer days come on the distance rapidly increases, until by midsummer it is a good hour's walk, while there are other curious effects which manifest themselves as spring draws on.



Professor Goop's original "Happy Days" pushable receiver.

Other Weather Effects

Whereas in winter when my battery shows signs of tiredness I say, "I will take it to be charged to-day," once the warmer weather arrives it is always to-morrow that is selected for the act. You will probably notice, too, an amazing increase in the weight of the accumulator at the same season of the year. This is a problem that has puzzled Professor Goop and myself not a little. After a great deal of experimental work we have found that the weight of an accumulator at any time of the year may be calculated by the following simple formula:—

$$W = W_1 + \frac{T \times B}{E}$$

Where W is the seasonal weight,
W_1 is the weight upon New Year's Day,
T is the temperature in degrees Centigrade,
B is the barometer reading in millibars.
E is the energy of the carrier in micropeps.

More Experiments

But, as I have remarked, the Great Wireless Public demands portable sets, and portable sets it shall have. It was with such thoughts in my mind that I made my way to the Microfarads a week or two ago to call upon my friend and colleague Professor Goop. It was the Professor himself who opened the door in answer to my ring, though for the moment I failed to recognise him. So completely black was he from head to foot that I came instantly to the conclusion that the cannibal chieftain billed to give during the following week 2LO's topical talk on "My Day's Menu" must have been invited to the Microfarads for a visit. As soon as he spoke I knew who he was, and when I observed the marks left on my spring suiting by his welcoming slap on the chest, I realised that his colour was not even skin deep. "Come in, my dear fellow. Come in," he cried enthusiastically. "You are just in time to witness the second of a most interesting series of experiments.' I went in, keeping my distance as well as I could.

The Latest Idea

Meantime, the Professor was talking hard about his latest idea. This, it appeared, was a pyrotechnic chimney sweeper. The thing was perfectly simple. It consisted of a sky rocket with a large circular brush attached to its base. You placed the rocket in the fireplace and touched it off. A special time fuse caused an explosion to take place just as the sweeper

Something had gone wrong.

entered the chimney. This loosened the soot, and the brush thing carried through by the rocket removed the lot into the upper atmosphere. During the first experiment something had gone wrong with the time fuse; the explosion had taken place, not at the lower end of the chimney, but at the top, and its force had been such as to make the sweeper return boomerang-wise to the feet of the startled Professor. He was frightfully keen to try the second one in another room, but I managed to steer his mind away from such a dangerous subject by talking for all I was worth about wireless. That is a bait that the Professor

A professional strong man could carry it.

never can resist, and he rose to it as a trout rises to a fly.

The Project

"Professor," I said, "it is clearly up to us to design at once a portable receiving set. Wireless folk have grown so accustomed to relying upon us to supply their needs in the matter of designs, that we cannot possibly leave them in the lurch in the matter of portable sets. Everybody is simply dying to lug wireless sets about the place, and far be it from us to deny the populace its simple, healthy pleasures." The Professor agreed that something must be done about it at once, and we proceeded to talk the matter over, examining the problem which presented itself from every angle. We found it a little difficult at first to decide just when a set becomes portable. I suppose that a professional strong man, for example, could carry any five-valve set, complete with loud-speaker and batteries, from London to Brighton without thinking about it; yet no one would class your receiver, dear reader, or mine, as portable sets—at least, I hope not; I trust too that it will never fall to my lot, or yours either for that matter, to have to carry my outfit for any distance.

A Working Definition

When we had been thinking over the subject for quite a long time, having said what appeared to be all that there was to say, the Professor roused me from the little nap in which I was indulging in order to refresh my tired brain, and suggested a working definition. "A portable set," he said, "is one that a normal man can take to a picnic, conveying it in his car." "But," I objected, "heaps of normal men do not possess cars. Look at me, for instance." "I am looking," remarked the Professor. "I find the process slightly painful, and I fail to see how your statement affects my argument."

For a brief spell we both talked at once. For two pins I would have given my old friend a good shaking. Fortunately for him there was no one there to present me with two pins. At length I managed to persuade him by pointing out that it would never do for us to cater solely for those who rushed about the country in haughty cars. "I detest the word autocars," barked the Professor, "one of those nasty hybrids." "I said haughty cars," I protested. "You should be careful of your h's," snapped the Professor. It looked for a moment as though the trouble were going to start all over again, but a little tact on both sides quelled the threatening storm.

Eureka!

We agreed eventually to define a portable set as one that the

One hand is used for swatting wasps.

normal man can take to a picnic whether the motive power is provided by himself or by a smelly-thing with a chugging engine. This point settled, it remained to discover the maximum weight that any human being could be expected to carry upon a hot day. "You must remember," I pointed out, "that you have only got one hand for the job; at picnics you always want the other for swatting wasps." On considering the problem carefully, we came to the conclusion that the greatest weight that could be carried without distress in such circumstances did not exceed one pound, and even our great brains were unequal to the task of designing a five-valve loud-speaker set that would not be a few pennyweights or so over the limit. For a few moments we sat in silence, baffled and disheartened. But the setback was only temporary. The Professor suddenly leapt to his feet, meaning, I am sure, to say "Eureka," though as he caught his foot in the carpet and came to earth with his face in the coal-scuttle, what he did cry was something quite naughty.

A Pushable Set

When I picked him up and soothed him down a little he told me that the solution had come to him. "We will design," he exclaimed, "not a portable set but a pushable set, and then everyone will be happy." Though I have known the Professor for a long time and have been present during the emission of many brainwaves of great amplitude, this was, I think, the very finest flash of his superb genius that I have experienced.

Instantly the way became clear. By making your receiving set pushable, that is, by placing it upon wheels, it is immediately possible to increase its weight to a reasonable figure without anyone finding the task of transporting it from place to place a laborious one. Fathers of families are already in splendid training for the job, whilst the wheeled set provides the care-free young bachelor with a simple and effective means of fitting himself for the duty that will fall upon him when he has committed matrimony.

Hints on Construction

In order to obtain perfect results from the pushable set, which Professor Goop has named his "Happy Days" receiver, readers are advised to copy exactly our design, which is the outcome of an enormous amount of thought and experimental work. I am quite sure that this advice is superfluous, for I have never known any wireless man yet who, upon being shown a design of somebody else's, did not at once point out a dozen ways in which it could be improved. I

Professor Goop's latest pattern "Pushable" receiver.

feel bound to offer it, though, since the Professor and I can take no responsibility whatever for the defective performances of Happy Days pushable sets in which every detail of the original design is not faithfully reproduced. A single badly driven nail or screw, for instance, may lead to the tearing of

(*Continued on page* 882.)

At Home with the Set

By

A. JOHNSON-RANDALL.

It is surprising how often difficulties are encountered when operating the various types of receiving sets, and each month, under this heading, the reader will find some useful practical hints on operating essentials.

ALTHOUGH operating hints are given in all Radio Press constructional articles, the information in most cases applies only to the particular receiver being described. It is practically impossible to lay down hard and fast rules which cover every type of set, but it is certainly possible to deal in a general way with the essential operations common to all sets.

It is hoped that this short article will remove some of the difficulties—or at least what often appear to be difficulties—from the path of the listener with little or no experience.

A Single Valve Receiver

Starting with a single valve receiver, we find that, in general, two main controls are provided. The first involves some sort of tuning arrangement; probably, in the case of a recent design, this will consist of a grid coil tuned by means of a variable condenser connected in parallel. The second will be a method of obtaining reaction, possibly with the aid of a swinging coil or alternatively the popular Reinartz method in one of its forms may be employed.

The Case of Magnetic Reaction

If ordinary magnetic reaction is used as shown in Fig. 1*a*, signals are received initially with the coil L_3 well away from the grid coil L_2, which for the broadcast band would be in the neighbourhood of a No. 60 if of the plug-in type. The condenser C_1 is now rotated slowly from zero towards its maximum, the maximum position being when the moving vanes are entirely interleaved with the fixed ones. When signals are heard the movable coil L_3 may be brought towards the grid coil L_2, and an increase in volume should be noticed until a point is reached when distortion begins to occur and finally oscillation commences.

Avoiding Distortion

The receiver should be operated with the swinging coil L_3 away from the point at which distortion becomes noticeable, and with each movement of the coil a slight readjustment of the condenser C_1 should be made.

In some cases upon bringing the reaction coil nearer to the coil L_2 the set will suddenly "flop" into oscillation and will not stop oscillating with the coil placed in the same position as when oscillation started.

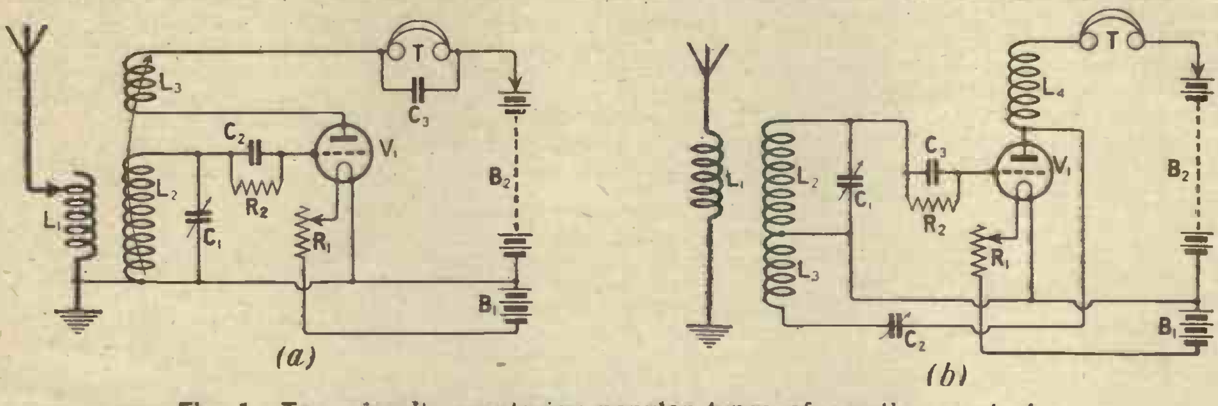


Fig. 1.—Two circuits employing popular types of reaction control.

In such circumstances tuning in a distant station where fine adjustment is essential will be practically impossible, and the remedy lies in the use of a smaller reaction coil and careful adjustment of the H.T. voltage. A lower value grid-leak may help matters considerably. If, as sometimes happens, bringing up the reaction coil causes signals to decrease in strength, the two leads to the coil holder should be reversed.

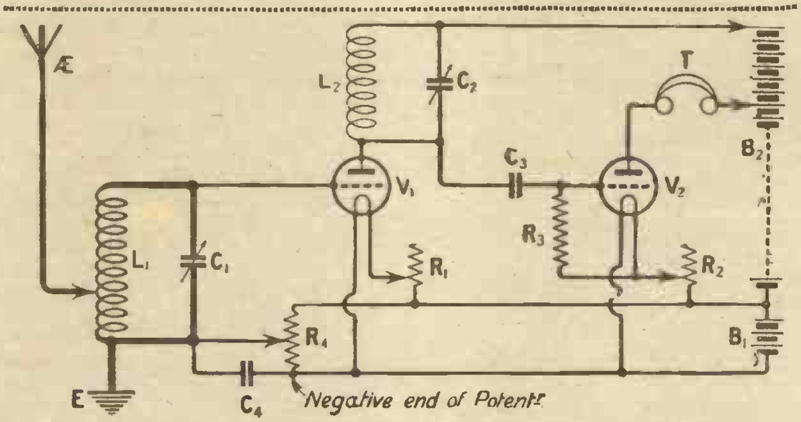


Fig. 2.—A tuned-anode potentiometer controlled type of circuit.

A Form of Reinartz Reaction

Dealing with the case of a circuit employing some form of Reinartz reaction, it will be seen from Fig. 1 *b* that the swinging coil is replaced by a coil L_3 and a variable condenser C_2.

The procedure is very similar to that adopted in the case of the Fig. 1*a* circuit, signals being tuned in by adjusting C_1, C_2 being at zero. Signals having been received, the value of C_2 can be increased to a position just short of the distortion point. After a little practice it is usually possible to follow up each adjustment of C_1 with a corresponding movement of C_2, without "going over the edge" into oscillation.

Another Popular Circuit

Even in these days of efficient neutralising methods, the simple tuned anode potentiometer controlled type of circuit remains deservedly popular.

In the Fig. 2 type of circuit, if the set is working efficiently oscillation will occur as the two tuned circuits L_1 C_1 and L_2 C_2 are brought into tune, provided, of course, that the potentiometer contact arm is at the negative end.

Using the Potentiometer

A reaction coil is not necessary, signals being increased or decreased in strength by means of the potentiometer R_4. The effect of varying the contact arm from the negative end towards the maximum positive position is equivalent to connecting a variable resistance across the tuned circuit L_1 C_1. The method of operating a receiver of this type is to place the contact arm of R_4 in a position about half-way round its arc and to vary C_1 and C_2 until signals are heard. C_1 may be moved slowly through the full 180 degrees, while C_2 can be rotated, say, ten degrees at a time.

Final Adjustments

When signals are heard the two condensers should be adjusted accurately for the position of maximum volume and R_1 may be moved towards the negative end, that is towards the point where oscillation begins. Signals should increase in strength until a position is reached where distortion and oscillation occur.

The set is working at its best where the contact arm of R_4 is as near as possible to the negative end, and much can be done in this direction by a suitable adjustment of the H.T. voltage.

Neutrodyne Circuits

Fig. 3 shows a neutrodyne circuit in which a centre tapped coil of the "Dimic" or Peto-Scott "Universal" type is employed. To operate a receiver having a similar circuit, the aerial and earth should be removed and the reaction coil L_4 taken from its socket, a short-circuiting plug being inserted to complete the anode circuit of V_2. With the valves alight and suitable values of H.T. applied, the condenser C_2 may be placed in a position about half-way round its scale. Then rotate C_1—the receiver, of course, being in a state of oscillation—and adjust the neutrodyne condenser N.C. As N.C. is adjusted the frequency band over which oscillation occurs should decrease until at one point on N.C. no oscillation is present. A further increase of N.C. will again produce oscillation.

Further Operations

The reaction coil can now be plugged into its socket, the aerial and earth attached, and the receiver is then ready for work. Manipulation is similar to Fig. 2 except that the potentiometer is replaced by a reaction coil L_4. C_1 and C_2 should be varied as before, with L_4, to commence with, well away from L_2. Signals having been heard, L_4 may be brought nearer to L_2 with beneficial results, a slight readjustment of C_1 being necessary with each movement of L_4

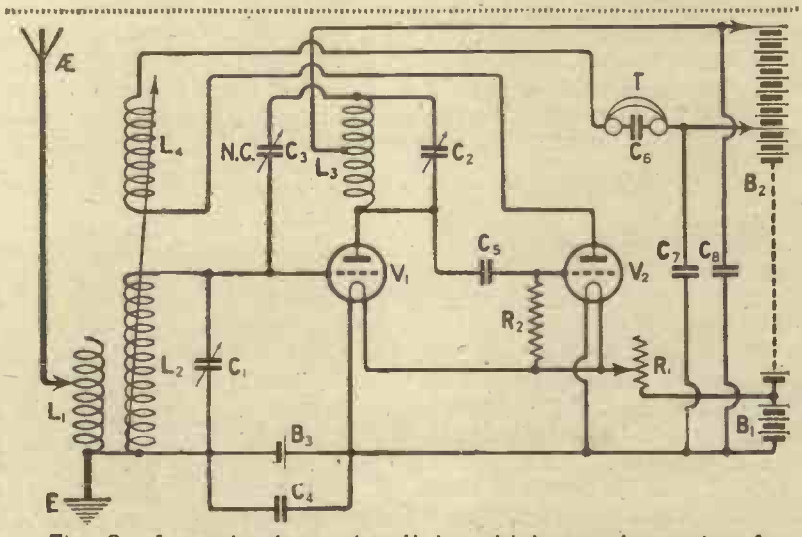


Fig. 3.—A neutrodyne circuit in which use is made of a centre tapped coil.

: From My : Notebook

By

H. J. BARTON-CHAPPLE,

Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

FOLLOWING on some recent investigations into the influence of coil fields upon the selectivity of a receiving set, a large amount of interesting and important information has come to hand. There is no doubt but that the observations will lead to many improvements in future design when the subject is thoroughly understood. One of the main difficulties is to measure the effects brought about when the coil is carrying a high frequency current, for it is conceivable that the orientation of the magnetic lines of force may be considerably affected when compared with those produced by an ordinary steady current passing through the same coil.

In this connection it should be mentioned that a toroidal coil—that is, one wound in the form of a simple solenoid and bent into a circular shape—is not immune from electrostatic pick-up. It is often claimed, however, that this type of coil is more easily shielded without any increase in effective resistance. Perhaps the main objection to a toroidal coil is the practical difficulties encountered when manufacturing it, and this has often prevented it being marketed at a price which competes favourably with the ordinary type of coil.

* * *

It is particularly noticeable that the Reinartz circuit in some modified form, which permits a certain amount of latitude and flexibility, is very popular amongst wireless experimenters. The reason for this is not hard to find if we realise that this circuit gives a very simple form of reaction control with a very smooth action. The tuning can often be effected with one variable condenser, while the reaction condenser can be rotated towards its maximum in order to increase the signal strength.

* * *

It is surprising how many times one comes across the expression "aerial resistance" applied in the wrong sense, one of the most glaring errors being associated with the fact that this quantity is usually given without the all-important governing factor of the frequency or the wavelength at which measurements were taken. To be strictly correct the aerial resistance should be defined as the effective resistance offered by the aerial system at some particular wavelength or frequency. The figure expressing this resistance, multiplied by the square of the aerial current, is a measure of the total power dissipated by the aerial, the radiation power being included.

This consideration automatically leads up to an expression which is often confused with the aerial resistance, viz., the radiation resistance of an aerial system. This is really a component of the aerial resistance, which, when multiplied by the square of the aerial current, measures the power radiated. If these salient facts are borne in mind, the reader should experience no difficulty in differentiating between the two quantities on future occasions.

* * *

I hear that Mr. E. Foster, operating a small home-made transmitting station, at Port Alberni, British Columbia, established a new world record when he communicated across the Pacific and over a thousand miles of Australia, while more than a quarter of the distance was in daylight. It is well known in wireless circles that daylight transmission is usually more difficult than night transmission, and that sending over the sunset or sunrise line offers still greater obstacles to the travel of wireless waves.

The most remarkable feature of Mr. Foster's record, however, is the extremely low power used by his transmitter. Instead of a transmitting valve, he used an ordinary receiving valve, the necessary power being derived from batteries intended for reception purposes. The total power required by the Foster transmitter in establishing this trans-Pacific record was only 13 watts, a fraction of the power used by an ordinary electric light bulb.

Radio experts in discussing this achievement, ascribe the efficiency of the transmitter to the steady unwavering signals which it transmits. Often the amateur transmitter draws power from alternating current mains, causing a hum which detracts from the steadiness of the signals. By the use of batteries this difficulty has been eliminated.

* * *

According to the *Radio News of Canada*, there are 922 broadcasting stations in operation throughout the world. Readers who have heard all these stations need not report the fact !

* * *

I notice that one of our contemporaries has been giving a certain amount of attention to the important question of valve nomenclature in so far as it affects the application of the term " valve impedance." The new term suggested is " differential resistance," since it is merely the slope of a static curve which may entirely cease to have any reference to the condition existing when rapid changes or oscillations are taking place. There is much to be said in favour of this new expression, and we should welcome the publication of a complete list of accepted terms and definitions, together with the appropriate symbols, for universal adoption, as this would militate against the coining of new terms which tend to make the situation a trifle more confusing.

* * *

The trouble caused by the corrosion of accumulator terminals, which produces a high resistance contact or often binds the terminals together, has been realised by a well-known firm who are marketing a battery with a form of non-corrosive terminal. The brass screw, which is attached to the terminal thumb nut, passes through a chamber packed with vaseline when it is screwed down, and this improvement will no doubt be appreciated by users of this battery.

* * *

The provision of some form of enclosed fuse which would form one of the connecting links between the individual two-volt units of a four or six volt accumulator would no doubt save many accumulators from the deleterious effects of temporary short circuits which may occur from a variety of circumstances when connecting up or testing a receiving set. The cost of the complete fuse would be relatively small, and, being enclosed, any possibility of danger from fire, as a result of the fusing of the metal or the dropping of molten metal on to the celluloid cases, would be guarded against. Replacing the fuse wire would only be a matter of a few minutes, while the price of the wire is a negligible item.

* * *

It is surprising how many amateurs do not include a wavemeter as part of the equipment of their receiving stations. With the existing difficulties experienced in locating any particular transmitting station, due to the congestion of frequencies, the employment of a wavemeter enables the task to be carried out more expeditiously. It is unfortunately common practice to set the receiver oscillating, turn the condenser knob to pick up the carrier wave of the distant station, and then lessen the reaction coupling until the set is just below the oscillation point. Interference caused by adopting this procedure is to be deprecated when it is realised that by employing a wavemeter the reception of the required station is a relatively easy matter.

A valve wavemeter is more useful than the buzzer type, for the tuning in the case of the latter is very often flat, unless special precautions are taken, and it is only necessary to set the wavemeter oscillating at the particular frequency desired, loosely couple it to the receiver, and then tune in on this signal. The so-called dead spots will no longer be a bugbear, while the annoyance to neighbours will tend to become a thing of the past. I should strongly recommend the reader either to purchase or make a wavemeter for his purpose, and having once used one he will never want to dispense with it, and the small capital outlay will be more than compensated by the additional pleasure given to tuning in those elusive stations.

The studio indicators, S B. board and panels are shown in this photograph of the control room at 2 LO.

* * *

On certain types of fixed condensers the soldering tags are often attached to the outer cases of the components by means of two screws. When fixing these condensers into receiving sets the constructor is warned against tampering with these screws as invariably the screws at the centre of the condenser make contact with the plates. If these are unscrewed, the condenser is often rendered useless, hence the advisability of soldering the connections to the tags provided and not interfering with the screws at all.

* * *

Those amateurs who are keen on searching the ether for the very distant stations should make a note of the fact that a large radio telegraphic station with seven towers, each five hundred feet high, is to be erected at Pernambuco, Brazil.

Are you Preparing for the Summer Months?

by

John Underdown.

This three-valve receiver has been primarily designed to give good loud-speaker volume, for outdoor work, from the local station or 5XX.

THE receiver about to be described is mainly designed for volume and purity; on the loud-speaker from the local station, but is also excellent for telephone valves. Provision is, therefore, made to cut out the last valve at will. For telephone work also, three valves should not be required in most cases. The third valve will give really good volume for outdoor loud-speaker work during the summer months, for which purpose I have largely constructed the set.

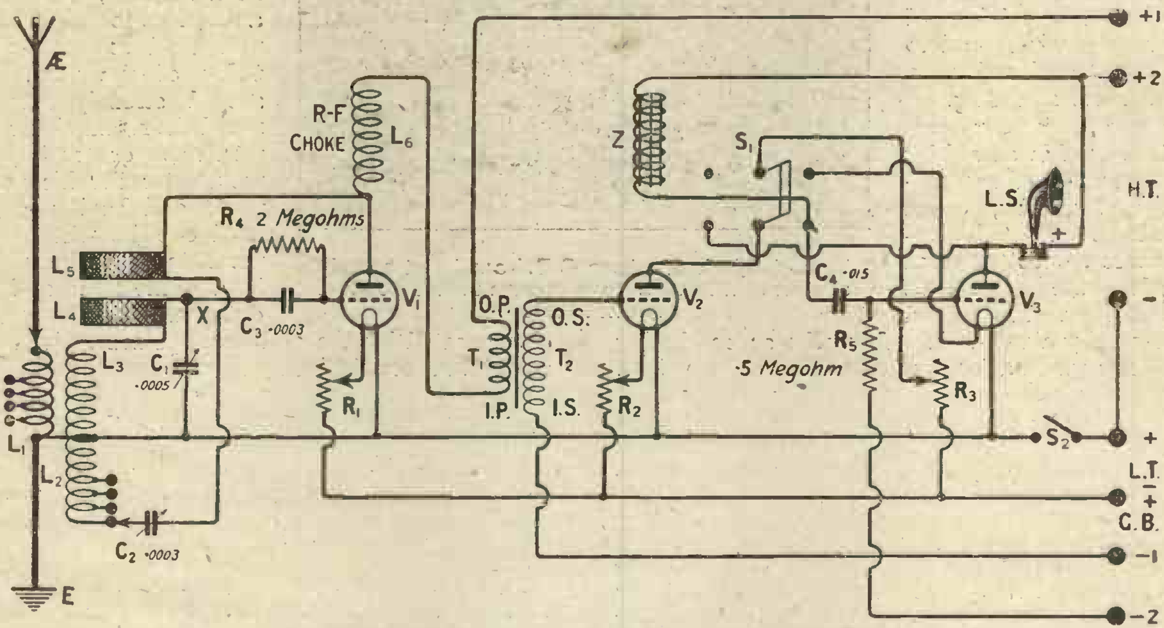


Fig. 1.—Switch S_1 enables two or three valves to be used at will.

Within a limited radius from the local station interference is often experienced from that source, and consequently the so-called "semi-aperiodic" aerial arrangement has been adopted, an untuned, but tapped, variably-coupled aerial coil being incorporated. It is thus possible to obtain very weak aerial coupling if desired.

Daventry Reception

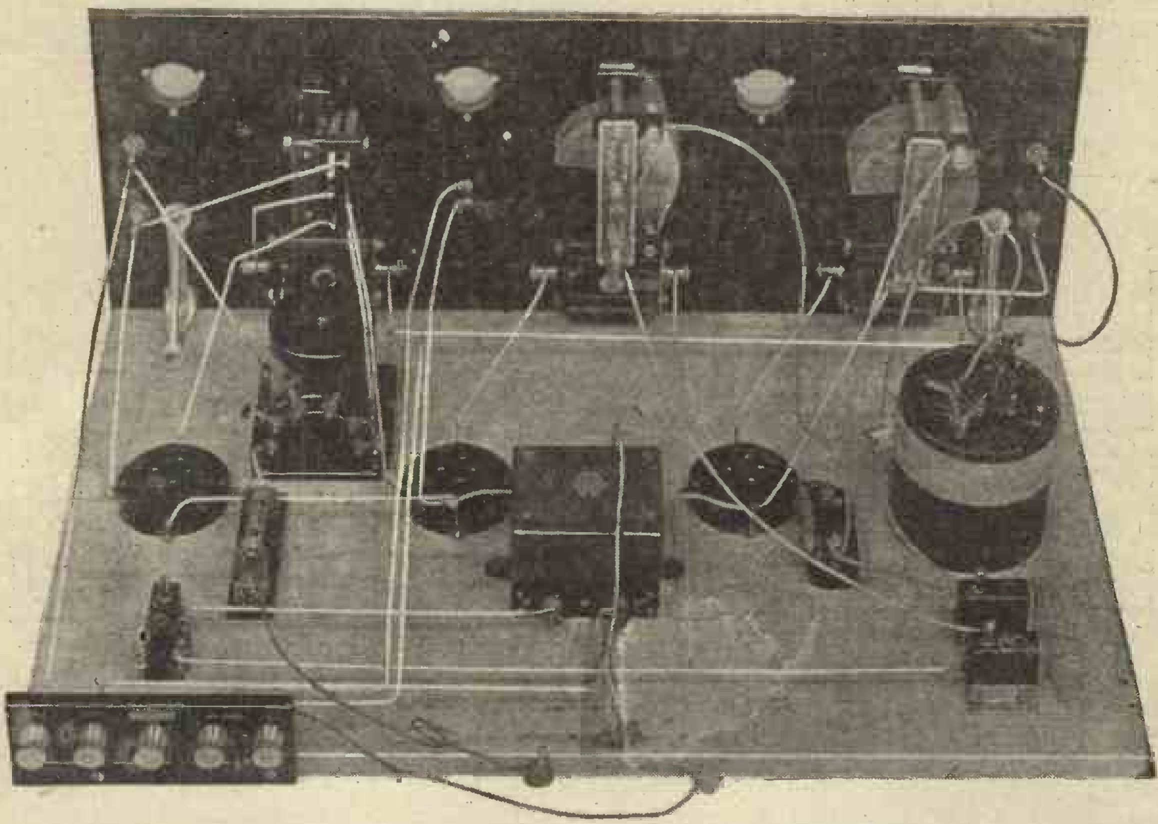
Generally with Reinartz type receivers, in which a specially wound coil is used, Daventry cannot be received, the frequency range being limited to the upper broadcast band only. In this set, however, a useful system of loading has been incorporated, so that 5XX may be obtained without difficulty.

reception from greater distances, the smooth reaction control obtained from the Reinartz arrangement proving particularly advantageous. Up to ten or fifteen miles from a main station, given an aerial and earth system of average efficiency, good loud-speaking should be obtained with only two

The Theoretical Circuit

The details of the circuit will

be readily grasped from the theoretical circuit diagram of Fig. 1. L_1 is the tapped aerial coil, wound on an "X" former placed within the ebonite tube on which the grid and anode coils L_3 and L_2 are continuously wound. The ancde or reaction coil is tapped so that the reaction turns may be varied to suit different valves, the best tapping being determined by simple experiment. L_4 and L_5 a e the grid and anode loading coils for 5XX, the wound coil alone only covering frcm between 200 and 250 metres up to over 600 metres when tuned by C_1, a ·0005 variable condenser. L_6 is switch in the right-hand position, and automatically cut out when this is placed to the left. The arrangement is one of which I am particularly fond, since in my position ample loud-speaker volume for an ordinary room is obtained with two valves, whilst the addition of the choke stage allows the programme from 2LO to be thoroughly enjoyed in a large garden. No loss of purity occurs in this case, and volume is little short of that obtained with two transformers, with which, if an unfortunate pair is chosen, the results are often not all that is to be desired. home use, this system has much to recommend it. The layout of the panel, which is of polished ebonite, has a pleasing appearance, the grid or aerial tuning condenser being located towards the left-hand side, whilst the reaction condenser is in the centre. The three filament rheostats are located towards the bottcm of the panel, whilst the filament "on and off" switch and that for cutting out the last valve are conveniently placed to the right-hand side. Three nickel valve windows are employed, since many times such an arrangement has prevented me from leaving the valves on all night.



Note the position of the "X" coil in the ebonite tube.

the radio-frequency choke, and here a plug-in coil of high inductance and low self-capacity is required. For the detector valve V_1, I strongly recommend a type which oscillates readily and smoothly, such as the D.E.5b, although certain small power valves, for example, the B.4, and general purpose types, function very satisfactorily.

The Switching Arrangement

Transformer coupling is employed between the detector and V_2, whilst a choke couples V_2 and V_3. The last valve is optional, being included in circuit with the

When working on the Daventry and Radio-Paris wavelengths, direct coupling is employed, and the aerial is connected to the upper end of L_4, marked with an X in the theoretical and wiring diagram.

General Layout

Once tuned to the local, or any given station, a touch of the filament "on and off" switch will put the receiver in or out of operation, which feature will appeal to the less initiated members of the family. An "all-enclosed" American type layout has been chosen, valves and coils being placed behind the panel, since, for

The wooden baseboard is somewhat larger than usual, being 20 ins. by 12 ins., as the loading coils and radio-frequency choke must be well separated, in order to obtain efficient working. The adequate spacing between components on the sub-base, which will be appreciated from the photographs, permits of the wiring being carried out in a very simple manner.

Components

The complete list of components employed in th receiver is given below, for the readers' convenience, but the discriminating constructor can, of course, employ a number of others, if of good make :

One oak cabinet to take panel 20 ins. by 8 ins. and baseboard 20 ins. by 12 ins. (W. H. Agar.)

One polished ebonite panel 20 ins. by 8 ins. by ¼ in. (Trelleborgs Ebonite Works, Ltd.)

One ·0005 "Popular" type variable condenser. (Bowyer-Lowe Co., Ltd.)

One ·0003 "Popular" variable condenser (Bowyer-Lowe Co., Ltd.)

Three dual rheostats. (Radio Instruments, Ltd.)

One "Utility" 2-pole, 2-way switch. (Wilkins and Wright, Ltd.)

One Connecticut "on and off" switch. (The Rothermel Radio Corporation of Great Britain, Ltd.)

Three nickel-plated valve windows. (A. F. Bulgin & Co.)

Four 2 B.A. nickel-plated terminals. (Burne-Jones & Co., Ltd.)

One first stage L.F. transformer. (Gambrell Bros., Ltd.)

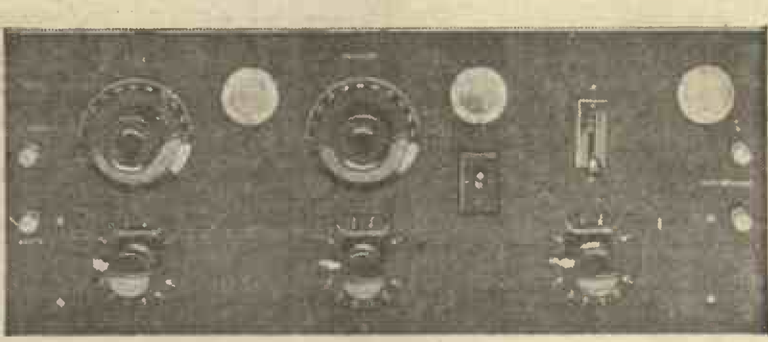
One "Success" super choke. (Beard & Fitch, Ltd.)

One ·0003 fixed condenser, type 610. (Dubilier Condenser Co., Ltd.)

One 2-megohm grid leak. (Dubilier Condenser Co., Ltd.)

One ·5-megohm grid leak. (Dubilier Condenser Co., Ltd.)

Three baseboard mounting coil blocks. (Burne-Jones & Co., Ltd.)



All controls are neatly arranged on the front panel.

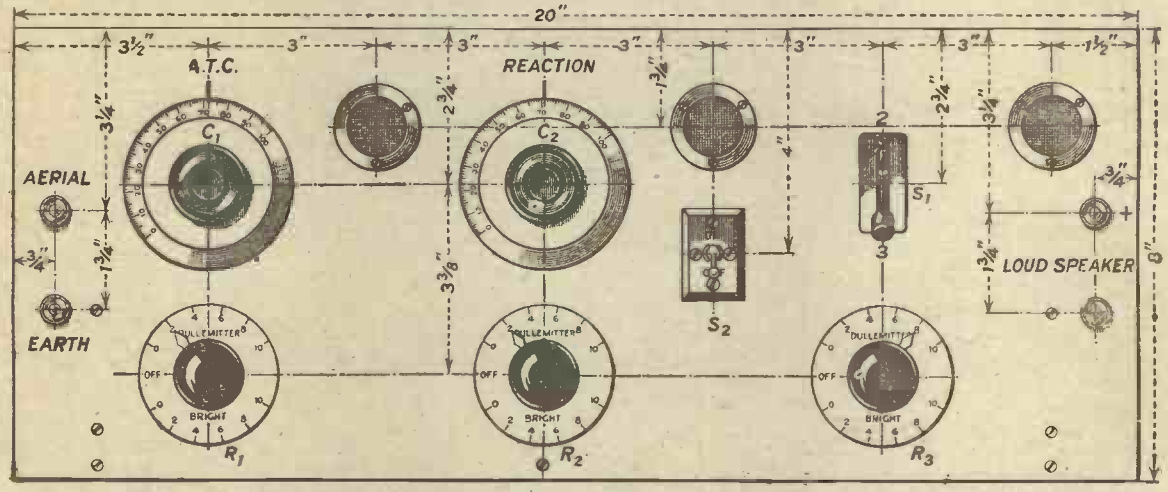
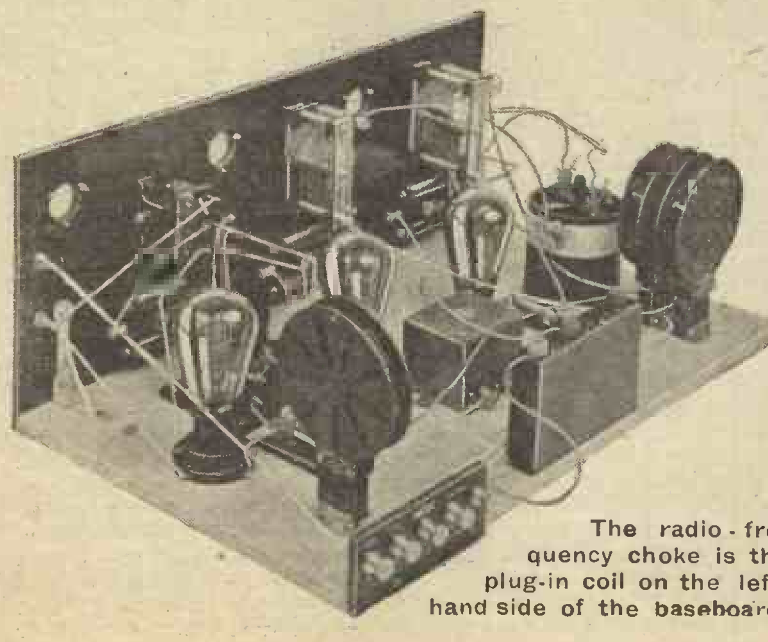


Fig. 2.—Blue print No. 153a is available for marking out the panels. Price 1s. 6d., post free.



The radio-frequency choke is the plug-in coil on the left-hand side of the baseboard.

Two small aluminium brackets. (Burne-Jones & Co., Ltd.)

One No. 1 terminal panel. (Burne-Jones & Co., Ltd.)

One aerial tuning coil unit. (Burne-Jones & Co., Ltd.)

Three "Lotus" valve-holders. (Garnett, Whiteley & Co., Ltd.)

One ·015 multiple fixed condenser. (C. A. Vandervell & Co., Ltd.)

Two shorting plugs and three "Lico" clips. (Peto-Scott Co., Ltd.)

A quantity of Glazite, flex and wood screws.

Radio Press panel transfers.

Three Clix plugs. (Autoveyors, Ltd.)

Construction

The panel is ample in size to avoid any overcrowding of the components, and since most of these are of one-hole mounting type, drilling work is comparatively simple, and reference should be made to Fig. 2. The only holes which may present any difficulties are those for the valve windows, for which I used a one-inch bit in an ordinary carpenter's brace, and that for the Utility switch. A suitable drill and a small flat file will, however, allow the last-named to be made without much trouble.

Having mounted the components upon the panel, fix this to the baseboard by means of the two brackets and three wood screws in the front, and then lay out the components upon the wooden sub-base, paying particular care to follow the arrangement, as seen in the wiring diagram of Fig. 3.

To mount the ½-megohm grid leak it will be necessary either to employ two clips which should be soldered to heavy leads or, alternatively, to make a clip-in stand, such as that seen in the photographs. This consists of a 3 in. length of ebonite, ¼ in. thick, and ¾ in. wide, upon which two home-made clips of brass or phosphor bronze are mounted by means of two screws and nuts, to accommodate the grid leak (see Fig. 4). The holes for the screws should be amply countersunk so that these do not touch the baseboard.

The Special Coils

The solenoid and "X" coils shown in the photographs were constructed from my specification, by Messrs. Burne-Jones & Co., Ltd., from whom the components may be obtained if desired, or, alternatively, they can be wound in a very simple manner, full details being given in Figs. 5 and 6. For the solenoid coil a 3-in. diameter piece of ebonite tube, 3 ins. long, will be required, and at ¼ in. from the top a 65-turn winding of 30 gauge d.s.c., taking up approximately 1 in., is started. The coil should be tapped at 5, 10, 15 and 20 turns from the beginning, the 20th turn being earthed. The method of tapping adopted in this case is to wind on a given number of turns, then to bare about 2 ins. of the wire with fine emery paper, finally twisting the bared portion together and soldering the twisted

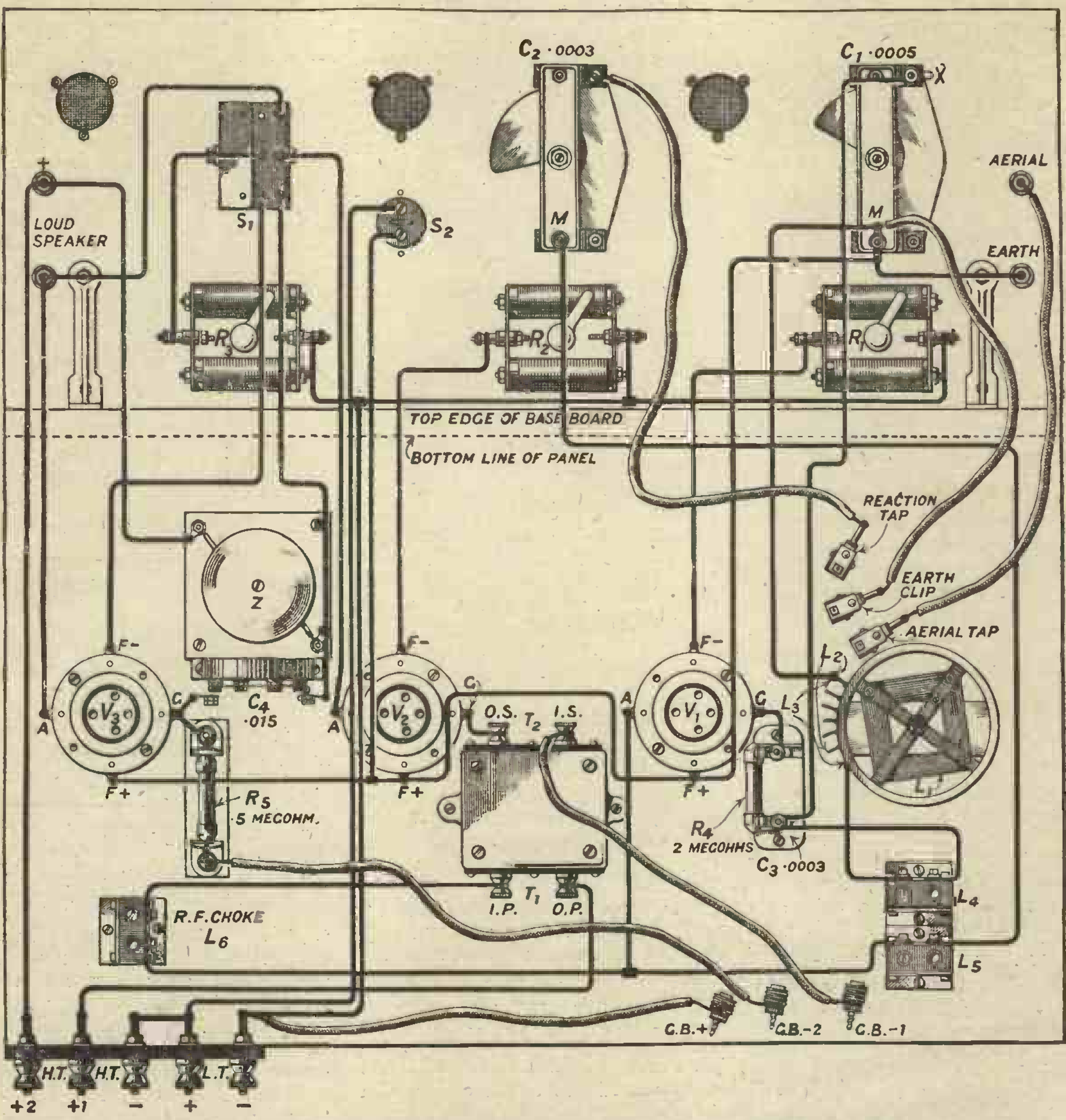


Fig. 3.—Readers building this set will find full wiring particulars in this diagram. Blueprint No. 153b. Price 1s. 6d., post free.

lengths with a really hot iron and a minimum quantity of flux. This will prevent the projecting tappings unwinding when you proceed to wind on further turns. The tappings should be staggered in some convenient formation so that a small spring clip, such as those seen in the photographs, will not touch any tapping but the one to which it is attached.

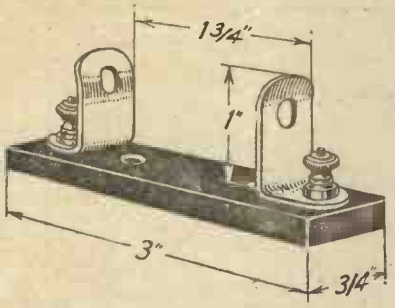


Fig. 4.—Details of the grid-leak mount.

The Primary Coil

The primary coil is wound in an "X" former, for which the dimensions are given, with 35 turns of 24-gauge d.s.c. wire tapped at 10, 20, 25 and 30 turns from the beginning of the winding. The tappings may either be twisted and brought out, or can be arranged to connect under suitable pins on the cross arms.

To these pins or tappings flex leads from the aerial and earth terminals are clipped when receiving on the upper broadcast frequencies. If the single layer coil is purchased ready-made, it may be fixed to the baseboard by means of suitable brackets and screws, whilst in other cases, if a 3 in. length of ½ in. square cross-section wood is attached to the baseboard by means of two screws, the wood may be shaped, with a chisel, so that the tube makes a sliding fit over it and can be wedged or screwed into position.

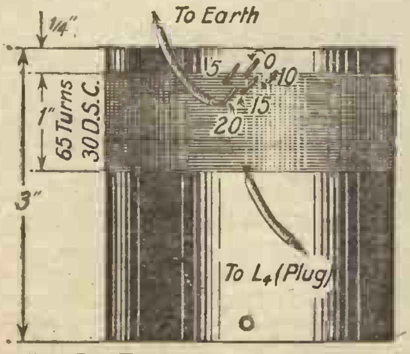


Fig. 5.—The coil L_3 L_2 can be constructed from these measurements.

From the No. 1 terminal strip I have removed, by means of a hacksaw, the end piece carrying the two grid-bias terminals, since these are not required. This battery can conveniently stand in the cabinet, flex leads and plugs being employed for tapping purposes.

The Wiring

The wiring is mostly carried out with Glazite wire, excepting in the case of certain short leads, where it is convenient to use 24-gauge wire covered with insulating sleeving, and where flexible leads, terminated by the spring clips, are used. There are three of these latter, one from the reaction condenser to a tapping on the reaction coil, and one each respectively from aerial and earth terminals. These last two go to the tapped aerial coil, or, in the case of the aerial lead when receiving 5XX, to a soldering tag joined to the upper contact of the aerial or grid tuning condenser. The only point which will need some explanation is the wiring to the coupling condenser C_4, which is of the mnltiple-fixed type, this particular condenser being chosen since it has mica dielectric and adequate insulation is required in this position. The tag marked 00 goes to the grid of valve V_3, whilst the other tags are joined together, thus paralleling the small fixed condensers, and are taken to the choke, etc.

Preliminary Adjustments

For a preliminary test, if your local station works on the higher broadcast band of frequencies, short circuit the L_4 and L_5 coil-blocks by means of the two shorting plugs, and insert a large plug-in coil into the L_6 position. Here I generally use a Gambrell "H" coil, but a No. 250 or 300 of any good numbered make is suitable. Join the aerial and earth to the appropriate terminals on the set, and internally connect the flex leads from these two points respectively to the outside and inside tappings of the aerial coil, which is placed within the solenoid coil at about the same height from the baseboard as the reaction or plate winding. The lead from the reaction condenser should be taken to a reaction tapping so that 10 or 15 turns are in circuit. Now, with only the low tension connected, insert a valve in turn into each valve-socket, noting whether it controls properly when adjusting the filament resistance, and whether V_3 switches on and off by means of the double-pole switch. Next connect up the H.T. battery, joining the two high-tension positive terminals together and tapping the lead therefrom first into a comparatively low value of H.T., such as three or six volts, when if all is correct a preliminary test may be made with about 60 volts on the anodes of all valves. Set the reaction tuning condenser to zero and tune in on the C_1 condenser, when the local station should be heard at good strength.

The Reaction Condenser

Next increase the reading of the reaction condenser, when, providing the reaction coil is of correct size and the high tension voltage on the detector valve is suitable in value, the set will slide smoothly into oscillation. If it does not, experiments should be tried with the number of turns in the reaction coil, whilst the H.T. and L.T. for the detector valve should be carefully adjusted until the desired condition of affairs is obtained.

5XX

When it is desired to receive 5XX, the flex lead from the aerial terminal of the set will be taken

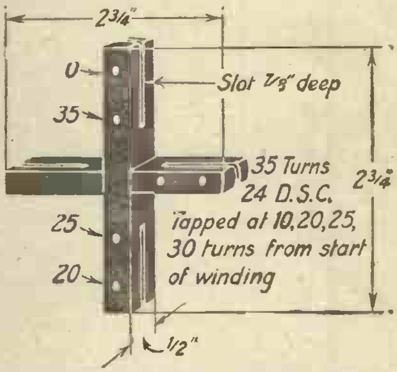


Fig. 6.—Former details for the "X" coil.

to the "X" point on the aerial condenser, whilst an E1 or 150 plug-in coil will be inserted in the L_4 coil socket and an E or 150 or 200 into L_5. It is desirable that the size of the radio frequency choke should be increased also, and here I have used a Gambrell "I" or "J" coil.

Valves

Now as to valves, I prefer to use a D.E. 5b. or D.F.A.4 type in the first valve-socket with approximately 50 volts high tension, whilst in the other two sockets valves of the B.4 type with 120 volts high tension and 6 or 7½ volts grid bias give very satisfactory service. When the listener is

(Continued on page 911).

Some Results Obtained with 'Modern Wireless' Sets

The DX Four

SIR,—Although I have made up quite a dozen sets from MODERN WIRELESS and the *Wireless Constructor* I had given up all hopes of cutting out 2LO until I made up the "DX Four" from Mr. D. J. S. Hartt's design in the Oct., 1925, issue of MODERN WIRELESS, and now it is possible to do so. I can bring in Manchester and foreign stations at fair loud-speaker strength without a trace of London, and this was accomplished on the first night of working. I am five miles from 2LO, right on top of a hill, and have a full size outside aerial 20 ft. high.

I think you will admit it is wonderful to have a set so near London, with the tuning so fine that it takes time to tune, although when same is done the volume is tremendous.—Yours truly,

P. F. BAILEY.

A Three-valve "Prince" Receiver

SIR,—Please allow me to congratulate you on the three-valve "Prince" receiver as described by Mr. A. S. Clark in MODERN WIRELESS for January, 1926. I have recently made this set from some odd components. One often hears claims to natural reproduction, but this is perfection itself, and I would like to see some wireless shops use this circuit for demonstration purposes. I am a professional musician (several of my colleagues are in the regular employ of the B.B.C. at 2LO), and you will appreciate the fact that I am a severe critic of good reproduction. During the past eighteen months I have built many sets, but they were just lacking that something for loud-speaker work on the local station which the "Prince" gives, volume and *perfect* reproduction. I am using a Marconi R5 for the first valve and B.T.H. B4's as second and third, 18 volts for the first H.T. with 4½ volts grid bias and 66 volts on the other two with 4½ volts grid bias.

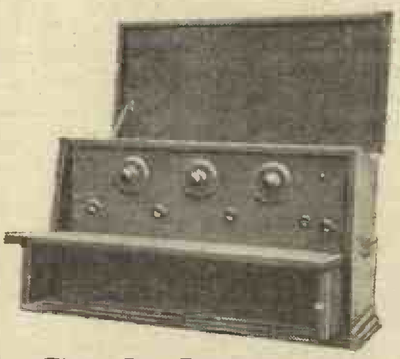
Wishing you the best of luck with all your publications and their wonderful variety of circuits and information.—Yours truly,

H. R. YOUNG.

Tufnell Park.

A Self-contained DX Four Receiver

SIR,—I enclose a photograph of the DX4 receiver described by Mr. D. J. S. Hartt in the October, 1925, issue of MODERN WIRELESS. As will be seen it is completely self-contained, earth and aerial connections being on the left-hand side of the cabinet and the loud-speaker terminals on the right-hand side.



This DX Four Receiver, constructed by Mr. E. H. Pineles, is self-contained.

This is the 41st set (crystal and valve) I have put together, most of them being from descriptions given in MODERN WIRELESS, *Wireless Weekly* and the *Wireless Constructor.*

The DX4 is the best set I have handled, being the only one which has enabled me to cut out 2LO and receive a station on a wavelength close to that of London.

I have substituted Colvern selectors for fine tuning in the three condenser positions, an Ideal Marconiphone transformer for the first L.F. stage, with a Polar resistance capacity unit for the second L.F. as I thought I might get purer signals.

I was so satisfied with the DX4 that I made the special cabinet for it, which keeps it completely enclosed, and when tuned in to the required station the doors can be closed. The flap is supported underneath and is used as an arm rest when tuning and as a desk when making logs.

With best wishes for the continued success of all your periodicals.—Yours truly,

E. H. PINELES.

Golders Green.

The "Quality Four"

SIR,—I write as one who was till recently a complete novice in wireless matters. I had not previously tried my hand at wireless constructional work, though I have some experience of small mechanical jobs. I was so attracted by the appearance of the "Quality Four" receiver on the cover of MODERN WIRELESS for February, 1926, by Mr. J. W. Barber, that I bought your journal and decided to have a shot at making the set.

As I was on new ground, I kept strictly to the instructions and list of parts given in your journal, and the results I am getting from the finished receiver fully justify my caution. It would certainly be difficult for anyone to go wrong with such careful instructions given for making the receiver.

I chose the series of valves given in the top line of the table of valves in the article, as I happened to have already a 6-volt accumulator.

A local firm put up for me what I believe is a good aerial, 35 ft. high and 100 ft. long overall. The earth consists of a large sheet of zinc buried outside the window of the room where the receiver is used.

I have by no means completed my list of stations received, as I seem to hear new ones every day. It includes all the well-known Continental stations, many of them being received at various times on a large Brown loud-speaker. I am now going to be a regular reader of MODERN WIRELESS.

Yours truly,

E. W. LOCKHART.

Bushey.

How Interference Helps

By Captain H. L. CROWTHER, M.Sc.

Have you ever thought that interference can be useful? Read this interesting article before giving your answer.

THIS title may appear a very peculiar one, as it is difficult to see what possible good interference can be. It certainly causes nothing but trouble and annoyance to the DX enthusiast.

Assisting General Advancement

Looked at from another point of view, however, there is little doubt that interference problems and their investigation have assisted in the general advancement of the science of radio. Since the introduction of broadcasting, our knowledge of radio in general has greatly improved, and it is purely owing to the investigation of problems which previously had either not occurred, or else had not become acute. Problems such as the elimination or reduction of interference and many others of a similar nature, when their solution is more or less of a necessity, stimulate research and investigation. Research on one type of problem nearly always opens up possibilities in other directions, and these may be of vital importance.

No Incentive for Investigation

Let us assume for a moment that in this country we were not seriously troubled by interference, and that we had two or three high-power stations that were well separated in wavelength, and that we were not influenced by Continental stations. In this case receivers would not necessarily have to be selective, and they could be quite simple in design. There would be little incentive to investigate the problems of highly selective and sensitive receivers. The receivers constructed under these conditions would then meet the requirements of this country, but they would be of no possible use to other parts of the world where interference was bad, or where the distances to be covered were much greater than our own.

Selective Receivers

In the early days of broadcasting in this country, the problem of interference was nothing as compared with the state of affairs at the present day. America, on the other hand, had started broadcasting some considerable time previously, and, at the time this country was starting, was confronted with the problem of interference. This led to the development of certain types of specially selective and sensitive receivers, and although in some cases the initial ideas did not originate in America, it was that country which developed the principles and made them a practical proposition. Highly selective receivers were not necessary in this country in the early days of broadcasting, and naturally they were not developed to any extent. The result is that America has been a little ahead of us as far as this side of radio is concerned, and this is simply because she had to face the problem of interference long before the matter became acute in this country, and has thus reaped the advantage of the very selective receivers for reception purposes.

Different Problems of Interference

Let us now consider some of the various problems of interference which at present concern us.

These can be divided into two classes: first, those which are purely the concern of the transmission side, and which cannot be eliminated at the receiver, and, secondly, those which are due to the receiver and which can be remedied completely or partially by proper design.

Spark Transmission

Spark transmission, of which we hear so much on the normal broadcasting range of frequencies, really consists of a multitude of waves of different frequencies, which in some cases cover quite a wide band of frequencies. For instance, a spark station may easily cause serious interference at 50 k/c on either side of the nominal frequency. That is, a single spark station is probably transmitting on all frequencies from, say, 750 k/c to 650 k/c, and although the power radiated falls off rapidly as we depart from the resonant frequency, yet there may be sufficient energy in the outside band of frequencies to cause considerable trouble, especially at short distances, and it might easily interfere with half a dozen broadcast stations.

Spark interference cannot be eliminated at the receiving station for reception of frequencies which come within its band, although by means of a selective receiver all the frequencies not actually occurring in the receiver band can be eliminated, and thus the effect can be reduced. This calls for skill in design and this is where interference is advantageous, inasmuch as it calls upon the ingenuity of the experimenter in the overcoming of obstacles.

Interference and Distress Calls

It should be borne in mind, however, that this type of interference, although a great trouble to the broadcast listener, is almost essential for the purpose of distress calls, as it will affect any receiver tuned to approximately the same frequency. If the transmission were only on a single frequency, such as continuous wave, or on a small band of frequencies, such as tonic train or telephony, then a large number of stations might easily miss a distress call owing to their receiver being slightly out of tune for the frequency of transmission. We thus see that a form of transmission that will cause interference is of great importance for S.O.S. calls.

It might be argued that it is not necessary always to use such a form of transmission for ordinary working, and that it could be reserved purely for distress calls. Such a scheme would naturally have many advantages, and this is the policy which is gradually being adopted in practice.

Interference from Harmonics

Harmonics are another source of interference which can only be eliminated at the transmitter. All oscillating valve circuits and arc generators generally produce a very large number of harmonics, which if transferred to the aerial will be radiated and will cause interference. For instance, a high-power station whose fundamental frequency is 100 k/c will, if special precautions are not taken, transmit signals corresponding to 200 k/c, 300 k/c, 400 k/c, 500 k/c, etc., and these are likely to cause interference with any broadcast station on or near these harmonic frequencies.

The controls being carefully adjusted at the Zurich Station.

The transmission of harmonics has led to considerable improvements in transmitter circuits, while they are also of considerable scientific interest. For instance, it has been found that the fundamental waves and the harmonics, although transmitted from the same aerial at the same time, will sometimes arrive at a receiving station from different directions, and also that fading effects in the two cases are not identical. This shows that the fundamental wave and its harmonics can be considered as entirely independent waves which have a separate existence in the ether, and may follow different paths. The pursuit of scientific investigations as the result of these effects can thus only be credited to the outcome of the advantages of a particular form of interference.

Problems of the Receiver

Up to the present we have only mentioned two types of interference which are entirely due to the transmission, so let us now turn our attention to receiving problems.

If two broadcast stations which are separated by, say, 20 k/c, cannot be discriminated between at the receiver, the fault is purely one of the design of the receiving apparatus. Of course, if one is very close to a station and desires to receive a distant one, the problem is a difficult one.

This interference difficulty has led to a number of developments in broadcast reception, such as supersonic heterodynes, the super regenerative and neutrodyned high-frequency circuits, to mention only a few.

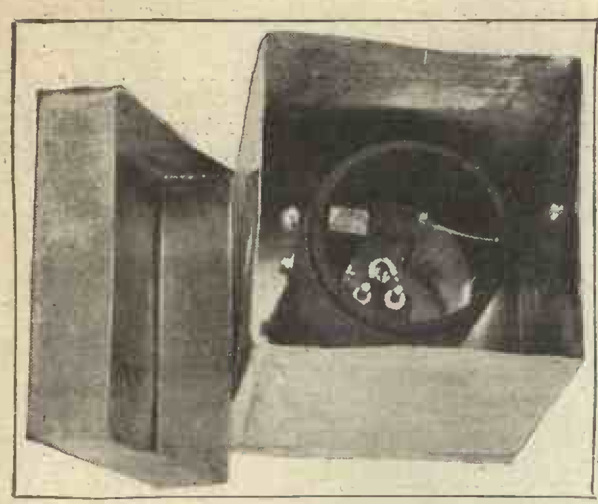
Atmospherics

Interference due to atmospherics of various descriptions is possibly the only type of interference for which at present there is no definite means of solution. Atmospherics are of many types, but they have a shock effect on the receiver, causing it to oscillate at a frequency to which it is tuned. They will thus cause trouble on any wavelength, although, generally speaking, they are worse for long wave reception. They vary greatly at different times of the day, also at different seasons of the year.

It is rather difficult to see what possible advantage atmospheric interference can have on radio development, as at present it is a very serious difficulty, particularly for long distance work.

Conclusions

It would thus appear that although the various types of interference have been usually looked upon as a bugbear by many wireless amateurs, they have in effect been the means of improving the design of receiving and transmitting stations. The problems involved in their elimination have given birth to numerous ideas which have done credit to the ingenuity of the experimenters, and the sets which have been produced in consequence give the desired purity and volume with greater freedom from unwanted noise.



Cutting Out the Stray Fields

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

The screening of coils is a subject of extreme importance, and the details of some research work carried out by Mr. J. H. Reyner make very interesting reading.

THE recent developments in the efficiency of high-frequency amplifiers have brought in their wake certain other difficulties. It has been found that effects which were hitherto swamped by the various sources of inefficiency have now assumed proportions sufficient in magnitude to occasion trouble of various kinds. One of the principal sources of loss is the stray field produced by the coils utilised in the make of the receiver.

Two Kinds of Fields

Electrical fields are of two kinds. There is the magnetic field which is produced when a current passes round a coil, and there is the electro-static field produced between two bodies, or two portions of the same body, which are at different potentials. These effects are utilised in order to produce the results which we require. For example, wire is wound into the form of a coil in order that it shall produce a certain magnetic field, and so we obtain a quality known as inductance. In a similar manner by arranging two sets of plates in proximity to one another but at different potentials, we obtain an electro-static field, which is the property utilised in an ordinary condenser.

Maintaining Stability

Now, as long as these several fields are under control, everything is satisfactory. The difficulty arises as soon as such fields come into play in portions of the circuit where they are not required. One of the prominent examples of this point is the capacity between the anode and the grid of the valve employed in the amplifier. The neutralisation of the effect of this stray electro-static field is one of the outstanding developments of the past few years. We are now approaching a state where we can control the neutralisation to any extent we require, and we can obtain circuits which will maintain their stability over a wide range of frequency.

A Loss in Efficiency

At this juncture we begin to experience trouble from other forms of stray fields. One of the principal offenders is the stray magnetic field radiating from the various coils in use. It is obvious that such fields will cause a transference of energy into parts of the circuit where such energy is not required, and this must result in a loss of efficiency. Stray fields, therefore, are to be avoided where possible, more particularly in the case of a multi-valve amplifier.

One method of reducing the fields has been in the use of coils having an astatic winding. In this case the coil is so wound that the various magnetic fields produced by the different portions all add up to produce a negligible external effect. Such types of coils have been described from time to time, and it is not proposed to discuss the matter in this article. The only alternative method is to enclose the coil in a metal screen on all sides.

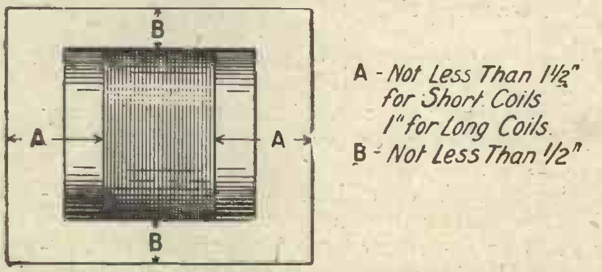


Fig. 1.—The relative dimensions of the screen and coil.

Screening the Coil

When this is done we obtain a neutralisation of the stray magnetic fields of the coils. The screening effect is really produced by small eddy currents which are induced in the metal of the screen. These currents, in turn, produce small magnetic fields which are in the opposite direction to those produced by the coil, and they adjust themselves so that the total field outside the screen is negligible.

If the screen is connected to earth it is found that the capacity effect between the coil and various other portions of the circuit is also practically eliminated, so that such an arrangement reduces both the magnetic and electrostatic coupling between the various portions of the circuit.

A Possible Loss of Energy

The only trouble occasioned with this method is that if the screen is placed too near to the coil in question the eddy currents produced in the screen are so large that an appreciable amount of energy is absorbed from the coil. This of course increases the effective resistance of the coil, and consequently renders the arrangement inefficient.

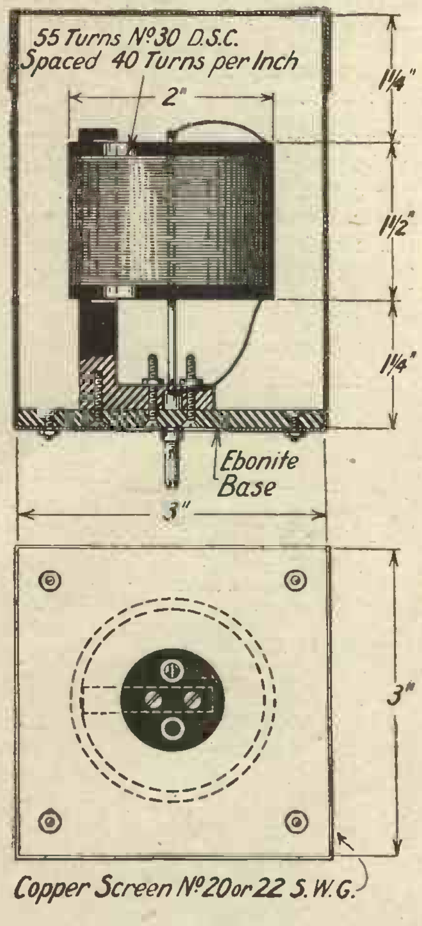


Fig. 2.—Details of a coil which gave satisfactory results when tested.

Experiments which have been conducted show that there are certain limits within which the screen must not be brought, and that if the dimensions of the screen are arranged so that it does not come nearer to the coil than the specified limits, then the increase in high-frequency resistance is comparatively small, and the arrangement becomes of practical value.

The Size of the Screen

The matter was discussed in *Wireless Weekly* a short time ago, when several experiments were described showing the effect of bringing a metal sheet near to a coil, and it was found that if the sheet were further away than ½ in. from the coil in a radial direction, and more than 1½ ins. in an axial direction, then the increase in effective resistance was quite small. Fig. 1 illustrates the relative dimensions of the screen and coil. The shape of the coil has a certain effect upon the dimensions, and it was found that for a long coil the screen could be placed nearer to the end without producing any serious effect than is the case with a shorter coil.

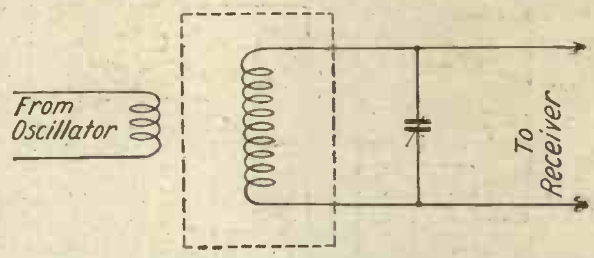


Fig. 3.—A scheme for testing the efficiency of screening.

For a coil wound in an efficient manner having its length equal to one-third or one-half the diameter, the figure dimension of 1½ ins. should be taken, but for a coil having a length equal to or slightly greater than the diameter, then the screen may be brought to within 1 in. of the end of the coil without causing any serious trouble.

The next experiment was therefore to make up several types of screened coils completely surrounded by a metal screen in some such manner. Fig. 2 illustrates a coil which was found to give very satisfactory results. This coil had an inductance of 200 microhenries, and a high-frequency resistance of less than 10 ohms, so that allowing for some slight inefficiency in the screening, this could be considered a reasonably good coil.

Actual Tests

The actual screening of this coil was tested by placing it close to a high-frequency oscillator and observing the amount of energy picked up (see Fig. 3). The coil, of course, was tuned with a variable condenser to the frequency of the oscillator, and sensitive instruments were used in order to detect what current was produced. It was found that unless the coil was placed in a position of maximum possible coupling (which naturally would not be done in laying out a receiving set), the coupling was practically negligible. Even in the maximum position, the energy picked up was less than would be picked up by the stray field of an ordinary unscreened coil.

Experiments were next made in order to ascertain whether a complete metal screen was necessary. If it is essential to enclose the coil completely in a metal box, the arrangement of necessity becomes more cumbersome, and it was thought that perhaps a reasonable degree of screening might be obtained if, say, all sides and one end of the coil were enclosed. Exhaustive experiments, however, indicated that this was not the case, and that the only method of obtaining satisfactory results was to enclose the coil as completely as possible, the only gaps permissible being those to permit the leads to be taken from the coil.

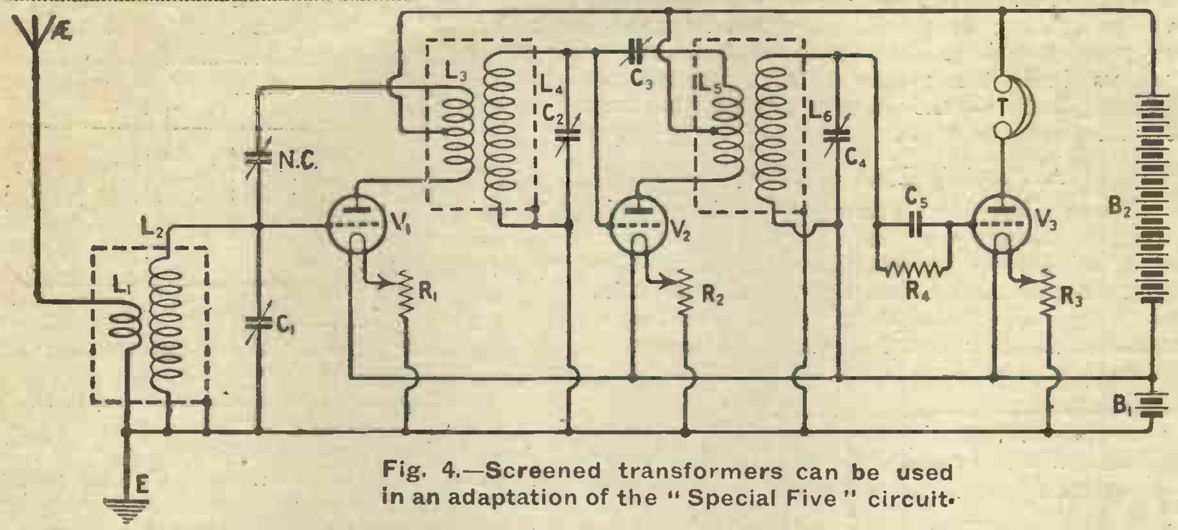
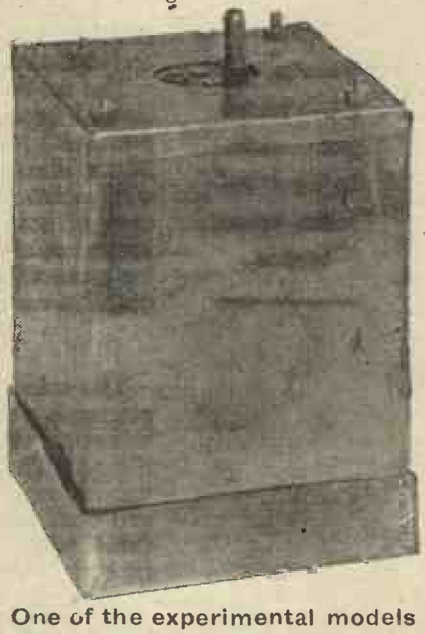


Fig. 4.—Screened transformers can be used in an adaptation of the "Special Five" circuit.

The Application of These Coils

The next point to be considered was that of the application of such coils to actual receiving circuits. Various simple forms of circuits were tried, and the coils were found to function efficiently in such positions, and, if anything, slightly better results were obtained than with the ordinary type of coil.

The efficiency of these screened coils, however, is not particularly noticeable unless two or more coils are employed in the circuit. That is to say, the principal application lies in the design of multivalve amplifiers which are required to be particularly selective. Anyone reading through the pages of Modern Wireless for the past few months will have realised that the number of cases in which a straightforward coil is employed are comparatively few. In the majority of cases, either a tapped coil is utilised or a transformer arrangement is adopted.



One of the experimental models of screened coil cases.

Not a Practical Proposition

It was not considered a practical proposition to make up various types of coils all completely fitted with totally enclosed screens, but it was thought preferable to make up some form of screen which would be applicable to any type of coil. After some consideration this was decided upon, and several sample coils were made up in which part of the screen was removable The coil itself was made to plug into sockets housed inside the screen, so that the coil itself could be changed and, if necessary, altered at will. By this means any of the usual forms of circuits may be adopted with the exception of such circuits requiring a swinging reaction, or other coupling coil of any sort.

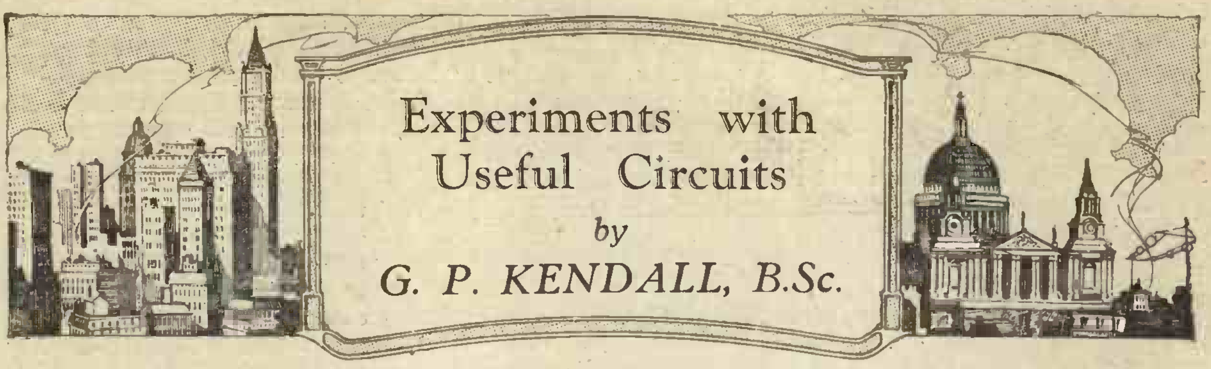
The only limitation is that the coil must not be greater than a certain size depending upon the size of the screen, and when the particular coil desired has been chosen and inserted in position the remainder of the screen may be placed over the base and clamped up by a small nut, so making a complete electrical contact.

The Advantages of Screened Coils

These screened coils have given considerable satisfaction in actual use, and in fact have shown up several pitfalls in the construction of the ordinary receiver, where selectivity is often lost through unsuspected sources. By the use of a screened coil of this nature, we are able to say that the majority of the stray fields have definitely been eliminated, so that we have to look elsewhere for the source of the trouble, and our search is thus directed into certain channels. In such circumstances there is a much greater possibility of success, and the preliminary results which have been obtained certainly indicate that we shall be able to achieve better reception as a result.

As has been mentioned, the coils may be used in any standard form of circuit. Fig. 4 illustrates a "Special Five" circuit in which the transformers initially used by Mr. Harris have been replaced by a similar article completely screened. It should be noted that in all these cases it is necessary to connect the screen to earth.

(*Continued on page* 883).



Experiments with Useful Circuits

by

G. P. KENDALL, B.Sc.

Experimenting with fresh circuits is one of the greatest joys of the keen experimenter.

ONE of the greatest fascinations of wireless as a hobby lies in the fact that one can always be trying something new, or, at any rate, something new to oneself. This is particularly true in the case of the enthusiastic experimenter who likes to try all sorts of special circuits, since there is truly no end to the varied and interesting ways of laying out the circuits of even a one- or two-valve set.

The circuits which I shall describe in this article have been chosen for their unusual character, but they are, of course, all of a thoroughly practical nature and capable of giving good results, in addition to the fact that they are interesting in themselves. Many of them have been tested in some form or other in connection with the feature "Circuits for the Experimenter," now appearing in *Wireless Weekly*, since a number of circuits of any given type may be tested at one time, although only one of that particular type has appeared in the series of circuits referred to.

The first circuit (see Fig. 1) is intended to illustrate a method of combining the T.A.T. system of stabilising with the neutrodyne type. This method possesses advantages which render it decidedly attractive for certain purposes, more particularly in sets employing a very weak coupling to the aerial, in order to achieve high selectivity.

Aperiodic Coupling

The circuit incorporates two stages of H.F. amplification, the first intervalve coupling being one of the resistance-wound tapped anode coils used in my "Simplicity" receiver and the T.A.T. sets, indicated by L_2 in the diagram. The second coupling consists of a tuned anode so arranged that one end of the tuned circuit is connected to the anode of the valve, a centre tapping goes to H.T. positive, and the other end is "up in the air," so that neutralising potentials can be obtained and fed back through the small condenser N.C. to prevent the valve from oscillating.

Detector Connections

A valve detector follows, and no provision is made for the use of reaction other than that produced by the inherent tendencies of the H.F. valves. It will be seen that in effect the detector is connected across only half of the tuned anode, and it might at first be thought that only half the possible signal strength would be obtained.

A Good Method

This, however, is not so, and the scheme is one strongly to be recommended on the ground of selectivity. It must be remembered that the use of the leaky grid condenser method of rectification causes appreciable grid current to flow, and this tends to produce damping, and hence flat tuning in the preceding circuit.

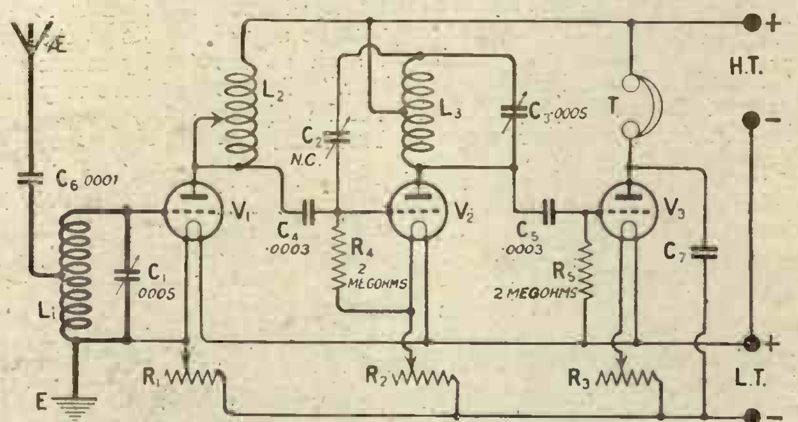


Fig. 1.—This circuit employs the T.A.T. principle in combination with a neutrodyne method.

Reduced Damping

Connecting the valve across only half the tuned circuit reduces the effect of the grid currents, and the consequent relief of damping enables the oscillations in the circuit to build up to a more effective value. Thus, although only half the total voltage is applied to the valve, that total is greater, and the net effect is that only a little signal strength is lost and selectivity is considerably improved.

Auto-coupling

The grid circuit of the first H.F. valve is composed of another centre-tapped coil, half the coil being included in the aerial circuit for the purpose of auto-coupling.

Since half a coil of adequate size for use in a secondary circuit will usually be too large for inclusion in the aerial, a small series condenser of ·0001 is shown, and it is rather a good plan to arrange for the value of this to be easily varied.

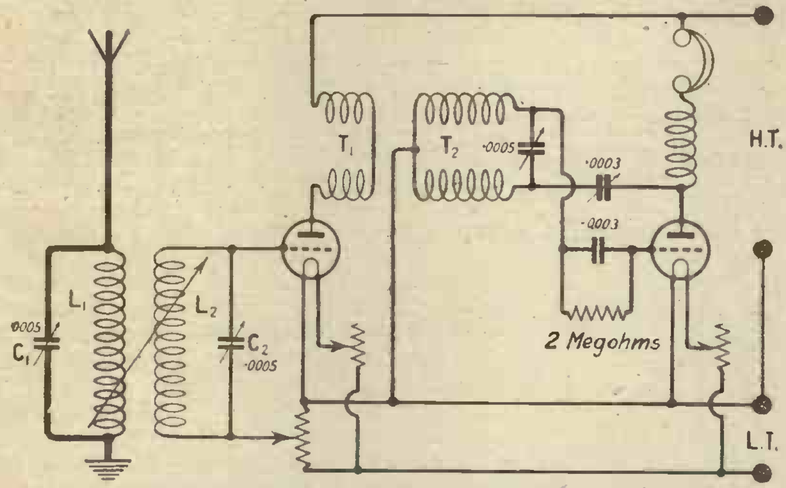


Fig. 2.—Fieldless coils are becoming of great practical interest, and this circuit shows how a special type of transformer may be used.

It is then easy to obtain the best results on any given frequency.

Coil Sizes

The two coils L_1 and L_3 are of the centre-tapped variety, as we have seen, and they can be any of the several makes now available, such as the Gambrell and the McMichael "Dimic." In the case of Gambrells they should both be of the B size for the higher range of broadcast frequencies and size C for the lower.

No low-frequency stages are shown in this circuit, but they could, of course, be added if desired, and the same applies to all the other circuits which we shall be considering.

Coil Fields

Much experimental work is now being done which tends towards the improvement of receivers by the reduction of the stray fields of the various coils, since these stray fields have all sorts of objectionable effects. Screened coils are being developed by Mr. Reyner, and some attention is also being paid to the various methods of arranging coils to limit the spread of their fields.

Toroidal Coils

For example, sets have been built and tested using different forms of toroidal coils, good results being obtainable in this way. A simple method of limiting the external field of a coil is to be found in the expedient of dividing it into two parts placed side by side, so that their fields join up and so do not spread out a distance. Such an arrangement, of course, is used in the Grebe receivers under the name of a "binocular" coil.

Fieldless Transformers

Fig. 2 illustrates one method of using such coils, the scheme depicted incorporating a "fieldless" transformer, such as the Bodine "Twin-Eight," which is now available in this country.

If it is desired to wind such a transformer, two pieces of two-inch diameter ebonite tube will be needed, and the primary and secondary will be wound half on each. Place the two tubes side by side, and see that the windings are so connected that the currents pass round in opposite directions on the two tubes (this applies to both primary and secondary, of course).

Turn Numbers

The primary may consist of two sections of 15 turns in each of No. 34 double silk-covered wire. The secondary will also be in two sections, each of 30 turns of the same wire. (These figures are open to small corrections, because the present tuning range of the transformer will be affected by the actual placing of the two tubes in relation to each other).

Reaction

It will be noticed that the centre point of the secondary circuit is connected to the filament circuit, and this is done to enable a particularly good reaction scheme to be used. This is an arrangement very similar to the Hartley transmitting circuit, and its great attraction is that adjustments of reaction by means of the .0003 variable condenser shown have very little effect indeed upon the tuning.

Sharp Tuning

The detector valve is once more connected across only half its tuned grid circuit, and this

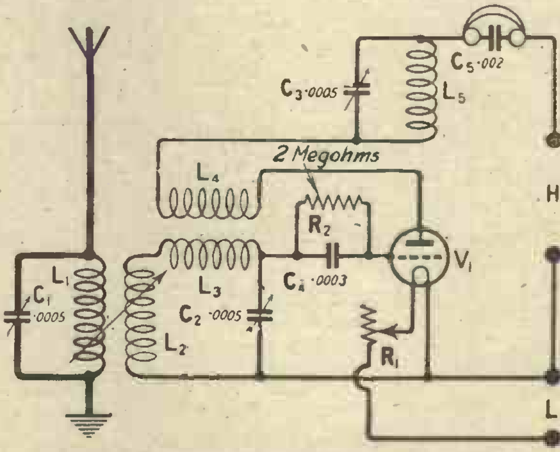


Fig. 3.—The split-secondary type of circuit has many adherents.

fact, coupled with the provision of reaction, ensures that tuning shall be really very sharp indeed in this circuit.

A vernier control is therefore desirable upon the condenser tuning the secondary of the transformer, and it is as well to make some provision to reduce hand capacity troubles on this condenser, since *both* sets of plates are above earth potential—a possible drawback of an otherwise very good circuit.

Stabilising

It will be seen that a potentiometer is provided for the H.F. valve, and this is to control any tendency to self-oscillation on the part of this stage. Whether this will be necessary or not depends to some extent on the layout of the set, but mainly on the valve used in the first socket. Most general purpose valves will not need the potentiometer, but one of an easily oscillating type will probably require it to be used.

Detector Valves

For the detector it is important that the right type of valve be used, if full benefit in the way of smooth control is to be obtained from the special reaction scheme. Suitable valves are those of the types specially designed for use in resistance capacity coupled L.F. amplifiers, such as the D.F.A. 4, D.E. 5 b, D.E.3 b, etc.

Selectivity is a quality we are all trying to impart to our receivers nowadays, but we should remember that multiple tuned high-frequency stages are not the only means of achieving our end. A separately tuned primary and secondary circuit, with a suitably weak degree of coupling, is a potent factor in the search for selectivity, and many good circuits can be put together in this way.

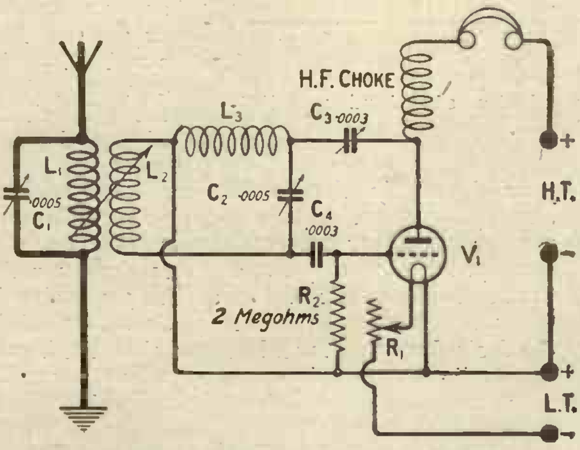


Fig. 4.—How reaction may be applied to a split-secondary circuit.

The usual scheme is to use plug-in coils in arranging a loose-coupled circuit, and the main difficulties when this is done are these. In the first place when the secondary coil consists of a single inductance it is usually so large that it is difficult to obtain a sufficiently weak degree of coupling to the aerial coil in the average coil holder. Secondly, if the reaction coil is coupled to the secondary, it must also be coupled to some extent to the aerial coil, and a number of undesirable features result from this fact. Also, slight variations of the degree of coupling between the secondary and the reaction coil upset the tuning of the secondary circuit to an undesirable degree, and the whole arrangement is one which is really very difficult to work with, and is only capable of giving good results in fairly skilled hands.

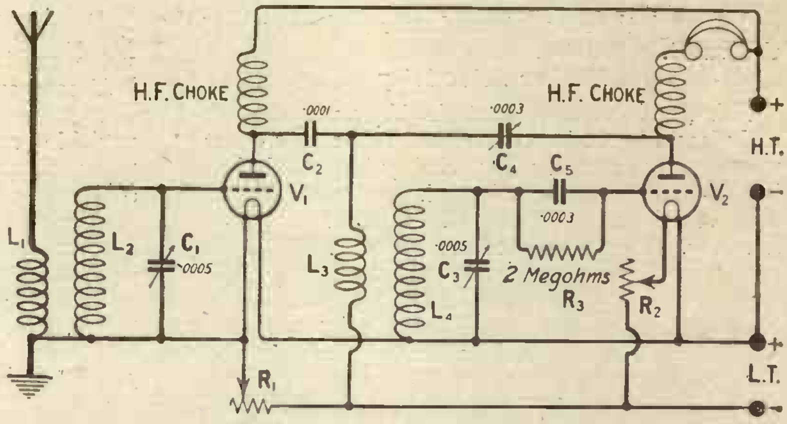


Fig. 5.—A simple scheme for applying reaction to a parallel-feed circuit.

A Simple Remedy

The simple expedient of splitting the secondary coil into two parts in series, however, overcomes most of the difficulties met with in the use of this circuit, and results in quite a practical arrangement.

The main advantage is that it enables one to couple a small coil to the aerial, instead of a large one, so that it becomes quite easy to obtain a fairly weak degree of coupling. Further, by coupling the reaction coil to the *other* portion of the secondary inductance, the trouble of coupling between the reaction coil and the aerial coil is removed, and also changes of reaction coupling will now produce less effect upon the tuning of the secondary circuit.

Throttle Control

A typical split-secondary circuit is illustrated in Fig. 3, and it will be seen that the method of reaction control indicated is that which has been called "throttle control." In this case a fixed degree of coupling is employed between the reaction coil and the coil upon which it reacts, in series with the reaction coil being placed a radio-frequency choke, shunted by a variable condenser which provides the necessary control of reaction. Very smooth reaction adjustment results, provided that a suitable valve is employed, and the whole scheme is one which is capable of giving very pleasing results.

The coil sizes will depend to some extent upon the arrangement of the various couplings, but good results will be obtained with a No. 25 or 35 in the aerial circuit, a No. 25 in the secondary circuit coupled to the aerial coil, and a No. 50 in the secondary coupled to the reaction coil, which should also be a No. 25 or 35.

Another Reaction Scheme

An alternative method of introducing reaction into a "split-secondary" detector valve circuit is indicated in Fig. 4, which will be seen to be arranged in a manner commonly employed in transmitting circuits. The coil L_1 may be of the same size as before, and the junction point between L_2 and L_3 is connected to the filament circuit, one end of the tuned circuit going via the grid condenser to the grid of the valve and the other end through the reaction condenser to the anode of the valve.

Higher Selectivity

This circuit is also characterised by a very smooth and pleasant reaction control which has little effect upon tuning, and it will probably be found that in most cases the selectivity is somewhat higher than in the preceding circuit. At the same time, however, the strength of signals of which it is capable will be found somewhat less. Stronger signals will in general be obtained by making the coil L_2 large, and the coil L_3 small; for example, L_2 can be a No. 50 and L_3 a No. 25 to obtain the best of signal strength with a fair degree of selectivity. When this is done, pains should be taken to obtain a weaker degree of coupling between L_1 and L_2 than was necessary before.

Circuits of the type known as "parallel feed" have achieved considerable popularity of late, and open up possibilities of a number of interesting modifications. In these circumstances it should be remembered that the anode circuit of the high-frequency valve contains a high-frequency choke, while direct from the anode of the valve to the filament is a parallel path which can be taken by the high-frequency component of the anode circuit. This parallel path usually consists of a small fixed or variable condenser, and a small inductance, which latter is used for coupling purposes to the grid circuit of the succeeding valve.

Applying Reaction

One of the main problems concerning these circuits is that of the application of reaction to the grid circuit of the valve succeeding the parallel-feed valve, which proceeding is, as a rule, particularly desirable. When the succeeding valve is a detector there will be upon this grid circuit the damping of the grid current of the valve, and reaction is usually found very beneficial. A very simple method of applying reaction is illustrated in Fig. 5, and this will be found well worth the trouble of trying.

Reinartz Reaction

The method shown is to employ the form of reaction which is familiar to us in the Reinartz circuit, the intervalve coupling winding being employed also as the reaction winding. It will be seen that the parallel-feed path from the anode of the first valve to the filament consists of a fixed condenser of .0001 and a small coil. This coil is coupled to the tuned grid circuit of the detector valve, and it also comprises a shunt path for the H.F. component of the detector valve anode current; this radio-frequency current is fed through the variable condenser from the anode of the valve, through the coil to the filament circuit and, of course, produces reaction effects which can be graduated in extent by the setting of the reaction condenser. A little experimenting with the respective values of the blocking condenser (which is indicated as being of .0001 as a basis for experiment) and the primary winding will usually result in a satisfactory control of reaction.

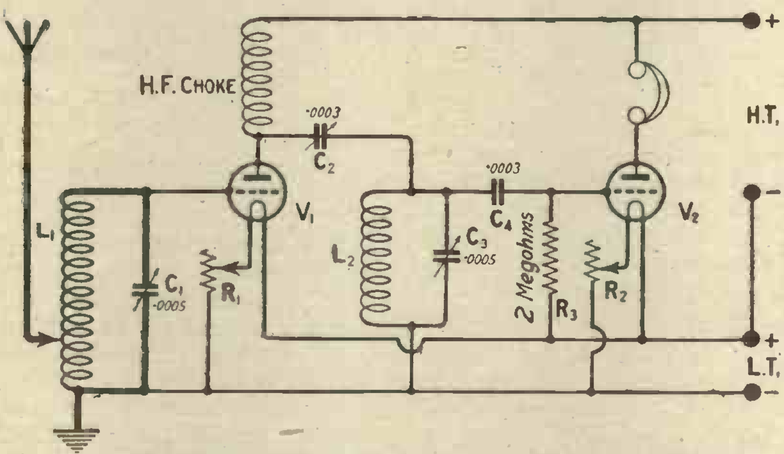


Fig. 6.—A simplified version of the standard parallel-feed circuit.

An Interesting Modification

A simple modification of the typical parallel-feed circuit appears in Fig. 6, and the attraction of this scheme is that no specially-wound coils are required to try it. The coil L_2 is common to both the grid circuit of the detector valve and the parallel path in the anode circuit of the H.F. amplifying valve. This coil may be of the conventional size for a secondary or tuned anode, namely, a No. 50 or 75, and the condenser in the parallel-feed path is shown as being variable in order that certain effects may be controlled in the desired way. It will be found that if this condenser is increased in capacity above a certain value the circuit will behave very much like the conventional tuned anode and will oscillate fairly freely when the two circuits are in tune. If, however, this condenser be reduced below a critical value the circuit becomes stable and quite satisfactory operation results.

The grid circuit of the H.F. valve is shown as being auto-coupled to the aerial, and for this purpose, of course, one of the various commercial auto-coupling units can be employed, such as a Lissen X-coil, or a centre tapped coil, such as a Gambrell, with the addition of a small series condenser in the aerial lead, a capacity in the neighbourhood of ·0001 being suitable.

The "Compactum" Two-Valve Receiver

By E. H. BERRY.

This receiver has been designed to meet the needs of constructors desiring a small but efficient set.

THE desirability of having a wireless receiver in the home is sometimes outweighed by the question of the space which an efficient receiver of the average type will occupy and the fact that such a set will obtrude upon the view. The necessity for a compact set which can be tucked away in some odd corner out of sight is then apparent, provided it will perform its duties in a manner quite comparable with a much larger set, thus giving equally efficient and satisfactory operation.

The receiver illustrated in the photographs accompanying this article has been designed in an endeavour to fulfil such conditions.

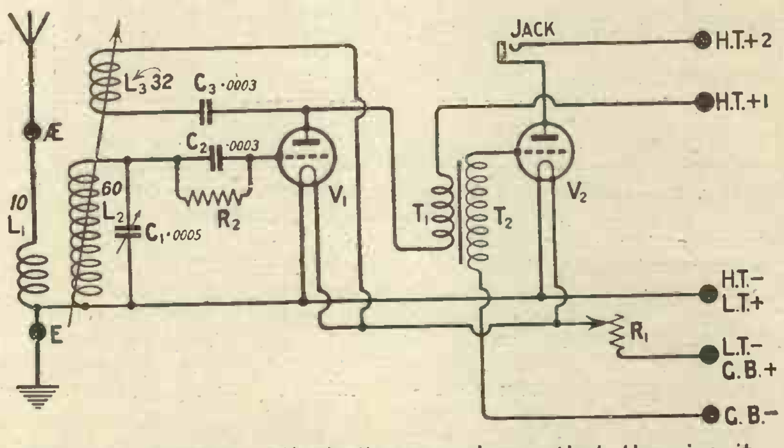
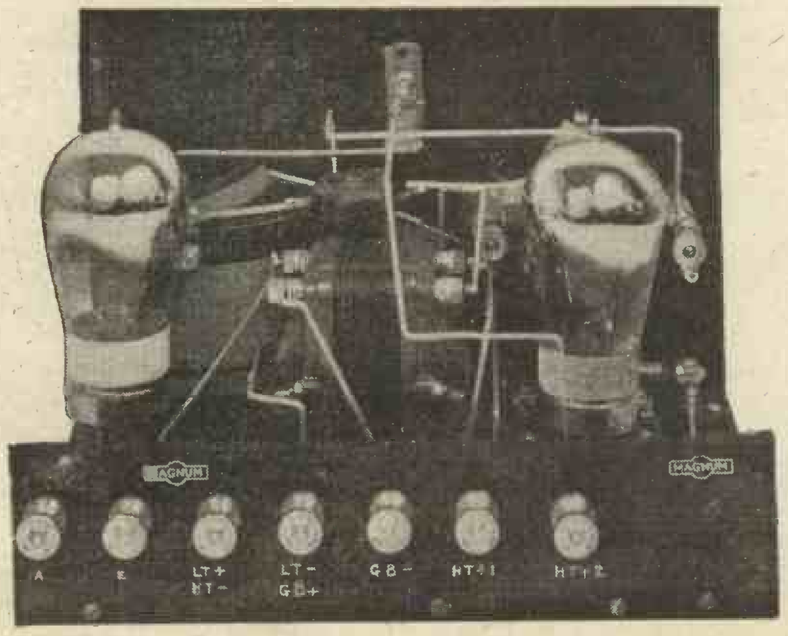


Fig. 1.—The theoretical diagram shows that the circuit is a modified Reinartz.

The Circuit

A perusal of the circuit diagram of Fig. 1—and this should always be examined carefully together with the photographs—will disclose the fact that it is of a form similar to the now well-known Reinartz circuit.



Condenser C_3 is supported above the L.F. transformer.

The aerial is loosely coupled to the secondary, the coupling being fixed. The reaction coil is contained on the rotor, which is accommodated in the end of the grid coil winding, while a parallel-feed method has been adopted. To obtain something of the advantages of the Reinartz arrangement it was decided to fix a condenser in series with the reaction coil, making the reaction control a variable magnetic coupling instead of condenser control.

Simplification

In addition to the elimination of one condenser by making the reaction the rotor of a coupler, it was decided to use only one rheostat. This necessitated the provision of two high-tension terminals and one grid bias terminal, which, however, occupy far less room than would be required by another rheostat, and on the whole is to be preferred as it enables a power valve to be employed with suitable L.T. voltage and grid bias voltage for loud-speaker work.

Another component usually used in this type of circuit, but not always necessary, is a high-frequency choke. This also has been omitted, the transformer in this instance acting as a choke. A note of warning should be given here, since it will be found that all transformers will not act efficiently in this manner, and it might be necessary, if the specified components are departed from, to incorporate a choke.

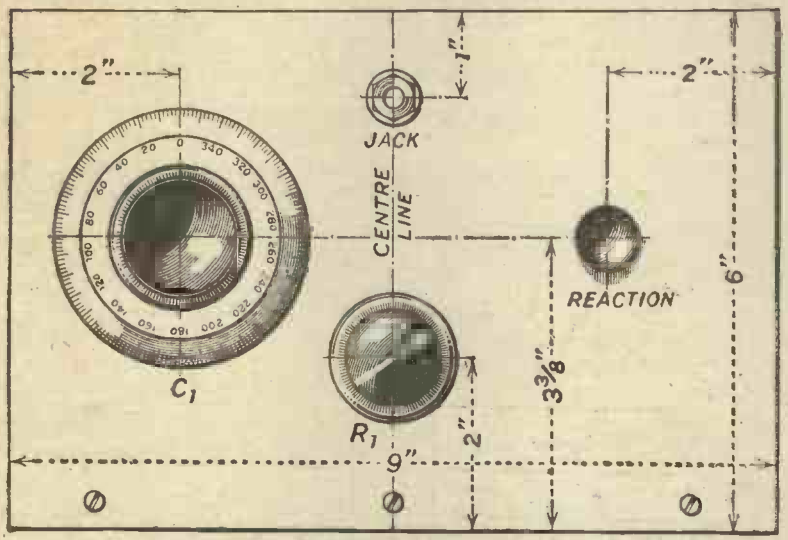


Fig. 2.—The panel details should present no difficulty. Blueprint No. 153a, 1s. 6d., post free.

A Suggestion

It is suggested that if a choke is necessary or is desired, it might be fixed to the panel just above, but not coupling with, the reaction rotor. A slight change in the wiring would also have to be made. The anode terminal of the detector valve would require to be connected to one side of the choke instead of to the I.P. terminal of the transformer as at present. The other terminal of the choke would then be connected to the I.P. of the transformer.

Another Use for the Receiver

This receiver forms the nucleus of a very handy portable self-contained receiver for summer use. Its present dimensions (the panel is only 9 ins. by 6 ins.) just enables it to fit into a case I possess, the rest of the space being occupied by batteries.

Components Required

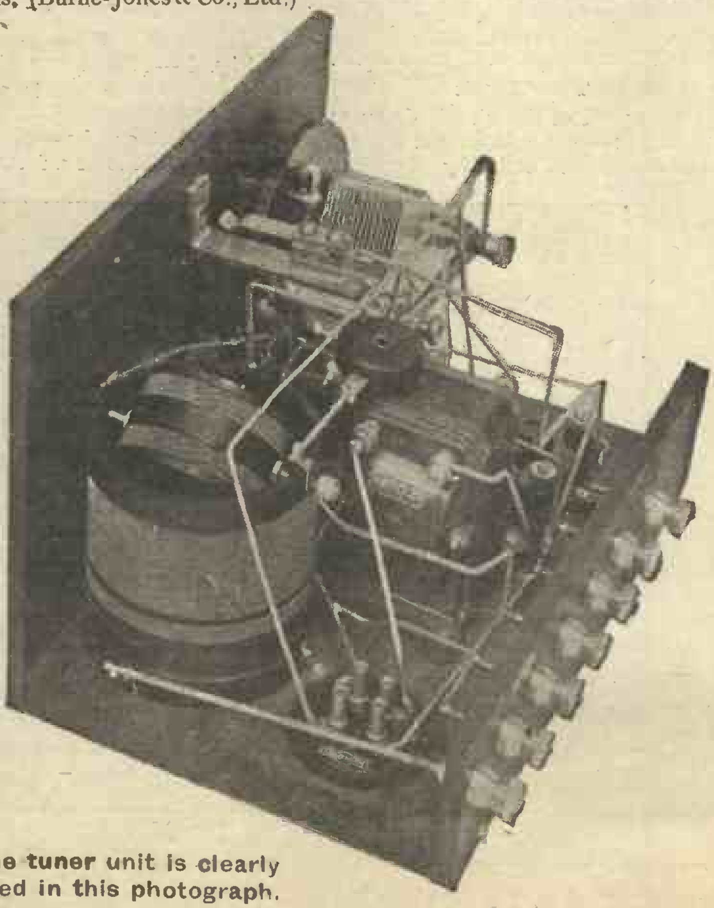
The components required are relatively few, and the reader has a wide choice of suitable ones. He must remember, however, that as the receiver is designed for small dimensions, any departure from the specified list of components should not be made unless it is first determined that the intended substitute will fit the space allowed.

A list is given of the actual components used for the benefit of those who desire to duplicate the receiver in each particular:

- One cabinet to take a 9 in. by 6 in. panel and 5½ ins. in depth with baseboard. (The Artcraft Co.)
- One panel 9 ins. by 6 ins. by ¼ in. guaranteed free from surface leakage (British Ebonite Co., Ltd.)
- One terminal strip carrying seven terminals. (Burne-Jones & Co., Ltd.)
- One tuner unit. (Burne-Jones and Co., Ltd.)
- One Newey four-point variable condenser ·0005 capacity. (Pettigrew and Merriman (1925), Ltd.)
- One Elwell single jack.
- One Elwell plug.
- One "Clearertone" anti-microphonic valve holder. (Benjamin Electric, Ltd.)
- One anti-capacity valve holder. (Burne-Jones and Co., Ltd.)
- One ·0003 grid condenser, complete with clips. (Dubilier Condenser Co., Ltd.)
- One 2-megohm grid leak. (Dubilier Condenser Co., Ltd.)
- One Yesly 30-ohm rheostat. (Engineering Supplies, Ltd.)
- One ·0003 condenser. (Watmel Wireless Co., Ltd.)
- One 2 to 1 low-frequency intervalve transformer. (British Thomson-Houston Co., Ltd.)
- Quantity of square wire, screws, etc.
- Radio Press panel transfers.

Baseboard Details

Because of the small space into which all the components are fitted, the baseboard should be laid out with great care. Before fixing the panel to the baseboard it is advisable to drill three holes in the panel at a distance of half the thickness of the baseboard from one



The tuner unit is clearly indicated in this photograph.

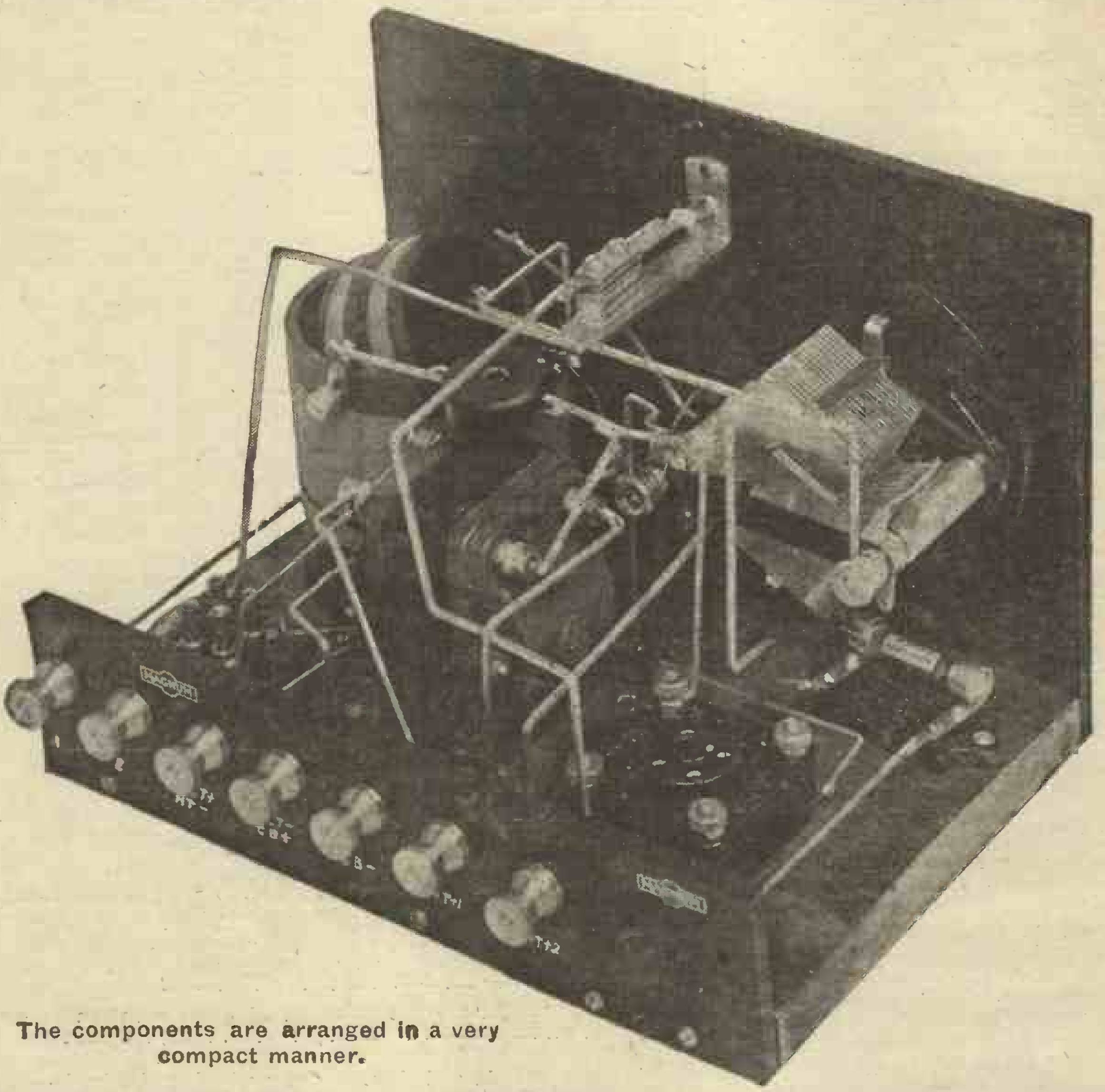
edge. Now place the baseboard in the cabinet, put the panel into position, insert wood screws into the holes and screw them home. This method ensures a satisfactory fitting of panel and baseboard into the cabinet.

Marking Out and Drilling

Now take the panel and drill the necessary holes for the condenser, jack, reaction control and rheostat. As the components are all of the one-hole fixing variety, only four holes will be required, and no difficulty should be found here. The diagram of Fig. 2 will give all the necessary dimensions.

The Tuner Unit

Having drilled the panel, the next point is the construction of the tuner unit. This may, as stated in the list of components, be procured ready wound from the manufacturer named, while others will also be pleased to supply a similar unit on request. The primary, or loosely-coupled aerial coil L_1, consists of 10 turns of 24 S.W.G. d.s.c. wire, the secondary L_2, spaced a quarter of an inch away, being 60 turns of the same wire. The reaction coil L_3, which is wound on the rotor, consists of 32 turns of the same wire, 16 turns on each half section of the rotor. For those who desire to fit such a refinement, a useful addition would be a vernier tuning knob attached to the reaction control spindle.



The components are arranged in a very compact manner.

An Advantage

The advantage of a tuner of this type is its great adaptability. It can be easily arranged to increase or decrease the selectivity by varying the spacing distance between the aerial inductance L_1 and the grid coil L_2. For instance, if greater selectivity is desired, where the present space is a quarter of an inch, this might be increased to half an inch. The connection between the earth end of the aerial coil and the earth end of the secondary is also optional, selectivity frequently being improved by the removal of this connection.

Wiring

The wiring should be carried out in a methodical manner, and in this case it has been carefully arranged so that it does not foul large valves such as the D.E.5 or D.E.5b.

The procedure to be adopted is as follows. Having mounted all the components on the baseboard and the panel, to verify that no components are fouling one another, remove the condenser and transformer.

Make a start by wiring the filament supply circuit—*i.e.*, join the two filament terminals on the valves and carry a connection from this link to the L.T.+ terminal and then to the earth terminal. This last connection from L.T.+ to earth is the suggested optional one. Now mount the L.F. transformer and proceed to join together the other two filament terminals, and make a joint from this connection to one side of the filament rheostat. The other terminal of the rheostat is then taken to the L.T.— terminal. The aerial terminal is connected to the bottom end of the tuner unit. Now proceed with the other wiring, after mounting the variable condenser, in accordance with the wiring diagram, when no difficulty should be experienced.

Testing

It will be noticed that two of the terminals are common ones. One terminal is used both for connecting L.T.+ and H.T.—, and another for G.B.+ and L.T.—. This should be kept in mind when joining up for test.

After connecting the low-tension circuit and turning on the filament rheostat, both valves should light.

After this preliminary test, join up all the other necessary external apparatus. Connect the aerial and earth to their respective terminals. Join L.T.+ and H.T.— to the common terminal, and then join the G.B.+ and L.T.— wires to their common terminal. Connect a wire complete with wanderplug at one end to H.T.2 and also to H.T.1. For H.T.1 the wanderplug should be connected to about 30 volts positive high tension, and H.T.2 should be connected to about 60 volts, the grid bias negative plug then being plugged into about 3 volts.

Tuning

Tuning a set of this design is very simple. Turn the reaction rotor to the minimum coupling position—*i.e.*, at right angles to the stator. Now gently rotate the condenser dial. The local station should be heard at one point. Adjust the reaction control until the loudest results are obtained. Now both maximum + ve and — ve couplings occur when the stator and rotor are concentric. If the well-known "howl" is heard when rotating the condenser, the rotor being set in a concentric position, then that is the position of maximum positive reaction. If no indication of oscillation is noticed, it would be necessary to turn the reaction through 180°. Having determined the correct position of the rotor, a small arrow marked on the reaction knob should be adjusted to correspond with the "maximum" mark on the panel.

When searching for other stations first adjust the condenser and then the reaction.

A Valve Point

To accomplish the necessary economy in space of components it was decided to use only one filament rheostat. This, of course, necessitates the use of valves requiring the same voltage. Two general purpose valves, such as the D.E.3, function very well, or, again, a good detector valve in the detector stage and a D.E.5 type in the amplifying stage are very suitable. Adjustments in the value of H.T. voltage to the detector should be made until the reaction used is a two to one ratio, possessed of a high primary impedance, so that the best results are obtained by using a high impedance valve in the detector stage.

Test Report

Tested on an average aerial about five miles from London, it was possible to receive 2LO at good loud-speaker strength. Tuning was found to be simple, and the set showed a considerable amount of sensitivity. Many other stations

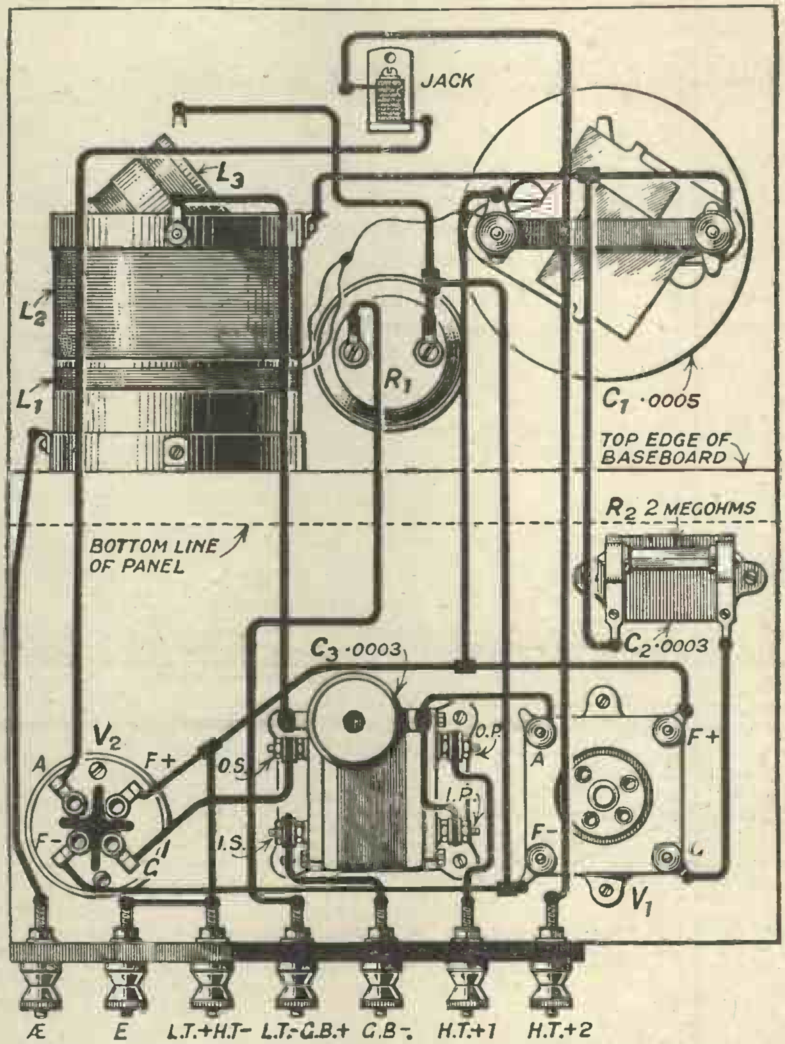


Fig. 3.—Carefully note the position of each component on the panel and baseboard. Blueprint No. 155b, 1/6 post free.

control is quite smooth, and there should be no overlap. By "overlap" is meant the unpleasant "plop" with which some sets go into oscillation, this position differing by some degrees from the point where they emerge from this condition.

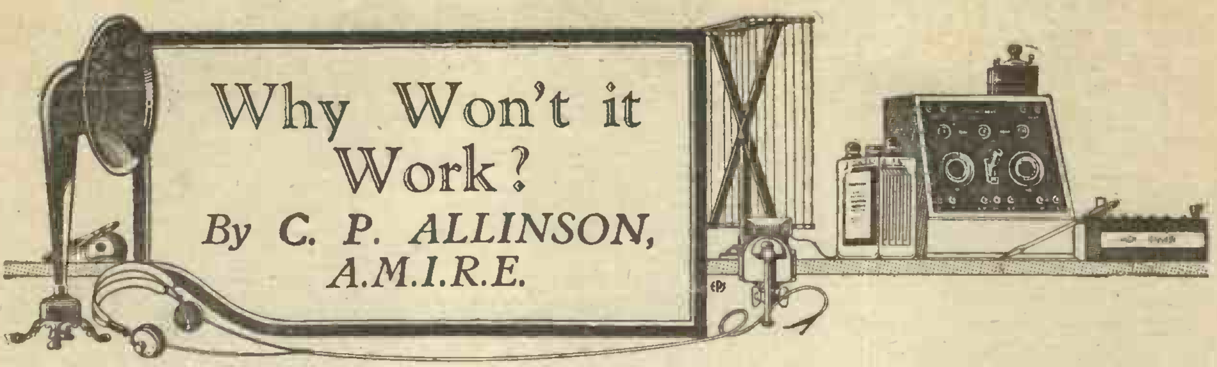
Good Results

If a suitable power valve, with correct values of grid bias and high tension, is used, very satisfactory loud-speaking is obtained on the local station. The transformer

were received, and Aberdeen came in quite clearly, as also did Birmingham and a number of Continental stations.

Elstree Report

Our Elstree laboratories report very favourably on this receiver, the strength of signals being good for a two-valve set, especially on the local station, London. Aberdeen, Munich, Birmingham and Hanover were among the other stations received at good strength during the period of the test.



Why Won't it Work?

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

When a fault occurs in a receiver a systematic search must be made to locate the trouble, and this article gives some useful practical hints.

MOST of the troubles that occur in a receiver usually have distinct symptoms, so that when they are encountered it is not a difficult matter to decide to what they may be due. What is a far more difficult matter is to find out just why a newly-completed receiver positively refuses to give even a whisper of a signal.

As this is something that is likely to happen to anyone at any time, it is just as well to have in mind the exact procedure to follow in a case of this sort. The tracing of the trouble must be followed out systematically in order that the fault may be located with the least waste of time. Haphazard tests applied to different parts of the receiver will at the best strike the right spot by luck, but at the worst will fail entirely to show the position of the trouble.

A Practical Example

Let us take a typical receiver as an example and examine all the causes that may result in its being absolutely "dead" even to the local station situated, say, three miles away. The set in question will be a four-valve receiver, consisting of one stage of high frequency amplification, a valve rectifier and two stages of low frequency amplification. The circuit is shown in Fig. 1. The receiver is seen to contain one stage of transformer coupled H.F. amplification. Since the grid circuit of this valve is auto-coupled to the aerial, the H.F. valve will be liable to oscillate and a potentiometer may be used to stabilise it, this serving at the same time to give the reaction control. Leaky grid condenser rectification is shown for the detector, while jacks are used to enable two, three or four valves to be employed at will.

This is the set which, on being connected up, the necessary valves and coils inserted and a loudspeaker plugged into the last jack, absolutely refuses to give a sound.

The First Place to Look

Now it is fairly certain that the trouble will lie in the detector or L.F. circuits, for if there is a faulty connection or even an absolute break in an H.F. circuit there is usually sufficient capacitative and/or magnetic coupling to pass signals on to the detector, and though they may not be up to strength they will probably be heard.

Let us, therefore, plug a pair of headphones into the anode circuit of the detector valve and see whether any signals are obtained

The result is again a negative one. Connect the aerial to the grid end

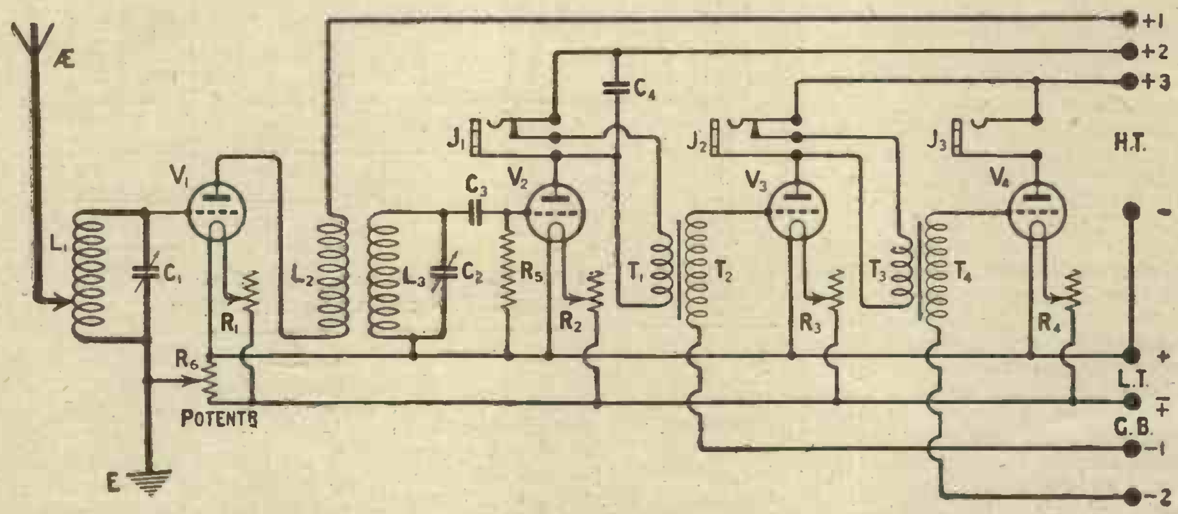


Fig. 1.—A popular circuit used by the author to show how faults can be traced.

of the H.F. transformer winding L_3, and even if the grid circuit is broken somewhere the local station should be heard unless the grid condenser is faulty, the anode and H.T. connections to the jack broken or the bypass condenser C_4 shorted.

Let us suppose signals are now heard. The next step will be to transfer the aerial lead to the anode of V_1, thus turning the primary of the H.F. transformer into an aerial coil, the aerial circuit being completed *via* the H.T. battery and L.T. battery to earth. No signals are heard. This may be due to a disconnection either in the primary or the secondary of the transformer, while should the tuning condenser C_2, or the grid return of the coil, be disconnected it will not be possible to tune the detector grid circuit L_3 C_2 and no signals may be received.

Further Tests

An examination of these points may disclose which is to blame and the aerial lead may now be transferred to its proper terminal. If this results in a serious loss of signal strength it may be that the grid coil L_1 is disconnected at some point or the grid or anode pins of the valve are not making proper contact in their sockets.

No difficulty need be experienced in checking these various points, and we will assume that we have now got this part of the receiver working satisfactorily.

The telephones are next transferred to the anode circuit of the first low frequency amplifier, and again no signals are to be heard. The trouble, therefore, lies either in the L.F. transformer or the jack. The first test is to place the 'phones in series with the H.T. + lead of the detector valve. This is most easily done by touching one of the telephone tags to the detector wander plug and the other to the positive tapping of the H.T. battery. If no signals are heard it means the fault lies in the jack or its connections to the primary of the L.F. transformer. First try out the jack spring contacts. With the end of a pencil press the top spring down and if signals are now heard it shows that this was not making contact with the spring immediately below; this, therefore, needs bending upwards a trifle so that the two springs make contact.

A Faulty Transformer

If, however, this procedure does not result in the local station being heard, the connections to the transformer primary and next the primary itself should be tested.

If with the 'phones replaced in the anode circuit of the third valve nothing is heard, the trouble may lie either in the secondary of the transformer and its connections or in the contacts between grid and anode pins of the valve and the sockets or the contacts of the second jack.

Having got this circuit working correctly the next valve is put into operation and a further series of tests applied. These will be similar to those just employed, except for the fact that there is no condenser in parallel with the primary of the intervalve transformer.

Faults that Reduce Efficiency

Let us now consider troubles that may occur which, though not serious enough to prevent the receiver from functioning, nevertheless result in either a loss of efficiency or reproduction of poor quality.

and their position relative to each other in no way influenced this low frequency oscillation. Finally it was noticed that when the detector filament was turned down the howl ceased.

How a Cure was Effected

This indicated that the trouble might be due to part of the H.F. component in the anode circuit of the detector valve being amplified by the first stage transformer, this being sufficient to set the second stage into oscillation at low frequency. The alterations shown dotted in Fig. 2 were therefore made in the anode circuit of the detector valve, and the trouble was cured. The by-pass condenser C_3 was connected between the top of the reaction coil and the nearest L.T. busbar, while an H.F. choke was

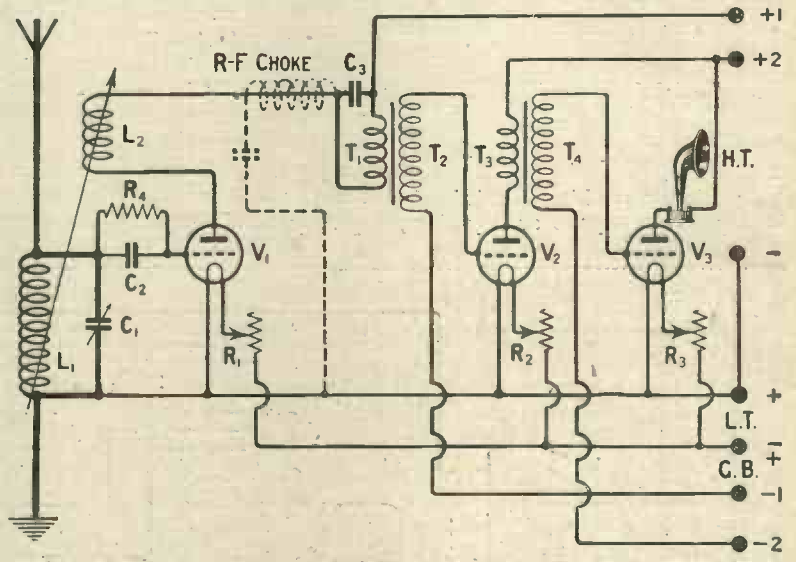


Fig. 2.—The alterations shown dotted were necessary to stop L.F. howling in this circuit.

One trouble that the writer found in a set of this description was that the potentiometer did not control oscillation. An examination of the wiring showed that this component instead of being connected across the positive and negative L.T. leads was connected across the H.F. filament resistance, the run of the wiring being such that this mistake could easily be made and not be obvious from a casual glance of inspection.

Low-frequency Howling

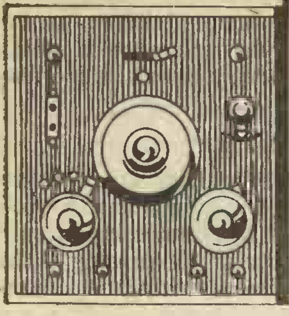
A bad case of L.F. howling was experienced in a straight detector and two note-mag. receiver, the circuit of which is shown in Fig. 2. All the usual remedies were tried, H.T. and grid bias batteries were heavily "condensered," the transformers were of the shrouded type

placed in series with the primary of the L.F. transformer as shown.

Conclusion

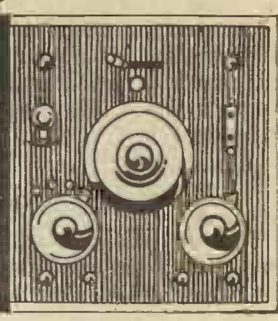
One of the chief points in searching for trouble is to take nothing for granted, and even the most innocent-looking components may hide the heart of the trouble within them. For instance, a very puzzling fault is given by the total disconnection of a valve socket from its connecting tag, especially when it occurs in an anti-microphonic valve holder where connections are made through springs that are liable to break, the break not being visible.

One of the simplest ways to test out for this fault is to use the dry battery and telephone method, touching the valve socket and appropriate terminal to get the characteristic click.



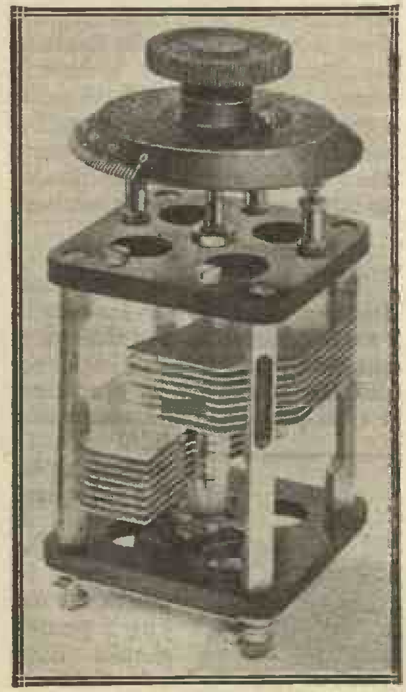
All About Your Condensers

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



An interesting article indicating the main features to be looked for when choosing a variable condenser.

IN an article entitled "The Era of Low-Loss" in last month's issue of this journal, I made a short reference to the problems involved in connection with condensers when viewed from the low-loss standpoint, and in this article, which is the first of a series giving useful hints on each particular component which has a definite function to fulfil in the efficient working of a particular receiving station, I propose to deal with the whole subject of variable condensers.



A.—Drilling holes in the end plates of condensers is often done to reduce the dielectric material.

Important Details

There are many important details which experience indicates affect its performance that are apt to be overlooked in the choice of a variable condenser. An examination should be made not only of the plates, type of support, insulating material, etc., but also of the dials and vernier mechanism, which are important features of present-day practice. Now it is reasonable to suppose that when a condenser is chosen to fulfil a particular purpose, in nearly every case it is desirable to obtain one which approximates to the elementary conditions imposed by questions of low loss. Now where do these losses really exist in condensers and what steps can be taken to reduce them to a minimum?

Leakage

If we consider the actual leakage across the insulation employed in the construction of a condenser, we find that for good quality commercial material it is very small indeed, but care must be exercised to ensure that the surface is not prone to moisture effects. If the surface has a tendency to take up moisture then, of course, the ultimate result will be considerably influenced, and for this reason it is advisable to have a very smooth surface for the material so as to prevent globules of moisture clinging to the rough finish. Good quality ebonite is among the best of materials, while if the condenser is employed in a dry atmosphere then this deleterious effect automatically ceases to exist.

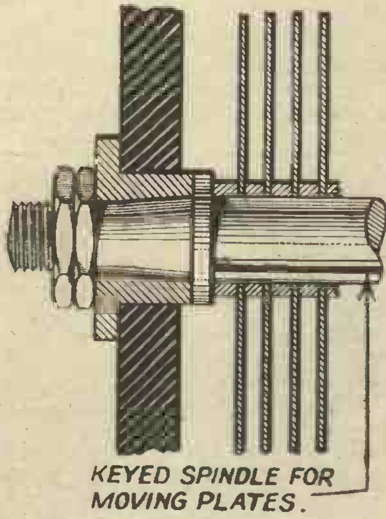


Fig. 1.—The type of cone bearing illustrated here is often used in the more expensive types of standard condensers.

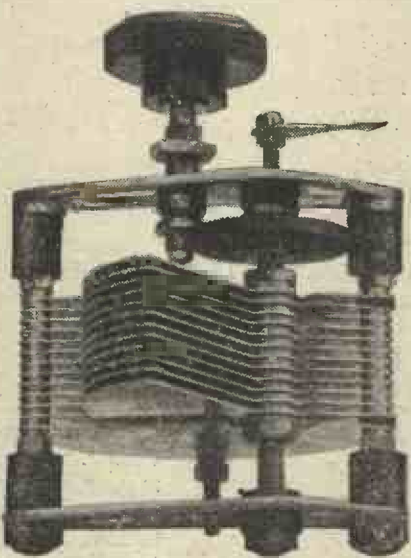
Since the insulating material has a high specific resistance, or in other words, due to its inherent properties presents a high resistance to the flow of current through it when a voltage is applied across it, the actual current leakage through the dielectric is very small, particularly as the voltage across the condenser in an actual receiving circuit is also very minute. Also the air which separates the vanes of this component has a negligible dielectric loss when it is dry.

Reducing Solid Dielectric

It is essential to employ very little solid dielectric material in the construction of a condenser as far as the portion situated in the electric field is concerned, and this point must be noted when examining the component in question before purchase is made. The dielectric material can be reduced by drilling holes in the end plates, an example of this being shown in one of the photographs accompanying this article (see photograph "A"), while metal end plates with ample-sized bushes are often used to accomplish the same purpose, as indicated in photograph "B."

Condenser Plates

The actual condenser plates should be made from a metal which is not liable to rapid oxidisation, for when this occurs extra loss will be introduced due to the film of oxide formed over the surface, while in addition the calibration of the instrument will be altered to a certain extent. It is for this reason that aluminium plates are not so reliable as good quality brass or some suitable alloy which is not subject to the effects of moisture to the same extent. The thickness of the plates is a matter of some purport, and about 22 S.W.G. is a fair average, for it is essential to ensure that the plates will not bend easily. Questions of heat loss must be taken into account at this juncture, as eddy currents will flow when the condenser is subjected to the rapid to and fro fluctuations of the electric field. With the plates of fair thickness the resistance will of necessity be small, and hence the resultant heat loss, which is proportional to the product of the square of the current in amperes and the resistance in ohms, will be kept down to a very small proportion of the total losses.



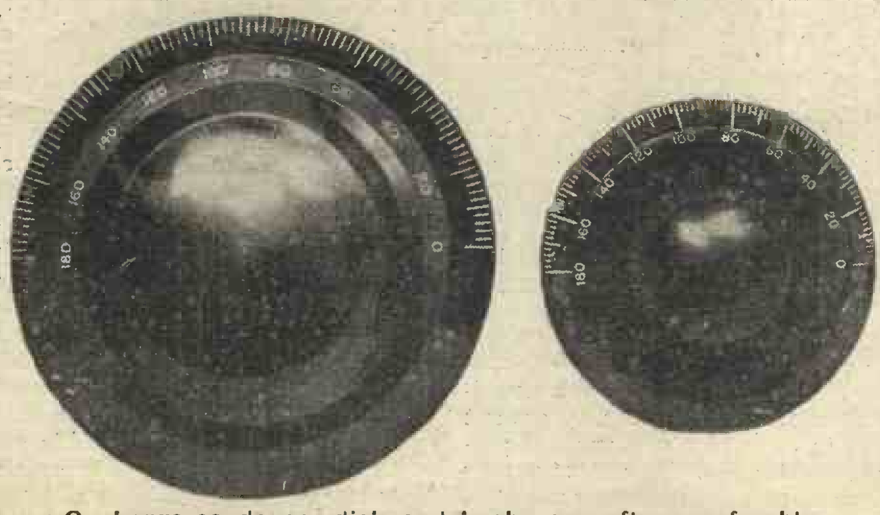
B.—Metal end plates with ample-sized bushes are a feature of this condenser.

Pigtail Connections

With reference to the connection between the moving plates and the requisite terminal a good rubbing contact is possible, but connections should preferably not be made through the bearing of the moving plates unless special precautions are taken. This often produces an unsatisfactory result, due mainly to the constant movement of the plates in the bearings. A better scheme is to utilise a thin helical spring connection with the minimum number of turns so as to avoid the possibility of condenser noises due to the turns touching and producing a sudden small variation in their inductance. If pigtails are resorted to they should preferably be insulated for the reason just given, and the thin wires used in making the flexible lead must not be liable to breakage as this is a further source of the objectionable scratching or crackling noises which, from want of experience, the experimenter often attributes to some other part of the receiver.

Mechanical Features

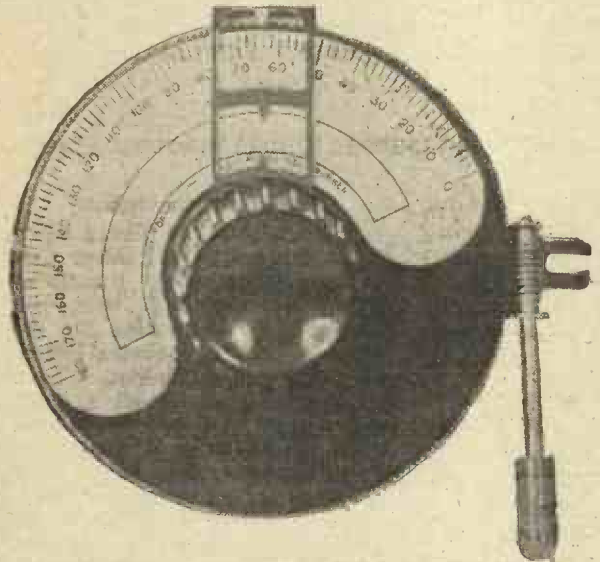
Turning now to the mechanical features, the points to look for in a good condenser are freedom from any side play, and free movement without slipping or backlash, together with a definite constancy in operation. The bearings must be quite rigid and adequately fulfil their purpose, while the method adopted in mounting the condenser in position on the panel should have no effect on the operation of the unit.



C.—Large condenser dials and knobs are often preferable to those of the smaller variety.

The Bearings

A good fit in the main bearings is one of the prime essentials, while the condenser should permit of ready dissembling for the purposes of a critical examination in connection with the points just enunciated. A cone bearing which can be pulled into position with the required degree of pressure by means of suitable lock nuts is indicated in Fig. 1, and this method is often resorted to in the more



D.—A 200 to 1 slow motion worm wheel and toothed dial permit very fine tuning to be made.

expensive types of standard instruments. Another method of construction which seems to be achieving a certain amount of popularity at the present time is in the adoption of ball bearings as shown in Fig. 2. With these bearings incorporated a condenser exhibits no tendency to stick, having a free movement, while the required pressure can be applied to the ball race, which is adjustable, to render possible a very fine turning motion.

A Possible Fault

With condensers of the one-hole fixing variety it is often found that on unscrewing the knob or appropriate nuts before mounting the component on to the panel the moving plates become loose, and on attempting to readjust their position relative to the fixed plates the operation is frequently hampered by the easy axial displacement of the moving plate spindle. Adequate care is

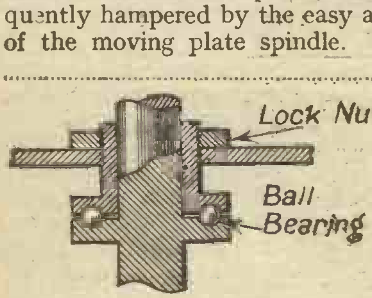


Fig. 2.—A ball bearing arrangement has many interesting features.

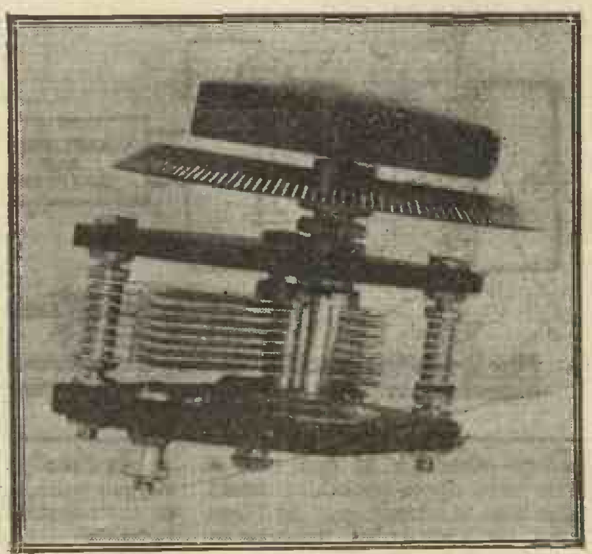
necessary in order to obviate this trouble, and a fixed register of the position of the moving plates should be incorporated in the design.

Type of Dial

Having passed the critic in most of the points just delineated, there is still another factor which calls for more than a passing reference, namely, the type of dial supplied. Questions of suitability will be largely governed here by considerations of the purpose of the condenser, i.e., its prime function in the receiving set, whether for controlling reaction or as the main tuning condenser, etc. Appearance is of importance, since the mounted controls on the finished panel should give a pleasing effect to the eye. Too often a good condenser is spoilt by the ordinary dials included with the unit, while the debatable point of large or small diameters has to be settled from certain considerations.

A Large Diameter

A large fluted knob with a dial, say 4 ins. in diameter, gives the effect of a reduction gear on the spindle and is comfortable to handle. Allied to this there is the further advantage that the scale is more open than in the smaller diameters which facilitates accurate settings to previously logged readings. These points are emphasised in photograph "C." Delicate tuning operations with a non-geared condenser are facilitated if a substantial knob is employed, and provided that due allowance is made when designing the receiver, the panel space required to accommodate the large dials should not be unduly great.



E.—The condenser illustrated here incorporates ball bearings while the pig-tail connection is insulated.

Plain Divisions

The number of divisions on the scale should preferably be limited to one hundred round half the circumference, so that the engraved lines can be quite bold. With wavelength variations the

(*Continued on page* 893.)

Working Valves from the D.C. Mains

By Capt. H. J. ROUND, M.C., M.I.E.E.

In this article Capt. Round gives the results of some further experiments he has made in order to remove the ripple on the D.C. filament arrangement.

IN MODERN WIRELESS, Oct., 1925, I gave instructions for connecting up a three-valve set so as to run both the low-tension and the high-tension supplies from D.C. house mains. One of the great difficulties of this work is the fact that the amount of mush and noise varies considerably on different electric light systems, and what will work in one case is not good enough in others. Since writing this article I have tried out four electricity supplies, and in all the cases the H.T. outfit was satisfactory—although in one case a little more ripple smoothing would have been of advantage. As I was using an eight-valve receiver in that particular case, it was certainly forcing the arrangement somewhat unduly.

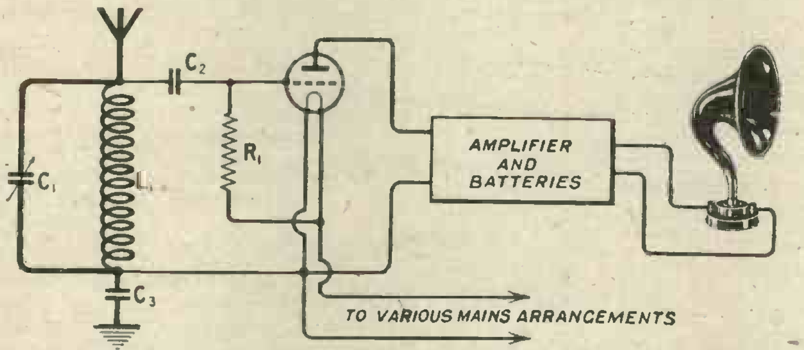


Fig. 2.—In the circuit used by Capt. Round for his initial experiments only the detector valve filament was run from the mains.

Additional Smoothing Arrangements

Only in one case, however, was the D.C. filament arrangement quite satisfactory with a three-valve receiver, and in the others I had to insert smoothing arrangements. I find also that noise on the mains varies from time to time and that an arrangement which is quite silent at one period of the day is not entirely silent at another time during the same day. There does not seem to be any serious difference between places where one is directly across the "outers" for 220 volts, or where the positive or the negative main is near earth potential.

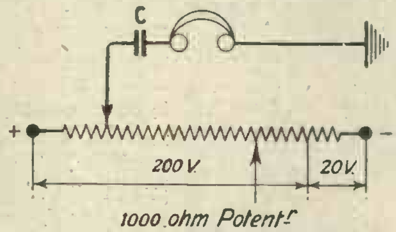


Fig. 1.—A method for locating the hum of the mains.

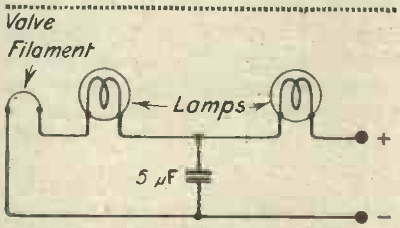


Fig. 4.—Two lamps were found decidedly better than one.

Certain Improvements

An examination of Figs. 1 and 2 in the original article shows that I have arranged a smoothing system for the H.T. side, but practically no smoothing for the filaments. Owing to several letters complaining of difficulties, I have examined this circuit on a noisy main supply, and indicate in this article various ways for improving the arrangement which should meet the demands of most cases in practice. The particular mains chosen had a pressure of 220 volts, and a test with a voltmeter showed that the positive conductor was 200 volts above earth potential, while the negative conductor was 20 volts below earth potential.

Locating the Mains' Hum

I also arranged a 1,000 ohm potentiometer across the mains and listened with a pair of telephones in series with a condenser C connected between earth and the moving contact of the potentiometer (see Fig. 1), and noted that the mains' hum was a maximum at the positive and negative ends with a blunt minimum in the middle of the potentiometer. The chief noise was a loud compound musical note—the lowest frequency of which was about 250 cycles per second.

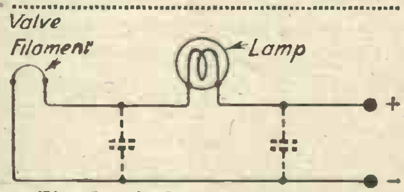


Fig. 3.—A filament smoothing arrangement which was sometimes noisy.

Experiments

In the first experiment on these particular mains I used an ordinary single-valve circuit, with only the filament run from the supply. To this circuit I added a double note amplifier run from

L.T. and H.T. batteries, as shown diagrammatically in Fig. 2. The H.T. on the first valve was also a battery. The arrangement enabled me to study carefully what happened in the simplest case. With the mains mentioned above, and using the arrangement of Fig. 3, the noise at five miles from 2LO was annoying in weak passages and during intervals.

Further Trials

I then tried the arrangement of Fig. 4, the two lamps being larger ones. This was markedly better,

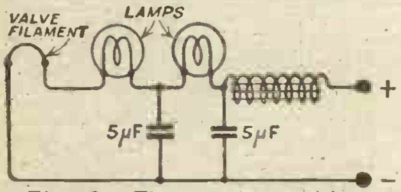


Fig. 6.—The final combination arrived at.

and, incidentally, I found that a condenser did not make much difference when put across either the mains or the filament, as shown dotted in Fig. 3.

In each case I found the bottom of the grid leak was preferably connected to the positive leg of the filament for least noise. In the tests I had an ammeter and variable resistance in the circuit to bring the valve (a D.E.5b.) always to the same filament current.

Then I wound a choke of No. 28 enamelled wire on a core of iron wire (8 ins. long and ½ in. in diameter), wound in three sections—a very crude affair which seems quite good enough and takes a very short time to make. This was arranged as in Fig. 5, and gave better results, while finally I combined the two ideas as in Fig. 6.

Noises Disappear

With this arrangement all noise vanished, except for a faint effect on the telephones, which was apparently introduced electrostatically through the body. I then connected in series with this rectifier valve the filaments of the note amplifier, rearranging the grid bias

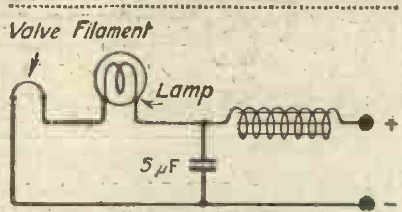


Fig. 5.—The addition of an iron cored choke helped matters.

accordingly, and found no appreciable difference. This was followed by changing the H.T. battery for a smoothed system off the mains without further trouble.

Retracing my steps, I found in the single-valve case that even the smallest accumulator, say a 3 A.h. type, across the filaments gave exceptionally good results and required very little condenser arrangements, but, of course, this is rather begging the question.

Filaments in Series

The reasons for series filaments are very obvious:—

(1) The consumption from the mains is less.

(2) The lamps can be smaller.

(3) The chokes can be wound of reasonable sized wire.

(4) The condensers need not be extremely large.

The Complete Circuit

Fig. 7 shows a complete diagram incorporating the improvements suggested in this article, and should be compared with Fig. 5 of the previously mentioned article in the October, 1925, issue of this journal. It will be noted that the grid bias arrangements are corrected, for which modification I am indebted to a well-known amateur of Weston-super-Mare.

Other Arrangements

Branching out into further arrangements, I think the circuit of Fig. 8 would not only work well but be economical in apparatus and current consumption for a small set. It depends upon the use of the new D.E.8 type valve with a ·12 ampere filament, and in the arrangement I have combined the smoothing for H.T. and L.T. I have put one more stage of choke and condenser in than may be necessary, and I would advise starting with only one choke. The valve circuit may be any one you choose. A condenser C to earth of 2μF may be sufficient to prevent any chance of earthing the mains and blowing fuses, and the top side of this condenser should be treated as earth for wireless purposes.

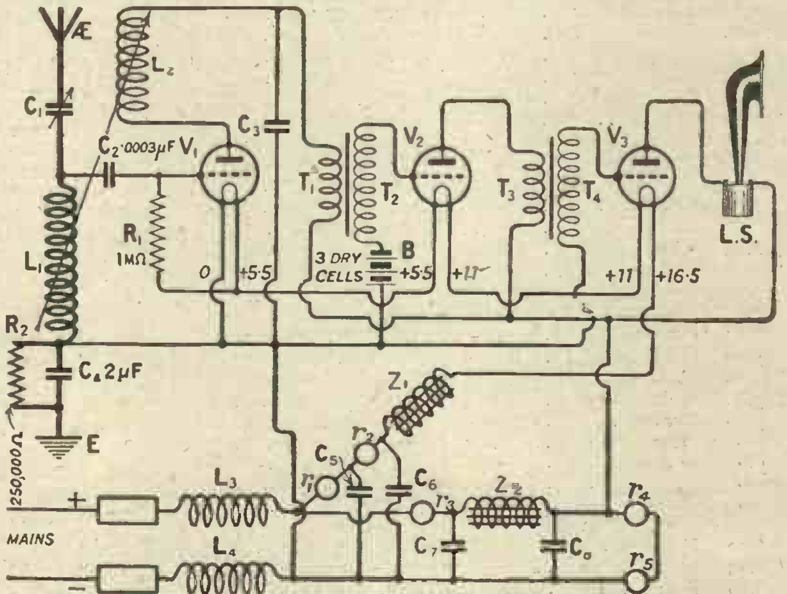


Fig 7.—A complete circuit incorporating the modifications suggested in this article.

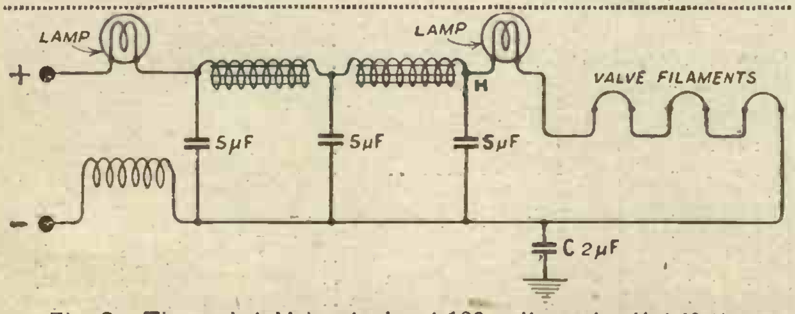
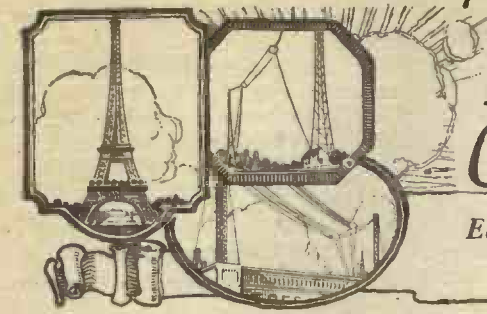


Fig. 8.—The point H is at about 120 volts potential if the two lamps are equal and the chokes of low resistance. Using different lamps will alter this voltage.



Regular Programmes from Continental Broadcast Stations

Edited by CAPTAIN L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

Corrected up to March 14th, 1926.

WEEKDAYS.

G. M. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
8.2	Eiffel Tower ..	FL 2650 m.	3 mins. Sp.
8.40	Eiffel Tower ..	FL 2650 m.	5 mins.
9.23	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
10.30	Radio Paris ..	CFR 1750 m.	10 mins.
11.0	Eiffel Tower ..	FL 2650 m.	20 mins.
11.20	Eiffel Tower ..	FL 2650 m.	10 mins.
11.40	Hilversum ..	NSF 1050 m.	10 mins.
*11.57	Nauen	POZ 3000 m.	8 mins. Sp.
p.m.			
12.30	Radio-Paris ..	CFR 1750 m.	2 p.m.
3.0	Zurich	—— 515 m.	5 p.m.
3.40	Eiffel Tower ..	FL 2650 m.	20 mins.
4.45	Eiffel Tower ..	FL 2650 m.	15 mins.
4.45	Radio-Paris ..	CFR 1750 m.	1 hour
5.0	Leningrad ..	—— 940 m.	8 p.m.
5.0	Warsaw.. ..	—— 380 m.	7 p.m.
5.15	Frankfurt ..	—— 470 m.	7.15 p.m.
5.30	Stuttgart ..	—— 446 m.	6.30 p.m.
5.30	Radio-Castilla ..	EAJ4 340 m.	7.30 p.m.
5.30	Union-Radio ..	EAJ7 373 m.	7.30 p.m.
5.40	Brunn	—— 521 m.	8 p.m.
6.0	Hamburg ..	HA 392.5 m.	7 p.m.
6.0	Leipzig	—— 452 m.	7 p.m.
6.0	Eiffel Tower ..	FL 2650 m.	7.5 p.m.
6.0	Radio-Barcelona	EAJ1 325 m.	7 p.m.
6.10	Hilversum ..	NSF 1050 m.	7.25 p.m.
6.15	Oslo	—— 382 m.	7 p.m.
6.30	Stockholm ..	SHSA 428 m.	10 to 11
6.30	Munich	—— 485 m.	10 p.m.
7.0	Radio-Vizcaya, Bilbao	EAJ11 383 m.	Midnight
7.0	Stuttgart ..	—— 446 m.	10 p.m.
7.0	Goteborg ..	SASB 288 m.	9.30 p.m.
7.0	Malmo	SASC 270 m.	9.30 p.m.
7.0	Sunsvall ..	SASD 545 m.	9.30 p.m.
7.0	Boden	SASE 1200 m.	9.30 p.m.
7.0	Oslo	—— 382 m.	9 or 11
7.0	Hamburg ..	HA 392.5 m.	10 p.m.
7.0	Lausanne ..	HB2 850 m.	8.30 p.m.
7.0	Copenhagen ..	—— 357½ m.	1 to 3 hrs.
7.0	Radio-Cadiz ..	EAJ3 360 m.	9 p.m.
7.0	Berne	—— 435 m.	10 p.m.
7.0	Radio-Wien ..	—— 530 m. and 590 m.	9.30 p.m.
7.0	Prague	—— 368 m.	9.30 p.m.
7.5	Eiffel Tower ..	FL 2650 m.	7.20 p.m.
7.15	Konigsberg ..	—— 463 m.	9.15 p.m.
7.15	Zurich	—— 515 m.	9 p.m.
7.15	Leipzig	—— 452 m.	9 p.m.
7.15	Frankfurt ..	—— 470 m.	10 p.m.
7.30	Breslau ..	—— 418 m.	9 p.m.
7.30	Munster ..	MS 410 m.	9.45 p.m.
7.30	Budapest ..	—— 546 m.	11 p.m.
7.30	Eiffel Tower ..	FL 2740 m.	9 p.m.
7.40	Rome	IRO 425 m.	10 p.m.
7.45	Geneva	—— 760 m.	9 p.m.
7.45	Royal Dutch Meteorological Inst.	KNML 1100 m.	5 mins.
8.0	Soro	—— 2400 m.	8.30 p.m.
8.0	Agen	—— 318 m.	15 mins.
8.0	Milan	1Mi 320 m.	10 p.m.
8.0	Voxhaus ..	B 505 m. and 576 m.	11 p.m.
8.0	Konigswusterhausen	AFT 1300 m.	11 p.m.
8.0	Radio-Cartagena	EAJ16 335 m.	10 p.m.
8.0	Radio-Paris ..	CFR 1750 m.	8.30 p.m.
8.15	Radio-Belge ..	SBR 262 m.	10.10 p.m.
8.30	Radio Toulouse	—— 430 m.	11 p.m.
8.30	Radio-Lyons ..	—— 280 m.	10 p.m.
8.30	Ecole Sup. des Postes	FPTT 458 m.	11 p.m.
8.30	Radio-Paris ..	CFR 1750 m.	10 p.m.
9.0	Radio-Barcelona	EAJ1 325 m.	2 to 3 hrs.
9.0	Radio Club, Sevillano	EAJ5 357 m.	10.30 p.m.
9.0	Radio-Catalana	EAJ13 462 m.	Midnight
9.30	Radio-Iberica ..	RI 392 m.	2 to 3 hrs.
9.30	Union-Radio ..	EAJ7 373 m.	1 a.m.
10.10	Eiffel Tower ..	FL 2650 m.	5 mins.
10.44	Eiffel Tower ..	FL 2650 m.	3 min.
11.57	Nauen	POZ 3000 m.	8 mins.

SUNDAYS.

G. M. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
8.2	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
8.40	Eiffel Tower ..	FL 2650 m.	10 mins.
9.26	Eiffel Tower ..	FL 2650 m.	3 mins. Sp.
10.10	Hilversum ..	NSF 1050 m.	11.10 a.m.
11.0	Konigswusterhausen	AFT 1300 m.	12 (noon)
11.14	Eiffel Tower ..	FL 2650 m.	10 mins.
11.57	Nauen	POZ 3000 m.	8 mins. Sp.
p.m.			
12.30	Radio-Toulouse	—— 441 m.	5 mins.
12.45	Radio-Paris ..	CFR 1750 m.	1.45 p.m.
2.10	Hilversum ..	NSF 1050 m.	4.10 p.m.
4.0	Radio-Castilla ..	EAJ4 340 m.	6 p.m.
4.40	Bloemendaal ..	—— 315 m.	2 hours

* This Spark Signal is relayed by all German, Swiss and Swedish Stations, except Stuttgart, Lausanne and Geneva.

SUNDAYS (Contd.).

G. M. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
5.0	Leningrad	—— 940 m.	8 p.m.
5.0	Malmo	SASC 270 m.	7.0 p.m.
5.0	Warsaw	—— 380 m.	7 p.m.
5.15	Zurich	—— 515 m.	6.30 p.m.
5.25	Hilversum	NSF 1050 m.	7 p.m.
5.40	Brunn	—— 521 m.	8 p.m.
6.0	Hamburg	HA 392.5 m.	7 p.m.
6.0	Eiffel Tower	FL 2650 m.	7.5 p.m.
6.0	Radio-Barcelona	EAJ1 325 m.	7 p.m.
6.0	Breslau	—— 418 m.	10 p.m.
6.0	Helsingfors	—— 318 m. and 522 m.	8.30 p.m.
6.30	Voxhaus	B 505 m. and 576 m.	10 p.m.
6.30	Munich	—— 485 m.	9.30 p.m.
6.30	Konigsberg	—— 463 m.	9 p.m.
7.0	Oslo	—— 382 m.	11 p.m.
7.0	Berne	—— 435 m.	10 p.m.
7.0	Prague	—— 368 m.	9.30 p.m.
7.0	Copenhagen	—— 347.5 m.	9.30 p.m.
7.0	Radio-Wien	—— 530 m. and 590 m.	9.30 p.m.
7.0	Lausanne	HB2 850 m.	8.30 p.m.
7.0	Hamburg	HA 392.5 m.	10 p.m.
7.0	Stuttgart	—— 446 m.	10 p.m.
7.0	Radio-Cadiz	EAJ3 360 m.	9 p.m.
7.0	Budapest	—— 546 m.	11 p.m.
7.0	Munster	MS 410 m.	10 p.m.
7.5	Eiffel Tower	FL 2650 m.	7.20 p.m.
7.15	Zurich	—— 515 m.	9 p.m.
7.15	Geneva	—— 760 m.	1 hour
7.15	Leipzig	—— 452 m.	9 p.m.
7.30	Bilbao	EAJ9 415 m.	8.30 p.m.
7.30	Eiffel Tower	FL 2740 m.	9 p.m.
7.30	Frankfurt	—— 470 m.	10 p.m.
7.40	Rome	IRO 425 m.	10 p.m.
7.50	Hilversum	NSF 1050 m.	9.50 p.m.
8.0	Radio-Agen	—— 318 m.	15 mins.
8.0	Milan	1MI 320 m.	10 p.m.
8.0	Soro	—— 2400 m.	8.30 p.m.
8.0	Radio-Cartagena	EAJ16 335 m.	10 p.m.
8.15	Radio-Paris	CFR 1750 m.	8.45 p.m.
8.15	Radio-Belge	SBR 262 m.	10.10 p.m.
8.30	Ecole Superieure	FPTT 458 m.	11 p.m.
8.30	Radio-Lyons	—— 280 m.	10 p.m.
8.30	Radio-Toulouse	—— 430 m.	11 p.m.
8.45	Radio Paris	CFR 1750 m.	10.30 p.m.
9.0	Radio Club-Sevillano	EAJ5 357 m.	11 p.m.
9.0	Radio-Catalana	EAJ13 460 m.	11 p.m.
9.15	Petit-Parisien	—— 315 m.	10.30 p.m.
10.0	Radio-Iberica	RI 392 m.	2 hours
10.0	Union-Radio	EAJ7 373 m.	1 a.m.
10.44	Eiffel Tower	FL 2650 m.	3 mins.
11.57	Nauen	POZ 3000 m.	8 mins.

SPECIAL DAYS.

G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.
3.45	Eiffel Tower	FL 2650 m.	Paris	Wed., relays P.T.T. Paris	5 p.m.
5.0	Radio-Belgique	SBR 262 m.	Brussels	Tues., Thurs., and Sat., Concert, followed by News	6 p.m.
7.30	Ryvang	—— 1150 m.	Denmark	Tues., Wed. and Sat. Concert	9.30 p.m.
8.30	Le Matin	CFR 1750 m.	Paris	Saturday, Special Gala Concert	11 p.m.
9.15	Petit-Parisien	—— 345 m.	Paris	Tues., Thurs., and Sat., Concert (Items announced in English as well as French)	11 p.m.
10.0	Oslo	—— 382 m.	Norway	Saturday, Dance Music from Hotel Bristol	11 p.m.

The following are Relay Stations :—

Kassel, 273.5 m., 1.5 kw., relays Frankfurt.
Elberfeld, 259 m., 1.5 kw., and Dortmund, 283 m., 1.5 kw., relay Munster.
Nuremberg, 340 m., 1.5 kw., relays Munich.
Gleiwitz, 251 m., 1.5 kw., relays Breslau.
Stettin, 241 m., relays Voxhaus.
Dresden, 292 m., 1.5 kw., relays Leipzig.
Bremen, 279 m., 1.5 kw., and Hanover, 296 m., 1.5 kw., relay Hamburg.
Graz, 387 m., relays Radio-Wien Sun., Mon., Thurs., and Sat.
Hjorring, 1250 m., and Odense, 950 m., relay Copenhagen ; sometimes Ryvang.
Lyons La Doua, 480 m., Marseilles, 350 m., and Toulouse, 310 m., relay Ecole Superieure, Paris.

The following Swedish Relay Stations are now working, using 200 watts. :—

Gavle, 208 m. ; Umea, 215 m. , Eskilstuna, 243 m. ; Saffle, 245 m. ; Kalmar, 253 m. ; Norrkoping, 260 m. ; Jonkoping, 265 m. ; Orebro, 237 m. ; Trollhattan, 322 m. ; Varberg, 340 m. ; Karlstad, 355 m. ; Falum, 370 m. (400 watts) ; Linkoping, 467 m. ; Karlsborg, 1350 m. ; and Karlskrono, 195 m.

These stations relay Stockholm as a rule, but also occasionally one of the other four main Swedish stations.

A Bijou Crystal Receiver

by The Radio Press Laboratories.

This compact crystal set will no doubt appeal to many of our readers in view of its compactness and efficiency.

THIS crystal receiver has been designed with the object of securing compactness in layout combined with efficiency in operation and ease of construction. These qualities are secured by the aid of a special variable inductance known as a Tunometer. This Tunometer coil, made by The Tunometer Works, provides a continuously variable inductance by means of a wheel which is guided round the spiral turns of the coil by means of a revolving arm. This latter can be rotated by a milled knob on the other side of the inductance coil as shown in the photograph. A semi-permanent detector is also employed so that it is not necessary continually to readjust the crystal detector.

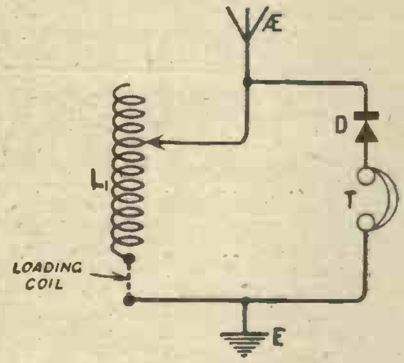


Fig. 1.—The theoretical circuit of this receiver.

The Circuit

The circuit diagram is shown in Fig. 1, and it will be seen that the tuning arrangement employed is similar to that frequently used with a tapped coil. The principle of the Tunometer, however, enables a much finer adjustment to be obtained, and the variation of inductance is continuous. A further advantage of this method is, that neither a series nor parallel condenser is necessary in order to tune, which ensures the greatest possible efficiency as regards the aerial tuning circuit. In the interests of simplicity the crystal detector was not tapped across part of the coil, and readings taken on several aerials showed that this did not detract appreciably from the efficiency of the set.

The Layout

A glance at the accompanying diagrams shows that the layout of this set is symmetrical, the four terminals labelled aerial, earth and telephones, being placed at the four corners of the square piece of ebonite. This piece of ebonite is mounted on a larger square piece of wood, the edges of which are bevelled in order to improve the general appearance.

Components and Material

The components required for this crystal receiver are given below, and before deciding to substitute any others care should be taken to see that these will fit in the positions provided.

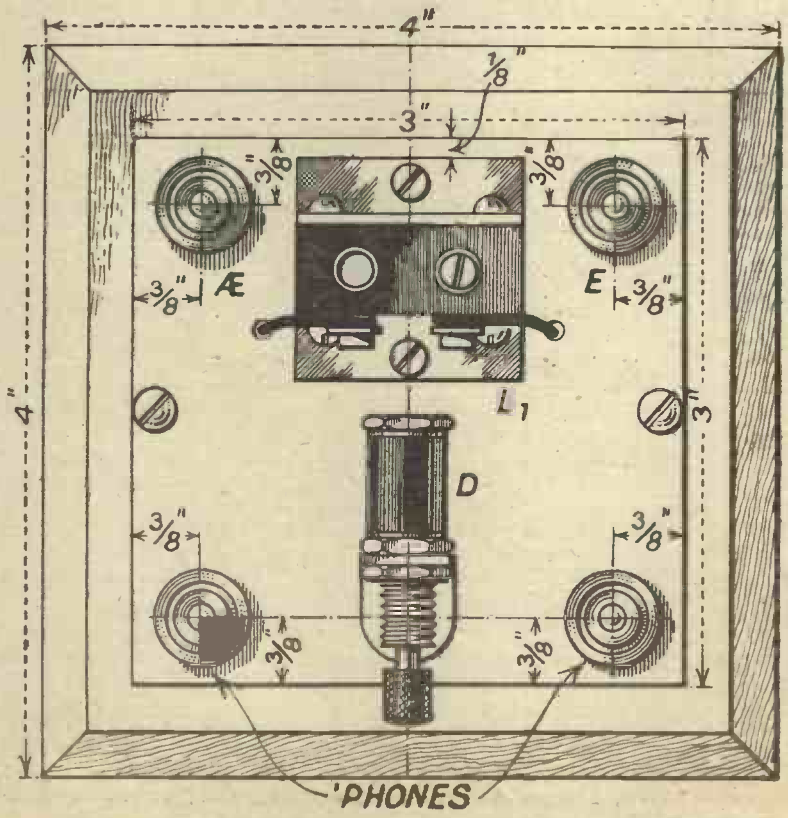
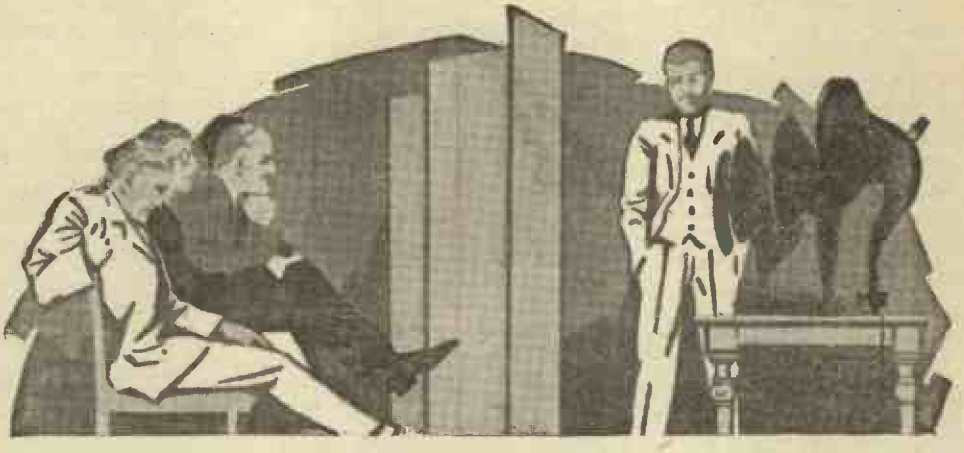


Fig. 2.—Complete panel details are given in this diagram.



A CONVINCING TEST
—now build your own loud speaker

When we first offered the public a full-powered loud speaking unit for 13/6 people were frankly incredulous. "No doubt it's excellent value for the money," they said, "but you can't expect it to equal an instrument costing several pounds."

So we invited four entirely disinterested judges to sit behind a screen while we carried out a simple test. We put on a well-known and expensive loud speaker and carefully noted the quality and volume of reproduction. Then the horn was removed from it and attached to the "Lissenola" and the result again carefully noted. This was repeated with half-a-dozen popular makes of loud speakers. *It was found impossible to say which gave the better result—the original loud speaker bases or the "Lissenola."*

The result of our test has, of course, been confirmed since by thousands of "Lissenola" converts—for the sales of the "Lissenola" have broken all records in the wireless trade.

Briefly, the "Lissenola" is the essential loud speaking base that only needs the addition of a horn to yield results equal to an instrument many times the price. And for a few pence you can make a really efficient horn yourself from the very simple directions and full-sized exact patterns given with every instrument. The "Lissenola" can also be attached to the tone arm of any gramophone, turning the gramophone into a radio loud speaker.

There is also the Lissen Reed (1/- extra) which adapts the Lissenola to take a cone or any other diaphragm working on the reed principle.

We challenge comparison. *Before buying go to your dealer and make the same test yourself.*

The "Lissenola" is obtainable from all Wireless Dealers throughout the country—or in case of difficulty by sending remittance direct to the makers.

Price 13/6. Post Free.

BUY THE LISSENOLA
and build your own Loud Speaker

Lissen Limited, 20-24, Friars Lane, Richmond, Surrey

'Phone: Richmond 2285 (4 lines). *'Grams: "Lissenium, Phone, London."*

L.20

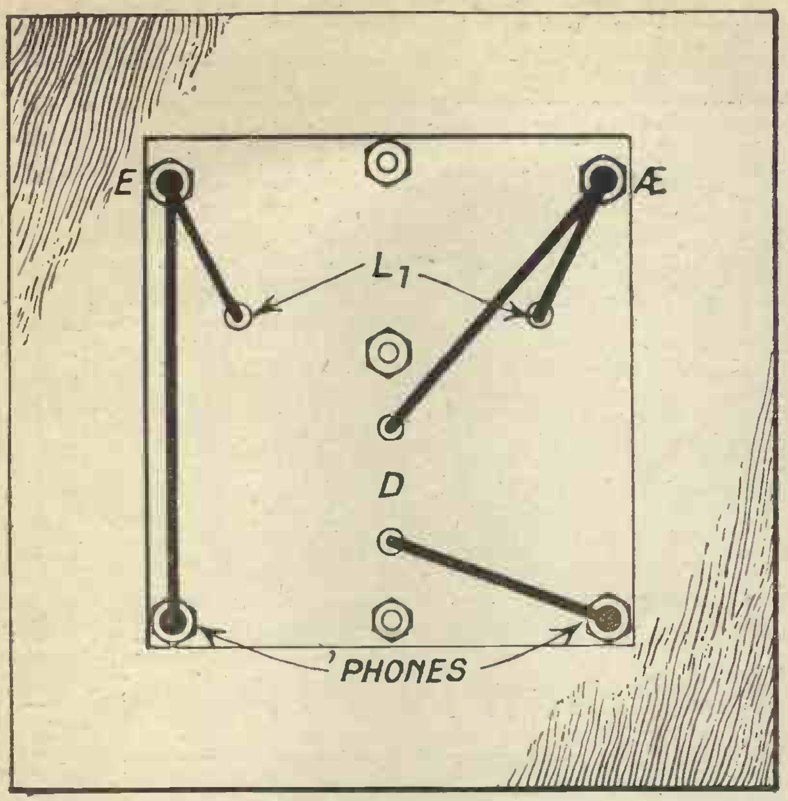


Fig. 3.—The wiring on the underside of the panel is simplicity itself.

A special note should be made of the fact that if any other loading coil is used, its winding should be in the same direction as that of the Tunometer, so that the coupling between the two is positive, and also that it does not foul the spindle of the Tunometer coil.

The crystal detector is of the semi-permanent type, and when once adjusted this should not be unnecessarily interfered with.

One piece ebonite, 3 ins. by 3 ins by ¼ in. thick.

One piece wood, ½ in. thick and 4 ins. square.

One Tunometer aerial inductance tuner (The Tunometer Works).

One single coil holder (Messrs. Burne-Jones and Co., Ltd.).

One semi-permanent crystal detector (Messrs. Simmons Bros.).

Two Igranic coils, No. 25 and suitable loading coil (Igranic Electric Co., Ltd.).

Four nickel-plated terminals.

Six wood screws.

Short length of tinned wire.

The Construction

This is quite simple, and should provide no difficulty. Having obtained the piece of wood cut out a square centre piece 2½ ins. each way, thus leaving a square frame. Then cut a piece of ebonite to the required size, i.e., 3 ins. square, and drill the requisite holes as shown in the drilling diagram. The components may then be mounted in their appropriate positions, and wired up, according to the diagram accompanying this article. The set is then ready for the aerial.

Testing Out

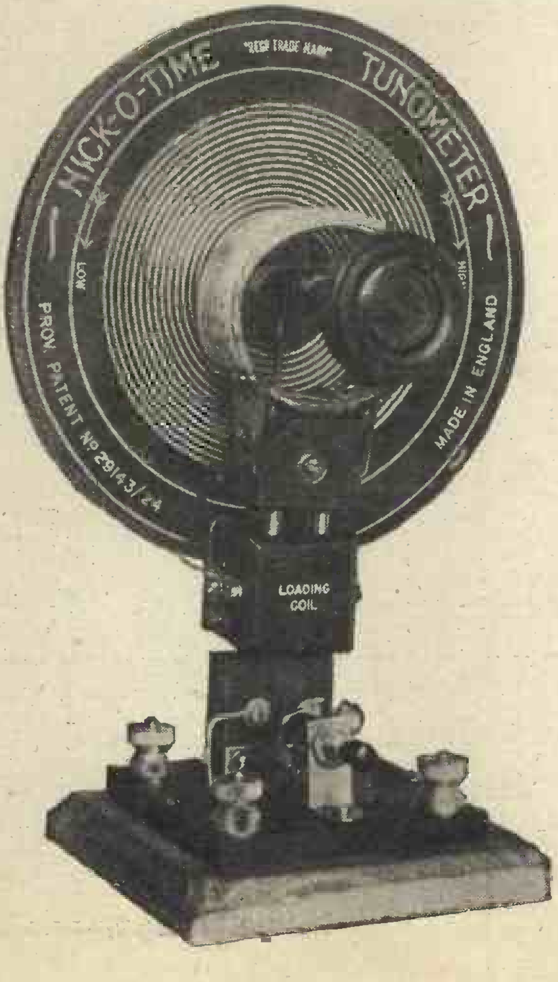
For testing out, the aerial, earth and telephones should be connected to the appropriate terminals, and the crystal adjusted. The Tunometer knob should then be rotated, until signals are heard and increase to a maximum. If the adjustment is found to be uneven and scraping sounds are heard, this indicates that the contact wheel of the Tunometer has slipped off the wire, and this should be corrected.

To receive Daventry, a suitable loading coil must be substituted for the No. 25, and the Tunometer used as a fine adjustment.

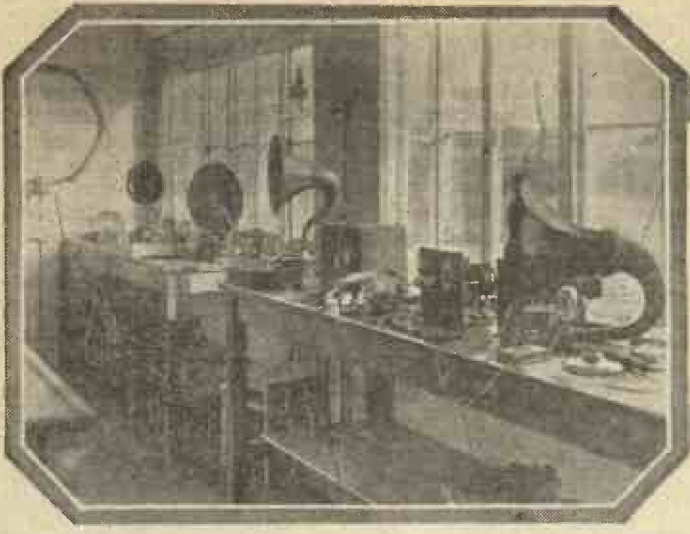
Test Report

When tested on London at a distance of about 13 miles, excellent results were obtained, approxi-

(*Continued on page* 894.)



The completed receiver presents quite an unusual appearance.



Is your Receiver Selective?

By The Radio Press Laboratories

Following on last month's article, the effect of tapping a valve across part of the coil in an H.F. amplifier is dealt with and some particularly interesting conclusions are drawn.

In an article entitled "The Importance of Valve Selection and the Effect on Selectivity" appearing in last month's Modern Wireless, the results of some experiments were given which showed the effect of the valve not only on the selectivity but also on the effective amplification of a tuned high frequency amplifier.

A Special Valve

It was shown that a valve having a high anode to filament impedance or resistance gave far better selectivity than a valve having a much lower value of resistance when connected in the circuit shown in Fig. 1. As a valve with a high impedance usually has a high amplification ratio, it seems that we not only gain in selectivity but also in effective signal strength. It would appear, therefore, that for high frequency amplification it would be advisable to use a valve having the highest possible impedance and a corresponding high amplification ratio, but this is not strictly correct. Capt. H. J. Round points out in his article on "Some Further Notes on Inter-valve Connections" in *Wireless Weekly* for November 18th, 1925, that quite a normal high frequency circuit has an equivalent parallel resistance of something like 130,000 ohms. The most suitable valve to use with this circuit, if connected as shown in Fig. 2, should have an impedance of approximately 130,000 ohms, and such a valve might have an amplification ratio above 100.

Objections

This valve would give excellent selectivity, and at the same time the effective amplification in the circuit would be very high. Why, then, is not such a valve generally used for this purpose? The reason is that a valve having this high impedance would, as stated by Capt. Round, require at least 600 volts for its operation, and this would be impracticable except to anyone who could employ rectified alternating current for the high tension supply.

Further Details

This month it is proposed to give some more figures further to emphasise the importance of the effects of the valve on the selectivity, and to show how the circuit can be employed so as to make the best use of any particular type of valve.

In all our measurements we are not considering the effects of reaction, and this has been eliminated as far as possible in the circuits used. The results, therefore, can be applied to high frequency amplifiers which have been properly neutrodyned so as to eliminate stray reaction effects.

Damping Due to Parallel Resistance

Let us first of all consider the effect of connecting a high resistance across either the whole or part of an oscillating circuit. If the high frequency voltage across the whole of the coil L of the circuit shown in Fig. 3 is represented by V, then the losses in the circuit due to a parallel resistance R across part of the coil L is equal to $\frac{v^2}{R}$ where v represents the voltage of that part of the coil across which the resistance is tapped. If tapped across the whole of the coil the losses would be equal to $\frac{V}{R}$. The

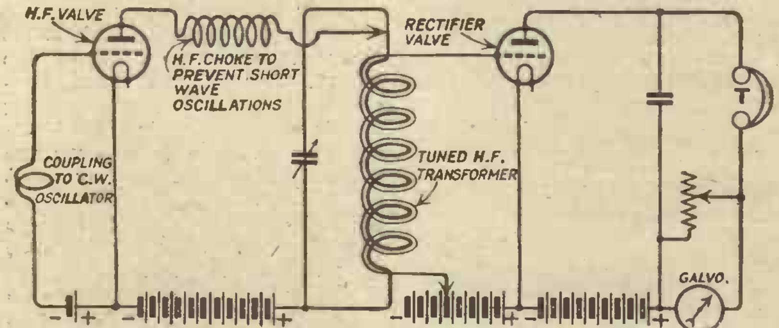


Fig. 1.—The circuit employed to carry out the investigations on selectivity and signal strength.

high frequency voltage across part of a uniformly wound solenoid inductance is directly proportional to the turns in the portion under consideration. Thus if a resistance across, say, one quarter of the turns of a solenoid inductance has a certain effect on the damping of the circuit, the same resistance connected across the whole of the circuit would have about four times the damping effect. In other words a high resistance R connected across

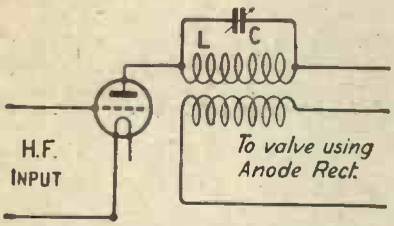


Fig. 2.—This type of circuit would require a special type of valve.

N turns of an oscillating circuit increases the effective high frequency resistance of the circuit by an amount which is directly proportional to the square of the number of turns N.

The Valve Acts as a Parallel Resistance

As is well known, a valve has a very definite resistance between its anode and filament, and when connected across a part or the whole of an oscillatory circuit it has exactly the same damping effect on the circuit as if a non-inductive resistance of the same value were connected across the same portion of the inductance.

Number of Turns for Best Selectivity

It would thus appear that to obtain best selectivity the anode circuit should include as few a number of turns of the oscillating circuit as possible. This actually is so, but there is another very important factor which must be taken into consideration, *i.e.*, the effective amplification of the valve and its associated circuit.

We must now consider the different factors which control the effective amplification of a high-frequency circuit.

Various Factors

First of all there is the amplification ratio of the valve itself. This constant, which was fully explained in last month's MODERN WIRELESS in an article entitled "Removing a Misunderstanding," is derived from the static characteristics of the valve, and is, of course, more or less theoretical.

If the equivalent anode resistance is equal to that of the valve, then the effective amplification, *i.e.*, the amplification factor, is only half that of the amplification ratio of the valve. The following table gives the amplification factors obtained with different values of anode resistance, the amplification ratio of the valve being μ and the resistance R :—

Impedance or Resistance R in anode circuit.	Amplification Factor.
Infinity.	μ
$8\ R_0$	$8\mu/9$
$4R_0$	$4\mu/5$
$2R_0$	$2\mu/3$
R_0	$\mu/2$
$R_0/2$	$\mu/3$
$R_0/4$	$\mu/5$
$R_0/8$	$\mu/9$
0	0

We thus see that in order to use the valve efficiently, the impedance in its anode circuit must be of a reasonable value compared with the valve resistance. As the equivalent impedance of that part of the inductance included in the anode circuit can be taken as being proportional to the square of the number of turns included in the anode circuit, it is obvious that we must not reduce these turns too low in order to obtain good selectivity, since we should lose too much amplification.

Voltage Step-up of the Circuit

There is still another factor to take into consideration, and that is the voltage step-up effect of the circuit. For instance, if only one-quarter of the coil of an oscillating circuit is included in the anode circuit, then the voltage across the whole circuit must be four times the voltage produced across the portion connected between anode and filament. Thus in this case we get a step-up effect of four, and if the impedance in the anode circuit is equivalent to the valve resistance, then we get a voltage amplification, from the grid of the first valve to the grid of the second valve (see Fig. 1), of one-half of the amplification ratio times four, that is equivalent to 2μ.

Varying the Anode Tapping

Let us now consider what happens to the overall voltage amplification if the anode tapping is varied both below and above this point, assuming, of course, that the other conditions are exactly the same.

Lower Anode Tapping

If the anode tapping is reduced so as to include only one-eighth of the total inductance, then the equivalent impedance in the anode circuit has been reduced to one-quarter, *i.e.*, to one-quarter the value of the valve resistance. If we refer to the table we see that under these conditions the amplification factor is only equal to one-fifth of μ. The overall amplification of the valve and circuit therefore is equal to $8 \times \mu/5 = 1\frac{3}{5}\mu$. Hence, although we have increased the selectivity of the circuit by lowering the tapping it is only at the expense of the amplification.

Effect of Raising the Anode Tapping

By raising the anode tapping so as to include half the coil in the anode circuit, the effective impedance has been increased to four times the valve resistance. Under these conditions the amplification factor of the circuit has been increased to $4\mu/5$, and the total amplification of the circuit is $2 \times 4\mu/5 = 1\frac{3}{5}\mu$, which is the same as we obtained before. In this case, however, the valve has considerably more damping on the circuit, so that we have not only sacrificed amplification, but also selectivity.

Best Results

Many other examples may be taken, but it will still be found that the best tapping point as far as amplification is concerned is that which gives an equivalent impedance in the anode circuit equal to the resistance of the valve itself. This condition also gives very fair selectivity, so that in the design of high-frequency valve circuits the impedance included in the anode circuit should be made equal to that of the valve impedance.

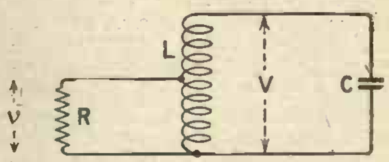


Fig. 3.—Tapping the same resistance across various points of coil L will alter the losses.

H.F. Resistance of Circuits and Amplification

By reducing the H.F. resistance of an oscillating circuit, the selectivity can be improved, but how is the overall amplification effected? Consider the case of a fairly high-resistance circuit which has an impedance equal to the resistance of the valve when the anode circuit comprises the whole of the inductance. The overall amplification in this case is equal to half the

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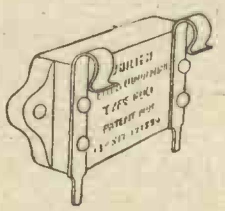

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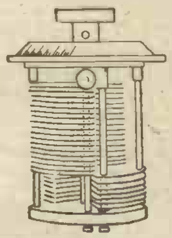

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Figure of Merit $\sqrt{\mu g}$	84	113

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Tuned Anode	Green ●
Transformer Loose Coupling	Red ●
" Tight Coupling	Green ●

If set oscillates use Red ● for all H.F. stages, especially for dual stage valves.

OTHER STAGES:

Stage	Transformer Coupling	Resistance Capacity Coupling
Detector	Green ●	Green ●
L.F. (1st Stage)	Green ●	Green ●
L.F. Intermediate	Red ●	Green ●
L.F. (Last Stage)	Red ●	Red ●

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RADIO VALVES

theoretical amplification ratio of the valve. If the H.F. resistance of the circuit can be reduced to, say, one-quarter, the valve need only be tapped across half the coil in order that the impedance in the anode circuit may be equal to the valve resistance. This gives us a voltage step-up of two, and we thus obtain twice the overall amplification with greatly improved selectivity. Hence the advantage of keeping the H.F. resistance of the intervalve circuits as low as possible.

Some Practical Tests

In order to emphasise the various points just discussed, a number of measurements of signal strength have been taken for different anode tapping points, and also different valves. The circuit employed consisted of a single tuned high-frequency circuit as shown in Fig. 1. Anode rectification was used in order to avoid complications due to damping that would be caused by cumulative grid rectification.

Optimum Tapping Point

The first table gives the relative signal strengths for a different number of turns in the anode circuit, when employing a D.E.5 valve. It will be seen from this that there is a very sharp maximum at between 15 and 20 turns out of a total of 56 turns. This means that the equivalent parallel resistance of the circuit is about nine times that of the valve resistance, that is about 72,000 ohms. The overall voltage amplification would be about one and a half times the theoretical amplification of the valve, or about 13.

Turns.	Relative signal strength.
0	0
5	8
10	20
15	38
20	37
25	32
30	25
35	20
40	15.5
45	13
50	11
56	8.5

Effect of Tapping on Selectivity

A series of resonance curves was plotted for a different number of turns in the anode circuit, the valve used being the same as before, namely, a D.E.5. The following table gives the relative signal strength and selectivity for the different tapping points, the actual figures being taken from the curves.

As last month, the selectivity has been defined as the percentage of detuning of the oscillator required to reduce the measured signal strength to half its resonant value.

Turns in anode circuit.	Relative signal strength.	Selectivity.
5	8·5	0·33%
9	16·8	0·58%
17	38·2	0·78%
56	8·5	5·25%

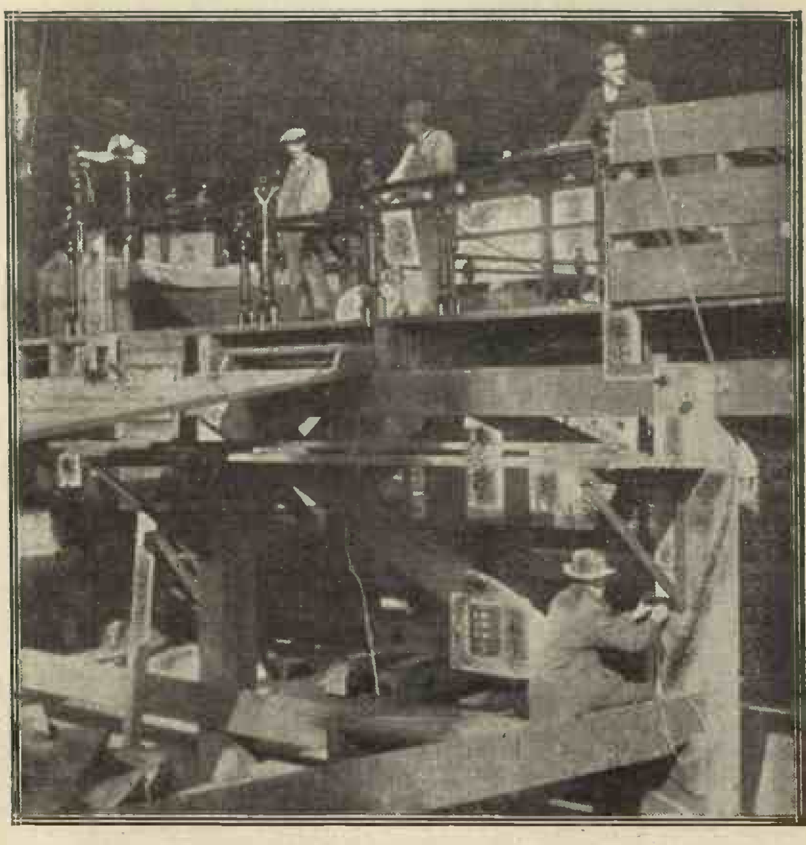
An Interesting Point

One interesting point is to compare the selectivity between 5 turns in the anode circuit, and all the turns in the anode circuit. Although the resonant signal strength is the same in both cases, the selectivity in the case of the 5 turns is much better than when the whole coil is included in the valve circuit. From the curves it was found that detuning the circuit by 14 k/c practically cuts out the signal in the case of the lower tapping, whilst with the top tapping a difference of 41 k/c only reduces the signal strength to about one-half, and even at a 55 k/c difference the signal was still strong.

Results with a High Resistance Valve

With a higher resistance valve, such as a D.E. 5b. (30,000 ohms), the effect of tapping would naturally not be so marked, as it has a resistance more nearly equal to the equivalent parallel resistance of the circuit. The optimum tapping for maximum amplification is about 36 turns out of the 56, but the curve is much flatter than in the case of the D.E. 5 valve. The equivalent parallel resistance for the circuit worked out from this figure comes to practically the same as for the D.E. 5 valve, namely, about 70,000 ohms. By tapping at the top of the coil, the signal strength is only reduced by about 20 per cent. on the optimum signal strength. The table below gives the relative signal strength and selectivity for different tapping points for a D.E. 5b. valve.

Turns in anode circuit.	Relative signal strength.	Selectivity.
13	19	0·36%
36	49	0·51%
56	41·5	1·15%



For the first time in wireless—the broadcasting of the launch of H.M.S. Cornwall at Devonport was made from the Plymouth Station.

Some Interesting Letters from Our Readers

The "America Three"

SIR,—I hope you may be interested to hear of my experiences with "The America Three," described by Mr. Stanley G. Rattee, M.I.R.E., in the September, 1925, issue of MODERN WIRELESS.

I followed the general scheme of the layout recommended in the article, only departing from it in minor particulars, owing to the fact that I used some different components from those given in the list. I find the reaction control very pleasant and smooth to handle. In my opinion, the fitting of slow-motion dials to the variable condensers, an addition which I have made on my receiver, makes a decided improvement.

The aerial which I use with the receiver is an indoor one, about 30 feet long, running along a fairly high passage; the earth has the usual water-pipe connection. I find the set works better on this aerial system than on my outdoor one, which is full size P.M.G., as the outdoor aerial gives some "dead" spots for oscillation when I am using the set for C.W.

I have had KDKA, East Pittsburgh, at quite good loud-speaker strength on some nights; the variable results I have noticed on this transmission are not, I think, due to the receiver, as other transmissions, such as London's harmonics, come in very well. The valves I use normally in the set are three B.T.H. B.4's. I am making up a new coil with fewer turns to try and get down to WGY, Schenectady, on about 35 metres. I shall hope to let you know shortly what success I have with this.

You will gather from this letter that I have no complaints about the set. In fact, I am delighted with it, and I feel duly grateful to your excellent paper.—Yours truly,

B. G. PITT.

Walthamstow.

S.T.100 with Extra H.F. Valve

SIR,—As a reader of MODERN WIRELESS for the past 2½ years, I always look carefully through the readers' experiences with Radio Press sets, but lately I have not seen much mentioned of the S.T.100 with an extra H.F. valve coupled, the design of which was described in the MODERN WIRELESS issue for June, 1924, by Mr. J. Scott-Taggart.

I c nstructed this set, and, as you will see by the enclosed photograph, have added one or two of my own modifications.

First, I have three separate H.T. supplies from the 3 stud switches at the top of the switch-box panel, and also two separate G.B. leads.

There is also a loud-speaker filter circuit in the switchbox, and the clip-in condenser at the bottom of the panel is for tone control.

The small stud switch in the middle of the panel is for voltmeter readings, while the right-hand meter is a milliammeter.

The two switches on the left are for cutting out the H.T., the switch on the right being for L.T. cut-out. There is a fuse in the H.T. lead shown across the fourth terminal down from the top of the connecting bars, the fuse being wire taken from old vacuum lamp filaments.

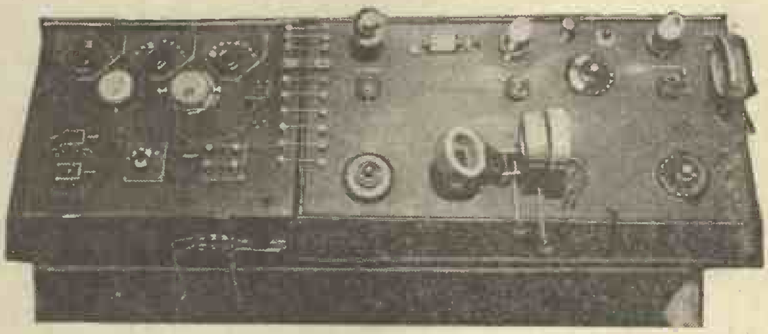
Another modification is a 0·5 microfarad condenser between the crystal detector and the primary of the first transformer, to obviate the H.T. potential from flowing through the crystal and yet pass H.F. currents. This was very necessary as I could not get a crystal to remain lively for more than about a week.

Now for results. On a standard P.M.G. 100 ft. aerial, single wire, 2LO and 5XX on two valves are much too loud for ordinary use and can be heard at least 80 yds. away. I have to use semi-aperiodic coupling for two valves, as the tram wires run within 20 ft. of the window at the back of the set and cause a high pitched note to be heard. The quality is all that could be desired, as many people in the town know, as it is used in the business for demonstration.

On three valves practically all Continental stations are received on the L.S., some being heard all over the house.

Wishing MODERN WIRELESS every success, and also other journals of the Radio Press.—Yours truly,

Sutton. L. DAVIS, Jnr.



The elaborate S.T.100 Receiver with an extra H.F. valve added, which has been constructed by Mr. L. Davis.

A DX Four Set

SIR,—You may be interested to hear that my DX Four set, made from Mr. D. J. S. Hartt's description in MODERN WIRELESS of October last, has turned out most successfully. I used the components mentioned in the article, except that for the variable condensers Nos. 1 and 2, I substituted Sterling "Miniloss." As these have a second spindle, which I arranged to come immediately below the condenser dial, the two outer valve rheostats had to be fixed nearer to the ends of the panel. In every other respect I have carefully followed the description, and now that I have got 2 B.T.H. B5 with 2 B.T.H. B.6 valves working, I am in a position to state that the set is thoroughly satisfactory. It is extremely selective, and the number of stations it is possible to tune in while London is working is remarkable. I have already received 45, though not all have been identified yet. They all come in on the loud-speaker, in varying strengths, and I have dropped the telephones entirely. I am more than satisfied with the set, which has charmed the family, and I must thank you very cordially for the very lucid and clear article which enabled me to do so much.—Yours truly,

T. MACKENZIE TRENCH.

Purley.

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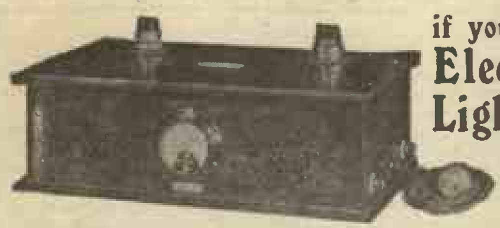

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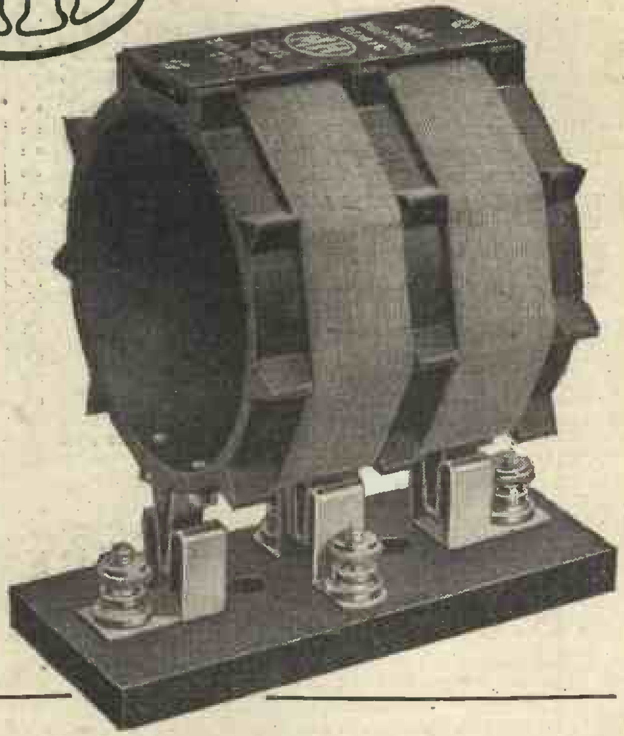


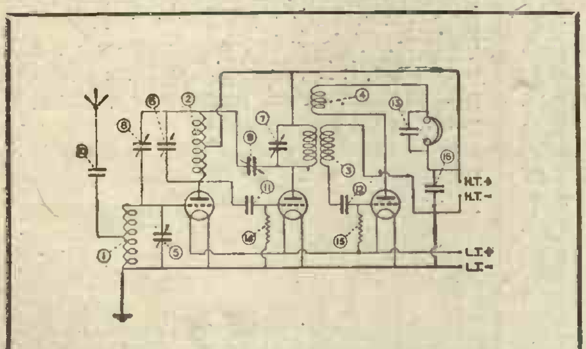
On previous occasions under this heading, we have pointed out the folly of assuming that the Barrel Type High Frequency Transformer is rendered obsolete by the introduction of the highly efficient "DIMIC" coil.

For the benefit of those interested in the construction of a set which, on the one hand, is highly selective, and on the other, easily manipulated, we repeat the circuit below.

Subsequent experiment at our Works has proved that the addition of a fine control over Reaction gives still greater command and facility in adjustment to weak signals.

Such control consists of a High Resistance Potentiometer, something in the nature of 1,000 ohms, connected in parallel with the MH Reactor 4.

This addition is worthy of note, since in conformity with modern design it enables all critical tuning operations to be effected from the front of the panel, without vitiating the facility for substituting internal units to cover any waveband.



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No. 0	150/ 300	M.
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,, 1a	450/ 950	M.
,, 2	600/1300	M.
,, 2a	900/2000	M.
,, 3	1100/3000	M.
,, 3a	2000/4500	M.

Price 10/- each

Base extra 2/6

INDEX TO CIRCUIT DIAGRAM.

Item		Each	Base
1 & 2	M.H. "Dimics" . .	10/-	2/6
3	M.H. H.F. Barrel Type Transformer	10/-	
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7	·0003 Variable Condenser	8/6	
8 & 9	Neutralising Condenser	2/10	
10, 11, & 12	·0003 M.H. Mica Condenser	2/6	1/
13	·001 Mica Condenser	3/-	1/-
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British, Continental and American Broadcasting Stations in their order of Wavelength

Edited by Capt. L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

Corrected up to March 18th, 1926.

This table has been drawn up for the express benefit of "Modern Wireless" readers, so that when a station is received on a wavelength which is known, or can be measured, the station in question can be logged readily by glancing down the columns marked Wavelength and noticing what station transmits on that wavelength. It will be appreciated that this will save a considerable amount of time, but, of course, experimenters must remember that the more distant stations, such as Boundbrook, Los Angeles, &c., can only be received when conditions are particularly favourable.

Wavelength.	Station.
64	East Pittsburgh, KDKA.
195	Karlskrona.
208	Gavle.
215	Umea.
233	Kiel.
237	Orebro.
241	Stettin.
243	Eskilstuna.
245	Saffle.
250	Angers (Radio-Anjou).
251	Gleiwitz.
253	Kalmar.
259	Elberfeld.
260	Norrkoping.
262	Brussels.
265	Jonkoping.
266	Shenandoah.
270	Malmo.
272.6	Staten Island.
273·5	Cassel.
275	Atlantic City.
279	Bremen.
280	Lyons (Radio Lyon).
280.2	Boston, Mass.
283	Dortmund.
286	Berrion Springs.
288	Goteborg.
291	Vancouver.
291.1	Moncton, N.B.
294	Dresden.
297	Hanover.
301	Sheffield.
306	Stoke.
309	East Pittsburgh, KDKA.
310	Bradford.
315	Blœmendaal.
315	Liverpool.
315	Paris (Petit Parisien).
318	Agen.
318	Helsingfors(Rad.Bataljong)
320	Milan.
321	Leeds.
322	Trollhattan.
325	Barcelona (Radio - Barcelona).
325	Malaga.
326	Nottingham.
328	Edinburgh.
329·5	Saskatoon.
331	Dundee.
333·1	Springfield.
335	Hull.
337	Northfield.
338	Plymouth.

Wavelength.	Station.
340	Madrid (Radio Castilla).
340	Nuremburg.
340	Varberg.
344	San-Sebastian.
344.6	Zion.
345	Chicago, WLS.
347·5	Copenhagen.
350	Bergen.
352.7	Detroit.
353	Cardiff.
355	Karlstad.
356.9	Toronto.
357	Seville.
360	Cadiz.
361.2	Oakland.
365	London.
365.6	Kansas City.
368	Prague.
370	Falun.
370	Chicago WGN.
373	Madrid (Union Radio).
378	Manchester.
379.5	Troy.
379.5	Schenectady.
382	Oslo.
384.4	Winnipeg.
387	Bournemouth.
389.4	Cleveland.
390	Madrid (Radio Iberica).
392	Hamburg.
394.5	Philadelphia.
397	Dublin.
402	Graz.
407	Newcastle.
410	Bordeaux.
411	Munster.
412	Montreal.
415	Bilbao (Radio Carlton).
417	Breslau.
418	Bilbao (Radio Vizcaya).
422	Glasgow.
425	Rome.
428	Stockholm.
430	Warsaw.
435	Ottawa.
435	Berne.
435.8	Calgary.
440	Belfast.
441	Toulouse.
446	Stuttgart.
452	Leipzig.
454·3	Boundbrook.
458	Paris (Ecole Superieure).
461.3	Pittsburgh, WCAE.

Wavelength.	Station.
462	Barcelona (Radio-Catalana).
463	Koenigsberg.
467	Linkoping.
468·5	Los Angeles.
469	Washington.
470	Frankfurt.
475·9	Fort Worth.
476	Regina.
479	Birmingham.
480	Lyons (La Doua).
482	Swansea.
485	Munich.
491.5	Portland.
491.5	New York.
495	Aberdeen.
505	Berlin (Witzleben).
508·2	Philadelphia.
515	Zurich.
516·9	Edmonton.
517	Detroit.
522	Helsingfors.
526	Omaha.
530	Vienna.
536	Chicago, KYW.
545	Sundsvall
546	Budapest.
576	Berlin (Magdeburger Platz).
590	Rosenhugel.
760	Geneva.
850	Lausanne.
940	Leningrad.
950	Odense.
1000	Moscow (Popoff).
1050	Hilversum.
1100	De Bilt.
1150	Copenhagen (Ryvang).
1200	Boden.
1250	Hjorring.
1300	Koenigswusterhausen, AFT.
1350	Karlsborg.
1450	Moscow (RDW).
1600	Daventry.
1650	Belgrade.
1750	Paris (Radio-Paris).
1950	Amsterdam.
2400	Soro.
2525	Berlin (Wolff's Bureau).
2650 2740	Paris (Eiffel Tower).
3000 4000	Koenigswusterhausen, AFT.

Useful Notes for the Experimenter on Parallel-Feed Circuits

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

Parallel-feed circuits are of great interest, and this article gives some detailed information on their evolution which can be usefully applied to the design of receivers.

UNTIL quite recently there were only two forms of high-frequency coupling in common use, namely, transformer coupling and the tuned anode method. While these achieved great popularity there were certain drawbacks, in that it was difficult to combine a good degree of selectivity with stability in a receiver employing these methods. Consequently means were found to overcome the difficulties and various methods of stabilising the high-frequency stages were proposed.

With the introduction of neutrodyne systems considerable progress was made, for by this method good selectivity and stability are obtained, and we now find that various types of neutrodyne receivers enjoy a deserved popularity.

Inter-valve Coupling

Another method of high-frequency coupling which has attracted attention is found in the parallel-feed scheme. Let us examine the circuit of Fig. 1, which shows a conventional high-frequency and detector circuit employing tuned anode coupling, and we shall see how the parallel-feed scheme is evolved and in what essentials it differs from the more conventional arrangements. In Fig. 1 the high-tension supply to the anode of the high-frequency valve V_1 is through the coil L_2 and the path of the radio-frequency component of the anode current is *via* the high-tension battery to the filament.

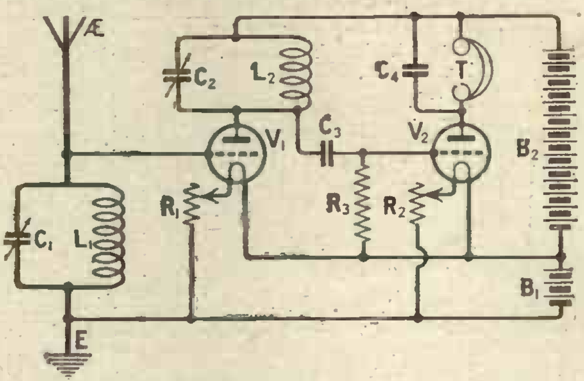


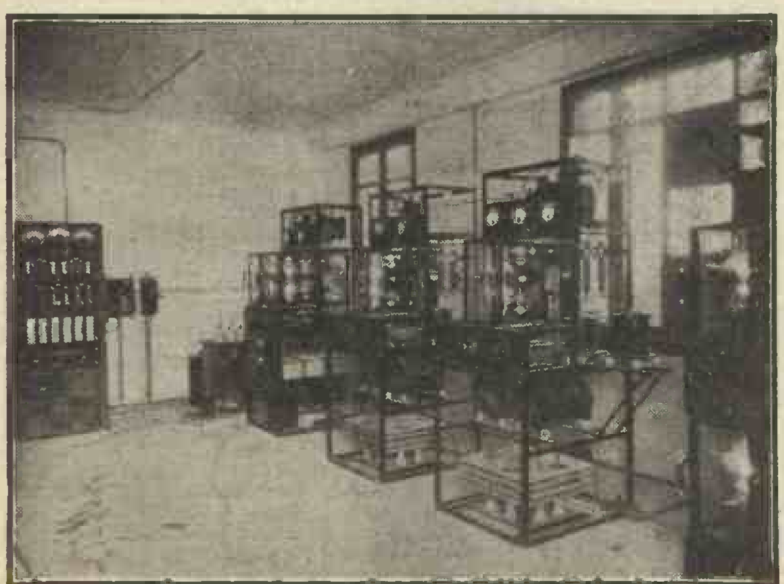
Fig. 1.—A conventional H.F. and detector circuit.

A Parallel-feed Circuit

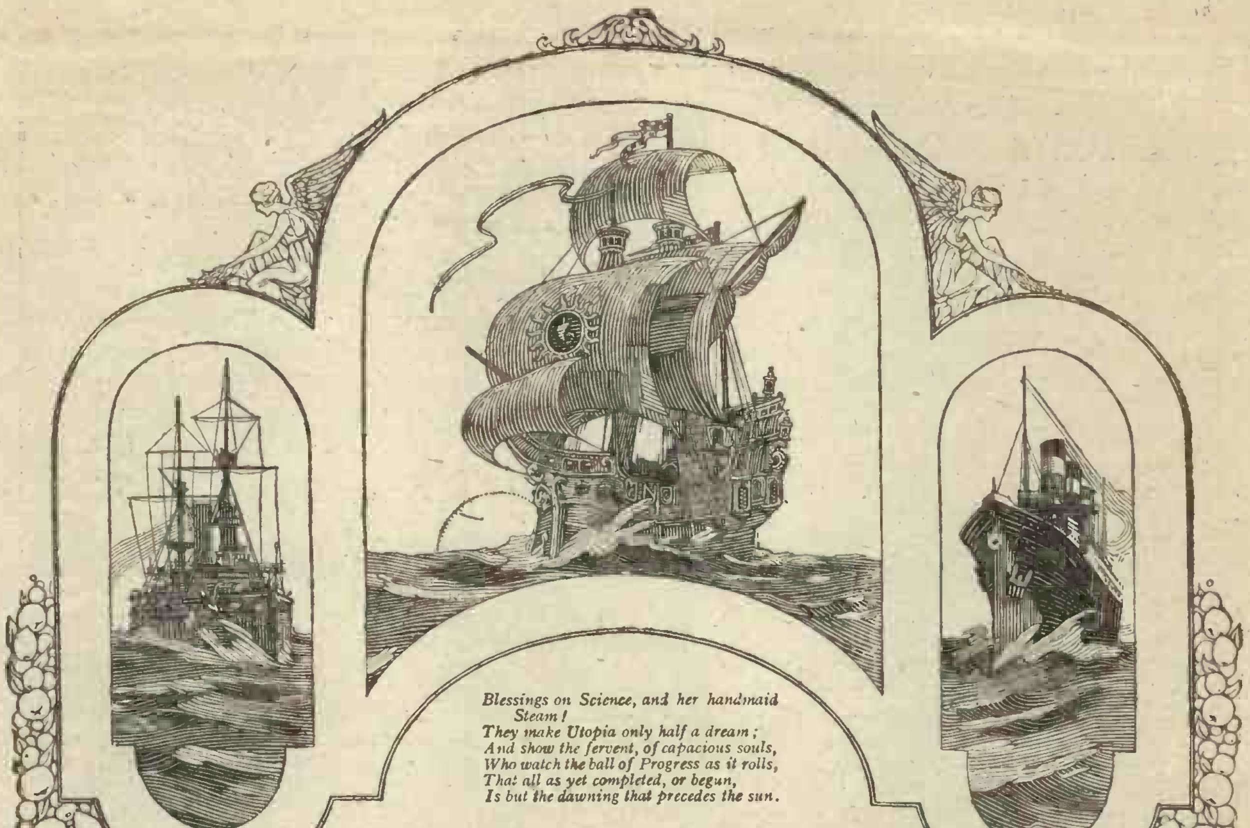
If now we supply the high-tension current to the valve V_1 through a high-frequency choke, and provide an alternative path for the radio frequency component through a blocking condenser connected to a tuned circuit which is across the grid and filament of the detector valve, we arrive at the circuit given in Fig. 2, this forming a parallel-feed system.

Stability without Neutralising

The particular features of the parallel-feed method of coupling are that it is possible to get a good degree of stability without recourse to any methods of neutralising, and at the same time a useful measure of high-frequency amplification is obtained. In the circuit shown of Fig. 2, plug-in coils may be used, the coils L_2 and L_3 having normal



During the recent Transatlantic Tests organised on this side of the water by the Radio Press, Ltd., the Madrid station shown above was successfully received in America.



Yesterday - wind power
To-day - - steam power
What will to-morrow bring?

YESTERDAY wind power was the force that propelled our ships upon the ocean. To-day Science, after slumbering for so many centuries, has been harnessed in the service of man to conquer the elements.

Yesterday a pioneer sat in a mean-looking hut, set high among the bleak snow-clad hills near St. John's, Newfoundland, waiting to receive the first faint signals from distant Cornwall which should tell him—and the whole world—of man's latest victory. The conquest of the Atlantic by Wireless.

Yesterday the uncertain and insensitive Coherer was the only Detector available for these pioneers. To-day it is but a relic of the almost forgotten past. The supremacy of the valve is unchallenged. Evolved by Fleming, improved by De Forest, one inventor after another has made some notable contributions to ensure its greater efficiency and to increase its sensitivity.

But most prominent of all recent valve improvements has been the introduction by Cossor of the triple-coated low temperature filament. Used exclusively in the Wuncell Dull Emitter it enables the valve to function with a filament glow which is almost invisible. Heat—the destructive influence which shortens the lives of all valves is almost entirely absent. The result is an extremely robust valve yielding an incredibly long service.

Couple such a wonderful filament with the fact that this Dull Emitter utilises the electron-retaining hood-shaped Grid and Anode made famous by Cossor, and you'll readily understand why the Wuncell is being everywhere chosen for its greater sensitiveness, superior tone and proved economy.

Types and Prices:

*W.1. For Detector and L.F. use 1·8 Volts. Consumption: ·3 amps.	14/-
*W.2. (Withred top) for H.F. use 1·8 Volts. Consumption ·3 amps.	14/-
W.3. The Loud Speaker Valve 1·8 Volts. Consumption ·5 amps.	18/6
**Also in special base with resistance to suit 2-, 4- or 6-volt Accumulator*	16/-

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IN ALL VOLTAGES AT ALL ELECTRICIANS.

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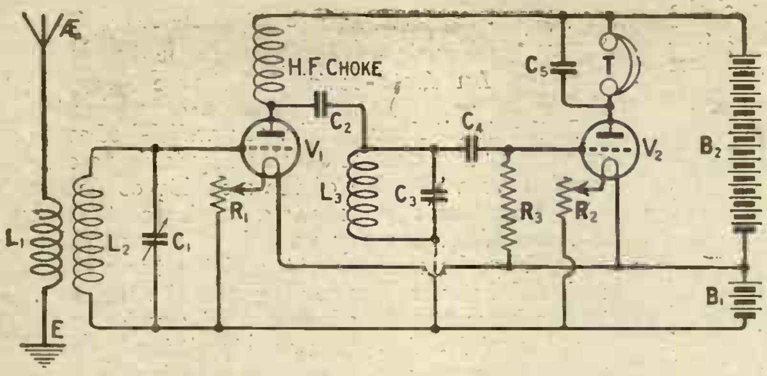


Fig. 2.—A parallel-feed system evolved from the circuit of Fig. 1.

values for closed circuits, such as No. 75 with ·0003 condensers for C_1 and C_3 or No. 50 with condensers of ·0005 for the broadcast band, while the aerial coil L_1 may be one of the smaller sizes, such as a No. 25.

A Point to Notice

A point to notice here is that the smaller the size of L_1 the greater will be the selectivity, but at the expense of signal strength. The high-frequency choke may be a No. 250 plug-in coil of low self-capacity. The size of the blocking condenser C_2 is not critical and the best value should be found by experiment in each individual case. With some types of valves if this condenser is too large there may be a tendency for the valve V_1 to oscillate, but a good average value is ·0003.

It will be noted that there is a certain negative potential applied to the grid of the valve V_1 equal to the drop in voltage across the filament rheostat R_1, but with some valves where this voltage drop is small it may be an advantage to increase the negative bias by the use of a 1½ volt dry cell.

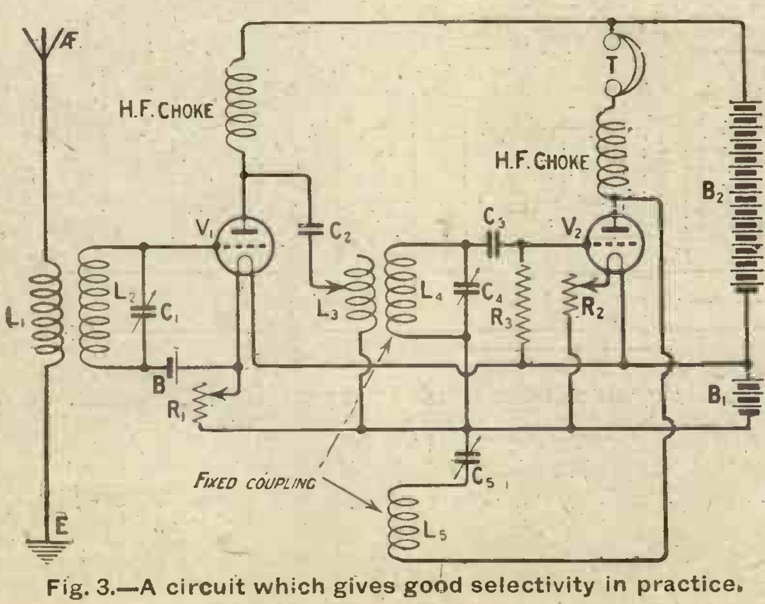


Fig. 3.—A circuit which gives good selectivity in practice.

Improved Selectivity

Variations of the Fig. 2 circuit are possible, and in fact the parallel-feed schemes shown in Figs. 3 and 4 are preferable from the point of view of selectivity. In Fig. 3 the parallel path from the anode to the filament is provided by the stopping condenser C_2 and the coupling winding L_3. The coupling unit L_3 L_4 may conveniently be made with L_4 a single-layer winding on an ebonite tube, and L_3 wound on an X former inserted inside the tube.

A Tapped Coil

The size of the coil L_3 is preferably adjustable and a coil of about 35 turns tapped, say, at the 5th, 10th, 15th and 25th turns is suggested here. The coil L_4 may

Mr. P. H. Dorte carrying out experiments on short-wave transmission at the Institution of Electrical Engineers, where he recently read a paper.

be 40 turns of No. 30 gauge, or thinner, double silk covered wire on a three-inch former, a ·0005 condenser being used for C_4. If it is found under some conditions that there is a tendency to self-oscillation in the first valve, this may be effectively counteracted by reducing the size of the coil L_3 or by decreasing the size of the stopping condenser C_2.

Provision for Reaction

Owing to the damping in the grid circuit of the detector valve, due to the grid leak and condenser rectification, it will be found that the tuning of the grid circuit L_4 C_4 is not particularly sharp, and it is a distinct advantage both from the point of view of signal strength and selectivity to arrange for reaction into this circuit. This may be done as shown in Fig. 3 by including a high-frequency choke in the anode circuit of the detector valve and arranging a reaction winding L_5 and control condenser C_5, as shown.

The Reaction Coil

This reaction coil is wound on the same former as L_4 and spaced about half an inch from the filament end of the latter. It may consist of quite a small number of turns, say 25, of thin gauge wire, if one of the L.F. resistance-capacity or other high amplification ratio valves is used for detector, with a value of ·0003 for the condenser C_5. If, however, a detector valve which oscillates less readily is used a larger number of turns may be required.

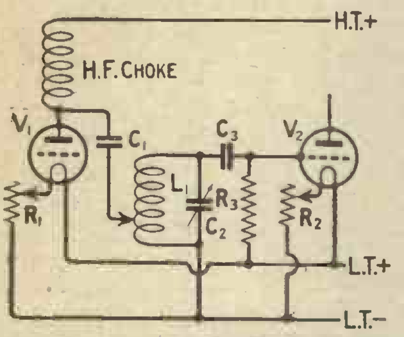


Fig. 4.—A parallel-feed auto-coupled scheme.

Types of Valves

Although only one high-tension tapping for both valves is shown in the Fig. 3 circuit, this arrangement proving satisfactory in practice, it is advisable to arrange for separate tappings if the best operation of each valve is to be secured, particularly if it is desired to try out a number of different types. For the detector valve the types previously mentioned give about the best results, and while low-impedance valves of the ·25 ampere type can be used successfully for the H.F. stage, a high-amplification ratio valve of higher impedance is found to give slightly increased selectivity, though the stability of the circuit is found to gain by the use of a general purpose bright emitter.

An Auto-coupled Scheme

In the circuit shown in Fig. 4 a parallel-feed auto-coupled arrangement is obtained by taking a connection from the side of the stopping condenser C_1 remote from the anode to a tapping on the coil L_1, the high-frequency path in this case being formed by the condenser C_1 and the turns of L_1 included between the tapping and the filament. This scheme has the advantage of simplicity, in that the coil L_3 of the previous circuit is dispensed with, although the selectivity obtainable does not appear to be as good as with two coils.

Two H.F. Stages

In the case where two high-frequency stages using parallel-feed coupling are employed, each valve has a separate high-frequency path from the anode to the filament, as distinct from other arrangements where the high-frequency path for each valve is through the H.T. battery, and thus a possible source of interaction is eliminated. Such a circuit employing two H.F. stages, detector and two stages of low-frequency amplification is shown in Fig. 5, which is the circuit of the "DX Five" receiver described by the author in the December, 1925, and January, 1926, issues of this journal.

It will be seen that the H.F. intervalve coupling is of the type shown in the Fig. 3 circuit of this article, and reaction is applied to the grid circuit of the detector valve. This set gave a very commendable degree of selectivity, and was quite simple to operate once the preliminary adjustments of tappings, etc., to suit the particular set of valves in use had been made. The size of the coupling windings L_3 and L_5 was adjustable as indicated, while provision was also made for varying the turns in L_1.

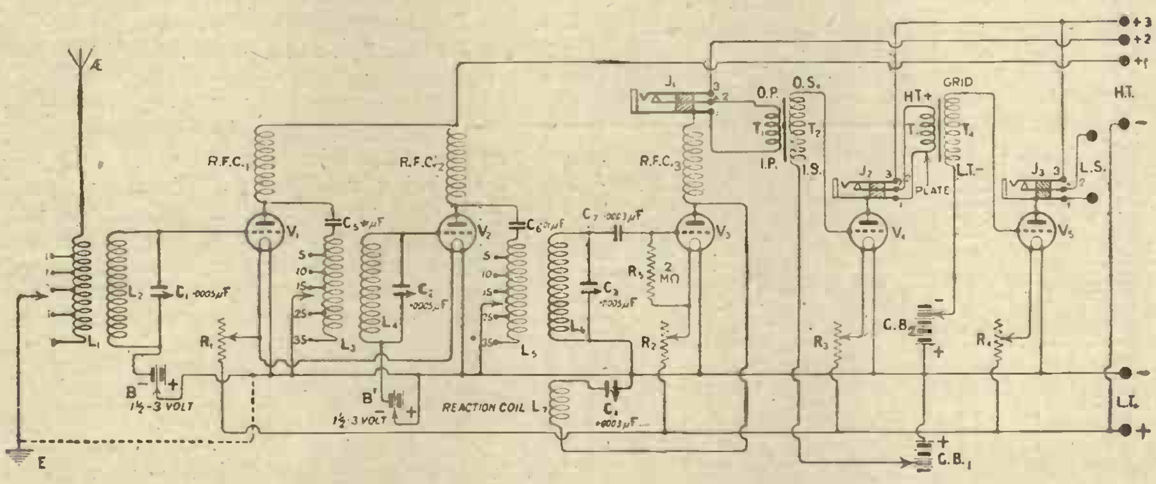


Fig. 5.—The circuit of the "DX Five" receiver, which makes use of the parallel-feed method.

An Interesting Superheterodyne Receiver

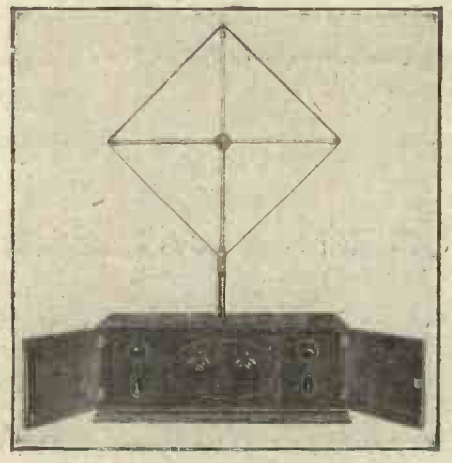
The Results of Tests made at our Elstree Laboratories on the Burndept Seven-valve Superheterodyne Receiver.

RECENTLY Messrs. Burndept Wireless, Ltd., sent along one of their Ethodyne receivers for test at our laboratories.

Makers' Claims

The makers claim that owing to its unique construction, the Ethodyne is a supersonic receiver of enormous power, and will receive most of the British and Continental broadcasting stations on the loud-speaker. The amplification obtained is so great that it may truly be stated that range of reception is limited only by local conditions, extraneous noises, etc.

The standard model supplied is of the open-fronted type, as can be seen from the accompanying photograph, the cabinet being made from mahogany, access to the valves being secured through the medium of a hinged top. The front panel itself is of polished and moulded mahogany instead of the usual ebonite, the efficiency of the set being unimpaired, since all the components which need to be highly insulated are mounted on ebonite panels behind this mahogany panel. The terminals are located at the back of the cabinet, but sockets are provided at the front for the use of telephones when required for tuning purposes.



The Burndept Ethodyne receiver with frame aerial mounted.

Special Features

One important feature of this set is the very adequate control of volume which is provided. A key switch enables either one or both the power-valves to be used at will for low or high power. This is used in conjunction with another refinement, *i.e.*, the rotary volume control, which provides for an adjustment of the intensity of the sound so that conditions of environment may be readily satisfied. This makes it possible to listen in comfort to the local station although within, say, two or three miles.

Frame Aerials

Two frame aerials are supplied with the receiver and can be mounted on the top of the cabinet; one being to cover the wavelength range from 250 to 550 metres, while the other is for the longer wave high-power stations, such as Daventry, Radio Paris, etc.

Tuning Controls

As is the case with most superheterodynes, this receiver is not a complicated one to operate, the whole of the tuning being carried out by two knobs situated in the centre of the instrument panel. A chart is supplied with each instrument, giving the dial settings for the principal broadcasting stations. Either of the two wavelength ranges is brought into operation by moving a special key switch.

Valves

The Ethodyne receiver is sent out complete with seven Burndept valves (one H.L. 310, three H. 310, one H.L. 512 and two L. 525), since the set has been designed to function with these types of valves.

Actual Tests

On actual test the receiver was found to be quite capable of getting any of the British main and relay stations, together with the Continental stations. There does not appear to be any long-wave pick-up, certainly not from inside the set. The reaction adjustment is sometimes of value, but not over the whole waveband, but this can be rectified by careful adjustment of the H.T. voltage.

The selectivity of the set was excellent, the background being particularly silent, while the quality of the reproduction is of a high standard. The long-wave reaction control is a commendable feature, and gives complete volume control.

Is the Separate Tuner Obsolete?

By A. R. DYSON.

Experimenters are often dubious as to the possibilities of a separate tuner. This interesting article makes the case quite clear.

NOT very long ago, in the earlier days of broadcasting, it was quite common practice for experimenters and designers of wireless apparatus to allow for the use of separate tuning units when designing receivers. In speaking of separate tuning units in this way the reference is not, of course, to such devices as plug-in coils and similar apparatus which make for easy wavelength changing. The separate tuner is an instrument complete in itself, comprising all the condensers and coils for the tuning of the aerial circuit of the receiver, with probably provision for reaction and switches for arranging different circuits with the coils and condensers.

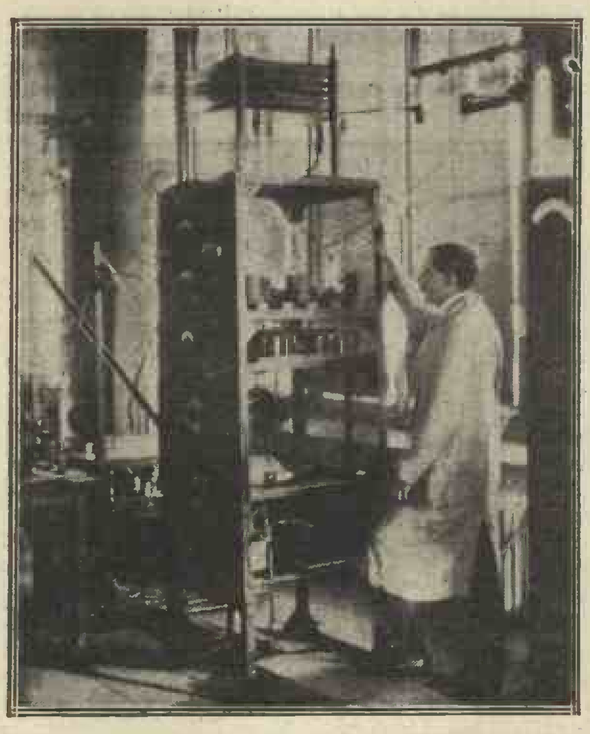
The Experimenter's Tuner

An example of this type of instrument which will be familiar to readers of MODERN WIRELESS was the "Experimenter's Tuner," designed by Mr. G. P. Kendall, and described in the issue of MODERN WIRELESS for September, 1924. This particular tuner had a considerable vogue at one time, and no doubt a number of these instruments are still in use. The modern tendency, however, is towards building the tuning controls of the receiver into one cabinet with the receiver itself. It is very doubtful, however, whether the tuner should be regarded as obsolete, since for certain experiments it has a distinct value of its own.

Present Day Needs

Owing to the necessity at the present day for selectivity and sensitivity of a high order, the problem of stable high-frequency amplification is receiving a considerable amount of attention by designers. Receivers which embody several stages of high-frequency amplification require careful attention to the layout of the component parts no less than to the quality and design of the individual components.

Now the principal advantage of the separate tuner is that it can be applied impartially to a number of receivers. The expense of purchasing tuning condensers and coils for every set made is avoided. This feature, no doubt, appealed to a large number of experimenters in the days when variable condensers were comparatively expensive components. The advantage mentioned has a limitation, however, in that once the tuner is constructed it is obviously not easy to try the effect of different layouts of the parts of the circuit which are contained in it. The whole convenience of the instrument would be lost, if it were made so "flexible" that its component parts could be moved about to suit the particular receiver in use at the moment. Under such circumstances, it would be preferable to build the necessary components into each receiver as required.



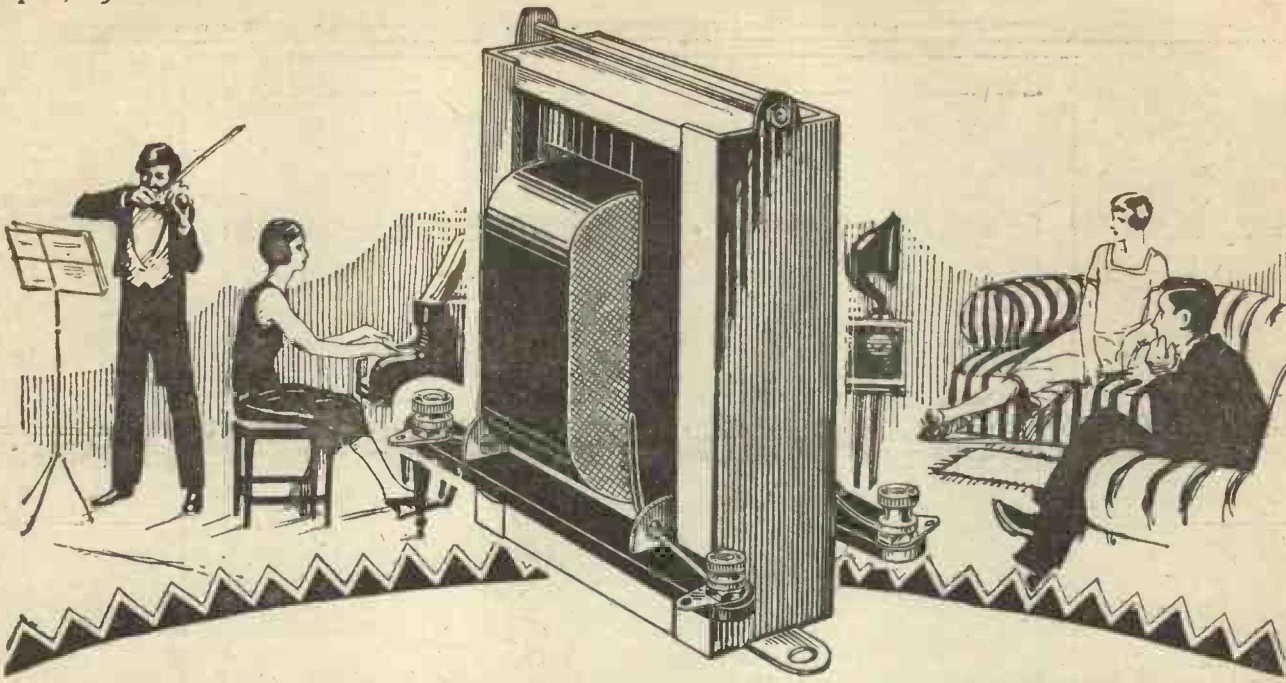
The transmitter at the popular Ecole Superieure Station is seen in the photograph.

A Complicated Matter

For high-frequency neutrodyne circuits the design of a separate tuner would be a complicated and difficult matter, and it is extremely doubtful whether any such design would be really efficient in practice. So long as the aerial circuit only was included in the tuner, satisfactory results might be attained, but if any attempt were made to incorporate in it the tuning of one or more of the high-frequency stages, the effects of long leads and the consequent stray capacities would militate against success. The receiver would have to be designed to suit the tuner, though, in fact, when these circuits are used it is necessary to design the receiver and its tuning arrangements as a whole and not in parts.

A Practical Case

It has been indicated already in this article that there is still a use for the tuner. For certain types of experimental work it can, in fact, prove invaluable. Suppose, for instance, that it is desired to carry out comparative



Music worth listening to!

Broadcasting has often been condemned by music lovers who have listened to imperfect reproduction of a beautiful musical composition. More often than not the transformer has been to blame, because it has not been designed to give that perfect reproduction which makes broadcast music really worth listening to.

There is a vast difference between a cheap transformer which has been indifferently designed and stinted of material for the sake of economy and one which is the result of exhaustive research and experiment by skilled radio engineers and incorporating ample materials of the finest possible quality for the purpose.

Such an instrument is the IGRANIC-PACENT SUPER "AUDIOFORMER"—it is an outstanding achievement in L.F. transformer design. It will reproduce with equal fidelity the grandeur of a full orchestral rendering or the more delicate passages of the solo instruments—the high notes of a soprano or the deepest cadences of the human voice.

The IGRANIC-PACENT SUPER "AUDIOFORMER" gives perfectly uniform amplification over a very wide range of audio frequencies—every note is amplified in proportion and the results will satisfy the most exacting critic. Ratio 3 : 1—suitable for use in first and second amplifying stages and with plate voltages up to 500.

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Ratio 3 :1. Price 27/-

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MH Filament Rheostats

A distinctive type made for use with all types of valves. Prices, each Bright Emitter Filament Rheostat, 5/6. Dull, 6/6; Dual Type (for either Bright or Dull), 7/6; Triple Rheostat, 22/6

MH Grid Leaks

All values 2/6 each, mounted on ebonite base, 1/- extra.

MH Anode Resistances

All values 4/6 each, mounted 1/- extra. Grid Leak and Condenser Unit (Mounted), 5/- each.

MH Mica Fixed Condensers

Are of the permanent capacity engraved thereon
Are instantly interchangeable, enabling the experimenter to change over from one condenser to another without disconnection.
Guaranteed against all climatic conditions.

Prices.

		each
0.0001 μF to 0.0009 μF	(030)	2/6
0.001 μF to 0.01 μF	(031)	3/–
0.015 μF to 0.02 μF	(034)	4/–

(Two clips are supplied with each condenser.)

Above, mounted on ebonite base, with terminals, any value, 1/- extra.

MH H.F. Transformers

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Price 10/- each.
With H.F. Damper 12/- each.
Special Neutrodyne Units and Superheterodyne Couplers also supplied.

No extra charge for matching if requested when ordering.

MH H.F. Damper, Price 2/-

The H.F. Damper is a device which, when inserted in the central hole of the H.F. Transformer, stabilises a circuit which otherwise could oscillate.

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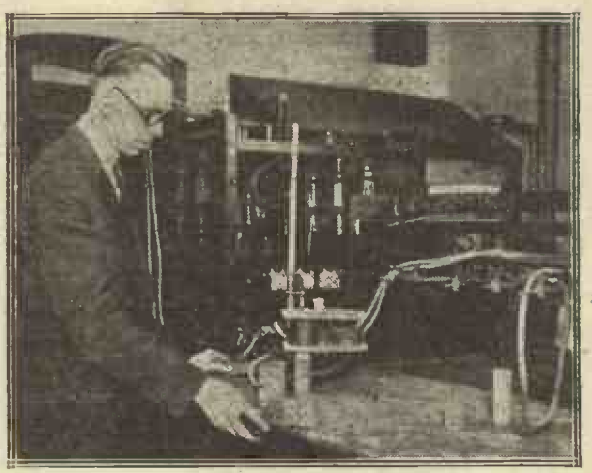
tests of different types of valve circuits independent of special aerial circuit arrangements. It is well known that it is a practical impossibility to construct two valve circuits which shall be exactly identical in performance. If, then, it is desired to compare the efficiency of, for example, different methods of rectification, using specially built apparatus for each method, then in order to ensure that the tests shall be comparable one with another, it is necessary to provide identical circuits to precede the other apparatus. The separate tuner in this case provides the essential tuning controls for the aerial circuit, making it unnecessary to attempt duplication of these in each piece of apparatus.

Not an Inefficient Instrument

It should not be assumed from the fact that it has somewhat gone out of fashion that the tuner is necessarily an inefficient instrument; a well-designed tuner can be of great benefit to the man of limited means. During the hours devoted to broadcasting it may be attached to a receiver comprising, say, a detector valve and one or more note magnifiers for the reception of the local broadcasting station, the direct form of aerial coupling being used in order to provide easy adjustment for the less skilled members of the family. When long-distance reception or special experiments are to be carried out, the tuner is removed from the broadcasting receiver and attached to another receiver intended for this work. It is not essential, or even in most cases desirable, to include the tuning controls of high-frequency amplifying valves in the tuner; these can be more satisfactorily arranged in closer proximity to the valves they serve. A layout of this latter type will be familiar to users of unit systems.

Designing Tuners

In designing tuners there is usually a temptation to include a number of switches, so that every possible circuit arrangement may be readily obtained. While this is, no doubt, convenient, it rarely makes for efficiency, and the aim should be to reduce the switches to a minimum and to prefer the use of suitable terminals. By the judicious disposition of terminals on the front panel of the tuner, it can be arranged so that a number of circuits may be tried, with simplified wiring and less liability to the ill effects of stray capacities. The designer should attempt to produce an instrument which will be suitable for efficient service with a limited number of receivers, rather than one which, intended for use with every possible class of receiver, fails to give good results owing to the complexity of its internal wiring.



The latest application of radio. A radio-operated furnace installed at the Bureau of Standards, Washington.

"The Transatlantic Four" & "The Special Five."

"The Transatlantic Four."

SIR,—I have completed the "Transatlantic Four Receiver," described by Mr. Harris in the November, 1924, issue of MODERN WIRELESS, having recently sent for blue prints, and I must say how pleased I am with it. For bringing in the signals and clear reproduction with the loud-speaker I have never heard a better. I have listened to a 5-valve set with capacity coupling and so have others, but they all say they have never heard one so clear as mine. With the amplifier made from the design in *Twelve Tested Wireless Sets* coupled to the set, I have listened to Madrid, San Sebastian, Paris, Hamburg, Berlin and many others. Hamburg, of course, comes in very loud. I listened to Vienna, Zurich and Helsingfors, and many others the other day, and I thought I should have had some trouble with oscillation, but this was not so. This set and the others designed by Radio Press, Ltd., that I have heard, increase my faith in your productions. There are many round here with sets, but I am sure Radio Press never designed them, so I keep telling them to put their trust in Radio Press and they won't go wrong.—Yours truly,

H. ALLANSON.

Freckleton, Nr. Kirkham.

"The Special Five."

SIR,—For the last month or so I have been using Mr. Percy Harris's "Special Five" Receiver, described in the November, 1925, issue of MODERN WIRELESS, and have been getting excellent results with it. The Continental stations come in with real volume and clarity, and Daventry is simply terrific, and this is coupled with pure reproduction. As regards selectivity, I can separate 5XX from Radio Paris on the loud-speaker, also on the B.B.C. I have often been able to separate stations which are heterodyning each other. I have followed Mr. Harris's specification fairly closely, departing from his design only on the L.F. side. I have used the following components: Ormond low loss condensers, Burndept supervernier dials, Burndept coils, Peto-Scott transformers, also Polar Neutrodyne condensers, Igranic filament rheostats, Burndept antiphonic valve holders, R.I. transformer in first stage L.F., A.J.S. choke coupling unit second stage. Valves, H.F., Cosmos, S.P.18 Red Spot; Detector, Cosmos, S.P.18 Green Spot; 1st L.F., Cosmos, S.P.18 Green Spot; 2nd L.F., Cosmos, S.P.18 Red Spot.

These valves I find give better results than any I have tried. The impedance of the Red Spot seems to suit the special H.F. transformers admirably. The H.T. voltages I use are 60 volts on first three valves, 120 on last two, with 9 volts grid bias on the last named. Many thanks for your excellent circuits and wishing you every success.—Yours truly,

A. G. SPICER.

Worcester.

Have you read about the remarkable Five-Valve Receiver on page 819?

In Passing

(Concluded from page 827.)

a brand new pair of trousers, whilst the omission of a split pin securing one of the wheels may easily result in the overturning, so to speak, of the entire applecart.

The Components Used

The components used are as follows :—

1 Cabinet, 36 ins. by 18 ins. by 18 ins. (Scrubbo Soap, Ltd.).
1 Set pram wheels (Rollford, Ltd.).
1 Loud-speaker (Adamstyles, Ltd.).
1 Flowerpot, complete with plant and soil (backdoor merchant, in exchange for pair of ex-trousers).
1 Cycle lamp (Jumble sale).
1 Horn with bulb (Hoots, Ltd., Tooting).
6 4B.A. by ½ in. screws (The Screw-loose Co.).
3 .0005 variable condensers (Snaggsby, His-loss).
6 yds. string (Stringers, Ltd.).
5 Valves (Poddleby).
2 lbs. assorted nails (supplied with lid of cabinet).
2 Terminals (Radio Doem's, Ltd.).
1 L.F. transformer (Gubbsworthy).
1 L.F. transformer (Bumpleby-Brown).
3 Tuning coils (Swedgels, Ltd.).
2 Aerial masts (Radio Doem's, Ltd.)
2 Spreaders (Workhouse Firewood Dept.).
1 Ebonite panel 36 ins. by 18 ins. by ¼ in. (Radiomud, Ltd.).
7 Fixed condensers, .0003 and .002 (Barrow in Farringdon Market).
2 2-megohm gridleaks (Hard Pencil Co.).
1 6-volt 50-ampere-hour accumulator (Found in Bilgewater-Magna 'bus).
5 Valveholders (Holdvalves Co., Ltd.).
12 Yards wire (The Wireless Co.).
Goop-Listener Flannel Transfers.

In Use

We have found the Happy Days pushable receiver delightful to use. The cabinet, I should mention, contains all the necessary batteries, and so roomy is it that there is ample space within for any tiny tots who may show signs of falling by the way. Since the original model was sketched by the *Radio Press* artist, Professor Goop has made a very great improvement in the design. He has arranged the panel so that it lifts up upon hinges.

Internal Layout

Within the cabinet he has placed two perambulator seats, and a row of portholes has been fitted along both sides so that the juvenile passengers, besides obtaining fresh air, may keep themselves amused by making faces at passers-by or by saluting them with banana skins and nutshells. Thanks to the provision of a hooter and a headlight the tired enthusiast, tramping home in the dark after an afternoon's revelry, need never be afraid of running down either pedestrians or motorists. We hope shortly to produce a de luxe model of the Happy Days receiver. This will be propelled by a small petrol engine, whilst the smiling owner will ride upon a dicky seat behind.

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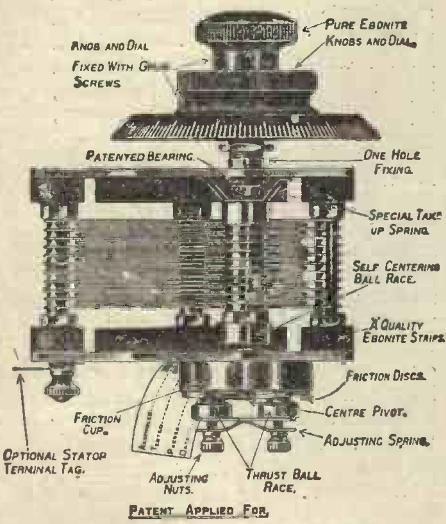

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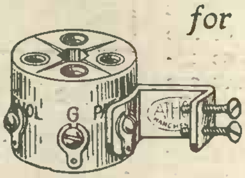

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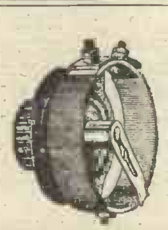

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Cutting Out the Stray Fields

(*Concluded from page* 842.)

A Wave-trap Circuit

A circuit where interaction between the two coils is also particularly undesirable is that shown in Fig. 5. Here we have a simple straightforward arrangement employing a wavetrap in the aerial circuit in order to cut out the local station. It has been found by many experimenters that any interaction between the trap circuit and subsequent circuits of the receiver gives rise to a variety of unpleasant effects, and in many cases completely destroys the effectiveness of the trap. In such a case the trap coil itself might reasonably be enclosed in a screened compartment. If there is only one other tuned circuit, it is not necessary to enclose a trap coil in a screen, but only the grid circuit.

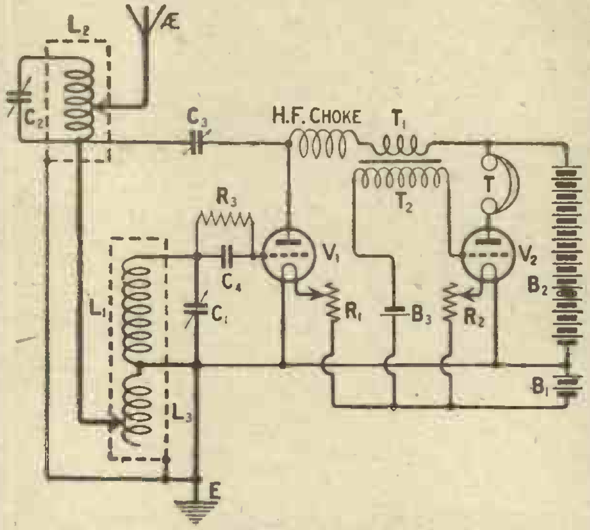


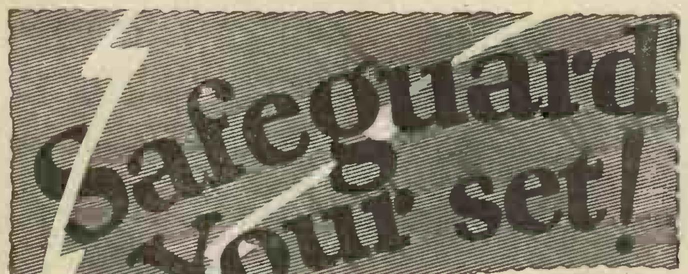
Fig. 5.—Interaction in wave-trap circuits is avoided with screened coils.

Another Aspect

Another aspect of the question worth considering is that direct pick-up of energy on the coils of the receiver itself is practically eliminated by this method. Those readers who live close to the local station will quite possibly have been troubled considerably by such direct pick-up. Even the inclusion of a trap in the aerial circuit will not eliminate this trouble, and in such cases screened tuning coils will be found of material assistance.

Considerable Possibilities

It will be seen therefore that the possibilities in the use of these screened units are considerable, and the elimination of the stray fields enables receivers to be made up in a very compact form. Further articles describing typical circuits and receiving sets incorporating such coils will appear in future numbers of MODERN WIRELESS. Details of these coils have been supplied to several manufacturers, many of whom have introduced interesting features of their own into the construction.



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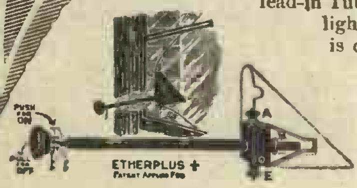

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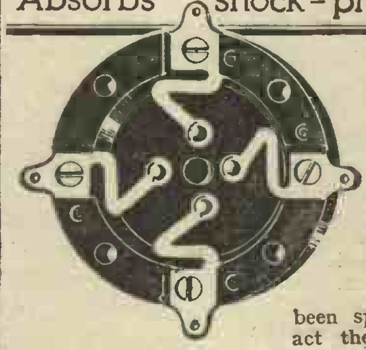

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Some Hints for the Short-Wave Novice

By

L. H. THOMAS, 6QB.

Some short-wave novices will find these notes of material assistance.

WHEN the owner of a standard broadcast receiver decides to "try his hand" at reception on the shorter waves for the first time, his results at first are too often disappointing. The reasons for this are many; they can, however, be summed up by the statement that "his ideas are wrong." There are a certain number of minor conventions that are taken for granted on the broadcast waves, which must very often be overlooked if one wishes to obtain successful results from a short-wave receiver.

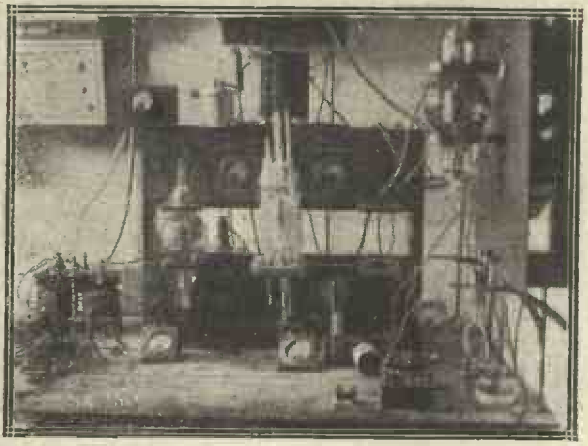
Reception of KDKA

As an example, the writer knows several enthusiasts who have little difficulty in obtaining excellent results on practically all the British and Continental broadcasting stations, but, on attempting to receive KDKA on the wavelength of 61 metres, have failed abjectly time after time.

First, it may be accepted fairly definitely that high-frequency amplification on these short waves will be a hindrance rather than a help. Unless a superheterodyne is employed, the writer is strongly in favour of employing a perfectly straight circuit comprising a detector and one or two stages of low-frequency amplification. The Reinartz circuit is one of the best to use for this circuit, on account of the easy reaction control obtainable. For the reception of telephony this is very desirable.

Points to Watch

It will most probably not be sufficient to cut out the H.F. stage or stages of your broadcast receiver, as such components as coils employing the standard type of plugs are undesirable. It will, therefore, well repay you either to re-design your broadcast receiver (if you are more keen on the short-wave work than on the broadcasting), or to build a separate receiver.



The short-wave station of Mr. Gerald Marcuse (2NM), where use is made of a Mullard 1kW silica valve.

An excellent method of using plug-in coils for efficient work on short waves is to mount each coil on a strip of ebonite about 3 ins. long, with a valve-pin screwed through the ebonite at each end, to which the ends of the coil are connected. Similar sockets can be made very easily.

Greater care than ever must be taken to keep metal components, such as transformers, variable condensers, etc., well out of the field of the inductances. Similarly, really "low-loss" condensers should always be used, and it will be found almost essential to use a vernier dial or slow-motion condenser of some description.

Capacity Reaction Troubles

If the "Reinartz" or some similar type of capacity-controlled reaction is employed, some trouble may often be experienced on short waves, in the form of unpleasant noises when the reaction condenser is adjusted. In most of these circuits it will be found that the high-tension is across the plates of the reaction condenser; these noises are often caused by a minute leakage of the H.T. battery across any dust (and there is always some!) on the plates. Here the remedy is fairly obvious—connect a fixed condenser of fairly large capacity in series with the variable. This, since it will not appreciably alter the capacity in circuit, will not upset the control in any way. It will, however, keep the high-tension from leaking across the variable condenser, and astonishingly quiet reception often results from this apparently trifling detail.

By-pass Condensers

If a straight circuit is in use, with the conventional by-pass

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Description	Ohms	Current Carrying	PRICE
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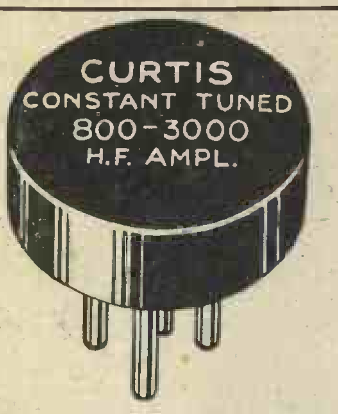

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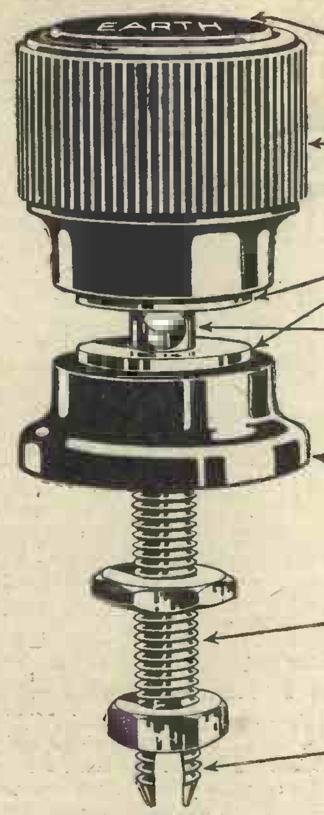

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condenser of ·0005 or ·001 capacity across the transformer primary (or the telephones), when difficulty is experienced in getting the receiver to oscillate in the first place, an improvement may often be effected by connecting the side of this, which formerly was connected to the positive high-tension, to the positive low-tension instead. Thus, instead of being connected simply across the primary winding of the transformer, it is connected across the primary *and* the high-tension battery. An improvement will almost certainly be noticed after this change, particularly if the connections to this condenser were originally inclined to be long. The golden rule in designing short-wave receivers appears to be "keep the oscillatory circuits as small as possible." It will often be found an improvement to connect the large condenser used across the H.T. battery on to the battery terminals on the set, instead of to the battery itself, which may be some distance from the set.

Aerial Coupling

The best method of coupling the aerial to the receiver is largely a matter of opinion; some favour a coil of three or four turns, loosely coupled to the secondary coil, while others swear by the use of a small "coupling condenser" of, say, ·00005 capacity, the aerial being connected, through this condenser, to the grid end of the secondary. The writer often employs auto-coupling; for the reception of KDKA a 10-turn coil is used, the aerial being tapped on at a point two or three turns above the earth end of this coil.

However, for any particular aerial there will generally be one method of coupling which gives distinctly better results than the others.

Aerials

Lastly, do not be misled into the idea that a short aerial is necessary for efficient reception on short waves. Your present aerial will almost certainly give as good results as any special aerial, provided that the best method of coupling is used. This must, of course, be determined by experiment. As a general rule, it will be found that for very long, high-capacity aerials, loose coupling will give the most satisfactory results.

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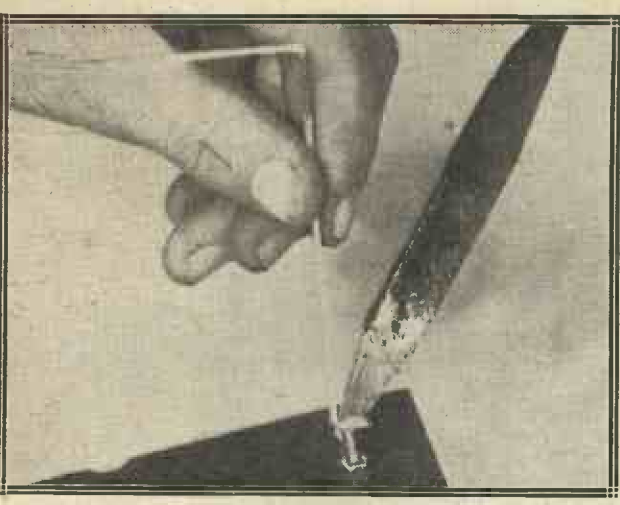

Solder Your Connections

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

Although a comparatively simple operation, soldering the connections of a receiving set may prove difficult. Read how it should be done.

FOR quite a number of constructors of wireless receivers and similar apparatus the word "soldering" probably conjures up visions of heat, smell, damaged ebonite panels and frayed tempers. When a receiver has reached the wiring stage, too often the task of soldering the connections is shirked in favour of the apparently simpler operation of fixing the ends of the wires under the nuts on the terminals and other parts. As a matter of fact, the forming of the loops at the ends of the wires for this method of making connections will usually take longer than soldering them. When once the knack of making soldered joints has been acquired it is much easier to secure a wire to the shank of a rather inaccessible terminal with a touch of a soldering iron than it is to place a loop of wire on the shank followed by the nut; the necessity for making sure that the nut is hard down on the wire does not tend to make the latter job any easier.

Contact Joints

Though it is maintained by some who have claim to speak with authority that "contact" joints, that is to say joints that are made by the pressure between a nut and the wire, are more satisfactory than soldered joints, at any rate of the kind which are generally made by amateur constructors, there is little doubt that for permanence and consistency of results from the receiver over a long period well made soldered joints provide the best means of connection. It should be emphasised however, that the essential point is that the joints should be well made. Bad joints make for imperfect and uncertain connections, and they may well offer a higher resistance to high-frequency currents than carefully made contact connections.

As indicated at the beginning of this article, soldering is to some an operation to be shunned, owing mainly to an exaggerated idea of the difficulties involved. These difficulties are really imaginary, and skill in soldering can readily be acquired by anyone who is prepared to follow simple directions and to be strictly methodical. Slapdash methods of soldering may be all very well for the experienced mechanic who could do the job with his eyes shut, so to speak, but care and method are necessary in order to make a satisfactory job of the wiring of a wireless receiver.

The Necessary Tools

Suppose now that we have a wireless receiver under construction. The components have been mounted on the panel, and all that lies between us and the first tests in actual reception is the fixing of the connecting wires. Certain tools will be needed. These are as follows: A soldering iron with a bit between ¼ lb. and ½ lb. in weight, a small file and a pair of pliers. In addition there will be required a piece of emery paper, a stick of solder and some flux. The last two items may vary in their composition. A convenient form of solder for the wireless constructor is made up in the form of thin tubes of solder containing a core of resin, the latter forming the flux. Alternatively the flux may be obtained separately, in which case resin, fluxite or one of the other *non-corrosive* fluxes which are obtainable will be found satisfactory. If in any doubt about the flux to use, it will be best to try resin, since this cannot possibly do any damage to the set if any of the joints "go wrong."

Heating the Iron

If a gas ring is available, the iron may very conveniently be heated over this. To heat the iron in an ordinary coal fire, a tin should be placed in the heart of the fire and the iron put inside this; this procedure will prevent undue fouling of the iron, and will also help to prevent it from becoming too hot. While the iron is heating, the receiver itself should be prepared for soldering. The ends of all the terminal shanks are to be cleaned first, and this introduces the cardinal rule which applies to all soldering operations, namely, that everything must be made scrupulously clean and must be kept clean. If this rule is adhered to, soldering will be found a perfectly simple matter. On the other hand, if it is disregarded, the "visions" quoted earlier are likely to become facts.

The ends of all the terminal shanks should be filed up smooth and bright with the file. This will be found better than emery paper, since the latter is liable to leave emery dust about, which is not easy to get rid of. By this time the iron should be ready. The correct temperature for the iron is most important, and it is in judging when the iron is just right that experience plays such a large part. This experience is not, however, difficult to acquire, and the

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Announcement of ALFRED GRAHAM & CO. (E. A. Graham), St. Andrew's Works, Crofton Park, London, S.E.4 best method for the beginner to adopt is that of trial and error.

The Correct Heat

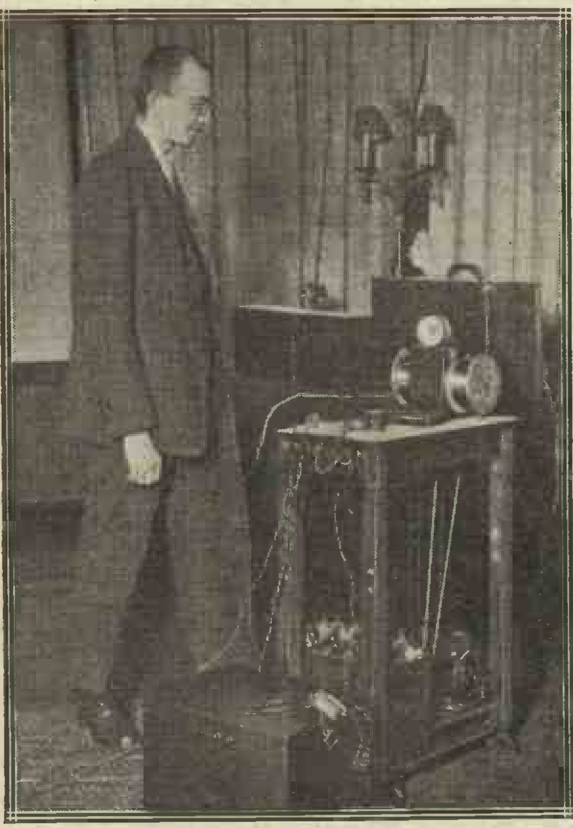
It is important to avoid overheating the iron, as this will damage its surface and make it harder to work with. If a ½ lb. iron, say, is being heated over a gas ring, leave it at first for two minutes. Then take it up, smear a little flux on one face at the tip, and press the end of a stick of solder on this face. Very likely the flux will smoke and burn away slowly while the application of the stick of solder will produce no result. In this case the iron should be replaced in the flame for another minute or so. When the solder melts and runs on to the iron as soon as it is touched on it, the iron is then hot enough. If the resin-cored type of solder is in use, the application of the solder to the iron will automatically supply the necessary flux, the resin running out of the solder. When this type of solder is in use the tip of the stick of solder will melt off as soon as it touches the hot iron, and the resin will burn away almost immediately. An iron not hot enough may just melt the solder after it has been held in contact with it for a few moments, but the solder will look "sticky" and will not run on to the iron.

A Film of Oxide

A trouble which is very often experienced at first is that of getting the solder to take on the iron. The purpose of the flux is temporarily to remove the thin film of oxide which forms on the surface of the bit, and thus enable the solder to come in contact with the clean copper surface and alloy with it properly. If too much flux is applied, it defeats its own object by fouling the surface of the iron. For this reason it is no use applying the flux to the iron when the latter is cold, since it will then burn away slowly as the iron heats up and leaves a deposit which will have to be scraped off. When the iron is hot enough, the flux will burn off almost as soon as it is applied, but if the solder is touched on the iron at once, the flux will have done its work and the solder will take.

Curing the Effects of Over-heating

In order to keep an iron in good condition the whole of the tip of the bit should be tinned all round, particular attention being paid to the corners in the case of a square bit. A well-tinned iron will be less liable to be damaged if it is slightly overheated at any time, and the tinning of the corners will prevent oxidisation from taking place at these points. If the iron does get fouled or covered with a hard scale so that the solder will not take on it, the simplest cure is to heat it red-hot and plunge it into cold water. The scale will then all flake off and the faces may be brightened up with an old file preparatory to re-tinning.



A new type of apparatus—the Telegraphone—used at KDKA for rebroadcasting German programmes, records of which were actually taken on a wire.

Tinning the Terminal Shanks

Assuming that the iron is ready and tinned, a trace of flux should now be put on the tip of each terminal shank. The stick of solder is then pressed on the face of the iron till a blob of solder has run on to it, and this face is brought to bear on the shank of the first terminal. The flux on the terminal should "fizz" off at once, and after about five seconds the iron should be removed. A small blob of solder should be adhering to the shank of the terminal. Leave this for a minute to cool, and then try and pull it off sideways from the terminal shank. If it is quite firm, the remaining terminals may be treated in the same manner. Each one should be tested before being passed as sound. If the blob does come off from one of the terminals, the latter should be cleaned up again with the file and the whole process repeated. No attempt should be made to tin the shank of such a terminal without cleaning it again. The heat of the iron will almost certainly have burned off all the flux, and a film of oxide will have formed again which fresh flux is unlikely to remove without thorough preliminary cleaning.

Using Resin-Cored Solder

It should never be necessary to hold the iron in contact with a terminal for more than a few seconds. If the job is done quickly with a hot iron, there will be little chance of the heat travelling along the shank and damaging the ebonite panel. The method of tinning the terminals described above applies to the use of separate solder and flux. When resin-cored solder is used, the operation is even simpler. The terminals are well cleaned in the same way, but no flux is applied until the iron is ready. Then the tip of the solder stick is rested on the shank of the terminal, and the tinned face of the iron is pressed down on the top of this. The solder will at once melt and run on to the shank, the correct amount of flux being automatically supplied. It is more than ever important in this case to have the iron hot enough, since when resin is used as the flux somewhat greater heat is required than with other fluxes. If the iron is too cool to make the joint, it may nevertheless melt the resin out of the solder and so clog up with too much flux the point to be tinned.

As soon as a little practice has been acquired it will be found possible to tin a dozen terminals or more without re-heating the iron. At first it will be as well to work slowly and to be sure that the iron is really hot for every point.

The Tinned Wire

Tinned wire is most commonly used for making connections nowadays, so that the preparation of the wires which have been bent to shape for their various positions is quite an easy matter. Even with tinned wire, however, a great deal of trouble will usually be saved by giving the ends of each wire a little extra tinning. This is most easily done by running a little pool of solder on to the iron and laying the end of the wire in this, putting a very little flux on the wire if necessary.

Fixing the Wires

Now when a wire is ready for attachment to one of the tinned terminals, it should be held with a pair of pliers against the shank of the terminal and the face of the iron with a good blob of solder on it brought to bear from the side on both the wire and the shank together. It is important that the iron touch both parts at the same time, as otherwise the solder will not melt properly on both parts and an imperfect joint will result. As soon as the solder on the two parts is seen to run together, the iron should be removed and great care should be taken not to move the wire until the solder has set. Close observation of the joint will show when the solder sets, as a crinkling of its smooth surface will take place as it suddenly contracts in cooling. As soon as this is noticed, the joint is finished. The wire should be given a pull to make sure that it is really firm, the joint being remade if it breaks away.

Saving Time

A good deal of time can usually be saved in the end in soldering the connections of a wireless set if every possible point is thoroughly tinned before any attempt is made to do the actual jointing. This applies specially to such parts as soldering tags, which are usually lightly tinned already, but which are almost certain to be sufficiently oxidised to prevent the solder from running easily and taking properly. Where, as in the case of some types of valve holders and similar components, the soldering tags are secured on short bolts and so come very close to the ebonite of the component, the tags should be removed from the bolts for tinning and their connecting wires should be soldered to them before they are replaced. This procedure will obviate the possibility of damage to the ebonite which might otherwise result from the heat of the iron transferred to it via the bolts.

The Final Operation

The final operation when the soldering of all the joints is complete, before testing the receiver, is to clean the back of the panel of all traces of flux. Paste fluxes, if left on the panel, will tend to pick up dust and so will eventually cause noises in the receiver and even considerable leakage of current. The writer has known of a case in which 1½ milliamps. were found to be passing from the H.T. battery of a receiver even when no valve was in the holder. This leakage was traced to the presence of an accumulation of flux and dust between the contacts of the valve-holder. Metallic dust in particular can, of course, be a fruitful source of trouble, and a certain amount of this will be produced in the operation of filing the terminals. A large soft brush and some methylated spirit will be found useful in cleaning. A certain amount of resin left on the terminals and other metallic parts will not be likely to give rise to trouble, as it is non-conducting and it does not tend to pick up dust to any serious extent.

Don't put up with poor results!

SELDOM, if results be poor, is the transformer suspected as the cause. Every other component is blamed, tested, changed—all of no avail. Make sure *your* results are the finest obtainable by fitting a "Powquip" **Orchestral Transformer**—a thoroughly efficient instrument, reproducing music, song, and speech without the slightest suspicion of distortion and on a background free from blurs. The "**Orchestral**" is remarkable for its flat amplification curve characteristic, over normal frequencies.

Voltage amplification at :—
250 v. = 29.
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WANDER-PLUGS
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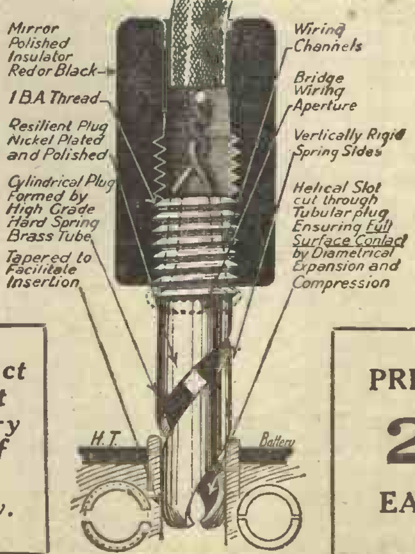

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For all other connect ons use CLIX plugsockets and adaptors.

From all traders or direct from:
AUTOVEYORS LTD., 84 VICTORIA ST., LONDON, S.W.1

All about your Condensers.

(Concluded from page 855).

dials should read in the same direction as the setting of the condenser, while for frequency variations the converse will hold.

Geared Dials

Geared dials are almost a necessity where fine tuning is required, but no backlash should be present, as this may militate against resetting to a previously recorded reading for a particular station. It is in connection with this last-mentioned fact that separate vernier plates have failed to achieve any marked popularity, and in addition these condensers have the objection of a double knob for separately adjusting the main moving plates and the vernier plates.

Slow motion gears vary from a two-to-one ratio up to an eighty-to-one ratio and each have their special advantages. An example of a fine-tuning recording dial in which a special friction device permits the rotor to be quickly turned to the desired position with a two-hundred-to-one slow-motion worm wheel and toothed dial for the final adjustment is shown in photograph "D."

If all these considerations are attended to in their proper perspective according to circumstances the choice of a suitable condenser will present no difficulties and such an instrument will be able to fulfil its purpose with every degree of satisfaction.

A Final Hint

As a final point it should perhaps be mentioned that a periodical examination of the condenser in a receiving set is desirable in order to ascertain that no dust particles have accumulated between the vanes, as this frequently leads to undesired noises. A pipe-cleaner brushed between the plates will remove this trouble and this operation can usually be carried out without removing the condenser from the panel.

SUMMARY OF POINTS TO NOTE

Minimum amount of solid dielectric.

Plates of not readily oxidisable metal.

Connection from moving plates preferably insulated.

Bearings quite rigid and no sideplay or backlash.

Large knobs and plainly marked dials are often very desirable.

Geared dials should have no backlash.

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The 'BRETWOOD' AMPLIFIER

The design and construction of the Bretwood Auto Audio Frequency Amplifier enables us to make the following statements in all good faith.

The Bretwood Amplifier practically eliminates all parasitic noises.

The Bretwood Amplifier tends to reduce those ripples caused through local power stations and the interference resulting from discharge of current operating electric trains, trams, etc.

Can be used with three or more stages without any trace whatever of distortion or noisy background.

To obtain the maximum filtration effects, at least two stages of amplification should be used.

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Guaranteed for 3 years.

Money refunded if not satisfied after one week's trial.

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BRETWOOD, LTD., 12-18, London Mews, Maple Street, London, W.1

H.F. 22

The Remarkable "Modern Wireless"

FIVE-VALVE RECEIVER

—build it the Pilot Way and we will guarantee you good results.

There is no more sure way of building your set than the "Pilot" way. Briefly, it is just this. We supply the complete kit of parts, Cabinet and Panel, ready drilled and engraved. All you have to do is to mount the parts on the panel and solder up connections. But "Pilot" Service does not end here, for if you do not get perfect satisfaction, return your set to us. Our Service Department will test it, and if the defect is due to a faulty component, will replace it without charge. If incorrect wiring is the cause, we will gladly rectify it at a small charge. Why not build this fine Five-Valve Receiver described in this issue under this safe "Pilot" way?

The "Pilot" Type "B" Kit of Components for building the above set comprises :—

4 Keystone Spiral Contact Condensers, .0005 mfd., fitted with 4 in. dials	£2	0	0	3 Peto Scott Neutralising Condensers	£0	16	6
4 Keystone Universal H.F. Transformers, 200-500 Metres ..	1	10	0	3 Peto Scott Plug-in Fixed Condensers, .006 mfd., mounted..	0	10	6
4 Bases for above	0	8	0	1 Marconiphone Ideal Transformer	1	10	0
4 Keystone H.F. Chokes, No. 1	2	0	0	1 On and Off Switch	0	2	0
3 Ditto No. 2	1	10	0	1 Double Circuit Jack	0	2	6
1 Peto Scott P.M. Neutralising Condenser	0	6	3	1 Plug	0	2	6
4 B.M. Single Coil Holders ..	0	6	0	5 Benjamin Valve Holders ..	0	13	9
1 T.C.C. Fixed Condenser, .05 mfd.	0	2	4	1 McMichael Potentiometer ..	0	7	6
1 Dubilier Fixed Condenser, .001 mfd. (vertical)	0	3	0	12 Large Terminals, nickel plated	0	3	0
1 "Pilot" Terminal Strip ..	0	2	6	Radio Press Diagrams	0	3	0
5 Amperites	1	10	0	12 yds. Square Copper Wire, Screws, etc.	0	2	0
3 T.C.C. Condensers, 2 mfd. ..	0	14	0	1 Baseboard, 13½ in. by 8 in. by 5/8 in.	0	1	6
1 Ditto , 5 mfd. ..	0	3	4	1 Ditto, 26 in. by 3 in. by 1½ in...	0	2	0
					£15	12	3

Type "A" Kit of Components (Author's Specification)	£17	15	6
"Pilot" Panel, 36 in. by 9 in. by ¼ in., drilled and engraved	£1	10	0
Polished Mahogany Cabinet	3	3	0

Packing Cases 10/- extra, refunded in full on return.

3d. POST FREE. The splendid 56-page "Pilot" Manual, containing full constructional details, for building many fine sets.

A Three-Valve Reinartz Receiver, described in this issue.

"Pilot" Type "B" Kit of Components	£6	15	0
"Pilot" Panel, 20 in. by 8 in. by ¼ in., drilled and engraved	0	17	6
Polished mahogany cabinet and baseboard	£1	12	6

When complete Sets of parts and panel are purchased together a Marconi royalty of 12/6 per valve must be remitted.

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Head Office, Mail Order and Showrooms.

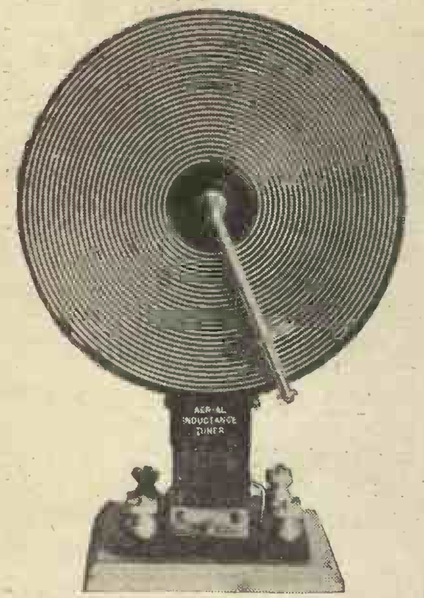
77, City Road, LONDON, E.C.1.

Branches: 62, High Holborn, London, W.C.1. Walthamstow :—230, Wood Street. Plymouth: Bank of England Place. Liverpool: 4 Manchester Street.

P.S.4812.

A Bijou Crystal Receiver

(*Concluded from page* 862.)



A back view of the set showing the Tunometer wheel bearing on the spiral inductance.

mately equal to that from the standard set. This is exceptionally good and is probably due to the fact that the Tunometer coil has quite a low high-frequency resistance, as was confirmed by actual measurement, while it is clear that the actual optimum tapping point could not have been far from the end of the coil, and is therefore sufficiently near it for practical purposes.

It will be realised that this set, while being extremely simple and easy to construct, gives results equal to that of the best, a feature which recommends it to both the beginner and the more advanced experimenter.

Have you purchased your copy of the

NEW

WIRELESS WEEKLY?

Same Size.

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Will all our Readers Please Note?

To the Editor of MODERN WIRELESS.

SIR,—Our attention has been called to the article on Page 701 of your issue for March, in which Mr. C. P. Allinson gives an extremely lucid account of a Superheterodyne set and how to construct it.

We have to point out to you that the patents covering the principle of Supersonic reception are the property of this company, and that all amateurs constructing sets employing this principle become liable for proceedings for infringement of our patents. It is, however, the policy of this company to issue licences to anyone who cares to apply for one to enable amateurs to construct a superheterodyne set for their own use, on receipt of a royalty fee of 30s. per set.

We shall be much obliged if you can find room in your valuable paper to publish this letter, so that all amateurs may once again have fair warning of their position in this matter.—Yours truly,

H. A. P. DISNEY, Secretary,
Standard Telephones and
Cables, Ltd.

THE COLVERN SELECTOR LOW LOSS
Capacity—
.0005 mfd. .. £1 1 0
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One hole fixing.
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COLVERN INDEPENDENT VERNIER Price 2/6
Ask your dealer also for the Colvern Low Loss Coil Former. Price 6/-

enables calibration and relocation to a high degree of accuracy without hand capacity.

CALIBRATION with certainty to the 1,000th part of the variable capacity. This is the tuning efficiency obtained with the Colvern Selector. The complete circle of the dial is divided to provide a value of 100 degrees for every rotation of the index. Pre-supposing your condenser and inductance to cover 300 metres, the degree interval represents 3 metres—obviously every station can be calibrated definitely.

The Colvern is logically the only condenser worthy of the attention of serious experimenters. An insulated spindle reduces the effect of hand capacity to a minimum, a point of paramount importance in the reception of distant signals.

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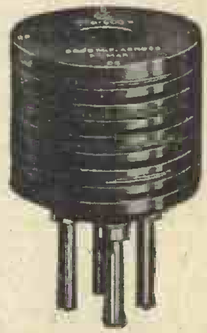

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Good dealers stock them, or you may order direct from The Bowyer-Lowe Co., Ltd., Letchworth.

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Here is an excellent product—The Tangent Two-Valve Radiomatic Receiver. This is manufactured specially to work with the new Daventry Station, and we claim that—even though it be a bold claim we can substantiate it—the Receiver obtains most satisfactory **Loud Speaker strength up to 100 miles.**

The whole instrument is designed and constructed according to Gent's best traditions.

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SUPRECISION Radio Testing Set, model 103, is the most remarkable measuring instrument in existence. It has 24 different ranges, from 0.1 volt to 600 volts, from 0.05 milliamp to 12 amperes, and measures resistances to 12 megohms.

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It revolutionises all previous conceptions of Radio reception and brings in all Europe without trace of unwanted noises.

A.C., £3 15 0 D.C., £2 5 0

Model 103 can be used in connection with Mr. Hartt's article on Measuring Instruments in the last issue of this journal. The illustration in this article was the Suprecision Model 109.

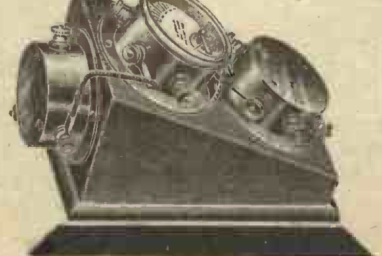
F. C. HEAYBERD & CO. 8, 9, TALBOT COURT, EASTCHEAP, E.C.3

SUPRECISION

Model 103,

Ten Range Set.

£3 : 16 : 0

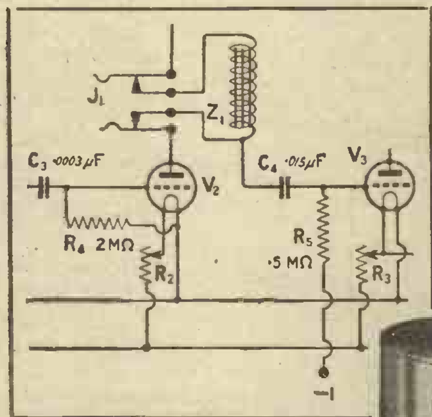


now try choke amplification

Given a good circuit with suitable valves you can demonstrate for yourself that choke amplification is decidedly superior to transformer coupling.

The result depends largely upon the efficiency of the Choke, and apart from our claim of the superiority of the Success Super Choke it is significant that leading constructional experts repeatedly include it in their specifications.

This Success product embodies the essential features indicative of a good choke. It is wound with ample turns of large gauge wire upon an effective iron core.



In the diagram we indicate the usual method of Choke coupling capacity.

With the Success Super Choke we claim that you can secure consistent amplification over audio frequencies—in fact, the power of reproduction and its remarkable mellow tone will be a revelation and immediately convert you to choke amplification.

SUCCESS SUPER CHOKE. Price 18/6

BEARD & FITCH LTD.

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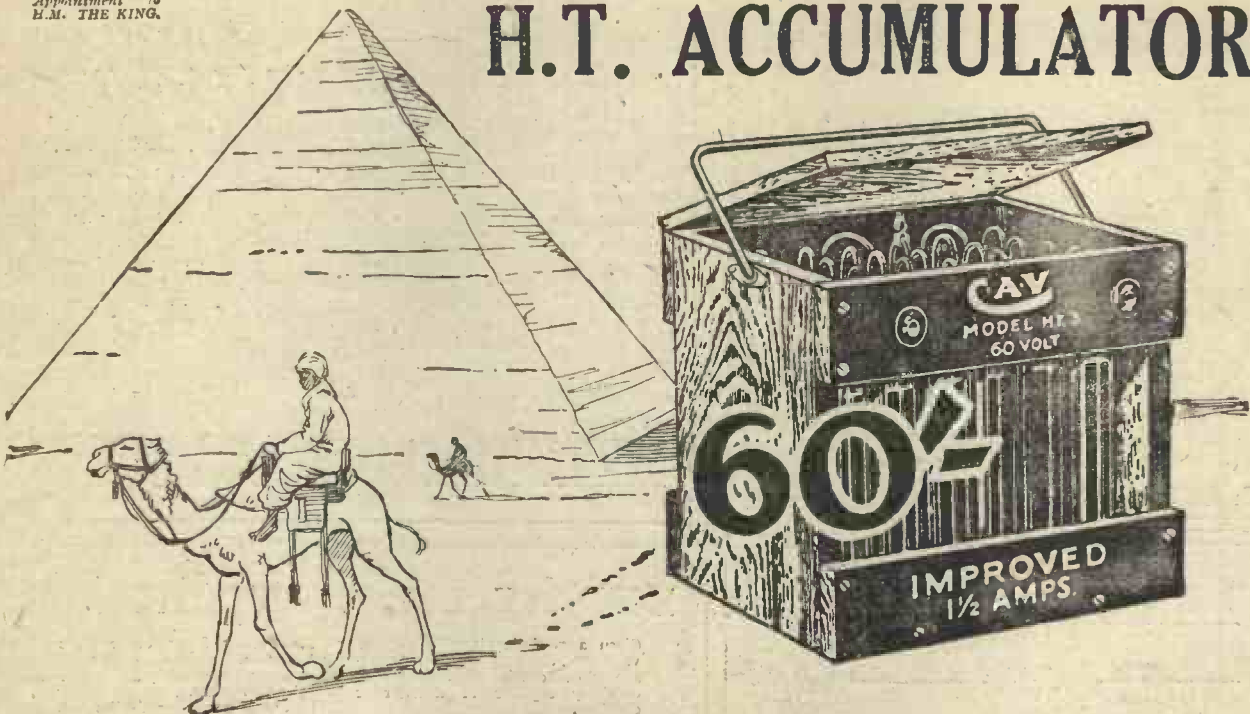
Built to last

C.A.V.

Car Equipment Manufacturers by Appointment to H.M. THE KING.

H.T. ACCUMULATORS



ACCUMULATOR claims are numerous, but C.A.V. claim 33 years' manufacturing experience. The C.A.V. H.T.3 was designed with that experience behind it and is constructed to work with the average broadcast receiver. It is electrically efficient and all that can be desired for really reliable radio reception.

OVER 10,000 SATISFIED USERS. Moreover, it is exclusively used by those who know, namely :—

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- Mr. J. A. Partridge, radio 2 KF ;
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and others who find them essential when setting up wonderful records in reception throughout the world.

For your L.T. supply, "Acton" Accumulators in celluloid or glass.

Write for a copy of our complete Radio Catalogue.

Supplied at 1/- per volt.

H.T.3.	60 volts	60/-
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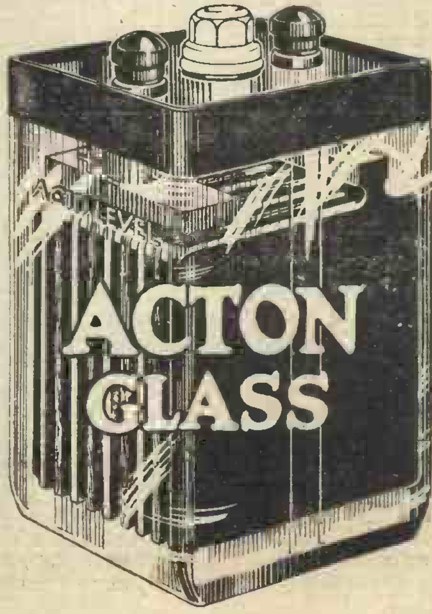
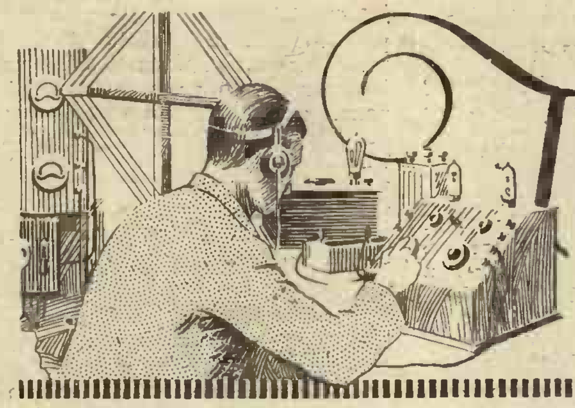
ALL C.A.V. H.T. ACCUMULATORS are supplied fully charged (first charge free).



C.A. Vandervell & Co. Ltd.
ACTON VALE LONDON, W. 3.



Tested by Ourselves

Grid-Bias Battery Holders

MR. A. G. BRINE has sent us a sample pair of the "Secure" grid cell holders for examination.

Description of Component

The holders consist of two right-angled metal brackets made from aluminium just under $\frac{1}{16}$ in. thick. Each has a vertical strip of metal 2 ins. by $\frac{3}{4}$ in., with two side flanges $\frac{3}{4}$ in. square, and a metal base of the same dimensions. By means of a countersunk screw hole at the centre of this base the holders are fixed into position on the baseboard. The holder is pressed into shape, and the distance between the insides of the flanges ($\frac{7}{8}$ in.) just allows an ordinary Ever-Ready 9-volt grid-bias battery to slip into position, these holders having been primarily designed for this cell. The feet are turned inwards with the object of economising space, and when mounted on the baseboard conveniently accommodate the grid-bias battery, the length of that battery being immaterial as long as the width does not exceed $\frac{7}{8}$ in.

These holders should prove useful to constructors.

Two-way Coil Holder

A SAMPLE of their L.E.S. Two-Way Coil-holder has been submitted to us for test by Messrs. The London Electric Stores, Ltd.

Manufacturers' Claims

It is claimed that this new two-way coil-holder embodies an entirely novel principle. At its maximum travel, it is stated that the reaction coil is right out of coupling, an important advantage which is not included in the majority of coil-holders. The movement is easily variable throughout, and the strength of the guide spring eliminates any possibility of backlash.

Description of Component

This component is designed for behind panel mounting, in which case the coils are at right angles to the panel, one or three hole fixing being provided as required. Two holes are also provided for fixing to a baseboard. The coupling between the coils is loosened by moving the adjustable coil across the face of the other coil until it takes up a position at right angles to its original position.

A knob of moulded material controls a screw which actuates a lever motion, so as to alter the

The novel two-way coil-holder of the London Electric Stores, Ltd.

coil's position. A coiled spring is provided to take up backlash.

Laboratory Tests

On test it was found that the fit for a number of coils was satisfactory, and that there was no detectable backlash. A few large coils were found to foul the panel when the component was mounted in position, and hence could not be used in practice.

General Remarks

This coil-holder is a very good specimen of its type. It suffers from the common disadvantage with coil-holders in which only a vernier motion is employed, viz., that it is a somewhat slow process to move from one extreme position to the other.

It is not possible to substantiate the claims made by the makers that when the two coils are at right angles the coupling is zero. There is, however, a position between the two extremes at which the coupling is zero, and when moved from one side of this zero position to the other the coupling changes sign. Another advantage with this double coil-holder is that the total space taken up by the coils and holder is less than that in many back-of-panel coil-holders, so that it will be of considerable use where a compact layout is required and yet it is desired to house the coils within the cabinet.

Fixed Condenser

MESSRS. The British Sangamo Co., Ltd., have submitted to us for test a sample of their Sangamo Mica Condenser. It is claimed that this condenser is moulded throughout in bakelite, and its capacity is guaranteed under varying conditions of temperature, moisture and pressure.

Description of Component

This condenser is made of brown insulating material, and is rectangular in shape, except for its ends, which are rounded off. Its overall length is $1\frac{7}{8}$ ins. and its width $1\frac{3}{8}$ ins. At each end of the condenser a screwed metal bush passes right through it and evidently makes contact with the appropriate set of plates inside. No soldering tags are provided, but both the makers' name and the rated capacity are marked on the case. The condenser is hermetically sealed.

Laboratory Tests

The condenser was found to be of the rated capacity within a sufficient degree of accuracy, and its insulation resistance was infinite. Both these qualities were found to be unaffected by exposure, the condenser having been left for a night in the open under particularly adverse atmospheric conditions.

The Varley Constant Wire-wound Resistance

ensures absolutely perfect tone and constancy under all atmospheric conditions, because it is wire wound on the famous Varley Bi-Duplex system, with the turns silk separated, eliminating all self-inductance.
This resistance is a sound product of 27 years' experience in intricate and accurate wire winding.
For inter-valve coupling where freedom from distortion is required, resistance capacity is unequalled.
To obtain the height of perfection the resistance unit should be a Varley.

Wire Wound and Weatherproof

Complete with Clips and Base **7/6**

Without Clips and Base, 6/-

60,000 ohms, 80,000 ohms, 100,000 ohms.

Write for Leaflet.

VARLEY

Constant always

The VARLEY MAGNET CO.

(Proprietors: Oliver Pell Control, Ltd.)

Woolwich, S.E.18.

Telephones: Woolwich 888, 889.

Cosmos Lead-in Tube

MESSRS. Metro-Vick Supplies, Ltd., have sent us a Cosmos Lead-in Tube for test and report.

This consists of a threaded brass rod 6 ins. long carrying two insulating bushes, which are conical in shape, and having heavily milled heads over 1 in. in diameter. These insulating bushes have a metal nut moulded into them which screws on the rod, and they can, therefore, be adjusted to any distance apart.

When mounting this component, the conical portions serve to lock the bushes in position, while the metal rod is carried through the centre of the hole, being surrounded only by air, thus reducing its capacity to earth.

Terminal nuts and washers are provided at each end for the necessary connections. The insulation resistance of the bushes was found to be infinity.

This is a very easily fitted lead-in tube, suitable for use where the material through which it is to be carried is not more than 4 ins. thick, although the substitution of a longer threaded rod would enable it to be carried through materials considerably thicker than the dimension given.

Vernier Dial

A SAMPLE of the "Accuratune" Micrometer Control has been submitted to us for test by Messrs. The Mydar Radio Co.

Description of Component

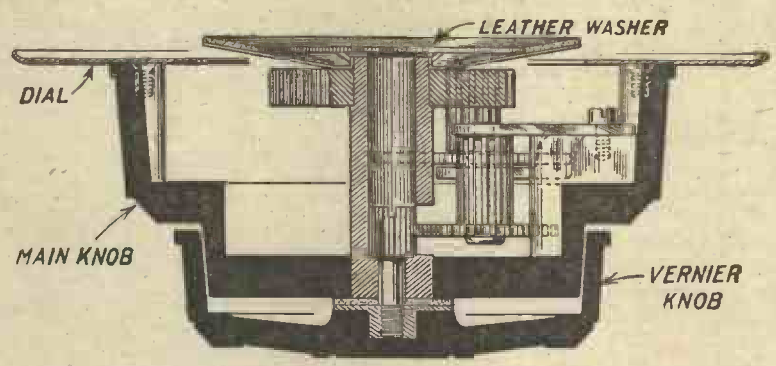
This vernier dial, which is 4 ins. in diameter, is provided with two large knobs, one for coarse adjustment, and another, slightly smaller, for rotating the vernier. Both knobs are hollow, one containing gearing which provides an 80 to 1 ratio. This gearing is of a very substantial nature, and means are provided to take up all backlash.

A cork pad of annular shape is incorporated to press against the panel, and holds the dial firmly in position, preventing wobble. The knob and dial are fixed on the condenser spindle by means of a set screw, and the frosted metal indicating dial is graduated from 0 to 180 degrees.

Laboratory Tests

On testing this dial it was found that there was no appreciable backlash, and fine tuning could be performed readily. Ease of tuning was greatly facilitated by means of the large fluted knobs. The attached scale was clearly marked, a feature which is particularly useful in the case of a tuning control giving such fine adjustment.

This dial can be thoroughly recommended wherever fine tuning is necessary, and is particularly suitable for use in sets where selectivity or accurate adjustments are special features.



The vernier dial of Messrs. The Mydar Radio Co. has a special gearing which provides an 80 to 1 ratio.

Anti-Microphonic Valve-Holder

WE have received from Messrs. The Norman Radio Co., Ltd., samples of their baseboard Anti-Microphonic Valve-Holders. These can be supplied for either baseboard or panel mounting, and a sample of each has been sent to our Elstree Laboratories for examination and report.

Description of Component

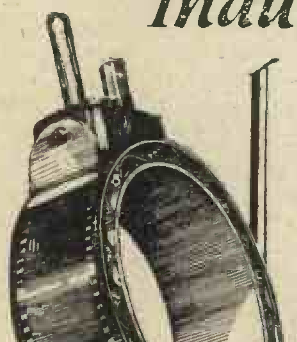
The valve-holder itself consists of a hollow ebonite moulding, in which contact strips for the ordinary type of valve pins are held by screws to the bottom of the moulding. These screws also secure further strips of brass which are bent round in such a way as to form a spring mounting to the component. In the case of the

"Just listen to the difference this LEWCOS Coil makes!"

CLEAR as a bell the typical French Orchestra came through as the listener tuned in with his LEWCOS Coil. Coil after coil had been tried and discarded in an endeavour to realise that rare selectivity and fine tuning so essential to complete radio enjoyment.

Try this new coil yourself. Each LEWCOS Coil is tested in our laboratory. It is then boxed and sealed up, and reaches you in perfect condition. Be sure the LEW seal is unbroken. Ask your radio dealer for a demonstration.

LEWCOS
Inductance Coil



3 LEWCOS advantages:

1. *High electrical efficiency with great mechanical strength.*
2. *Great selectivity resulting in extremely fine tuning.*
3. *Exceptionally low high frequency resistance with increased signal strength.*

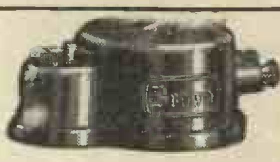
THE LONDON ELECTRIC WIRE CO. and SMITHS, LTD.,

Manufacturers of Glazite

Playhouse Yard, Golden Lane, London, E.C.1.

JUDD

There's a Brown for everyone



OF all the Loud-Speakers on the market to-day, one is unique. One—by a brilliant application of an entirely original principle—achieves results which can be obtained in no other Loud-Speaker. The Brown. Here is an instrument which steadily—month by month—has so grown in public favour that it is now recognised as the one great interpreter of true radio music. There is a Brown for every purpose at prices to suit all pockets.

Brown LOUD-SPEAKERS

Brown "Q."

Q de-Luxe Model. 2,000 ohms / 4,000 ohms } £15 15s.

H1. 21 ins. high.
120 ohms ... £5 5s.
2,000 ohms ... £5 8s.
4,000 ohms ... £5 10s.

H2. 12 ins. high.
120 ohms ... £2 5s.
2,000 ohms ... £2 8s.
4,000 ohms ... £2 10s.

H3. 15 ins. high.
2,000 ohms / 4,000 ohms } £3 0s.

H4. 10 ins. high.
2,000 ohms / 4,000 ohms } 30s.

HQ. 20 ins. high.
2,000 ohms / 4,000 ohms } £5 0s.

Cabinet Model.
2,000 ohms / 4,000 ohms } £6 6s.

Brown H2

Brown HEADPHONES

New A-type

Standard A-type Headphones.
120 ohms ... 50s.
2,000 and 4,000 ohms ... 50s.
8,000 ohms ... 60s.

New A-type Headphones
2,000 ohms ... 30s.

F-type Headphones.
4,000 ohms ... 20s.

S. G. BROWN, Ltd. Western Arcade, London, N. Acton, W.3.

H3

Retail Showrooms: 19, Mortimer Street, W. 1. Moorfields, Liverpool. 67, High Street, Southampton.
Depots (Wholesale only): 2, Lansdown Place West, Bath. Cross House, Westgate Road, Newcastle

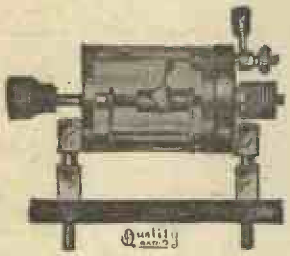
From all good Dealers.

Brown

Gilbert Ad. 4787.

Quality RADIO

CRYSTAL DETECTOR



THIS "Quality" Detector is as far in advance of standard pattern detectors as they are in advance of the magnetic coherer.

The crystal, held between two spring clips, can be rotated bodily by the left-hand knob. It can be moved through a horizontal plane by the right-hand knob.

And the "whisker" can be moved through a vertical plane by the small knob on top. This three directional movement permits of over 80 per cent. of the surface of the crystal being exposed to the "whisker."

The complete detector is mounted on plugs on the base and it can be lifted from the plugs and the glass cover slid off in two seconds. No nuts or screws to be slacked back and the detector does not fall to pieces when the glass cover is removed.

PRICE **5/6** *Postage 3d.*

from your dealer or post free from the manufacturers.

BRITISH—from start to finish

Goswell Engineering Company, Limited

95/98 White Lion St., London

Telephone: North 3051. N.1

baseboard mounting holder, these brass strips are joined to a small square piece of ebonite with four terminals. The panel mounting holder is fitted with suitable screws for mounting the holder in place.

Laboratory Tests

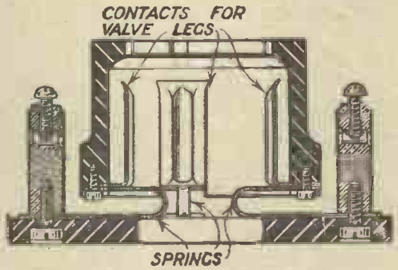
The insulation resistance of this valve-holder was found to be infinity, and the mechanical strength of the brass strips which are used for springing purposes was quite adequate when submitted to the most exacting tests.

General Remarks

These valve-holders are of good workmanship, and were found to be thoroughly satisfactory in use, except that no soldering tags are provided for connections, these having to be made to the screws themselves.

Loud-Speaker

MESSRS. Gent & Co., Ltd., have submitted one sample of their range of loud-speakers for test at our laboratories.



An anti-microphonic valve holder of good workmanship, made by Messrs. The Norman Radio Co., Ltd.

This particular one is called the "Concert Model," and the accompanying photograph indicates quite clearly the shape and style of the model. The reproducing mechanism is enclosed in a cylindrical case, and special feet enable the loud-speaker to rest on the table. The horn is so shaped that it turns back on itself in one sweep, the trumpet being made of cast aluminium and the flare of spun aluminium.

Adjustment of the mechanism is provided for through the medium of a milled nut, a pleasing feature being the very delicate movement made possible.

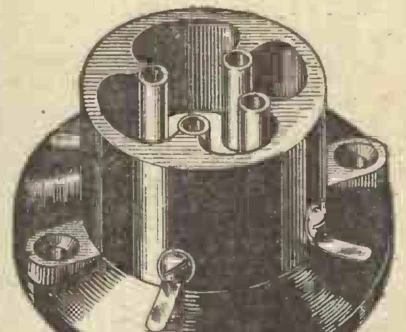
This loud-speaker appears to have been carefully designed to give faithful reproduction of speech, special care being paid to the acoustic properties of the material employed. On test the reproduction left little to be desired, the loud-speaker handling a large power quite adequately.

Valve-Holder

GREAT pains have been taken to remove all superfluous insulating material between the valve sockets of the Aermonic

The "Gent" loud-speaker, about which our laboratories commented favourably.

Anti-Capacity Valve-Holder sent for test by Messrs. A. F. Bulgin. Although at first sight it would appear that this would result in decreasing the mechanical strength of the component, it was found under the most stringent tests



Superfluous material is reduced to a minimum in this Aermonic anti-capacity valve-holder.

that this was not so. The insulating shell widens out into a large moulded circular base, provided with three holes for baseboard mounting.

The screws to which the soldering tags are attached screw directly

Figures to Remember

CHARLEY'S AUNT

The remembrance of sheer enjoyment.

Sheer enjoyment for the wireless enthusiast is born of perfect reception. You can be sure of perfect reception, and know that each and every evening will be full of real pleasure if you use Six Sixty Valves.

Our new range embodying the latest improvements of modern research marks a real advance in scientific Valve design. We have studied the needs of every section of the Radio Public, and the most exacting wireless enthusiast can get a Six Sixty Valve to suit his own special requirements.

Here's one particular type—the S.S.7 a wonderful Dull Emitter Power Amplifier capable of handling output sufficient to work the largest Loud Speaker without distortion. The design of this Valve is such that prolific emission is obtained at temperatures so low that the filament does not glow when operating under its rated conditions; in short, practically a "cold" valve. Just consider for a moment what this means. The destroying influence of high temperature and the alternate expansion and contraction of the filament is almost eliminated, with the result that the life of the valve is proportionately increased. Remember, too, this valve is entirely non-microphonic, and owing to the low filament current consumption can be satisfactorily operated from drycells or a 4-volt accumulator.

For long life, good service, and perfect tone insist on 660 Valves.

S.S.7.

Voltage - 3.7 volts.
Consumption 1 amps.

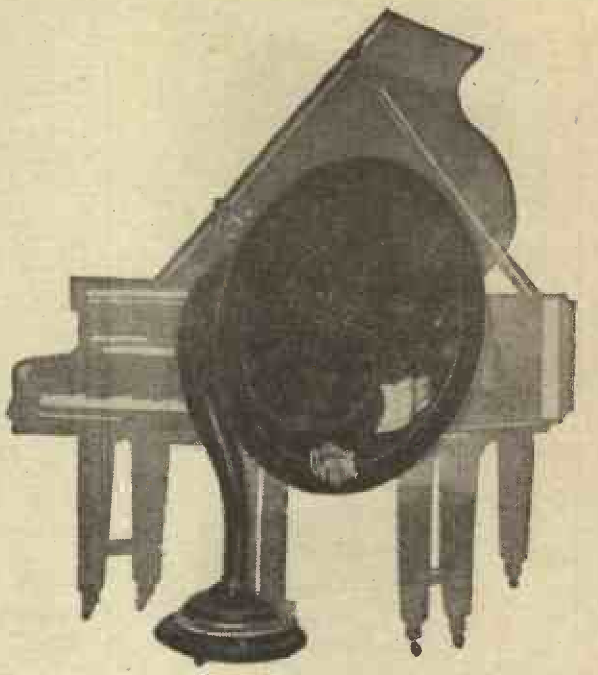
PRICE 22/6

Ask your Dealer for Leaflet S.S.1.7 for full particulars of complete range.

ELECTRON
SIX SIXTY

BETTER BY SIX TIMES SIXTY

The Electron Co., Ltd., Triumph House, 189, Regent Street, London, W.1. 3



JUST AS YOU'D CHOOSE A PIANO

—so the sweet purity of tone and magnificent volume of the Claritone Loud-speakers will appeal to the music in your nature and influence the choosing of your loud-speaker.

The faithful reproduction and remarkable sensitivity of these instruments has made them favourites wherever they go and the results obtained are equal to many loud-speakers of considerably higher price.

CLARITONE LOUD-SPEAKERS

Senior Model, 2,000 ohms, W.290.
120 ohms, W.291. £5 0 0
Junior Model, 2,000 ohms, W.295.
120 ohms, W.296, £2 15 0

CLARITONE HEADPHONES

W.216. 20/-

Sold by all Reputable Dealers.

Sole Distributors :

ASHLEY WIRELESS TELEPHONE COMPANY

NOTE OUR NEW ADDRESS

17 Finch Place, Falkland Street, London Road, = = = Liverpool.

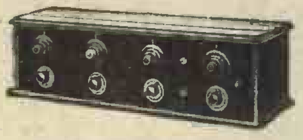
MAGNUM

SIMPLICITY 3 RECEIVER.

As described in Radio Press Envelope No. 3.

Ready wired and Aerial tested, £6 10 0
Plus Marconi Royalties .. £1 17 6

Complete Set of Components for Home Construction £4 18 10



THE D.X.5.

As described in December and January issues of MODERN WIRELESS.

A Highly Selective Set.

Eliminates 2LO at 1½ miles, and receives B.B.C. and Continental Stations on the Loud Speaker.

Complete Set of Components .. £19 10 0
As above, Ready Wired and Aerial tested 22 0 0
Plus Marconi Royalties 3 2 6

We specialise in the following Radio Press Sets:—

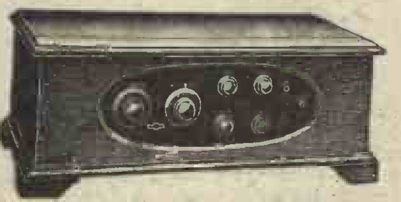
	Price.	Royalties.
S.T. 100	£8 17 6	£1 5 0
4 Valve Family ..	11 15 0	2 10 0
Simplicity 3 ..	6 10 0	1 17 6
All Concert de Luxe	12 15 0	1 17 6
Omni	15 15 0	1 17 6
A.B.C. Wave Trap	2 17 6	—
D X 5	22 0 0	3 2 6
Special 5	18 0 0	3 2 6
New S.T. 100 ..	12 10 0	1 5 0
Transatlantic 4 ..	13 13 0	2 10 0
Transatlantic 5 ..	13 13 0	3 2 6
Harmony 4 ..	14 0 0	2 10 0
Anglo-American Six	22 0 0	3 15 0
Twin Valve Loud Speaker Set ..	9 5 0	1 5 0

The above are constructed of best quality Components and to Author's specification, and supplied ready wired and aerial tested.

A REMARKABLE FIVE-VALVE RECEIVER,
as described in this issue.

1 Polished Mahogany Cabinet, as described	£3 7 6
1 Polished Ebonite Panel, 36 in. by 9in. by ¼ in. drilled ..	1 9 0
1 Baseboard, 38 in. by 13½ in. by ⅜ in. with sub baseboard ..	0 5 0
1 Terminal Strip, 8 in. by 2¼ in., with terminals	0 4 0
4 Magnum Terminals	0 1 0
4 Cyldon Variable Condensers, .0005	3 10 0
1 Polar Neutrodyne Condenser ..	0 5 6
1 Push Pull Switch	0 2 6
1 Double Circuit Jack	0 2 6
1 Plug	0 1 6
1 R.I. Potentiometer	0 7 6
5 Benjamin Valve Holders ..	0 13 9
4 Dimic Coils, No. 1A, on Bases ..	2 10 0
4 Magnum Single Coil Mounts ..	0 7 0
5 Amperite Rheostats, 1A, on bases	1 10 0
4 Lissen H.F. Chokes	2 0 0
3 Lissen H.F. Chokes (Short-Wave)	0 15 0
3 P.S. Neutrodyne Condensers (baseboard)	0 15 0
1 R.I. Fixed Condenser, .05mfd. ..	0 2 9
1 Dubilier Fixed Condenser, .001 mfd.	0 3 0
1 T.C.C. Fixed Condenser, .2 mfd.	0 4 8
1 T.C.C. Fixed Condenser, .5 mfd	0 3 4
1 Marconiphone Ideal Transformer, 6-1	1 10 0
3 M.H. Clip in Condenser and Bases, .006	0 12 0
Glazite Wire	0 3 6
1 9-volt Grid Battery	0 2 0
1 1½ Volt Grid Cell	0 0 6
1 Set Radio Press Transfers ..	0 0 6
	£21 9 0

THE NEW MAGNADYNE.



An entirely new design incorporating a stage of H.F. before the first detector. Price, ready wired and aerial tested, £45, plus Royalties £3 10 0. Full particulars on application. Demonstrations arranged by appointment.

Send stamp for Latest Lists dealing with 15 Radio Press Sets, and new Illustrated Catalogues.

NOTE.—Where a complete set of components, together, with a drilled panel, is purchased, Royalties as the rate of 12/6 per valve holder are payable.

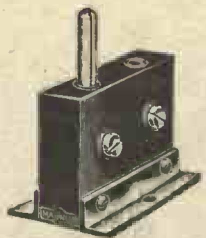
APERIODIC H.F. TRANSFORMERS.

This transformer enables a stage of High Frequency Amplification to be employed without the attendant complication of additional controls. It is connected in exactly the same way as the tuned type of H.F. Transformer, but the variable tuning condenser is omitted. Perfectly stable amplification is obtained in this way and searching for signals is greatly simplified.

FOR SUPER-HETERODYNE SETS these Transformers are invaluable, a stage of H.F. before the first detector giving greatly increased range and selectivity.

Made in the following ranges:—
No. 1. Aperiodic .. 300–600 metres.
No. 2. „ .. 550–1200 „
No. 3. „ .. 1100–3000 „

PRICE 10/- EACH.



MAGNUM SINGLE COIL HOLDER.

For Baseboard Mounting, as used in several Radio Press Sets. Price 1/9.

Lists on Application.

BURNE-JONES
& CO., LTD.
Manufacturing Radio Engineers
MAGNUM HOUSE,
296, Borough High Street,
LONDON, S.E.1.

Telephone: Hop 6257.
Telegrams: "Burjomag, Sedist, London."
Cables: "Burjomag, London."

The "PELICAN" UNIVERNIER

Fits any Condenser and makes just that difference in fine tuning that you need to be certain of bringing in the station you really want.

Fit Pelican Univerniers in place of your present variable condenser dials and you will secure reliable micro-selective tuning.

Price 6/-

Obtainable from all Dealers.

CAHILL & CO., LTD., 64, NEWMAN ST., LONDON, W.1.

H.F.A.11.

This Revolutionary Crystal Detector

puts a new outlook on crystal reception. You simply rotate the knob—the detector itself does the rest. *Automatically* two crystals are brought in contact at the correct pressure. *Automatically* their surfaces are searched until the most sensitive spot is found, and *automatically* this is registered for future reference. Truly a single-action Detector. Fit any set.

North Eastern Instrument Co., Durham Rd., Low Fell, Gateshead-on-Tyne.

7/6

CYMOSITE AUTO-DETECTOR

Gilbert Ad. 4810.

into the metal valve sockets, thus ensuring good electrical contact.

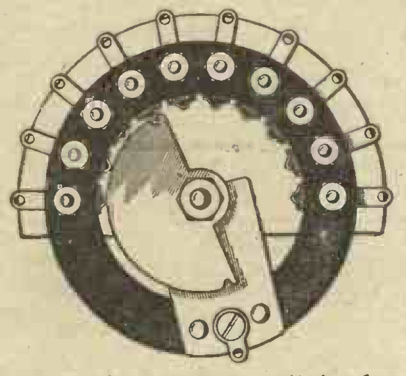
The component is of good appearance, having several novel and interesting features, and can be thoroughly recommended.

Ten-Way Switch

MESSRS. The Silvertown Co. have sent us one of their Ten-way Switches for test and report.

This switch is of the under-panel mounting type, and is for use with either inductances or capacities, being used for placing these either in series or parallel.

When used with inductances it forms a dead-end switch, since the portion not in use is short circuited. A drilling template is supplied for mounting the switch, while an indicating dial is provided for showing the position of the switch segment. Soldering tags are used for making connections, and the



A useful ten-way switch of Messrs. The Silvertown Co.

insulation resistance between the contacts was found to be infinity.

The switch is solidly constructed and well made, while a ratchet-like arrangement gives positive indication to the touch when the switch is in the various positions.

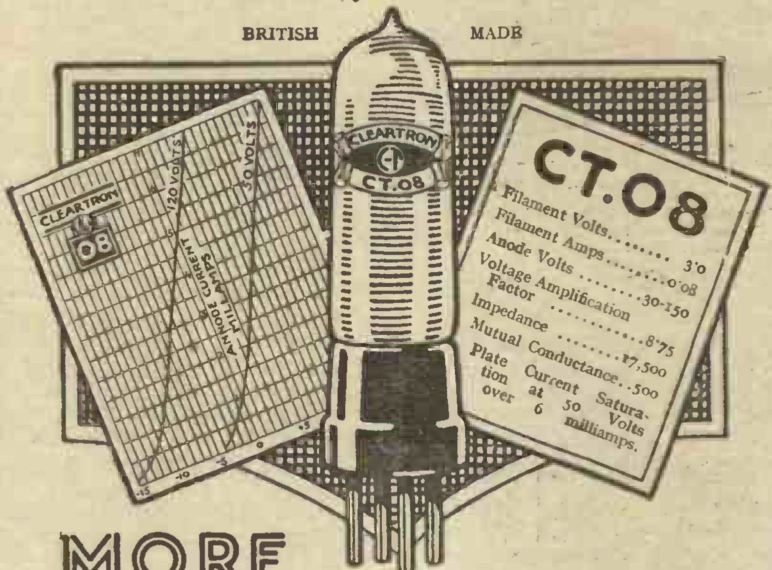
Least Loss Condenser

WE have received from Messrs. the Marconiphone Co., Ltd., one of their Sterling Least Loss Variable Condensers. It is a well constructed instrument, the fixed plates being insulated from the moving plates by means of Pyrex glass. The vanes are constructed of brass, while the end plates are aluminium castings, one-hole fixing being provided.

Positive connection is made to the moving vanes by means of a pigtail, and a pointer and scale are used instead of the conventional knob and dial. Only one adjustment is provided, this being of a

America's foremost Valve.

BRITISH MADE



MORE CLEARTRON CHARACTERISTICS

NOW we have the characteristics of the C.T.08, another excellent example among the seven different types of the CLEARTRON range. It is an every purpose Dull Emitter which will work equally well as a high or low frequency amplifier or as a detector. However used, it gives maximum volume without distortion. In *your* set it means greater distance, operatic purity, keener selectivity, lowest current consumption, and moderate initial cost. The "Ironclad" Guarantee goes with every valve. Your Dealer in giving you this knows that both you and he are fully protected by the efficient principles of the CLEARTRON organisation.

Send for Illustrated Price List—post free.

Type	Accumulator or Battery volts	Fil. volts.	Fil. amp.	Purpose	Price
C.T.08.	Dry cells	3	0'08	H.F., L.F. Detector	12/6
C.T.15.	2 volt Accumulator	1'8	0'15	H.F., L.F. Detector	12/6
C.T.25.	6 volt Accumulator	5	0'25	H.F., L.F. Detector	15/-
C.T.25.B.	6 volt Accumulator	5	0'25	General purpose resistance coupled amplification	15/

CLEARTRON RADIO LIMITED

1 CHARING CROSS, LONDON: & BIRMINGHAM

Telephone: Regent 2231/2. 'Grams: Cleartron, Westrand, London.

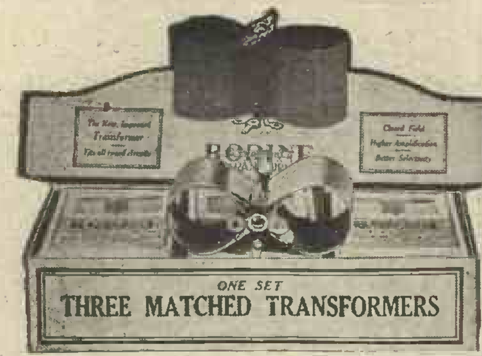
British Made

37/524 C1 *Service Advertising*

AMPERITES.

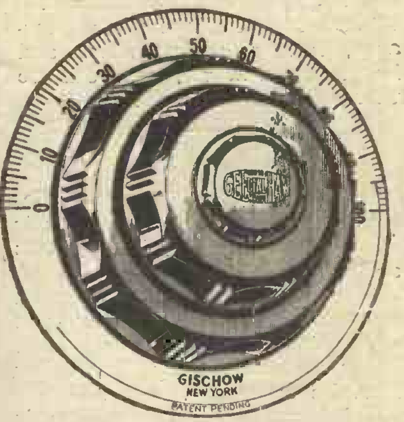
The self-adjusting rheostat used in MODERN WIRELESS receivers. Made suitable for the following valves :—

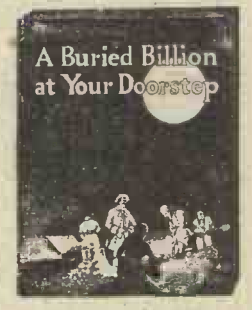
No. 1A. 5-volt .25 on 6 V. Accumulator.
,, 4V-199 3 volt .06 on 4 V. Accumulator.
,, 6V-199 3 volt .06 on 6 V. Accumulator.
List price 6/- each.



BODINE TWIN EIGHT BINOCULAR TYPE COILS.

In matched kits of 3.
List price 38/- per kit.
(See Mr. P. W. Harris's Fieldless Coil Receiver in "Wireless Weekly," 17.2.26.)





GEE-HAW VERNIER DIALS.

100-1 RATIO.

List Price 14/- each.

SECOND EDITION.

Our 1926 Catalogue of High Class American Radio Apparatus and Circuit Supplement will be sent on receipt of 9d. in stamps to cover cost of postage. It is the most interesting and instructive list yet issued and contains a wealth of information for the Amateur and Experimenter.

ROTHERMEL RADIO CORPORATION of GT. BRITAIN LTD.

24-26, Maddox Street, Regent Street, London, W.1.

Phone: Mayfair 578 & 579, 'Grams: Rothermel, Wesdo, London.

In the months to come

The first time you use a "Cyldon" you'll tune in the most truant station with amazing ease. Never before will you have experienced such smooth, silky action. And the months to come will confirm the wisdom of your choice—a "Cyldon" will always give perfect service—will never lose its pristine smoothness of action. The secret lies in the accurately grounded Rotor, backed by long experience and perfect workmanship in every detail of construction.

CYLDON

(*pronounced Sil-don*)
Straight-Line Wavelength.

SYDNEY S. BIRD

"Cyldon Works," Sarnesfield Road, Enfield Town, Middlesex.
Tel.: Enfield 672.

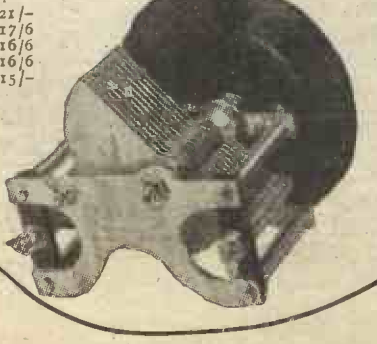
PRICES:

.001 mfd.		21/-
.0005	,,	17/6
.0003	,,	16/6
.00025	,,	16/6
.0002	,,	15/-

Complete with 4 in. knob dial. From all good dealers or supplied POST FREE.

Cyldon Dual Condenser

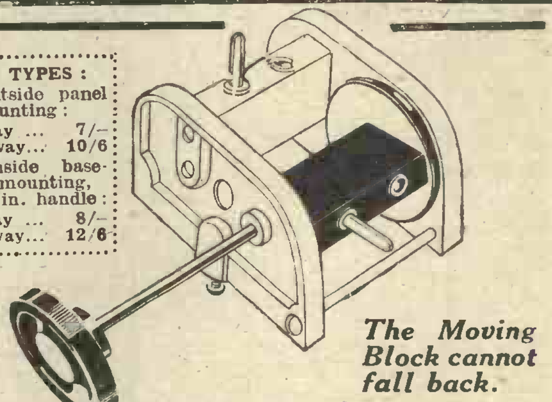
.0005 ...... 27/6
.0003 ...... 25/-



TWO TYPES:

For outside panel mounting:
Two-way ... 7/-
Three-way ... 10/6

For inside baseboard mounting, with 6 in. handle:
Two-way ... 8/-
Three-way ... 12/6



The Moving Block cannot fall back.

Do away with that irritating, time wasting fading away of volume caused by the falling of your moving block! Fit a Lotus Geared Vernier Coil Holder and get really accurate tuning. Has an easy Vernier movement which reduces the speed by eight times, and stays where it's put—exactly!
Fit in any position, with any weight of coil—you'll be satisfied with the results.

Bakelite mouldings for the side plates, coil blocks and knobs; heavy Nickel Plating for the metal parts.

LOTUS

VERNIER

COIL HOLDERS

From all reliable Radio Dealers.

Garnett, Whiteley & Co., Ltd., Lotus Works,
BROADGREEN ROAD, LIVERPOOL.
Makers of the New LOTUS BUOYANCY VALVE HOLDER.

semi-fine nature, the actual reduction, which is obtained by means of special friction gearing, being about 8 to 1. The maximum capacity of the condenser is exactly the value given by the makers, namely, .00028 microfarad, while its minimum capacity is only 11 micro-microfarads, which is well below the average.

The efficiency is of a high order, and the losses at broadcast frequencies are too low to be measured. The two small points which call for criticism are that only soldering tags are provided for making connection to the condenser, and the use of rubber in the friction gearing introduces a slight amount of backlash.

The mechanical design of the condenser is excellent, and neither

The large dial and fluted knob of the Wootophone condenser are pleasing features.

side play nor end play were perceptible in the bearings.

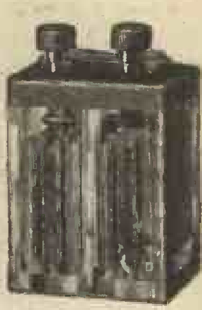
Wootophone Variable Condenser

WE have received one of their Variable Condensers from Messrs. F. E. Wootten, Ltd., for test and report.

This condenser is of good low loss construction, the vanes being of brass, while skeleton end plates are used. The fixed plates are insulated from the end plates by strips of ebonite in a manner familiar in low loss condensers. A pigtail connection is made to the moving spindle, and the connections to the condenser are made by means of terminals. The condenser is supplied with a 4 in. dial graduated in 100 divisions, and the condenser is designed for one-hole fixing.

On test it was found that its minimum capacity was 11 micro-

Oldham Accumulators save you money



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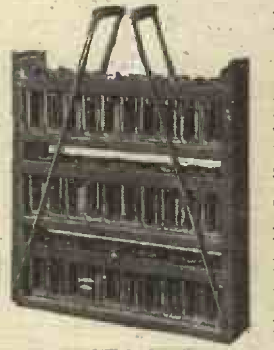

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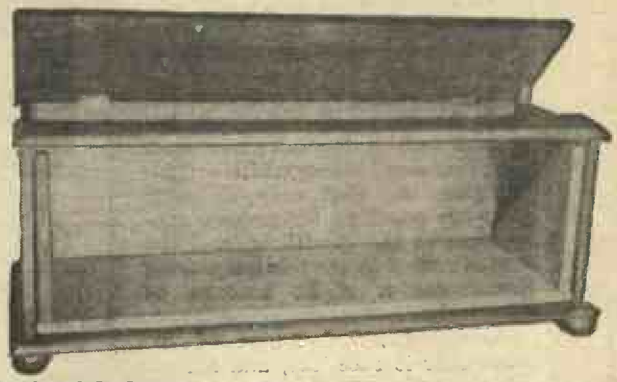

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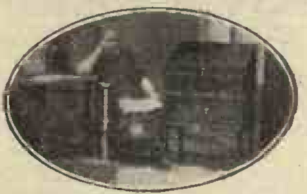

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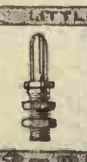

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microfarads, which is well below the average, while the maximum capacity for the .0005 size was .00046. The losses in this condenser were of a very low order, and the efficiency of the component is quite satisfactory.

Repaired Valves

We have received for test from Messrs. Radion Valves Co., Ltd., a valve repaired by their special process. No rating was given for this valve. It was tested at a filament potential of 3.8 volts, under which conditions it passed a current of .6 amp. With an anode potential of 80 volts, an impedance of 50,000 ohms was obtained with an amplification ratio of 11.5. It was noted, however, that a positive potential of 1 volt had to be applied to the grid in order to get on to the centre point of the straight part of the characteristic.

A valve repaired by a special process by Messrs. Radion Valves Co., Ltd.

When placed in a test set it was found to function satisfactorily as an H.F. amplifier and detector, but results as an L.F. amplifier were distinctly bad, as would be expected from the results obtained above.

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THE WIRELESS DEALER
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Eliminating the L.T. Accumulator

The possible use of A.C. for lighting valve filaments is not always appreciated by experimenters, and this short article deals with some of the points to be observed.

WHERE an alternating current supply is available, as is the case with a large number of up-to-date houses, use can often be made of this for lighting the filaments of valves, and also for supplying the H.T. voltage after suitable apparatus has been made or purchased for rectifying the alternating current.

The Use of A.C.

It is possible, however, to light the valve filament without resorting to rectifying units, and this is frequently done in transmission work, and, provided suitable precautions are taken, valves in receiving sets can be supplied from this source, thus obviating the necessity for L.T. accumulators.

Most readers of this journal are aware of the fact that the grid return of the valve is made to the positive or negative end of the filament, according to the valve function and the particular type of circuit incorporated, but with an alternating current supply the filament ends are made alternately positive and negative many times per second according to the frequency or periodicity of the supply.

Special Precautions

This feature necessitates the adoption of special precautions so that connections can be made from the grid of the valve to a point

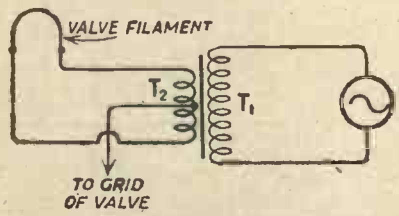


Fig. 1.—The centre tap of the transformer secondary is not always satisfactory.

representing the mid-point of the filament so as to balance out any mains' hum that may be present, and which would, of course, produce unpleasant effects in the telephones or loud-speaker. The supply to the filament must be taken through a step-down transformer, and it generally can be arranged for the secondary of this transformer to be designed so that the terminal voltage is exactly that required for the particular valve chosen.

A Centre Tap

The circuit of Fig. 1 gives the arrangement shown in a simple form, T_1 T_2 being the primary and secondary windings of a step-down transformer, and the point representing the centre of the filament potential is obtained by taking a tapping from the mid-point of the secondary winding T_2. The objection to this method, however, lies in the fact that considerable difficulty is generally encountered in locating the exact centre of the winding, due largely to the possibility of a lack of uniformity in the winding itself. Again, great care must be exercised to ensure that when making this tapping no damage is done to the insulation of the secondary winding, with the consequent effects of short circuits across the mains.

Another radio wonder.—The Radio Pen is operated by ordinary wireless waves.

A Better Method

The method indicated in Fig. 2 is to be preferred, although it will necessitate the use of a little more apparatus, but this will be counterbalanced by the consequent saving of L.T. accumulators and the attendant charging troubles. A potentiometer of about three or four hundred ohms resistance is placed across the secondary winding T_2, the potentiometer being one which is capable of carrying the required current without overheating, *i.e.*, in the case of a 6-volt terminal voltage and a 300 ohm resistance, .02 of an ampere.

The Sliding Contact

The sliding contact is taken to the mid-point of two small condensers joined in series across the filament, the capacity of each being about .04, so that a low impedance path is provided for the high-frequency current which otherwise would have to pass through part of the potentiometer resistance.

The Grid Return

The return from the grid through the usual apparatus and grid-bias batteries is made to the sliding contact, as also is the negative of the H.T. supply, since this contact now becomes the datum point.

The adjustment of the slider arm is made until the exact centre point

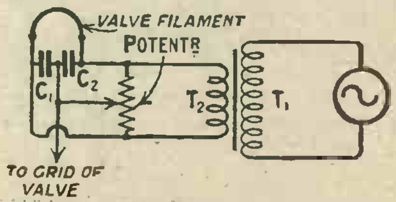
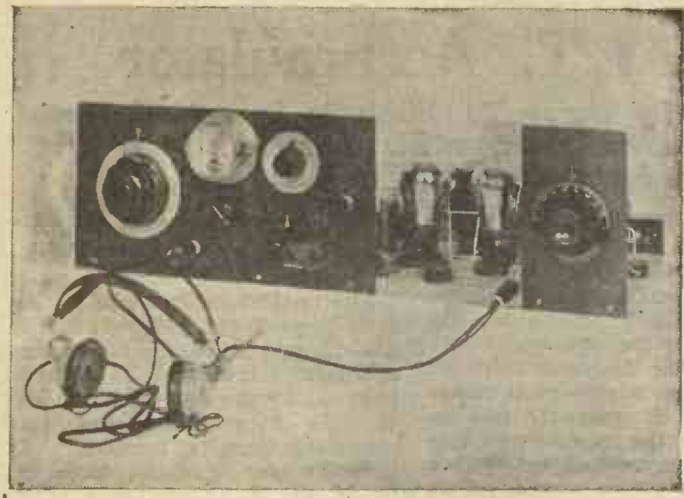


Fig. 2.—A better method for obtaining the equivalent of a centre tap.

is found, and hum from the mains should then be eliminated.



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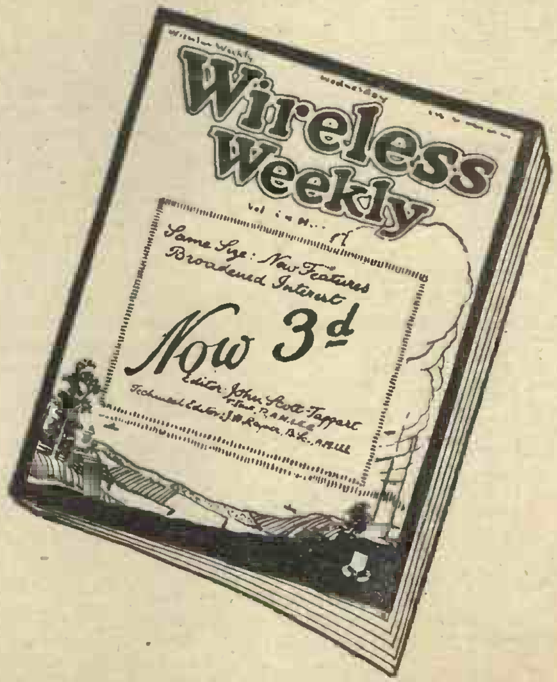
In the same issue Captain Round deals with the real mode of functioning of a valve in a way that enables the veriest beginner to take a full interest in the working of his set. Mr. Reyner, the Technical Ed tor, raises some points concerning low-frequency amplifiers which indicate that it is possible this part of the receiver has been unduly neglected, while an article also appears from Mr. Kendall which will prove very helpful to everyone who has tried the Reinartz circuit and failed to obtain the expected results.



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"MODERN WIRELESS"

April, 1926.

Are You Preparing for the Summer Months?

(*Concluded from page* 836.)

somewhat more distant from the local station, it may be found advantageous to employ two D.E.5b type valves in the first two valve-sockets, but it is essential for good loud-speaker reproduction that the last valve should be a power valve capable of handling fair volume without distortion. Three volt and two volt equivalents of the valves mentioned will, of course, prove satisfactory also.

Final Adjustments

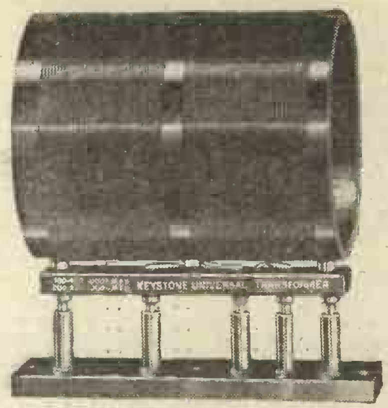
In obtaining the best results from the receiver, there is considerable latitude for experiment, and on the upper broadcast frequencies it is found that the fewer the turns in the aerial circuit proper, the greater will be the selectivity, but beyond a certain figure signal strength will tend to fall off. A compromise should, therefore, be obtained between these two conditions. It will generally be found best to connect the aerial clip to the outside of the aerial coil whilst varying the position of the earth clip.

Test Report

The receiver was tested upon a good outside aerial at 12 miles S.E. of 2LO. From that station, using only two valves, excellent loud-speaker results were obtained, whilst the addition of the third valve gave volume which was too great to be comfortable even in a large room. With twenty turns in the aerial circuit, selectivity was greatly improved over that obtained with the more usual direct-coupled arrangement. On two valves good telephone signals were obtained from a number of German, French and Spanish stations, whilst the third valve brought several up to fair loud-speaker strength. For these stations I used a Gambrell "H" for the radio choke.

On connecting the aerial to "X" and loading L_4 and L_5 with "E.1" and "E" coils, and inserting a "J" for L_6, 5XX gave adequate loud-speaker strength on two valves, and, like 2LO, too much volume for the room on three.

Employing a D.E.5b valve for the detector, followed by a D.E.5 and a B.4, quality was excellent, 48 volts H.T. being applied to V_1 and 120 to V_2 and V_3, these latter receiving 6 volts grid bias.



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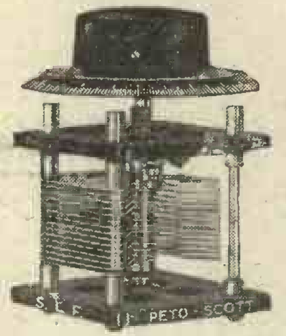

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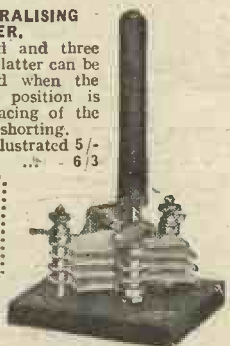

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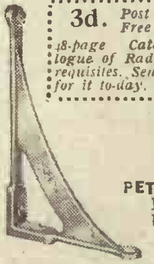

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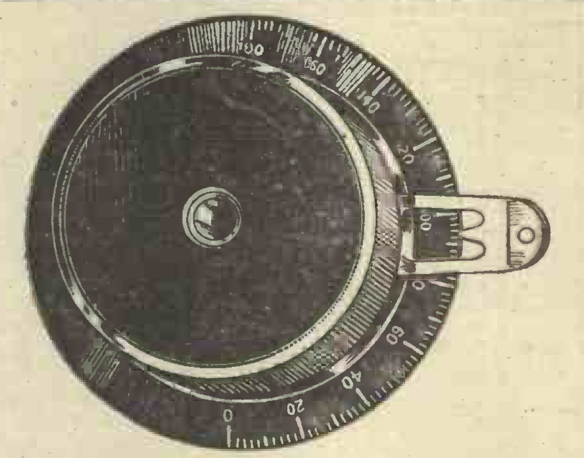

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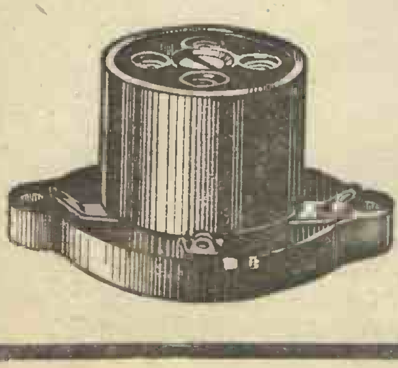

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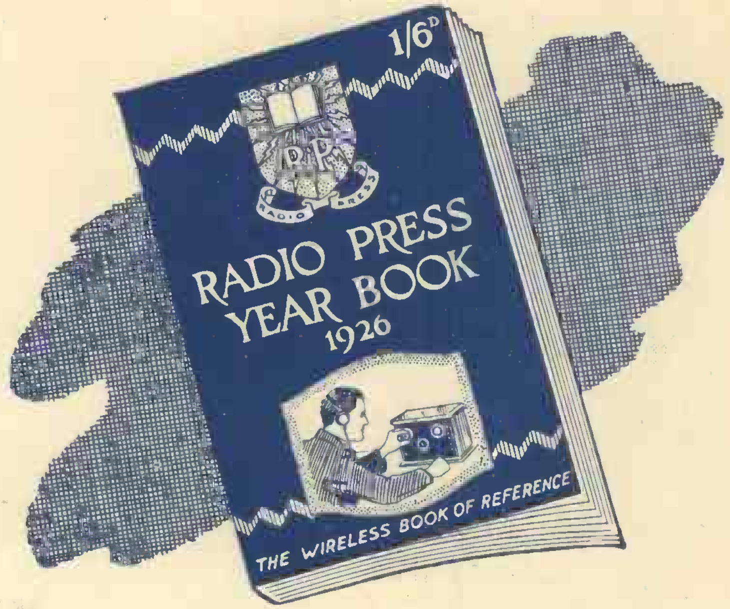

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