OUR SPECIAL CHRISTMAS NUMBER

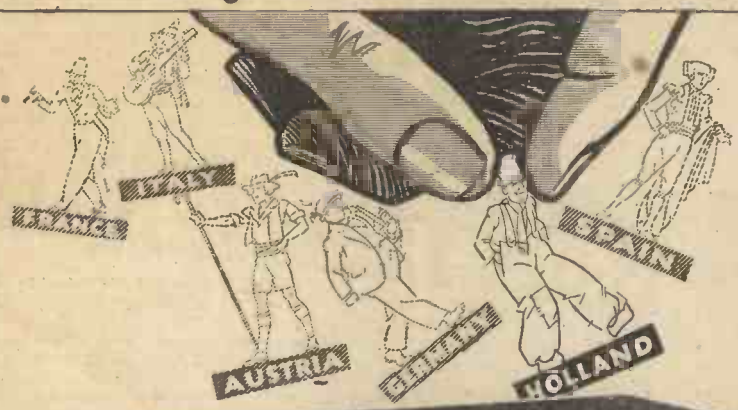
Practical Wireless

4d.

Vol. 3.——No. 63.
DECEMBER 2nd, 1933.

HOME BROADCASTING AND RADIO ENTERTAINMENTS

Pick your own Programmes



Wouldn't you like a Receiver which would bring you a whole host of programmes from which to choose your entertainment — station after station — free from interference — at generous volume — with a rich, true-to-life tone? For a remarkably small outlay you can own such a Set — the Cossor Melody Maker. This remarkable Receiver incorporates every worth-while radio development. Its performance is outstanding — equal to many highly priced Sets. Yet it is so simple that you can assemble it at home — *even if you know nothing about Wireless* — send the coupon for a Constructional Chart.

Illustration shows Models 342, 344 & 347. Model 341 has similar cabinet but with Loud Speaker adjustment in centre of fret.

with the New

COSSOR MELODY MAKER

BATTERY MODEL KIT 341
PENTODE OUTPUT
Balanced Armature Loud Speaker

Complete Kit of Parts including Cossor Variable-Mu Screened Grid, Detector, and Pentode Valves. Fully screened coils, Double-Gang Condenser, all-metal chassis, and all the parts. Handsome cabinet 18½" x 13½" x 10", space for batteries and accumulator. Balanced Armature Speaker; provision for Gramophone Pick-up Plug and Jack, Wave-length range 200/530 and 900/2,000 metres.

Price **£6.7.6**

Hire Purchase Terms 16/- *deposit and* 10 *monthly payments of* 12/6, *or alternatively* 20/- *deposit and* 6 *monthly payments of* 20/-.

BATTERY MODEL KIT 342
MOVING COIL LOUD SPEAKER

Complete Kit of Parts similar to Model 341 described above, except that it is supplied with a Permanent Magnet Moving Coil Loud Speaker.

Price **£7.2.6.**

Hire Purchase Terms 17/6 *deposit and* 9 *monthly payments of* 15/6.

BATTERY MODEL KIT 344
CLASS "B" OUTPUT

Complete Kit of Parts as Model 341, described above, but with four Cossor Valves, Class "B" Output Stage and Permanent Magnet Moving Coil Speaker.

Price **£8.2.6**

Hire Purchase Terms 20/- *deposit and* 10 *monthly payments of* 16/-.

Prices do not include batteries or accumulator

ALL-ELECTRIC MODEL KIT 347

Complete Kit of Parts, similar to Model 341, described above, but with four Cossor A.C. Mains Valves (incl. Rectifier) Power Unit and Mains Energised Moving Coil Loud Speaker. For A.C. Mains only 200/250 volts (adjustable) 40/100 cycles.

Price **£8.19.0**

Hire Purchase Terms 20/- *deposit and* 9 *monthly payments of* 20/-.

Prices do not apply in I.F.S.

SEND FOR CONSTRUCTIONAL CHART

To A. C. Cossor Ltd., Melody Dept., Highbury Grove, London, N.5.

Please send me a Constructional Chart which tells me how to build a Cossor Melody Maker.

Model..... *State Model No. required*

Name .....

Address .....

P.W.C. 2nd/12.

♡ 4077

RADIO ENTERTAINMENTS & HOME BROADCASTING

ROUND *the* WORLD *of* WIRELESS

Radio Budapest, December 2nd

IT has taken almost two years to build the 150-kilowatt Csepel super-power station, but tests have now been carried out, and the transmitter will be formally opened on December 2nd, when it will take over the regular daily broadcast of the Budapest programmes. Hungary may now boast of possessing possibly the most powerful and up-to-date plant existing in Europe, and the world's record for the highest aerial tower.

New High-Power Stations for Czecho-Slovakia

WORK is to be started shortly on a 30-kilowatt station to be erected on a site near Banska Bystrica (Eastern Slovakia), and which, when built, would operate on 765 metres. The power has been limited in view of the fact that the "channel" is one borrowed from the shipping band. It is also proposed to transfer Bratislava to a position some thirty miles north or north-east of its present location, and to take this opportunity of increasing the power to 100 kilowatts. The work will be carried out during 1934.

French Engineer's Sensational Project

AS a special attraction to the next International Exhibition at Paris, a French engineer has submitted plans for the erection of a thousand-metre-high tower, to bring back to France the record held for so many years by the *Tour Eiffel*. This project contemplates two motor ways permitting cars to reach the summit! The top storey of the building, according to the inventor's plans, will accommodate a powerful radio station, a planetarium, and also ample space for a fully-equipped meteorological observation post. At a height of 800 and 900 metres, it is proposed to build a sanatorium. The lower and ground floors will be occupied by arcades for the erection of shops, swimming pools, tennis courts, etc., and a sports arena. It is stated that the carrying out of the inventor's plan would take three years to accomplish, but that the result would be one of the world's greatest architectural and engineering feats.

American Relays of Antarctic Broadcasts

FROM November 18th, every Saturday night at 22.00 (Eastern Standard Time), or 03.00 G.M.T., the Columbia Broadcasting Company will attempt to carry out relays of transmissions from the Byrd Antarctic Expedition on its way to the South Pole. The broadcasts will also be made through the usual Columbia short-wave channels.

The Editor and Staff Join in Wishing Every Reader a Very Happy Christmas

P.T.T. Rennes

ACCORDING to a Paris wireless journal *T.S.F. Programme*, the French State transmitter at Rennes, following a thorough overhaul, will shortly increase its power to 25 kilowatts. Although it had been hoped to effect a complete reconstruction of the plant, this is hardly likely to take place, as the authorities have agreed to the installation of a larger station at Thourie. It will, however, not be ready for many months to come.

Moscow's Broadcasting House

IT would appear that the ambition of the Soviet authorities is to possess a Radio Palace in Moscow of such a size that it will surpass in every respect the headquarters of the B.B.C. in London and those of the *Funkstunde* at Berlin, and be comparable only to Radio City, New York. Some twenty-four different schemes have been put forward and are to be judged within the next few weeks.

Delayed Opening of Cairo Station

CONTRARY to the statement made that the 10-kilowatt Abu Zabal transmitter would be brought into operation in January next, it is now reported that the official opening cannot take place before April, 1934. In the meantime, licences to work the small local stations have been extended.

Broadcasting in Dutch East Indies

A NEW broadcasting organisation, styling itself N.I.R.O.M. (*Nederlandsch-Indische Radio Omroep Maatschappij*), will start its activities on March 1st, 1934. The transmissions will be carried out by a number of existing stations, as well as by others to be erected at Batavia, Bandoeng, Samarang, and Soerabaya. A high-power transmitter is to be built at Priok, to give an effective service to the entire archipelago. In order to keep in close touch with Europe, the N.I.R.O.M. proposes to relay broadcasts from Holland through the Dutch short-wave station PHI at Huizen, which, in consequence, will increase its transmitting hours. Special broadcasts to the Dutch East Indies by PHI on 25.57 metres can be heard daily between G.M.T. 15.20 and 16.20.

America's Pocket Radio Receiver

A TWO-VALVE set no larger than a postcard-size folding camera, and weighing no more than two pounds complete with a three-inch loud-speaker, is the latest achievement of a radio-set manufacturer in the United States. The two valves are said to do the work of five, and are of the latest pattern. The apparatus is not battery-fed, but operates from either D.C. or A.C. mains. It is claimed that the complete outfit, small as it is, will permit its owner to listen to a number of stations, the tuning being effected by a miniature drum condenser dial; the set is even equipped with an efficient volume control.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Early Morning Catches

AT this period of the year the super-early riser, or the night worker, will find no difficulty in tuning in a number of North and South American broadcasts. As in most instances the wavelengths almost correspond with the condenser readings of well-known European stations, the search for these distant broadcasts is an easy one. Of the best heard the following should be specially noted: WCAU, Philadelphia (256.3 m.); WTIC, Hartford (282.8 m.); WPG, Atlantic City (272.6 m.); WBZ, Boston (302.8 m.); WEAF, New York (454.3 m.); WJZ, Bound Brook (394.5 m.); WABC, New York (348.6 m.); WIOD, Miami Beach (230.6 m.) and WRVA, Richmond (270.1 m.). The following Buenos Aires transmitters may also be relied upon on most nights: LR4, Radio Splendid (303 m.); LR5, Radio Excelsior (361 m.); LR3, Radio Nacional (316 m.) and LU3, Radio Mayo (476 m.).

A Colliery Broadcast

IF you are interested in a transmission from a coal mine roughly one quarter of a mile deep, listen to the Midland Regional programme on December 9th. On that date the B.B.C. engineers will relay the noise of the miners hewing coal from one of the deepest seams in the Bestwood pit, near Nottingham. An explanatory commentary will be given on the coal-mining industry, and the life of the men who procure the fuel for your household grates.

New Budapest Short Wave Relay

AS soon as the Budapest (1) 120-kilowatt transmitter has been brought into daily operation, the Hungarian authorities will carry out a regular relay of the main programmes through one of the short-wave transmitters at Szekesfehervar (Stuhlweissenburg). As the station is a powerful one, namely 20 kilowatts, the broadcasts will be well heard throughout Europe. The wavelengths used by HAT are 21.92 m. for day transmissions and 43.86 m. during the night hours. Special programmes will be prepared at Christmas for the benefit of Hungarians dwelling in North and South American States.

Revival of *Good Night, Vienna*

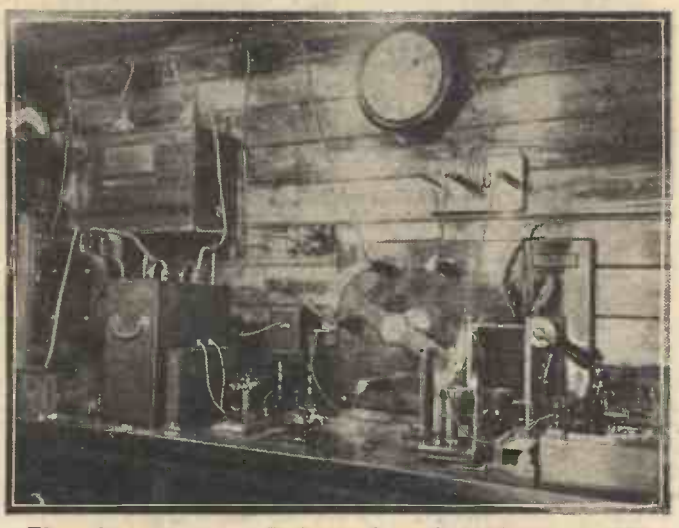
HOLT MARVELL'S romantic operetta, first produced two years ago, will return to the microphone in the Regional and National programmes on December 6th and 7th. At the time it was to be one of the first productions from Broadcasting House, but the eleven studios required were not ready, and so it became the final big show at Savoy Hill. A successful "talkie" version was seen and heard in Great Britain at a slightly later date.

Lucerne Plan and Long Waves.

AS a result of the recent conference held in Amsterdam it is stated that no difficulty is anticipated from the general changing over of transmitters operating in the medium broadcast band. As regards stations of which the channels are above 1,000 metres no definite decisions could be taken, inasmuch as Finland, Holland, Poland, and Sweden maintain their right to their previous allocations in the long-wave band. As, however, such higher powered stations as Madrid, Brasov, and others for which channels have been provided will not be working for some time, it will be possible to make certain adjustments in the plan which should prevent mutual interference when it is brought into operation on January 15th, 1934. On that date most stations will close down at 11.0 p.m., G.M.T., in order to permit the engineers to re-adjust wavelengths, and listeners who care to sit up during the later hours of the night will hear a number of test transmissions carried out with a view to measuring the respective channels. Similar tests will take place on following nights until the stations have been proved to have taken up their exact positions in the ether.

INTERESTING and TOPICAL PARAGRAPHS

THE NEW L.N.E.R. RADIO STATION, "G.U.Q."



The radio equipment at Parkeston Quay Radio Station in 1909. A description of this station was given on this page in last week's issue.

London as the World's Telephone Exchange

THE Swiss authorities are establishing a wireless public telephony service with Costa Rica, Guatemala, Nicaragua, Panama and the Canal Zone. All communications will be made *vid* London, New York and Miami (Florida).

Hungarian Programme on Short Waves

IN order to give its nationals resident in the United States an opportunity of hearing the pick of the Budapest radio entertainments, the Hungarian broadcasting authorities have made arrangements to relay the programmes through one of the Szekesfehervar short-wave stations.

Radio Normandie and Fishing Trawlers

MOST readers will have noticed how badly, at times, the Fécamp broadcasts are marred by shipping morse transmissions. It is due to the fact that the French trawlers working off the coast use 200 metres for their wireless telegraphy communications with owners, and in most instances their apparatus is strangely out of date and, consequently, very flatly tuned. An arrangement, however, has now been concluded between the Radio Normandie station and the fishing companies which should give general satisfaction. In future the trawlers "sparking" from 6.0 to 7.15 a.m. will close down from the latter time to 8.45 a.m. in order to allow the broadcasting station to put out its early morning programme. For other periods during the day and evening it would appear that the possible urgency of the traffic would not permit of any definite allotment of time on the ether.

Possible New Dutch High-power Station

IN an endeavour to settle the differences existing between the numerous programme associations interested in radio entertainments in Holland, the Dutch authorities are seriously considering the erection of a further high-power station to operate on a medium wavelength. So far these various societies have had to share time, and there are in the country only two stations at their disposal.

Another German Interval Signal

ALTHOUGH the bulk of its programmes are relayed from Breslau, the Gleiwitz station has introduced a special theme played on a musical box for its own local broadcasts. It consists of an excerpt from a popular Upper Silesian folk-song.

SOLVE THIS!

Problem No. 63.

Being desirous of making some efficient coils, Jackson started by winding a tuning coil. He read all the articles he could find on the subject and finally used Litz wire, together with a large diameter former, and wound the coil for a detector circuit. When finished and tested he found that the medium-wave reception was quite good, but on the long waves only Daventry could be received. As the reaction control was rotated the set seemed to go dead and no reaction could be used. No reaction squeals could be obtained at all. The winding was tested for continuity and found in order, and no short-circuits existed. Every component was tested and found in order. What caused the trouble? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark the envelopes Problem No. 63. All entries must be received not later than December 4th.

SOLUTION TO PROBLEM No. 62.

The smoothing choke which Atkinson purchased was too small and was not providing sufficient smoothing. The second choke was of the same type, and when wired in circuit the windings of the two chokes were inductively coupled, with the result that the hum was accentuated. The two chokes should have been wired in series in the positive lead and stood so that the fields were in opposition.

No reader succeeded in correctly solving Problem No. 61. Several solutions were inadequately expressed and simply stated that "The coils were wrong," or "Wrongly connected coils," and solutions should, therefore, be expressed in a manner which leaves no doubt as to the fault which is thought to exist.

Connecting that Extra Loudspeaker

How to Connect an Additional Loud-speaker to Obtain Maximum Results

By W. J. DELANEY

IN many cases there will be an " overflow " meeting in the house at some part of the season's festivities, and it will be found most useful to have an extra loud-speaker connected to the receiver so that everyone may partake of the wireless or gramophone music. The problem of adding a second loud-speaker is not the simple one which it might at first appear to be. It is true it may only be joined in series or in parallel with the existing loud-speaker, but if the two speakers are of different resistances, and also of different types, it may be found that the total output is reduced, or distortion is introduced. The following notes are therefore given to assist in deciding upon the best method to adopt for different types of receiver.

The Commercial Set

The majority of commercial receivers of modern design already include sockets or terminals for the inclusion of an extra loud-speaker, and the makers will have given particulars, either in the instruction booklet or printed on the inside of the cabinet, regarding the resistance or type of loud-speaker which should be employed. If no information is forthcoming, and no provision has been made for an additional reproducer, the wiring of the receiver will have to be modified as described further on. The loud-speaker is always connected in the output circuit, and may be directly-fed or parallel-fed, and in the case of most moving-coil loud-speakers an input transformer is employed. Fig. 1 shows these two methods, with the speaker represented diagrammatically. It should be understood, of course, that the connections may actually be to the speaker windings or to the primary of the input transformer. Where a speaker with a transformer is employed, undoubtedly the best connection is that shown in Fig. 2. Here the primary of the transformer is connected direct in the anode circuit of the output valve and a fixed condenser is joined between the anode and the extra loud-speaker. This may be of the ordinary type or one with an input transformer, and the other side of it is joined to earth. Thus one speaker is directly fed and the other parallel-fed, and providing the two speakers are not too dissimilar the results from both will be as good as when one only is used. Naturally, any great differences will result in the quality being impaired, and this point should be borne in mind if a second speaker is being purchased.

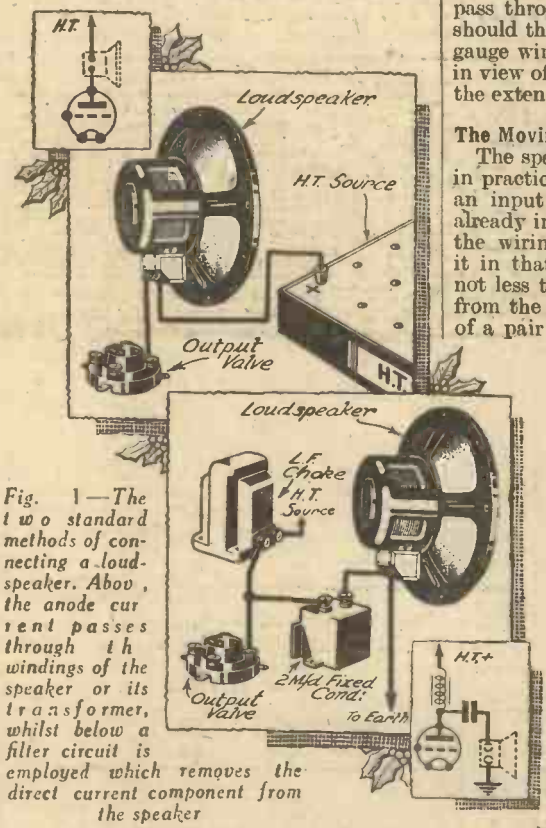


Fig. 1—The two standard methods of connecting a loud-speaker. Above, the anode current passes through the windings of the speaker or its transformer, whilst below a filter circuit is employed which removes the direct current component from the speaker

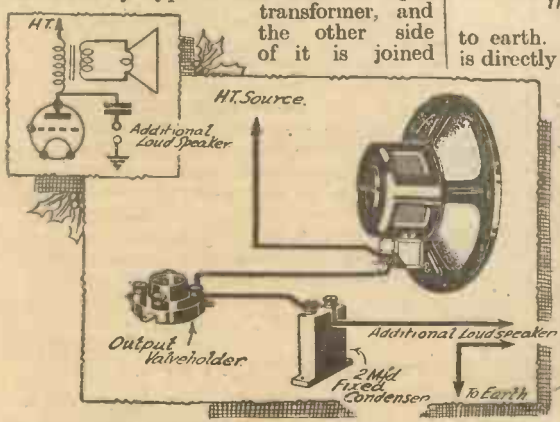


Fig. 2.—The best method of connecting an extra speaker. Here the primary of the speaker transformer acts as a choke and the additional speaker is filter-fed. There are many advantages from this scheme and a few drawbacks.

The Simple Set

The simple type of receiver will employ a moving-iron speaker connected direct in the anode circuit, and in this case a similar type of speaker may be used in conjunction with it, and it should be connected in parallel, that is, as shown in Fig. 3. On no account should the speaker be joined in series in view of the voltage drop which will result. If it is desired to use one speaker whilst the other is out of action, a simple single-pole change-over switch should be fitted as shown in Fig. 4, but it must be remembered that the H.T. current has to pass through the distant speaker, and this should therefore be wired with good, heavy gauge wire, and not placed too far distant, in view of the inevitable voltage drop along the extension leads.

The Moving-Coil Speaker

The speaker of the moving-coil type will, in practically every case, be provided with an input transformer, and if this is not already included direct in the anode circuit the wiring should be modified to include it in that position. A fixed condenser of not less than 2 mfds. should then be wired from the anode of the output valve to one of a pair of extra terminals, and the other terminal should then be joined to earth. This arrangement will prove the most satisfactory in every case, and the additional speaker may be at any required distance from the receiver with no ill effects, as the direct current is not passed through the extension leads. Furthermore, only one single wire need be taken to the distant listening point, and the other speaker terminal at that point may be joined to the nearest available earth, such as a water-pipe, gas-pipe or buried connection. If it is desired to cut out the speaker which is connected direct to the receiver, it will be necessary to break the secondary lead of the trans-

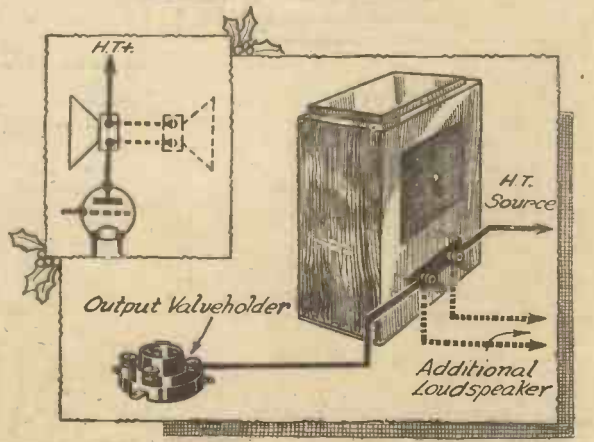


Fig. 3.—When an ordinary moving-iron speaker is employed direct in the anode circuit, an additional speaker of the same type may be joined in parallel.

former and fit a simple on/off switch at that point. Provided the switch is fitted fairly close to the speaker this will occasion no ill effects.

Controlling the Volume

When the additional loud-speaker consists of one of the ordinary moving-iron types, and the self-contained or existing speaker is of the moving-coil type, the reproduction on both will be upset to a certain extent. The principal fault will be that the moving-iron speaker will be overloaded, as the volume which can be handled by the moving-coil is vastly greater than that which the moving-iron will carry. Thus, when the receiver is tuned-in on the moving-coil and volume adjusted to give best reproduction, it will be found at the distant listening point that the reproduction from the ordinary speaker is terrible, due to the overloading. To obviate this, a volume control should be fitted on the speaker, and it should preferably be combined with a condenser in order to introduce a tone-control effect and so assist in obtaining a balanced reproduction. Fig. 5 shows the connections for this type of circuit, and the most suitable values for the control and condenser have been marked on the pictorial diagram. With the filter arrangement it is possible, of course, to employ more than one distant listening point, and the extra speakers should all be joined in this extension lead, with separate earthing points if desired.

Separate Listening Points

For some requirements, such as one or two of the games mentioned in another part of this issue, it may be found desirable to have separate listening points in a number of different rooms, and each point may only be required at one time. For this arrangement it would be best to include a simple on/off switch on each speaker and to wire them all in parallel in the filter extension lead, as shown in Fig. 6. This arrangement permits of all the speakers being used at once, or of any one being used singly. It must not be forgotten, of course, that when the extension speaker is used in any form it is essential to remember to switch off the actual wireless receiver when no further listening is required. There is a risk where the receiver and speaker are housed in one cabinet, and the speaker is fitted with a silencing switch, that the distant speaker may be switched off, and the receiver left in a live condition, due to the fact that it is in another room an' no sound can be heard from it. The obvious safeguard is to fit some form of panel light, although if you do not go back into the room where the receiver is situated, this will not be of much use.

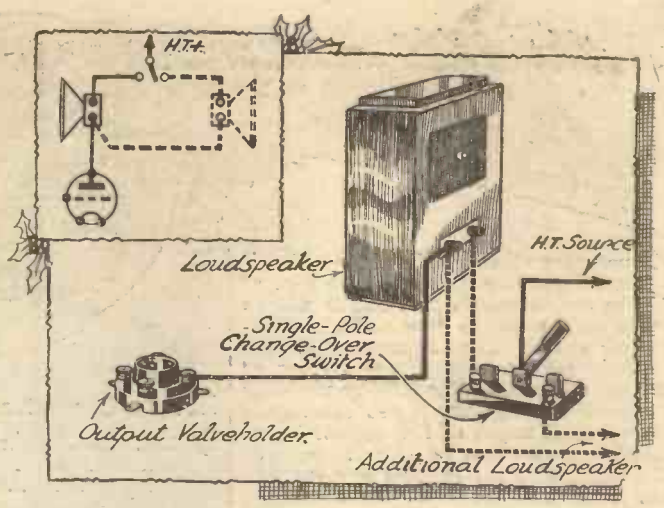


Fig. 4.—If the method of Fig. 3 is adopted a change-over switch may be included in the H.T. positive lead to change from one speaker to the other.

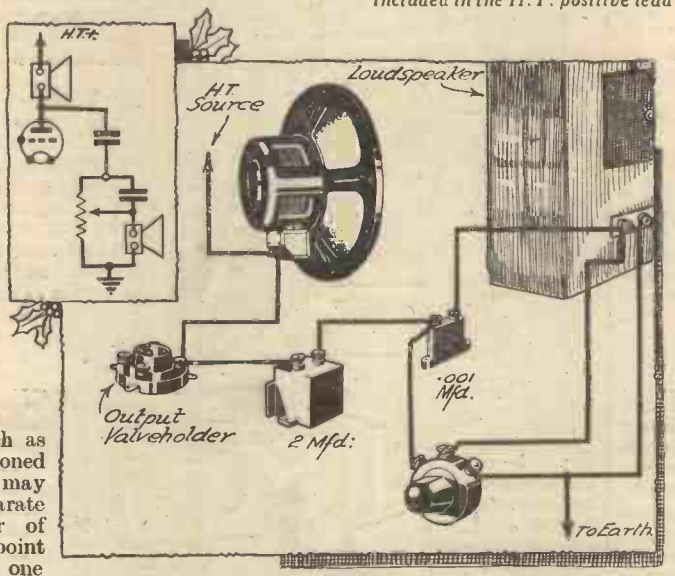


Fig. 5.—When the Fig. 2 method is adopted for connecting an extra speaker, a volume control may be used in conjunction with the latter, but a fixed condenser should also be included to prevent high-note loss.

Where it is desired to instal the extra loud-speaker in a distant room in a permanent position it would be advisable to fit one of the well-known Remote Control devices which operate on the filament (or heater supply) as well as on the loud-speaker. Thus, when the listener desires to switch off, the control fitted on the speaker, or in a convenient position, is operated, and the distant receiver is switched off without the risk of the valves being left in circuit. These controls must, of course, be correctly wired, by which I mean that the inter-connecting leads must be sufficiently heavy to enable the heater or filament current to pass without undue voltage drop, or, alternatively, one of the relay devices must be employed. The ideal arrangement, of course, is to employ a socket in which is fitted a jack-switching device, and to connect the loud-speaker to this point by means of a plug. Thus, in order to hear the signals the plug has to be first inserted into the socket with the result that the filaments are switched on and the anode circuit is also completed through the loud-speaker connection. When finished, the plug is removed, thus switching off the receiver and also presenting the user with the necessity of using only one extra speaker, with the connections made, if desired, to every room in the house.

One small point might be referred to and that concerns the installation of distant listening points where there is definitely a real drop in strength due to the length of the leads. In this case it might be found desirable to include with the loud-speaker a single stage L.F. amplifier.

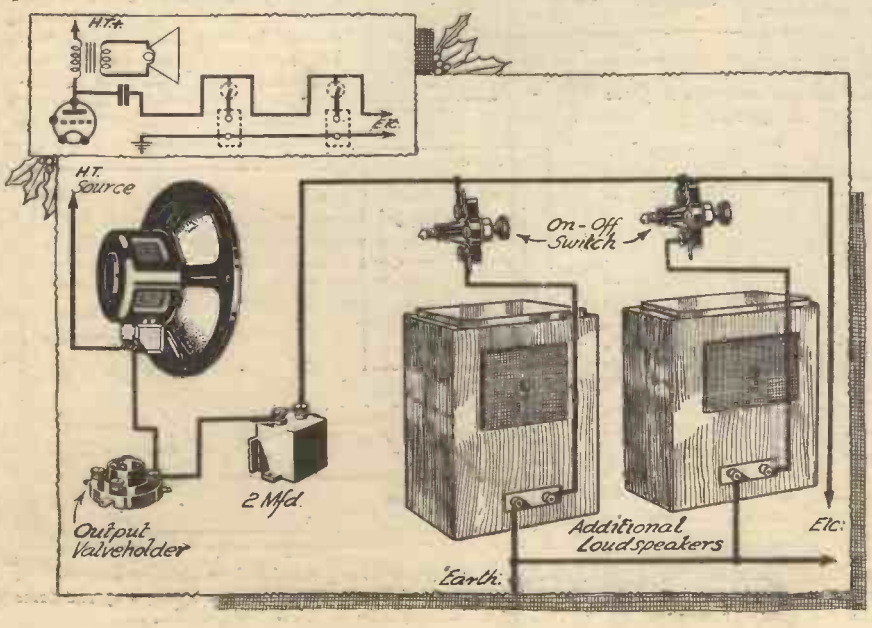


Fig. 6.—(Left).—A number of extra loud-speakers may be joined on the filter-fed system, and each may be switched in, or out, of circuit as desired, by means of simple on-off switches inserted in one of the supply leads.

Radio Entertainments for Christmas

In this Article the Author Describes a Number of Forms of Entertainment which can be Provided by Means of the Wireless Set Without the Necessity for Extra Gadgets.

IN another article in this issue there are described a number of entertainments which can be provided by means of a wireless set used in conjunction with a microphone. There are, however, many other forms of amusement that can be obtained from the use of a receiver in conjunction with odd components and accessories that almost every reader is sure to have on hand.

A "Radio Violin"

Some excellent amusement is to be obtained from using the wireless set as a musical instrument. By that we do not mean using it as a means of reproducing broadcast music, but for actually producing the original sounds. A form of "radio violin" can be made by the simple process of connecting a 2ft. length of stout copper wire or copper tubing to the grid terminal of the detector valve (see Fig. 1). The aerial and earth leads must be disconnected and reaction turned up to its limit so that the set oscillates strongly. By moving the hands to and fro near to the projecting rod different notes can be produced. The sounds might not be very musical at first, but by slightly varying the reaction setting, changing the high-tension voltage, or using a different value of grid condenser it is possible, after a little experiment, to obtain quite pleasing effects. The "radio violin" is by no means an easy instrument to play, and a good deal of practice is required before a "recital" can safely be given in public.

If it is found that, after making the slight modifications described above, sufficiently strong oscillations cannot be produced, you should try increasing the degree of reaction coupling by wiring a fixed condenser in parallel with the variable one used for reaction control; it might also be found necessary to increase the detector anode voltage.

An Electronic Piano

Another form of electronic or radio music can be produced by connecting different grid condensers in the detector grid circuit. These can be arranged on a baseboard and connected to push switches of the kind used for electric bells, and which can be bought for a few coppers each at sixpenny stores. The connections required are clearly shown in Fig. 2, where it will be seen that the idea is to bring any one of a number of condensers into circuit by depressing the plunger of the appropriate switch. Better results can be secured by employing pre-set condensers, for then it is possible to "tune" the "piano" by setting each condenser in turn to produce a particular note.

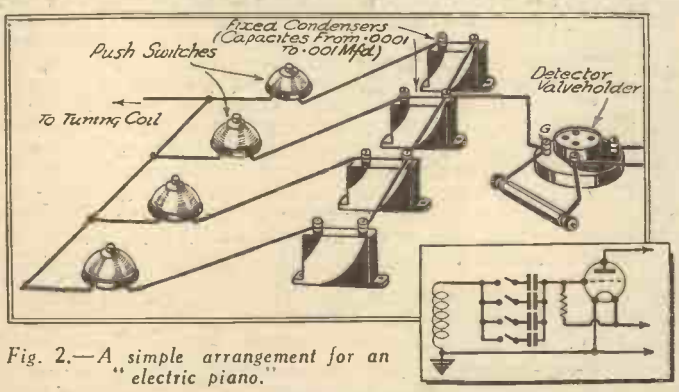


Fig. 2.—A simple arrangement for an "electric piano."

As an alternative to the ready-made switches, a very simple and equally effective "keyboard" can be made by using a number of strips of springy brass bent to the shape shown in Fig. 3. These can be made to complete the grid circuit against the heads of brass wood-screws when they are pushed down by means of short lengths of dowel rod. All the required constructional and wiring details are given in Fig. 3, and no difficulty should be experienced in following them. The same remarks, in regard to obtaining sufficiently strong oscillations and removing aerial and earth leads, apply as for the "violin" previously described.

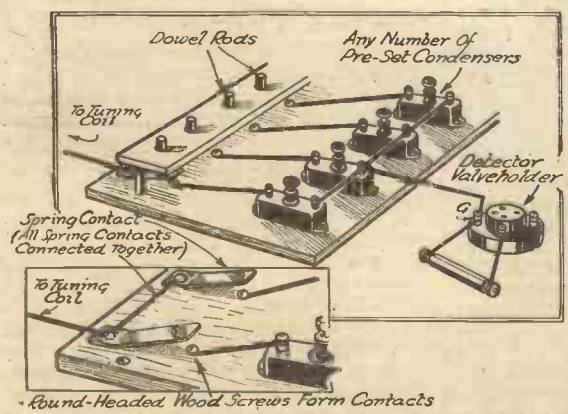


Fig. 3.—A better idea for the keyboard of the "electric piano."

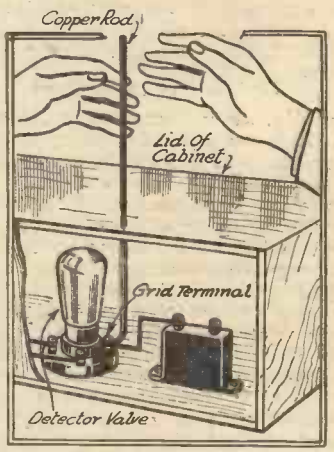


Fig. 1.—How the "radio violin" is made and played.

Simplified "Home Broadcasting"

In another article in this issue on "Home Broadcasting" some interesting games and experiments, which can be tried by using a microphone connected to the pick-up terminals of the set. are fully described. For the benefit of those readers who do not possess a microphone, however, it might be mentioned here that an old loud-speaker of the horn type, or even a telephone ear-piece, makes a fairly good substitute. The speaker or earpiece is simply connected to the pick-up terminals, no intermediate transformer being required. Naturally, this form of extemporized "microphone" is not so good as the real thing, but it is quite satisfactory for some purposes. When a telephone earpiece is employed, it is interesting to place a small watch on it and to listen to the "Big Ben" ticks reproduced by the loud-speaker. One word of warning, though: do not leave the watch in position for very long, since the powerful magnets in the earpiece will not improve its working.

Fun with a Pick-up

When a gramophone pick-up is available, no end of interesting tricks can be played. The simplest is that of playing "crazy" music, and to do this all that is required is to make a hole through a record

(Continued overleaf)

Fig. 4.—This sketch shows how two pick-ups can be used to produce echo effects. If desired, the "mechanical" second pick-up can be replaced by an ordinary sound-box and tone-arm.

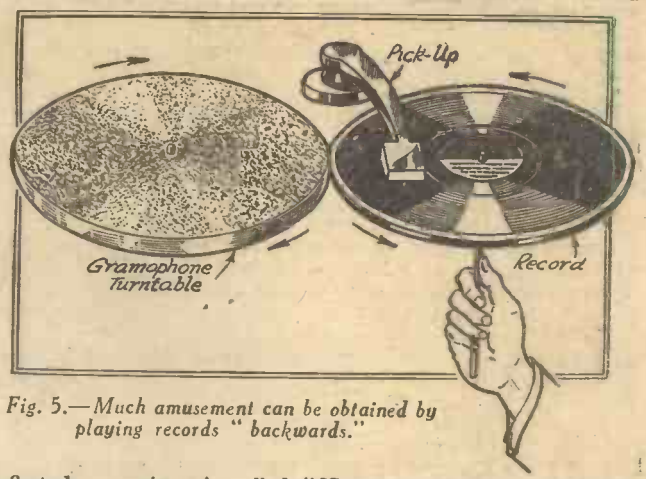


Fig. 5.—Much amusement can be obtained by playing records "backwards."

RADIO ENTERTAINMENTS FOR CHRISTMAS

(Continued from previous page)

about 1in. away from that in the centre. The best method of making the hole depends chiefly upon the substance of which the record is made. With some records it can be made with the hot end of a thin poker or length of iron rod, but in others it must be drilled out. In the latter case the record must be placed on a perfectly flat surface, whilst the drill must be revolved as quickly as possible and with a very light downward pressure.

After the hole has been made, the record is played in the usual way, except that the new hole is placed over the spindle. Reproduction is very weird, due to the eccentric movement of the records. In some cases it is very difficult even to recognize the tune, and much fun can be had from running a "guessing competition" with a few selected pieces.

This treatment is certainly not good for the record, so it is best to use old ones for the purpose.

Echoes

If you have two gramophone pick-ups, or one pick-up and an ordinary sound-box, some peculiar echo effects can be produced by using the arrangement shown in Fig. 4. Both pick-ups are allowed to travel over the record at the same time, one running behind the other. By arranging the second one to lag behind the first by varying distances all kinds of echoes can be obtained.

Yet another good way of producing funny effects with a pick-up is to play the record "backwards." With some types of gramophone, where the motor board is not recessed, this can be done fairly easily by holding the record on a wooden spindle (or even on the end of a pencil) and allowing the edge of the record to touch the edge of the revolving gramophone turntable as shown in Fig. 5. When the turntable is recessed, this method cannot usually be applied, although it can sometimes be made to work by placing a pile of records on the table and allowing the edge of the one in use to fit between the edges of the two uppermost ones.

It will be found extremely difficult to recognize tunes as they are being played backwards, and a "guessing competition" will again provide ample amusement. For preference well-known tunes should be chosen, and each member of the party provided with a slip of paper. As each tune is played the "competitors" are asked to write the (supposed) name down, and after playing about ten (or just a portion from each of ten) each player is asked to read out the names he or she has written down. The results will be found extremely amusing.

Name the Station

Another game which is principally of appeal to regular listeners and radio "fans" is called "Name the Station." For this game it is essential that the receiver in use should have a long range and should be accurately calibrated. The set is turned so that no one except the operator can see the dial. A number of different stations are then tuned in, and each listener has to try to identify them and write down the names. Incidentally, this game provides an interesting opportunity for learning to recognize the various interval signals and peculiarities of the different European stations.

A rather similar game, which might be called "Radio Blind Man's Buff," is one which will prove very interesting among amateurs and experimenters who pride themselves on their abilities in the way of operating a receiver. Each player in turn is blindfolded, given a seat at the controls, and asked to tune in as many stations as he can. With most kinds of "straight" sets (as opposed to superheterodynes) this game can be made more fascinating by making it a condition that the set must not be allowed to oscillate. In scoring, two points are allowed for every medium-wave station and one point for every long-wave station clearly received. Two points are deducted from the score each time the set is allowed to oscillate.

Many of the games I have mentioned can be modified or combined to provide all kinds of variations. Many readers will also think of innumerable other games on similar lines.

ROUND THE WORLD OF WIRELESS

(Continued from page 564)

Radio Salonika

AS, so far, Greece is still without a broadcasting service, a local association of radio amateurs has opened at Salonika a 1-kilowatt broadcasting transmitter. Only one concert is given weekly—namely, on Saturdays between 19.00 and 21.30 G.M.T., on 298.8 metres (1,004 kcs.). The call is: *Empros etho Thessaloniki*, and the Greek language alone is used. In accordance with the Lucerne Plan, the station, on January 15th, 1934, should alter its wavelength to 373.1 metres (804 kcs.). If this channel is used, a power up to 20 kilowatts is permissible.

Crystal Sets are Not Obsolete

FROM recent statistics established in Austria, seventeen per cent. of the total 48,000 registered listeners still use primitive crystal receivers. In Italy also the number of similar sets in existence has prompted the authorities to assist reception of programmes by installing local relay stations in the cities. The opening of Turin (No. 2) has followed the bringing into operation of the local Milan transmitter. Another similar station destined for Rome will be opened towards the end of the year. The duplication of transmitters thus furnishes alternative programmes to owners of the simplest type of receiving apparatus.

New Zagreb Station

WORK has been started on the new 20-kilowatt transmitter destined to replace the small station now operating at Zagreb. When completed, in the early spring of 1934, it will work on 276.2 metres (1,086 kcs.), a channel to be shared with Falun (Sweden). The old transmitter will then be dismantled and re-erected at Spalato (Split).

The King's Broadcast on Christmas Day

SO far as arrangements have been made, the King's greeting to his people throughout the Empire on Christmas Day will take place from Sandringham at about 3 p.m., and will be heard, to use his own words, "by men and women so cut off by the snows and deserts that only voices out of the air can reach them."

Japan Leads in the East

THE Japanese broadcasting authorities, at the expense of roughly one hundred thousand pounds sterling, have decided to erect a new high-power transmitter at Kurume.

Germany's High-Power "Push"

AS work has already been started on the reconstruction of the Hamburg station, it is expected that simultaneously with the bringing into operation of Muehlacker and Berlin, Hamburg will rank as a 100-kilowatter on January 15th, 1934. Its new wavelength will be 331.9 metres (904 kcs.), or roughly on your condenser readings where you now pick up Milan. Every effort is being made by German engineers to convert the plant of the stations as quickly as possible.

The A.C. QUADPAK

Full Constructional Details for This Powerful and Efficient Mains Receiver are Given Below

By FRANK PRESTON, F.R.A.

EVEN a cursory glance at the complete wiring plan given by Fig. 1 will at once make quite clear the fact that the "A.C. Quadpak" is delightfully simple to build, despite the fact that the finished receiver has every appearance of a really "professional" job. A considerable amount of work is saved by making use of the new "Igranipak" which includes not only all the tuning coils and condensers, but also the first three valve-holders, grid condenser, grid leak and the necessary connections. In addition to being very neat and compact, however, this complete unit offers another most important advantage, due to the fact that the three-gang condenser is accurately "trimmed" so that all three tuned circuits will "track" perfectly over the whole of both wave-bands. The preliminary trimming adjustments are carried out by the makers in a scientific manner, and with the aid of calibrated oscillators and the like which are quite outside the reach of the home-constructor. This initial calibration does not consist of merely screwing up pre-set condensers, but in correctly bending the split end plates of each condenser section in order that every circuit tunes to precisely the same frequency, no matter what may be the position of the dial.

Constructional work is further simplified by the use of a metallized chassis, to which a number of earth-return leads can be taken. Another point worthy of note is that the mains transformer chosen is provided with wire leads from the secondary windings, instead of terminals, and these can be joined directly to the correct points of contact. The same thing applies to the two .2 mfd. centre-tapped condensers used for decoupling the anode and cathode circuits of the two H.F. pentodes. I have made fairly extensive use of dry electrolytic condensers, which provide a better degree of smoothing than do ordinary types, and which are also easily mounted on the chassis by making a single hole to receive the mounting bush. There has been no necessity to employ a panel, since two of the controls are attached to the tuning pack and the third is fixed to a small component-mounting bracket. When the receiver is later fitted into its cabinet the control knobs will project through the sloping front and so give an air of neatness and simplicity to the complete instrument.

It will be observed that I have made extensive use of fixed resistances of the wire-ended type; these are low-priced and can be connected up with the greatest of ease. Added to these facts, it is worthy of mention that the resistances specified are (conservatively) rated at 3 watts, and they have thus an ample margin of safety even when used in a powerful set such as this. In the interests of safety I have included a 1 amp. fuse in the mains-supply circuit, and have also fitted safety-anode connectors to the leads on the pack, which make contact with the anode terminals of the H.F. pentodes.

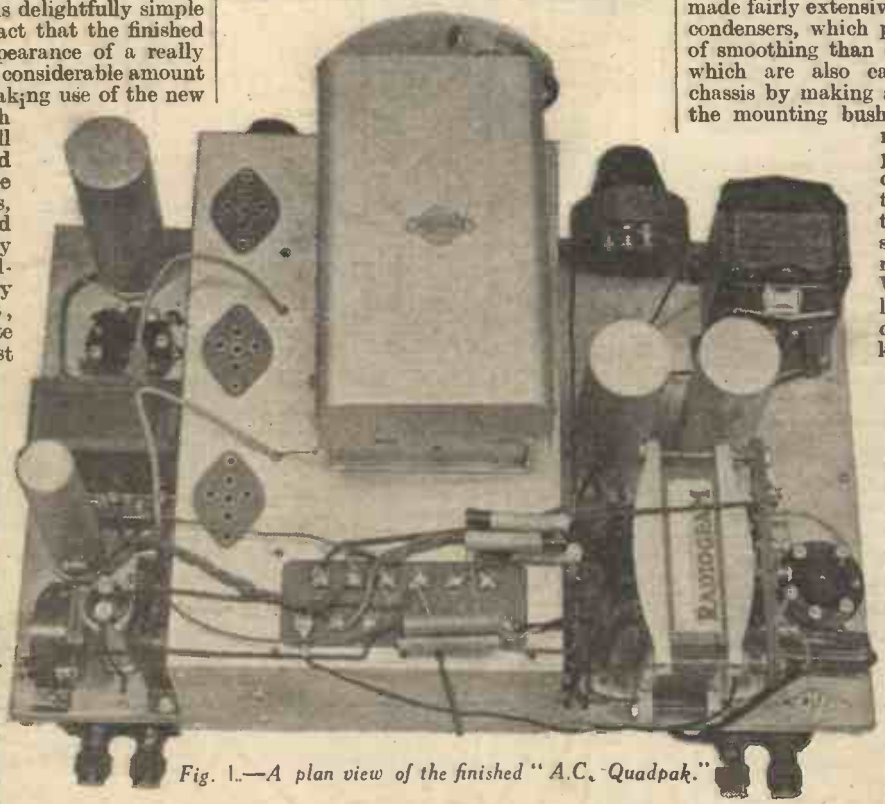


Fig. 1.—A plan view of the finished "A.C. Quadpak."

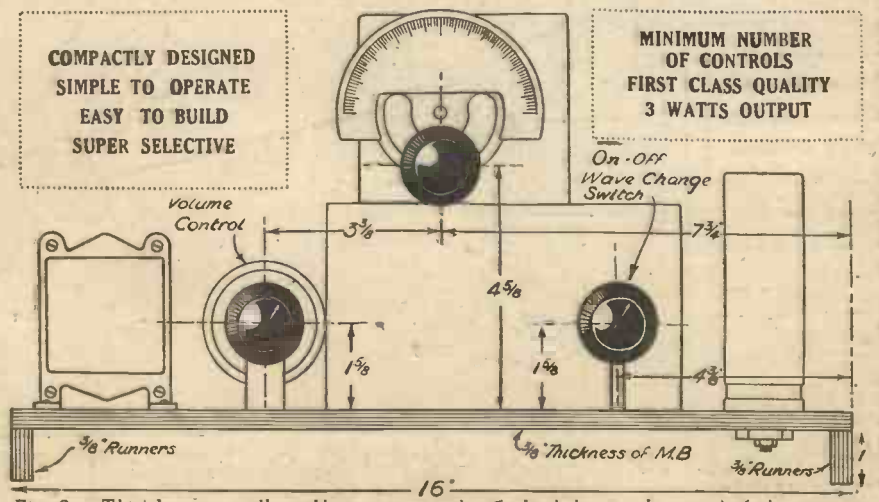


Fig. 2.—This drawing will enable you to mark off the holes in the panel of the cabinet.

Arranging the Components

Having obtained all the required components, the first thing is to arrange them on the chassis in the positions indicated in the wiring plan and

(Continued overleaf)

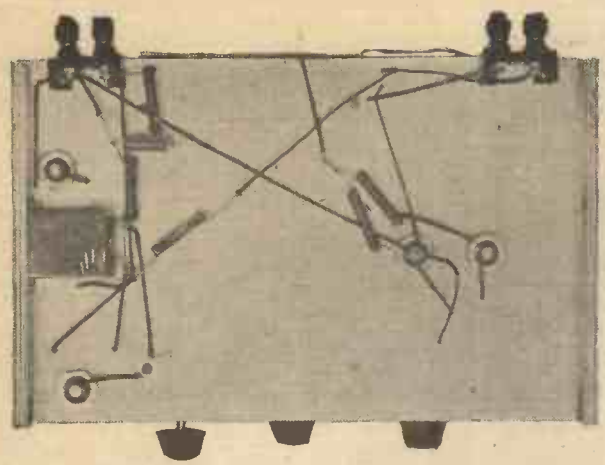


Fig. 3.—The sub-baseboard wiring.

(*Continued from page 569*)

photographs. The "Igranipak" is not in the centre of the chassis, but is so placed that the tuning knob comes half-way along the front edge. The bracket upon which the volume-control potentiometer is mounted is situated the same distance to the left of the tuning knob as the combination-switch knob is to the right.

When the exact position of every component has been located the main parts should be screwed down, commencing with the "Igranipak," which is mounted on the chassis by means of four 2B.A. bolts, about 1in. long. Next, the .2 mfd. condenser should be mounted just beside the mains transformer, and then the other condenser of the same type can be screwed down and the rest of the parts fitted in their correct places.

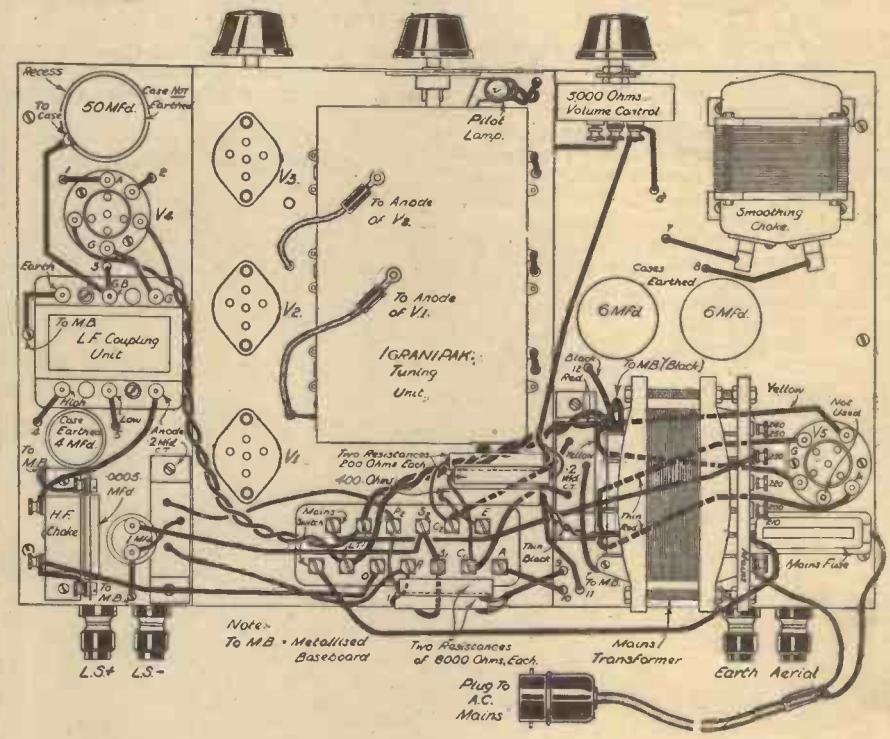
LIST OF COMPONENTS FOR THE A.C. "QUADPAK."

One Peto-Scott "Metaplex" Chassis, 16in. by 10in., with 1in. runners.
One Igranic "Igranipak."
One British Radiogram Mains Transformer, Type 55.
One Heayberd Smoothing Choke, Type 752.
Two Benjamin 5-pin Baseboard Mounting Valve-holders.
One Graham Farish "Snap" H.F. Choke.
One Bulgin "Transcoupler."
One Graham Farish 5,000 ohm "Megite" Potentiometer.
One British Radiogram Component Bracket, Type No. 22.
Two Dubilier 6 mfd. Dry Electrolytic Condensers, 500 Volts Working.
One Dubilier 4 mfd. Dry Electrolytic Condenser, 500 Volts Working.
One Dubilier 50 mfd. Dry Electrolytic Condenser, Type 0281.
Two Dubilier .2 mfd. Centre-tapped Condensers, Type BE31L, with flexible leads.
One Dubilier 1 mfd. Non-Inductive Condenser, Type 9200/BS.
One Dubilier .01 mfd. Tubular Condenser, Type 4411.
One Dubilier 1 mfd. Fixed Condenser, Type LEC.
One Dubilier .0005 mfd. Fixed Condenser, Type 670.
Ten Watmel "Hy-Watt" Fixed Resistances; two 200 ohms; one 400 ohms; one 1,000 ohms; three 10,000 ohms; two 8,000 ohms; one 50,000 ohms.
One Belling-Lee Baseboard Mounting Fuse-holder with 1 amp. Fuse.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Terminals: marked "A," "E," "L.S.+," and "L.S.—," Type B.
One Heayberd Mains Flex.
Two Clix Anode Connectors.
Two Coils, Bulgin "Quickwyre," Flex, Screws, etc.
Four Mullard Valves: two V.P.4, one 354V., and one P.M.24M.
One Mullard Rectifying Valve, Type D.W.2.
One R. & A. "Challenger" Loud-Speaker Unit.
One Peto-Scott "A.C. Quadpak" Cabinet.

The Electrolytic Condensers

Holes ⅜in. diameter are required for the electrolytic condensers, but before making these, and after the centres have been marked off, it is a good plan to make 1½in. recesses about ⅛in. deep on the underside of the chassis. These are to enable the nuts to obtain a better grip on the threads of the mounting bushes. As a matter of fact, it is not essential to make these recesses, since the nuts will *just* obtain a firm hold without, but if it is not done there is some danger of breaking the threads on the ebonite mounting bushes. It can be seen from the circuit diagram that the 50 mfd. condenser is connected in the "reverse" way to that normally used; in other words, its *negative* (containing case) side is not joined to the chassis, but to the high-tension negative lead from the mains transformer. This is due to the method which is employed for biasing the directly-heated power-pentode valve, and because of that the aluminium container must be insulated from the metallized chassis. The necessary insulation can be provided in one of two ways, both of which can be adopted very easily. One way is to make an insulating washer (from mica, fibre, or thin ebonite) about 2in. outside diameter, and with a hole ⅜in.

(*Continued on page 573*)



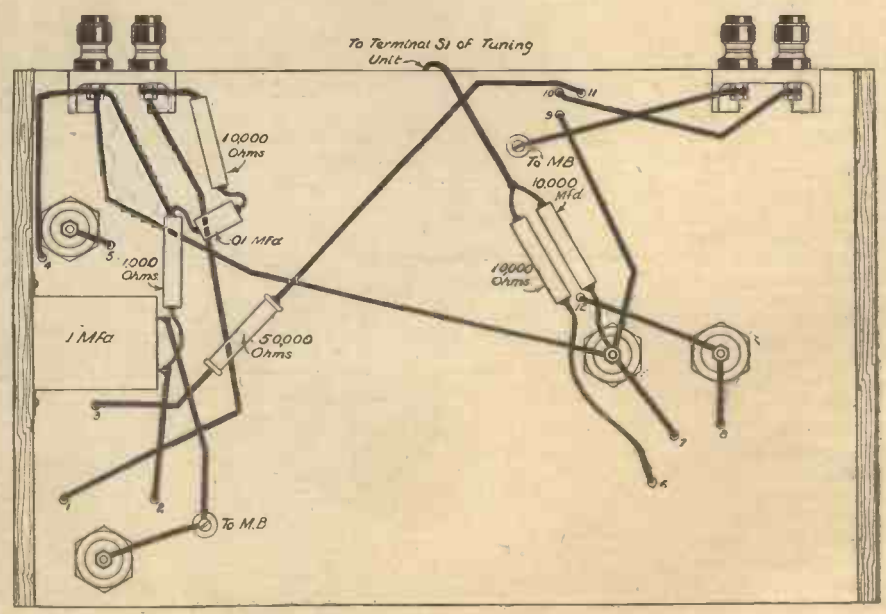
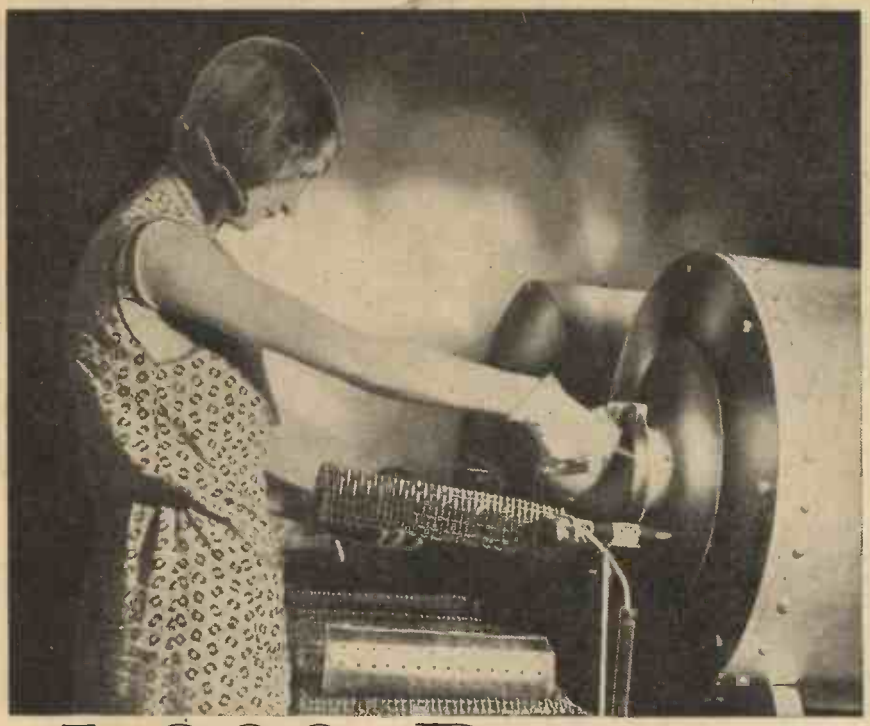


Fig. 4.—The wiring of the Quadpak may be carried out from the above diagram or from a full-size Blue Print, price 1/-



KINGS OF THE AIR

1,000 Degrees Centigrade

that you may enjoy **BETTER** *Radio Reception*

There's more—much more—in the manufacture of Cossor Valves than meets the eye. Consider for a moment the nickel anodes. Any impurities in the metal — even minute traces of gaseous matter — might, at a later date, impair the efficiency of the valve. Each one, therefore, is subjected to intense heat in an electric furnace, in an atmosphere of hydrogen, to drive off all impurities. Here is a process which is unseen by the public. Many in fact might consider it an elaborate—and rather unnecessary precaution. Yet it is but one of many similar processes devised by Cossor engineers to safeguard a reputation of which they are justifiably proud. When you buy a Cossor Valve you can be certain that no expense has been spared—that nothing has been left undone — to make sure that it will give you long and dependable service.

COSSOR VALVES

A. C. Cossor Ltd., Highbury Grove, London, N.5. Depots at Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Belfast, Cardiff and Dublin.

To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5.
Please send me free of charge, a copy of the 64-page Cossor Valve Catalogue B14.

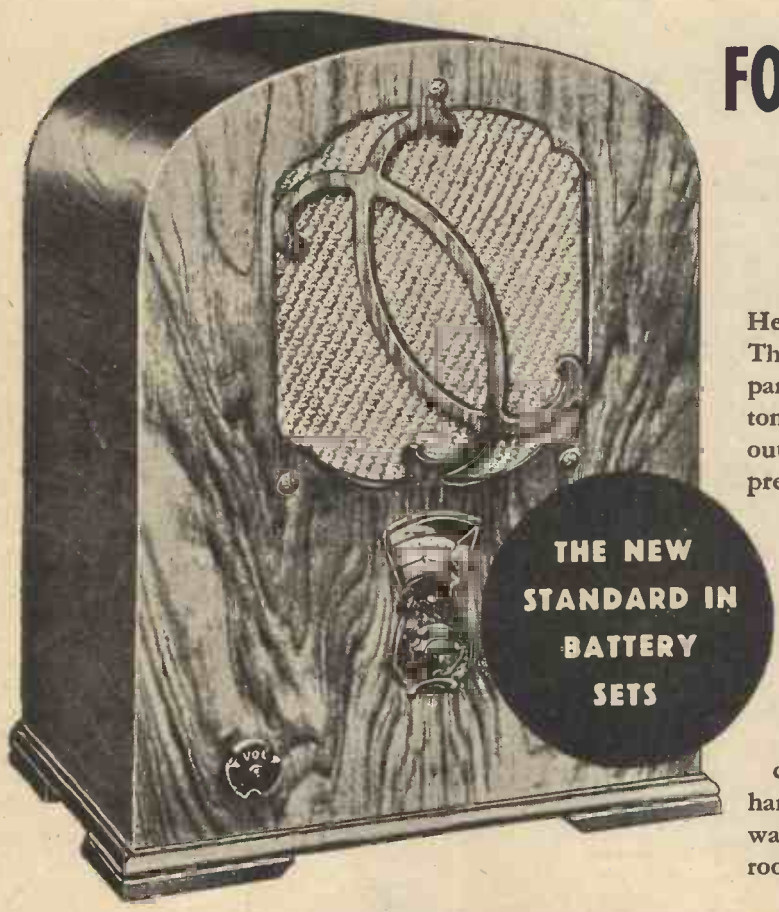
Name .....

Address .....

PRAC. 2/12/33.

4076

ENJOY QUALITY PERFORMANCE WITHOUT ELECTRIC CURRENT



FOR £8.15.0

Here is the remarkable Columbia M.C. *Battery* Three with a performance in every way comparable with that of much dearer sets. The tonal quality from its moving-coil speaker is of outstanding power and purity. The band-pass pre-selector circuit brings in all the main foreign programmes, each clear of its immediate neighbour on the dial. Local station reception is held in check by the sensitivity control—and heterodyne whistle is eliminated by the Tone Control. Gramophone record reproduction from a pick-up is heard on this set with astonishing realism and volume. If desired, an additional speaker may be connected. H.T. consumption is low—only 7 m.a., and the large, handsomely-proportioned cabinet, finished in walnut, adds distinction to the furnishing of any room. Ask to hear it at any Columbia dealers.

SPECIFICATION

Inductively-coupled band-pass circuit. Permanent-magnet moving-coil speaker with provision for additional speaker. Single tuning with local-distance control. Tone selector. Output, 200 milliwatts. Marconi valves. 120 v. H.T. Battery with 6 v. grid-bias combined. 2 v. 45 amp-hours accumulator. Facilities for connection to pick-up. Walnut finished cabinet 18⅞" high. *(Prices not valid in I.F.S.)*

Have you heard the amazing Columbia C.Q.A. Battery Radiograph Four—the first really satisfactory battery radiogram? Ask your Columbia dealer to let you hear it, and to explain the wonderful new Columbia C.Q.A. principle which gives all-mains performance from a battery set on radio and records at astonishingly low battery consumption. **The Columbia C.Q.A. Battery Radiograph Four — price 20 guineas, or by Hire Purchase.**

To the Columbia Graphophone Co., Ltd., 98 Clerkenwell Road, E.C.1.

Please send me particulars of the M.C. Battery Three and the C.Q.A. Battery Radiograph Four without obligation.

NAME.....

ADDRESS.....

.....P.W.21233

Columbia

RADIO AND RADIO-GRAPHOPHONES

THE COLUMBIA GRAPHOPHONE CO., LTD., 98 CLERKENWELL ROAD. E.C.1.

(Continued from page 570)

diameter and to fit this between the container and the chassis. The second way, which I followed in my original receiver, is to make a 2in. sinking on top of the chassis with an expanding bit before making the condenser-mounting hole. In that case the condenser fits into the sinking and is satisfactorily insulated. No matter which method is employed, a soldering tag must be gripped between the condenser and chassis for making a connection later on.

Connecting Up

After mounting all the components in the positions which are clearly shown, the simple wiring can be taken in hand. Most of the connections are made by looping the ends of the connecting leads to fit over the terminal shanks, but about ten connections require to be soldered. As a matter of fact, the soldering need present no difficulty, since the points to be soldered consist in every case of clean, tinned-copper wire, and all the joints are very accessible. You will notice that two connections on top of the chassis are made directly to the metallized coating by fitting the end of the wires under the nuts of round-headed brass screws. On the underside of the chassis three connections are made to the 2 B.A. bolts used to mount the "Igranipak." It might also be wondered why there is no connection to the "earth" terminal on the pack; this is because this terminal is internally connected to the metal container, which is itself in contact with the surface of the chassis.

There is really no necessity for following any particular method of procedure in wiring up, although it will be found rather easier if a start is made by making the necessary connections to the terminals on the pack. After that the output leads from the mains transformer may be dealt with. These are not marked in any way, but are of different colours and thicknesses, so that there will be no trouble in recognizing them. In order to assist you in this direction, I might say that the two thin red leads are from the H.T. secondary, and go to the grid and plate terminals respectively of the rectifier valve-holder; the two thinner yellow ones are from the 4-volt 1 amp. winding, and go to the filament terminals on the rectifier valve-holder; the double thin black lead is the H.T. negative one and is soldered to one end of the 400-ohm resistance; the two thick red leads come from the heater winding and connect up to the terminals marked "L.T." on the pack; the thin black lead is the positive H.T. one and passes through a hole in the chassis to the positive terminal on a 6 mfd. condenser; the remaining lead (thick black) is the centre-tap of the heater winding, and is earth-connected by being gripped between the foot of the transformer and the chassis.

The rest of the wiring does not call for any special comment, and I do not think you will experience any difficulty in following it from the wiring plan and photographs.

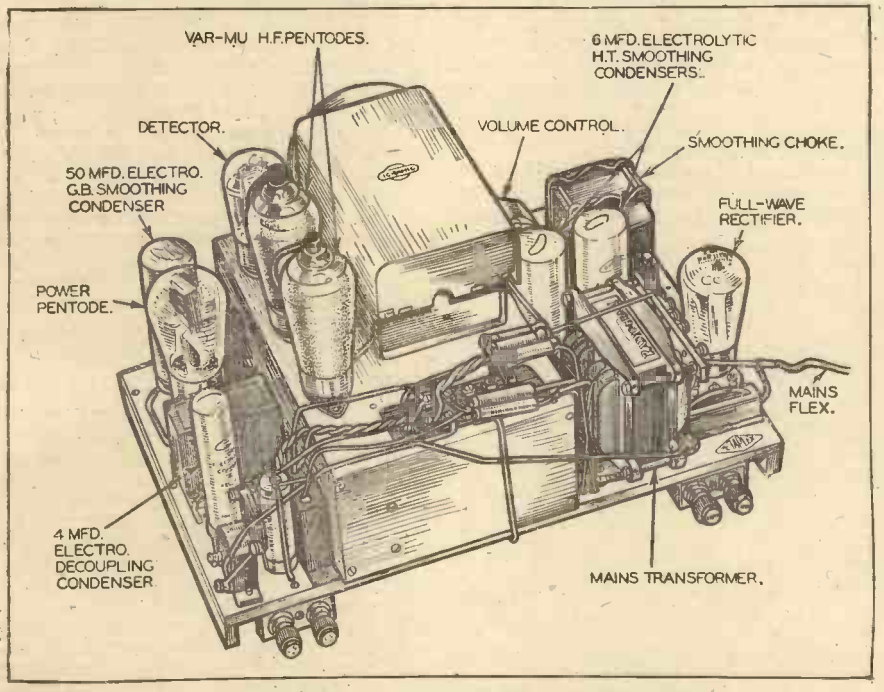


Fig. 5.—Our artist's impression of the complete receiver.

Trying Out the "Quadpak"

After all the wiring has been completed it would be as well to check it over carefully before connecting up to the mains in order to avoid the possibility of "blowing" the fuse. Of course, no harm can be done in any case, but there is no reason why a sixpenny fuse should be ruined due to carelessness. When you are satisfied, insert the valves, commencing with the two H.F. pentodes which fit in the holders at the rear of the pack. The Mullard 354V. detector fits in the front holder, whilst the P.M.24M. and D.W.2 rectifier fit in the holders to the right and left of the pack respectively. Connect aerial, earth and speaker in the usual way, and insert the mains plug into any convenient socket after making sure that the lead from the mains switch is attached to the terminal on the mains transformer which is appropriate to the voltage of the A.C. supply.

Simple Operation

The set is switched on by turning the right-hand knob in a clockwise direction through a few degrees. The set is then adjusted for medium-wave reception, and a further turn is required to change over to long waves. The particular valves employed

(Continued on page 620)

IMPROVING SUPERHETERODYNE PERFORMANCE

An article dealing with adjustments necessary to ensure maximum results.

By P. E. BARNES, B.Sc.

THE recent return to popularity of the "superhet" in this country proves that little now remains of the original dread of complexity, instability and a low standard of quality which resulted in its temporary decline from public favour some years ago. Modern design and research have removed most of the troubles often encountered in the early types.

There is still need, however, for care in the construction, and especially in the initial adjustment, of a receiver of this type. Paradoxically, results are often so much better than those obtained from a straight set that the constructor does not realise the extent to which really accurate adjustment might improve them.

Causes of Unsatisfactory Results

There are still certain points, attention to which may prove worth while. The following are the principal causes of inefficient performance.

(i) "Mixing" of frequencies, i.e., the straying of H.F. currents into the I.F. stages, or, more usually, of I.F. currents into the L.F. stages.

(ii) Lack of proper tone correction to compensate for sideband cutting.

(iii) Incorrect adjustment of the I.F. transformers.

The mixing of frequencies in the earlier types usually arose from the inadequate shielding provided, which undid the good work of the filtering devices. While the H.F. currents were usually disposed of in their passage through the I.F. stages, the latter were prone to wander into the low frequency part of the receiver, whence they could usually be removed only at the cost of most of the upper musical register.

The Second Detector Anode Circuit

This problem has only recently been satisfactorily solved, by the use of proper tone compensating types of L.F. transformers.

The essentials are: a proper H.F. choke (most of the smaller patterns offer much too low an impedence to the I.F. currents) and an adequate by-pass condenser from the detector anode to earth. The choke should be one intended for use in this position, or the one specified by the designer. The by-pass condenser should be much bigger than the .0002 mfds. or thereabouts, usual in straight sets, and .001 will be nearer to the correct value in most cases. This will result in a considerable high note loss, which makes the use of a transformer with a rising characteristic, and a tone control device, essential in order to restore these frequencies to their correct value.

Some form of tone control is needed in any case, as there will always be a certain amount of sideband cutting in the earlier stages.

The Intermediate Frequency Stages

The band pass transformers now almost universally used as an I.F. coupling represent a considerable advance on any previous method, but, like any other part of the set they require careful and exact adjustment if they are to do their work properly.

(To be continued.)

ENTERTAINMENTS with the MICROPHONE

Various Methods of Connecting a Microphone to a Wireless Set are Described on Another Page. On This Page a Number of Interesting Games which can be Played with the Aid of a Microphone are Explained.—By BERNARD DUNN.

Auditions

HAVING suitably connected the microphone in circuit there are numerous novel and interesting games that can be played. One simple game which I call Auditions will provide no end of fun. For this, the microphone must be placed in one room and the loud-speaker in another. One half of the party go into the room where the microphone is situated, the other half remaining in the "loud-speaker" room. Then persons speak, sing, or recite into the microphone whilst the listeners try to guess who it is. An M.C. is required to go from one room to the other after each "performance" and if the listeners guess correctly, the person who has just broadcast must return to the other room; if not, the person remains and either immediately, or later on, "broadcasts" again. This continues until all the "broadcasters" have been recognized, after which the two halves of the party change rooms. In this game a rule can be made that every person must speak or sing in a natural voice or it might be decided that any kind of mimicking will be allowed. In either case the game provides plenty of fun.

Radio Charades

A modification of "Auditions" is Radio Charades. In this, as in the previous game, the party is split up, one portion being in the same room as the microphone and the other in the room where the loud-speaker is situated. Those persons who are near the microphone can then either speak lines or make various sounds to represent the name of a song, play, person, book, etc. It is, of course, the object of the listeners to recognize the name represented. Various combinations of words and sounds can be employed to produce all kinds of interesting and puzzling effects. As a very simple example I might mention the one-time popular tune "Rain on the Roof"; this would easily be represented by dropping peas on to a table. Another example, again the title of a song, is "The King's Horses and the King's Men." This could be "sound represented" by knocking empty wooden boxes on a table and by "marching" with the feet. "The Talk of the Town" also provides unusual material for a Radio Charade; the "broadcasters" could carry out conversations in two or three small groups. The following titles of recent "shows" will be found to provide a good deal of useful material for Radio Charades—"Ball at the Savoy," "Eight Bells," "Music in the Air," "Hay Fever," "While Parents Sleep." Numerous other names will soon suggest themselves when the game is given a trial.

Home "Broadcasting"

Another way of using a microphone for entertainment purposes is for the owner to run his own "broadcasting" programme. He takes up his position at the microphone and makes announcements, sings, plays a piano or broadcasts gramophone records as he desires. This scheme can be worked out in the form of a competition in which every member of the party gives his or her own "broadcast" programme in turn, the listeners afterwards voting for the best "show." In this respect much more effective results can be obtained by using both a microphone and a pick-up in conjunction and so connected in circuit that either can be "faded" in or out as required. The simplest form of connection for this purpose is shown in Fig. 1, where a 100,000 ohm potentiometer is used as a "fader"; when the slider is at one end of its travel the pick-up is connected to the amplifier, whilst when the slider is moved to the other end of its track the microphone is in circuit. Between the two extremes both microphone and pick-up reproduction are heard simultaneously. This idea will make it possible to give some very realistic imitations of real broadcast programmes and will be found well worth a trial.

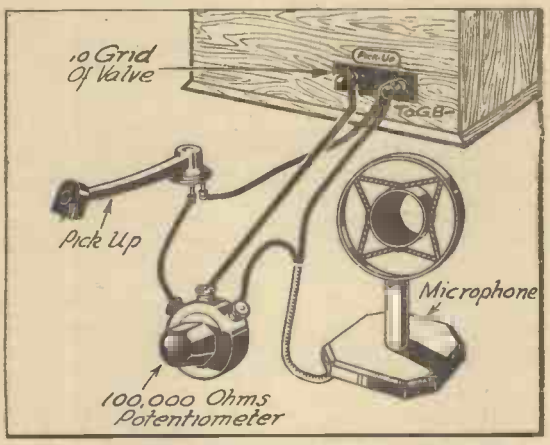


Fig. 1.—A simple and effective method of "fading" in and out a pick-up and a microphone.

Home Recording

Home recording is another diversion which is always attractive. Records of community singing, solos, or duets made at Christmas time may prove very entertaining later on when the home is quiet and the friends perhaps miles away. There are special outfits made and sold for home recording, many of which are by no means expensive, but very often quite satisfactory results can be obtained by using a pick-up in conjunction with the receiver and microphone. The method of connection is clearly shown in Fig. 2, from which it will be seen that the pick-up is connected to the loud-speaker terminals of the set. This method of connection is only suitable with a low-power receiver, and with a powerful instrument it would be essential to insert a 1 : 1 output transformer between the receiver and the pick-up. The pick-up runs over a "blank" record, which can later be "played back" in the usual way. To obtain reasonably good results it is necessary to use "loud" needles in the pick-up. It is also very desirable that the pick-up should not be of a particularly sensitive type.

I have made a number of suggestions for using a microphone with the receiver, but there are innumerable other methods which will occur to readers and which may be better than those described. There is only one hint I would like to pass on; that is, "rehearse" all the "stunts" you propose to try before the guests arrive. You will then prevent the possibility of unsuccessful results at the last moment.

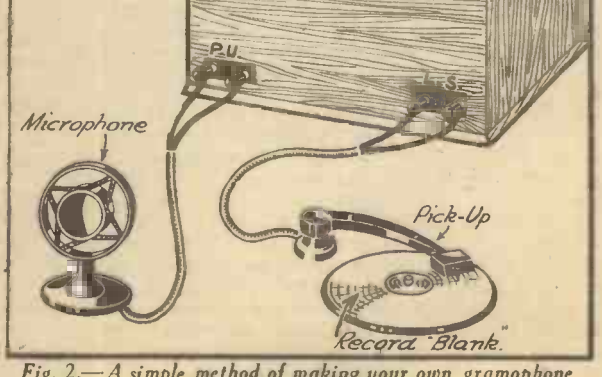


Fig. 2.—A simple method of making your own gramophone records.

Many more excellent seasonable features next week.

Fitting & Using the Pick-up

Various Methods of Connecting a Gramophone Pick-up to the Wireless Set Simply Explained.

By E. WATTS

THERE is no need to have a special receiver for the reproduction of gramophone records, and although many may perhaps by now have obtained a gramophone pick-up, there are no doubt a number of readers who will come into possession of one of these devices

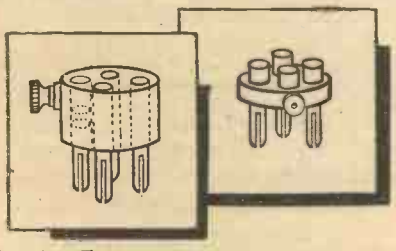


Fig. 1.—Two typical gramophone pick-up adaptors. The method of splitting the grid connection may be seen from the left-hand illustration.

for the first time this Christmas. The following notes are, therefore, given in order that the best method of fitting one of these useful accessories may be decided upon according to the type of receiver which you possess, and also according to the degree of ability to which you may lay claim.

Its Position in the Circuit

As we have mentioned many times in these pages, the pick-up has to be included in the grid circuit of a valve, that is to say, one side of the pick-up has to be joined direct to the grid of a valve, whilst the other side of the pick-up has to be joined to the cathode. In the case of the battery-operated receiver, the cathode, of course, is the filament. The output from the pick-up is composed of low-frequency currents only, and, therefore, it is essential that the valve to which these currents are fed must be adjusted to operate as a low-frequency amplifier. This introduces the first important point in arranging for the employment of the pick-up, for, if you own a four or five-valve receiver, you are naturally in some little doubt as to which valve the pick-up should be joined. It would naturally be very unwise to include it in one of the H.F. stages in view of the drastic alterations which would have to be made to the circuit to change the H.F. valve into one which works as an L.F. The detector valve follows the H.F. stages, and although this is an H.F. valve in the strict sense of the word, there is not a great deal of trouble in converting it into an L.F. amplifier, as the anode components of that valve will be essentially of the L.F. type. We may say, therefore, that the pick-up may be joined in the grid circuit of a detector valve, or in the grid circuit of any L.F. valve. This gives us our first definite starting-off point.

How Many Valves?

Before we can decide definitely in which circuit to connect the pick-up, we must consider the voltage output of this component, and this varies greatly in the various makes which are obtainable. In one specific case, the output is as low as .4 volts, whilst in another type of pick-up the output reaches nearly 5 volts. The majority of makers include either a chart giving this information, or the box carries a list of the pick-up's various characteristics, so that it should not be very difficult to ascertain approximately the voltage which is developed. If the voltage is very low, it will be necessary to use several L.F. stages in order to obtain an adequate loudspeaker signal, and on the other hand, the extremely sensitive pick-up will only need perhaps one valve to give sufficient volume for normal domestic requirements. Very few receivers of recent design employ more than two L.F. stages, and it may, therefore, be stated that the best position for the pick-up is in the grid circuit of the detector valve, which will ensure that the whole of the L.F. portion

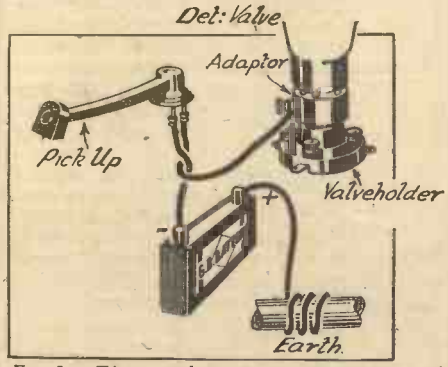


Fig. 2.—The complete circuit arrangement of the pick-up, bias battery, and adaptor.

of the receiver is employed in amplifying the pick-up signal with a reasonable certainty of fully loading the output valve. The question of controlling the output will be dealt with a little later on.

Converting the Receiver

The grid of the detector valve will, in practically every case, be joined to one side of a small fixed condenser, whilst a grid leak will also be joined to this point. This applies to both battery and mains-operated valves. The exception will be, of course, a valve acting as an anode bend rectifier or a diode rectifier. In the first-mentioned case the grid must be joined to the pick-up, instead of the condenser and leak, and this may be carried out with the aid of a switch or by means of a special adaptor. If the pick-up is only to be used temporarily, the adaptor will be quite good enough, and this will entail absolutely no alteration to the receiver. The detector valve is simply pulled out of its socket in the receiver and the adaptor plugged in its place. The valve is then replaced into the sockets on top of the adaptor. The connection from the sockets on the adaptor to the sockets on the valve-holder are complete in the case of the filament and anode, but the grid connection is broken and is brought out to two terminals mounted on the side of the adaptor. By joining the two leads from the pick-up to these two terminals the pick-up is connected in circuit, and all that remains is to plug in to some grid-bias voltage in order that the valve may work as an L.F. amplifier, instead of a rectifier. Fig. 1 shows two typical adaptors, whilst Fig. 2 gives in diagrammatic form the complete circuit arrangement with the adaptor. It will be seen that there is no need to fit terminals or any other device with this idea, but to receive the wireless programmes it will be necessary either to remove the adaptor and re-insert the valve in the holder, or disconnect the pick-up leads and short-circuit the two terminals.

A Permanent Connection

It is much better, however, to connect the pick-up permanently, and to arrange for a switch to change over the operation of the receiver from wireless to gramophone reproduction, as by this means gaps in a wireless programme may be filled and the whole of the music of an evening may be kept in the strain which most suits the particular mood of the moment. The same consideration will apply in this case, namely, the disconnected grid lead, and as the grid must be in circuit for either type of reproduction, it will be obvious that this lead must be connected to some arrangement which remains fixed, whilst the pick-up and the grid condenser (and leak) are connected to some arrangement which may be changed

(Continued overleaf)

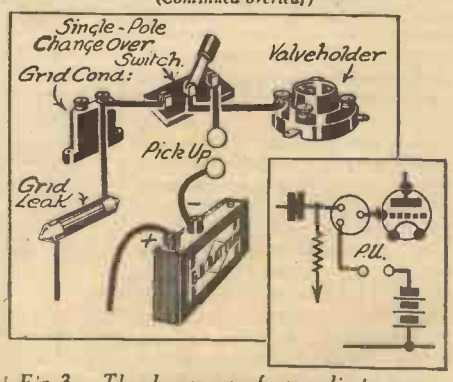


Fig. 3.—The change-over from radio to gramophone reception may be carried out by means of a single-pole change-over switch as shown in this illustration.

(Continued from previous page)

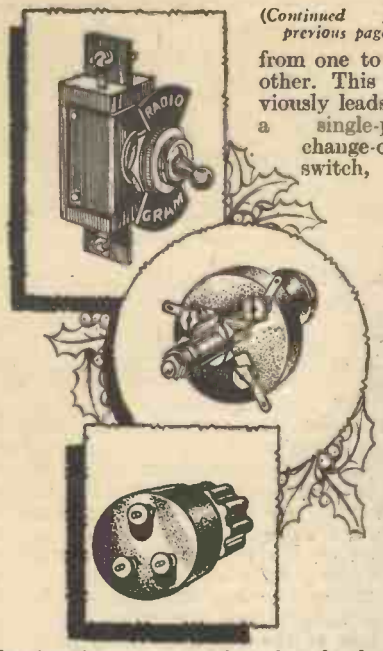


Fig. 4.—Various types of single-pole change-over switch as used for radio-gramophone switching.

from one to the other. This obviously leads to a single-pole change-over switch, a diagrammatic representation of which is shown in Fig. 3. It is obviously impracticable to use a large switch of this type for carrying out the change-over, but there are a number of switches on the market which embody the same principle but which are both small and easily fitted. Fig. 4 shows a representative group. The switch should be fitted on the panel of the receiver *as near to the grid of the detector valve as possible.* This latter point is most important, as a long lead joined to this part of the circuit will result in all sorts of trouble. For this reason, it may be found necessary to fit the switch at the rear of a receiver, on the terminal strip, for instance. The grid terminal of the valve-holder is joined direct to the arm of the switch, and the grid condenser (and leak) is then joined to one of the remaining two contacts. In the case of a battery-operated valve the remaining contact of the switch must be joined to one terminal (or lead) of the pick-up whilst the other pick-up lead is joined to a flexible lead fitted with a wander-plug. This plug should be inserted in the grid bias battery to provide clear signals, a value of 1.5 to 3 volts probably being found most suitable. In a mains-operated receiver, the wander-plug will not be required, and the lead must be joined direct to the earth line, whilst a biasing resistance is included in the cathode lead of the valve. In order that this bias is not applied when the receiver is used for radio reproduction, the grid leak must be joined direct to the cathode. Fig. 3 shows the arrangement for the battery type of valve in theoretical and pictorial form, whilst Fig. 5 shows the arrangement with an indirectly-heated mains valve.

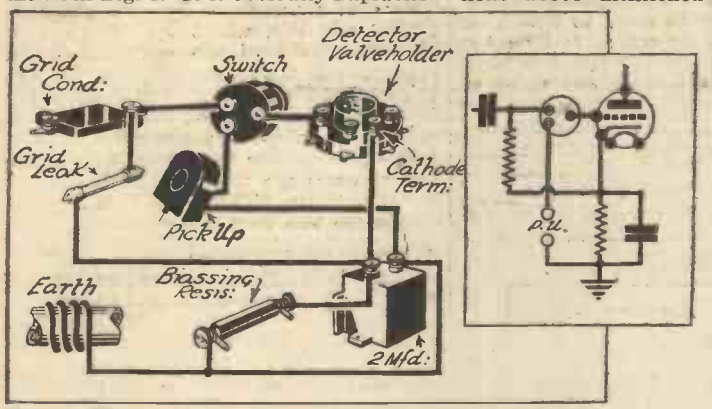


Fig. 5.—When an indirectly-heated detector valve is used for record reproduction the pick-up leads must be joined direct to earth, with a biasing resistance joined in the cathode lead. The grid leak is connected direct to the cathode.

Volume Control

It is essential that some form of control shall be provided to compensate for varying outputs with different records, and the majority of pick-ups which are sold to-day include this control on the rear of the carrier arm. Where, however, a pick-up is employed which has no volume control fitted, one should be included on the panel or the motor-board at some convenient position, and the best method of wiring it into circuit is to connect the two ends to the two pick-up terminals, and then to take a lead from the arm of the control and from one end of the control and consider these as the two pick-up leads. The connections above mentioned should then be made to these leads, with the result that the volume control will be included in the pick-up circuit and will enable the volume to be varied from a whisper to maximum. The value of the control must be chosen according to the recommendations of the pick-up manufacturers, and unless care is taken the quality will be spoilt. Unless the makers recommend it, a value lower than 100,000 ohms should not be used, and any value up to 2 megohms will prove satisfactory. (Fig. 6.)

(Continued on page 620)

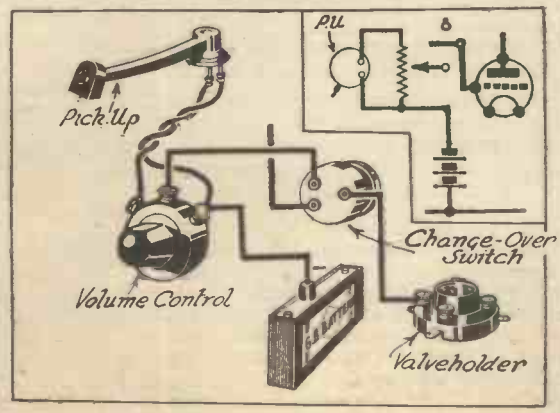


Fig. 6.—For volume control purposes a potentiometer should be joined across the pick-up as shown in this illustration, and the arm of the potentiometer connected to the change-over switch.

Over three million aerials lead down to Mullard Master Valves. Why? Our answer is because they are good, reliable valves, well tried and tested in home-built and factory sets all over the country. This is the most tangible evidence we can offer in support of our product, and you will agree that any manufacturer who succeeds in dominating a market of millions can only hold that position by virtue of unequalled technical and manufacturing resources. In short, a Mullard radio valve must be the Master valve.

JOIN THE BETTER RADIO BRIGADE

ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. D.C.R.

Mullard

THE·MASTER·VALVE

The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.

Hook-ups & Makeshifts

Temporary Measures which will Enable a Programme to be Heard in the Event of a Fault Developing in the Wireless Receiver.

By Our Technical Staff.

THERE are quite a number of simple devices which will enable a receiver to function even after some vulnerable part has completely broken down. Naturally, the same volume will not be obtainable, but it is well worth while knowing that a particular item of the broadcast programme need not be missed, and the following notes will demonstrate some of the arrangements and artifices which may be tried should a breakdown be experienced during the Christmas period, when all the shops are shut and no spare parts are obtainable. I will deal first with the accessories of the receiver as distinct from the valves and other parts which go to make up the apparatus.

The Batteries

It should be unnecessary to remind you to check up your battery voltages before the holiday period arrives, but there are some who will overlook this point due to preoccupation in other directions, and it will be found in nearly every case that the battery will cease to work in the middle of an important item which you particularly want to hear. In the case of the ordinary 2-volt type of receiver, should the L.T. accumulator run out, it is possible to call in to your aid the ordinary bell battery, which in most cases will be found to be of the 1.5-volt type. This will not deliver the same output from the receiver as the accumulator, but it will probably enable you to hear the necessary item at a reduced volume and perhaps with slight distortion, but it will render a little first-aid for the occasion. In the event of the H.T. battery failing there will be found no substitute in the average household, but the battery may be rejuvenated, for a short period, by subjecting it to a slight heating. The simplest way of carrying this out is to place it in the oven for a few minutes, but do not turn the gas full on and shut the door, or you will have great difficulty in cleaning out the oven afterwards. The gas should be very low, and the door should only be just pushed to so that the battery is only warmed, and not baked. The extra life will not be of great value, but, as in the previous case, will probably enable a single item to be listened to in comfort.

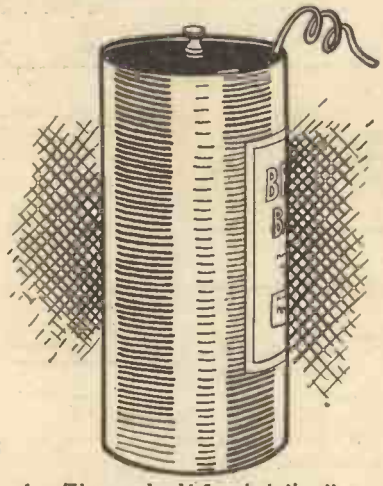


Fig. 1.—The standard 1.5-volt bell cell may be used temporarily for a 2-volt receiver when the accumulator runs out.

The Aerial

In the unlikely event of the aerial collapsing, there are several temporary measures which may be adopted. One of the simplest is to run the actual aerial wire along the top of the garden fence, holding it in position with nails. It may be found in many cases that this will provide better signals and selectivity than the standard aerial which has been in use. Among other makeshift aerials may be mentioned the bell wiring where such is fitted to the house. Simply twist a short length of any type of wire round the nearest point in the bell wiring, and run this wire to the aerial terminal. No electrical connection should be made to the bell wiring, the actual pick-up being capacitative. Similarly, any wiring which runs through the house may be used in this manner, and, if the wiring is tacked tight to the wall so that the extra wire may not be twisted round it, a length of about 18in. should be run parallel and close to it, and held in position with drawing pins or small tacks. Naturally, the electric house wiring should not be used for this temporary aerial system in view of the risk of introducing hum. If a telephone is fitted to the house a piece of tin, aluminium or other metal may be stood beneath the 'phone, and a wire led from this to the aerial terminal. Again, make no direct connection with the telephone, but rely entirely upon the capacity between the aerial and the object which is being pressed into service.

The Earth

Should the earth lead break, any type of temporary bridge may be introduced, although it may be found that the programme can still be received without an earth connection at all. In most cases it will lead only to slight instability, but a short length of wire may be used to connect the broken ends together and enable the full efficiency of the earth to be obtained until the break can be properly soldered and made good. If the buried earth connection comes adrift, a temporary connection may be made to an earth of the pipe variety, either the water system or some other piping being used for the time being.

Alternatively, the capacity earth may be used, a sheet of metal, gauze or coil of wire being joined to the earth

Fig. 2.—When the aerial collapses, the wire may be temporarily fixed along the top of a wooden fence.

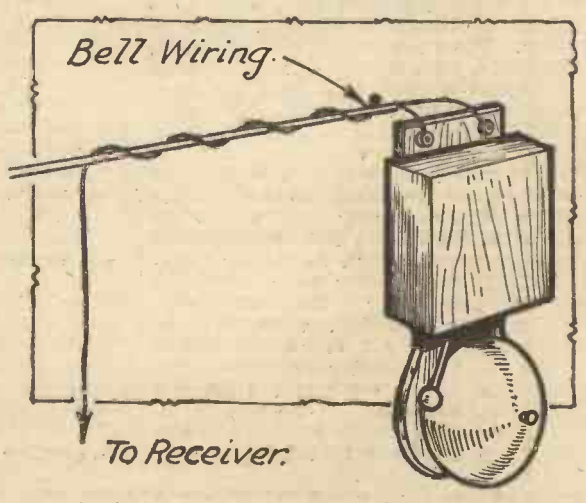


Fig. 3.—The bell wiring system forms a good make-shift aerial.

terminal and the "earth" simply laid on the floor beneath the receiver. The counterpoise, consisting of a length of wire running parallel with,

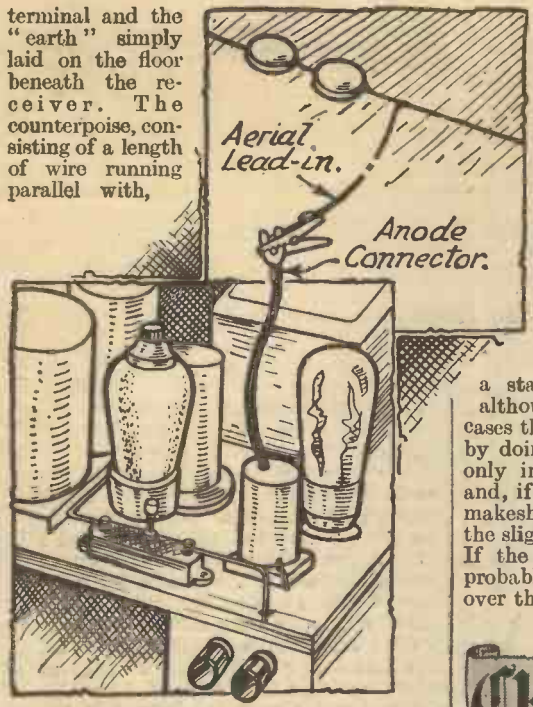


Fig. 4.—An H.F. stage may be cut out by using a connection direct to the H.F. Choke

and immediately below, the aerial proper will also prove of great utility, and, as with the temporary aerials mentioned, it may be found that results are improved by one of these makeshift earthing arrangements.

The Receiver

When we come to consider the receiver itself, there are so many parts which can go wrong that it is rather difficult to describe makeshifts which will apply in every case, and, it is, therefore, only possible to deal with a few of the more common faults, and rely upon the individual to ascertain that which will most satisfy the requirements of the moment. With the H.F. type of receiver, for instance, a fault in the H.F. stage, whether due to a broken component, disconnected lead, or faulty valve, may be overcome by cutting out the stage completely. In the case of the S.G. type of valve, the lead which is joined to the cap on top of the valve should be taken as the input to the next stage, and, therefore, it will only be necessary to join the aerial to this lead in order to completely eliminate the H.F. stage or stages. The tuning range will, no doubt, be altered, and, therefore, it is advisable to connect a fixed condenser, having a value from .0001 to .0005 mfd. between the aerial and this lead, in order to enable the lower wave stations to be heard. If two or more H.F. stages are in use, the aerial should be joined to each anode lead in turn, as it may happen that the second or third stage has broken down, but this can, of course, be quickly ascertained. If the detector stage has failed matters are rather complicated, and, although the first L.F. valve may be biassed down to act as an anode-bend rectifier, it will probably be necessary to arrange a direct connection from the H.F. anode to the grid of the L.F. valve. If the coupling between detector and L.F. stage is of the R.C. type, it may only be necessary to run a wire from the anode of the H.F. valve to the anode of the detector valve, and this may quickly and conveniently be done by twisting a wire round the anode leg of the detector valves and reinserting it in the valve-holder, the other end of the wire going to the cap on the H.F. valve. Care should be taken that the wire does not touch any leg other than the anode. If the H.F. valves are of the ordinary unscreened type the anode legs may be used in a similar manner to eliminate a stage.

The L.F. Side

On the low-frequency side a similar arrangement will permit of a stage being eliminated completely, although it may be found in some cases that slight instability is introduced by doing this. However, the measure is only intended to be a temporary one, and, if the item is so important that the makeshift has to be made, then obviously the slight disadvantages must be tolerated. If the output valve is at fault, it will probably prove most desirable to change over the L.F. valve and the output valve, and to bridge the stage with the anode-to-anode wire as above-mentioned. This will be preferable to endeavouring to include the loud-speaker in the anode circuit of a preceding stage in view of the various alterations which would have to be carried out. If, of course, the coupling unit between the output stage and the valve preceding it has failed, the anode-to-anode lead may again be adopted.

A Christmas Message from the Editor

This issue, which constitutes the second Christmas Number since the advent of No. 1, marks another milestone in the history of the paper. The festive season is appropriate to retrospect, and we can look back on the year's progress with satisfaction, and in the knowledge that we have enjoyed the cordial and loyal support of a vast and ever-growing band of enthusiastic readers. We are assured by prominent members of the radio component industry that we have been largely responsible for the remarkable increase in confidence and interest in home-constructed receivers evinced since No. 1 of "Practical Wireless" was published. We are encouraged, by the sheer enthusiasm of our readers, to believe that our efforts to provide home constructors with a 100 per cent. practical paper have been universally appreciated. We shall continue our efforts to provide the reader with fresh ideas, a new outlook, easily understood subject-matter and illustrations on every practical branch of radio. Our sincere thanks to our readers and to the industry for their wholehearted co-operation.

THE EDITOR.

Substituting Valves

If the breakdown is due to a broken valve it is worth while remembering that a valve of a different type may be employed, temporarily, in a position other than that for which it is strictly intended. Thus, a simple triode may be used in place of a pentode output valve, although it may be necessary to complete the anode connection if the pentode is of the four-pin type. Practically any type of valve, other than an S.G. valve, may be inserted temporarily in the detector stage and will give signals, of a sort, whilst on the H.F. side any type of H.F. valve may be used in place of the faulty valve, provided it is of the same class, that is, triode or tetrode. It is not worth while attempting to use one in place of the other in view of the possibility of introducing short-circuits to the H.T. supply.

The Fuse

In the event of a fuse being blown whilst making some connection, signals may be obtained by short-circuiting the fuse-holder, although it should first be ascertained that there is no actual short in the receiver which will result in damage to the valve. Thus, if the H.T. battery, for instance, is being connected up and the wander lead drops by accident on the accumulator lead or some other part where the short results in a blown fuse, it is obvious that the short will not exist when the battery is properly connected, and this should be carried out first and then the fuse removed and the fuse-holder shorted with a piece of bare wire.

All the above expedients are for battery or mains-operated valves, but it must be emphasized that, in the case of the latter type of receiver, it is essential that a full understanding of the character of the temporary modification is made, in case damage is done to the apparatus or even the house wiring owing to an overload in some part of the wiring system. It is better, therefore, to adopt the rule that where there is the slightest doubt about a makeshift connection the receiver should be left alone, and no temporary measures taken.

Fig. 5.—A temporary aerial system formed by capacity coupling with the house telephone system.

The YEAR'S PROGRESS in RETROSPECT

Stages in the Progress of Radio During the Year 1933 Reviewed and Discussed by OUR STAFF

WHEN we come to view the year in retrospect we are bound to admit that it has been one of the most astounding years in the history of the wireless industry. A substantial list could be compiled of the various stages which have marked the passing of the months, but presented in the cold form of a list or table the full moment of the individual developments would not be apparent. It will be food for refreshing thought, therefore, if we commence with the month of January and travel again over the year 1933 in order to see just what has been dreamed, discussed, and produced for the advancement of the "science" which is now part of our everyday lives.

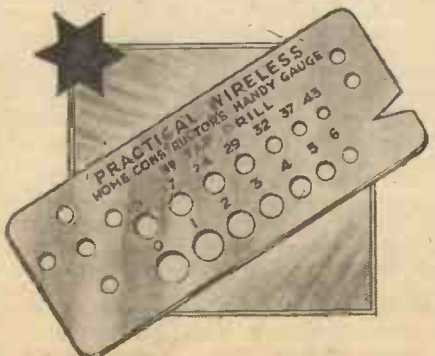
Event No. 2.—"The Wireless Constructor's Encyclopædia"—The Standard Work of Reference—the Presentation Volume which marked the publication of No. 1 of Practical Wireless, *and a new era in wireless journalism.*

The year was ushered in by manufacturer and home-constructor with renewed enthusiasm and added zest, primarily on account of the arrival a few months before of PRACTICAL WIRELESS. The industry was revitalized, and the home-constructor, who was beginning to feel that wireless as a hobby was dead, realized an awakening ambition when he first saw PRACTICAL WIRELESS appear on the bookstalls. The industry, too, renewed its activities, with the result that as January passed on its way a far greater number of listeners were making their own receivers or taking an interest in that branch of the hobby, which made its effect felt in the increased sales of components. Quite naturally, the progress of the art was given a much-needed fillip, and before long we were greeted with the news that with every issue of PRACTICAL WIRELESS on sale on January 28th a handy Free Gauge was to be included. Those readers who obtained this unique device will no doubt have found it invaluable, and we have had evidence of workshops that are provided with the tool on the benches.

Quiescent Push-pull

Next came the announcement that a new form of low-frequency amplification had been perfected, and this was known as Quiescent Push-pull. Two valves, for preference pentodes, were employed in a push-pull circuit, and biassed to the bottom of their anode-volts—anode-current curves to provide a large volume economically. It was hailed as a remarkable development which gave the user of a battery-operated receiver practically all the advantages of the listener with a mains-operated set. Unfortunately, before the home-constructor had time fully to study this interesting circuit arrangement a modification known as Class B arrived. It should be pointed out here that neither of these schemes was actually new, but in America they had been in use for some time. As, however, we are dealing with the year's progress in this country, they will be classed as new.

Event No. 1.—The "No Alternative" Specification and the Guarantee, which reawakened interest in home construction and enables a set to be built with the same confidence as when purchasing a ready-made receiver.



Event No. 4.—The Home Constructor's Handy Gauge, made of Steel, also presented free with Practical Wireless.

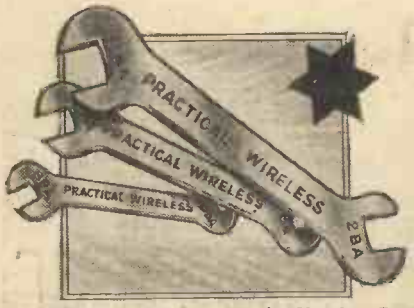
Event No. 3—The Handy Data Sheets, which were presented free with Practical Wireless.

Class B

For the Class B circuit a similar idea to that employed in Quiescent Push-pull, or Q.P.P. as it is known for short, was utilized, although instead of two separate valves a special valve was produced in which were built two grids, two anodes and a double filament. This possessed advantages not obtainable with the Q.P.P. circuit, and new transformers were speedily on the market. A new era was thus opened for the humble battery-operated set, with the result that quality requirements of the listener became improved, and thus the moving-coil loud-speaker came more into demand.

Iron-Core Tuning Coils

About this time, too, rumours were being heard through the trade of a new type of tuning coil which would revolutionize wireless receiver design, but full details were not forthcoming, and one could only speculate regarding the efficiency and practicability of the ideas which were mooted. We heard, for instance, that the tuning condenser would probably become obsolete by the end of the year; that selectivity would reach such a high degree that transmission circuits would have to be modified; that receivers would become of such small dimensions that the "cigar-



Event No. 5.—Our set of Handy Steel Spanners, given free with recent issues.

box" set would be the order of the day. The iron-core coil did not, however, appear until March, and we therefore had to wait and see. Towards the end of February we again made our stupendous offer of the Wireless Constructor's Encyclopædia, a volume which should be in the possession of every interested home-constructor. The response was amazing, and the tribute which we received from readers showed that once again we had hit the mark and introduced something which had heretofore been lacking.

Push-pull Detection.

At the beginning of March we erected another milestone by introducing for the first time a 3-valve receiver employing two valves for the purpose of push-pull detection. This marked a further stage in the improvement in home-constructed receivers, and was later improved by using one of the special Class B valves which appeared on the market.

The Cold Valve

During the month of March an interesting device appeared which was referred to commonly as the cold valve. Actually this was an ingenious form of metal rectifier, a small edition of the popular H.T. rectifier used in many battery eliminators, and it was looked upon as a valuable accessory in wireless receiver construction. Its principal use, of course, is as a second detector in super-heterodyne receivers and for the purpose of automatic volume control. One is included, for instance, in the ingenious A.V.C. unit which forms part of the make-up of the "Orbit" receiver recently described in these pages.

The Super-heterodyne

The ether was by now becoming terribly congested owing to the increased number of stations and the high powers which were being adopted, and the super-heterodyne receiver became once more popular. Numerous articles were published in our pages dealing with the principles of this circuit, and the Supersonic Six was produced by our laboratory.

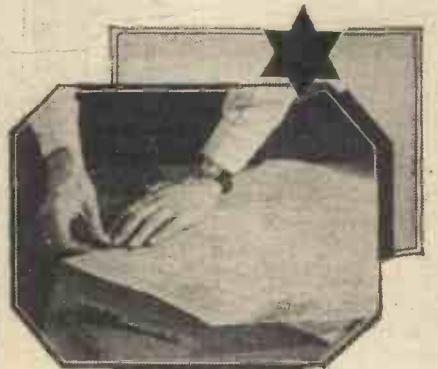
The iron-core coils were now being produced by one or two coil makers, and receiver design naturally improved, owing to the higher selectivity which was obtainable, and the reduced size of the coils. Coupled with the greater output of the Class B circuits, battery-receivers gave high quality, high selectivity, and great volume, and many old receivers were scrapped as modern outfits were built up. Swiftly on the heels of these progressive developments came a suggestion for utilizing a special valve as a combined frequency changer oscillator-detector in super-heterodyne receivers, and the device first appeared as an American product with the name Pentagrid, to be swiftly followed by the Ferranti valve which bore the English name Heptode. This enables a super-heterodyne receiver to be built up with only four valves, but is, as yet, only available as a mains-operated valve. Amongst the other valve developments may be mentioned the special pentodes which have been developed for high-frequency amplification, and the double-diode types of valve. These employ two separate diodes for rectification and automatic volume control, and in one case combine in the same glass envelope a low-frequency pentode, whilst in other cases a simple three-electrode valve is included. At this stage, therefore, a super-heterodyne

Event No. 6.—Our Pocket Tool Kit, available to regular readers for a nominal sum.

may be constructed with apparently four valves yet having eight actual stages.

Automatic Volume Control

The method of compensating for a fading signal by using a cold valve or a double-diode valve was now past the



Event No. 7.—Another Practical Wireless *idea—our protected transfer print system, first introduced to wireless constructors in a recent issue.*

experimental stage, and receivers were being designed which incorporated one of these devices so that a distant station could be received and listened to without any inconvenience due to fading. The volume remained constant. By the time the Radio Exhibition had arrived, receivers were obtainable which were absolutely beyond the comprehension of one who had been absent from radio for, say, twelve months. At least one coil of the iron-core variety was on the market in which was employed a device for varying the position of the core and thus making possible permeability tuning. This removes the necessity for the tuning condenser and thus brings true one of the dreams of the early part of the year.

Shortly after the Exhibition, we announced the gift with every copy of PRACTICAL WIRELESS dated Sept. 23rd of two steel spanners, designed to fit standard B.A. nuts, and which proved, like the gauge, invaluable to the home-constructor. This was followed the next week with the gift of another spanner to complete the set of three, and ere long the reader was astounded to see that we were offering for his use a splendid kit of tools, especially designed by the Editor, and made to fit the pocket. The spanners pack into the case of the kit, and every tool required by the constructor is there at hand.

At the moment there does not seem to be anything drastically new in the offing, but who knows what may be waiting in the laboratory of some research worker, ready, as soon as the necessary finishing touches have been put to it, to render still more perfect the wireless receiver of the day?

LATE NEWS

READER'S ADDRESS WANTED

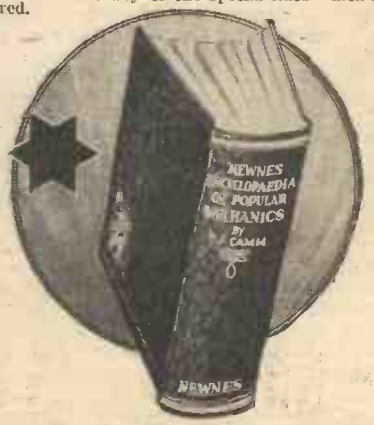
The 362 Valve Company inform us that they have received a letter from Mr. W. G. Nickolson enclosing a P.O. for 3s. 6d., purchased at Lydd in Kent. The envelope bears the post-mark, Ashford, Kent. Unfortunately Mr. Nickolson was in such a hurry to order a valve after reading one of this firm's advertisements in this journal that he omitted to give his address, and the 362 Valve Company would, therefore, be glad to hear from him in order that they may execute his order.

R. AND A. "MULTEX" MODEL

Messrs. Reproducers and Amplifiers Ltd. of Wolverhampton, have introduced a new and universal Reproducer at a popular price, and which is supplied either in cabinet or chassis form. This is the "Multex," and it is fitted with a transformer which is truly "all purpose," and which matches any type of output load. This transformer is designed on the same principle as transformers which R. and A. have used in their factory for matching purposes during the past three years. One of the greatest points about the "Multex" is that, apart from the fact that as an extension instrument, it can be used with the output from any receiver whether commercial or home built, no matter what output valve, transformer, or choke may already be incorporated, but it can also be used as an original speaker, that is directly connected in the plate circuit of any output valve, whether high or low impedance Triode, Pentode, Class B, Q.P.P., or Push-Pull; consequently, only one model need be stocked. The "Multex" is listed at 45s. in a walnut finish cabinet, and 30s. in chassis form.

E. J. HERAUD LTD.

Readers who are looking for some really good bargains should write to Messrs. Heraud whose premises are situated at Number One, Edmonton, London, N.18. Five shillings will secure any of the well-known makes of component, and the easy terms which they offer will enable everyone to partake of some little improvement at a small cost. This Mail Order House has been in existence now for many years, and all goods are sold on straightforward terms with a Money Back Guarantee. Seven Days' Free Trial is also obtainable for many of the special lines which are offered.



Event No. 8.—The Presentation Encyclopædia of Popular Mechanics, for which regular readers are now qualifying.

A Ferranti Transformer *cannot* be cheap

Here are the three special insulating formers with their moulded-in pegs for external connection anchorage. Note the air-spacing for windings, and the absence of paper, cotton, or other hygroscopic material which causes breakdown.

These are the wound formers—three and a half miles of wire in an AF5! Winding is done by compressed air turbine driven machines—thus avoiding all trace of mechanical stress which is inseparable from direct driving.

The completed AF5—neat, compact, without an equivalent.

It is true to say that every part of a Ferranti Transformer is an engineering masterpiece involving expert design, experienced choice of material, and meticulous care in workmanship.

As an instance, take only the windings of an AF5. (A similar structure is employed in nearly all Ferranti Audio and Output Transformers.) The unretouched photos tell their own story; the captions give interesting details.

Add to these points the fact that Ferranti Transformers were the first to give good results even in the early days when the characteristics of valves made quality reproduction far more difficult than it is to-day, and you will know just why FERRANTI Transformers are the first choice of expert radio engineers, and why it is well worth paying a little extra for a quality product.

FERRANTI

TRANSFORMERS

PRICES:

AF3	Ratio 1/3.5 Inductance 220/60 Henrys	25/-
AF5	Ratio 1/3.5 Inductance 260/80 Henrys—	30/-
AF6	Ratio 1/7 Inductance 50/90 Henrys	30/-
AF7	Ratio 1/1¾ Inductance 400/100 Henrys	30/-
AF8	Ratio 1/3.5 Inductance 20/45 Henrys	11/6

AF10 at 8/6 is of similar, though not identical, structure.

Write for Lists

FERRANTI Ltd. HOLLINWOOD, LANCASHIRE

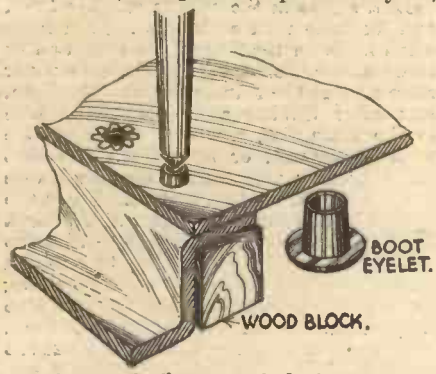
London: Bush House, Aldwych, W.C.2

READERS' WRINKLES

THE HALF-GUINEA PAGE

Riveting a Metal Chassis

AN efficient and neat method of fastening a metal chassis together can be executed by using boot eyelets, which are easily and cheaply obtained from most shoe repairers. Drill the holes so that the eyelets will pass through with a minimum of play, place the head on a wooden block, and use a centre punch to spread the eyelet,

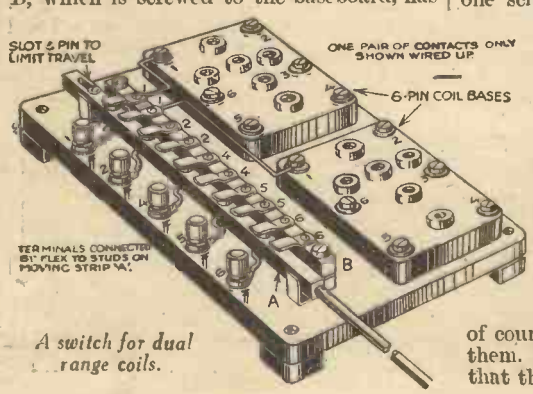


A neat and efficient method of joining a chassis together by means of eyelets.

finishing off with light taps using a small hammer. Where it is necessary to bring wires through the metal chassis the use of an eyelet in the hole will prevent the insulation from becoming worn through, thus preventing a possible short circuit.—A. H. DENTON (St. Heliers).

A Switch for Dual-Range Coils

THERE must be many readers who possess receivers in which the tuning coils are of the interchangeable six-pin type, and when it is desired to change from one wave-band to the other, it is necessary to open the cabinet and change the coils. The switch shown in the accompanying illustration will give all the advantages of a dual-range coil with no extra expense, beyond that of a second six-pin base. The two are mounted on a wooden baseboard, and alongside is mounted the wave-change switch. This consists of a moving strip A and a fixed strip B, both of ebonite, the former being drilled to carry five cheese-headed brass screws. The strip B, which is screwed to the baseboard, has

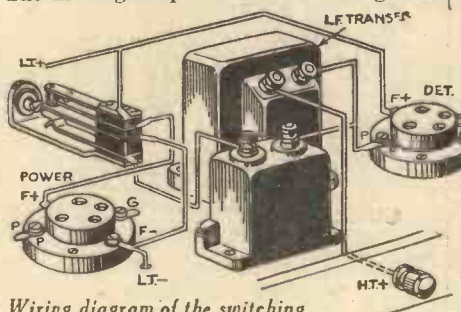


A switch for dual range coils.

THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

ten contact fingers of springy brass fixed to it by screws and nuts, the pitch of the holes being half that of those on the moving strip. Two distance pieces keep the heads of the screws clear of the fixed strip. The contact fingers are wired in pairs, each being connected to a similarly numbered terminal on each six-pin base alternately. The moving strip is carried in two guides



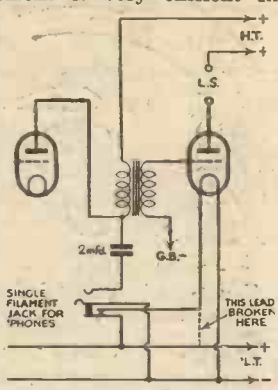
Wiring diagram of the switching device shown in theoretical form in the next column.

made from sheet brass, bent to the shape shown. The five terminals on the left of the baseboard are connected to the screws on the moving strip by means of flex. All that is necessary now is to wire the switch in the set, using the terminals instead of the original six-pin base, and to place the long-wave coil into one base and the medium-wave coil into the other. Two points to note and which give the switch free action, are that the contact fingers should be of such a width that they make contact with one screw head before leaving the other, and that the edge of the screw heads should be rounded.—A. J. P. MORLING (Norwich).

Using L.F. Transformer Winding as a Choke Coupling

HERE is an idea for using the primary winding of the low-frequency transformer preceding the power valve as a choke coupling for head phones. This method has the advantage that high-resistance sensitive 'phones can be used without fear of damage to the windings, as, of course, no direct current passes through them. It also has the further advantages that the original wiring need not be interfered with and it is cheap to instal, the only items required being a closed circuit jack, and suitable plug for attachment to the 'phone leads, and a 2-μF condenser.

This arrangement is very efficient in use as it permits of very accurate tuning on the 'phones, and at the same time effects considerable economies in current consumption, as when the 'phone plug is pushed into the jack the filament circuit of the power valve is automatically broken, thereby saving the filament current taken by this valve, together with the heavy drain of H.T. current. When a station has been tuned to good strength on the 'phones, the plug is removed from the jack, the filament of the power valve being automatically switched on and the station is heard on the loud-speaker. The diagram of connections will make the system quite clear.—C. TAYLOR (Oldham).

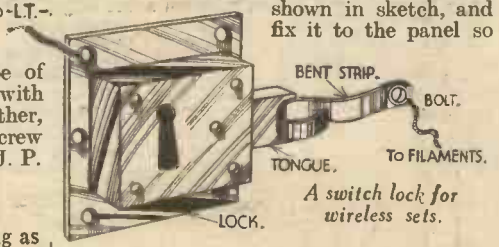


The circuit diagram for using L.F. transformer winding as choke coupling.

A Switch-Lock for Wireless Sets

A METHOD by which a set can be made so that it can only be used by authorized persons is as follows.

Obtain a small lock, such as is used on drawers and cupboard doors, a piece of springy brass or steel strip, and a few screws. Cut a hole in the panel for the key and mount the lock in the normal way behind it. Bend the strip to the shape shown in sketch, and fix it to the panel so



A switch lock for wireless sets.

that when the bolt of the lock slides out it makes a firm contact with the strip. Now connect a wire from the lock to L.T.— and connect the strip to filaments of the valves. The set can now only be switched on by those in possession of a key to fit the lock.—R. FOTHERGILL (Leeds).

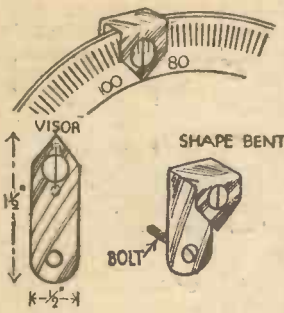
If you are qualifying for our Pocket Tool Kit or our Encyclopædia of Popular Mechanics, see the special announcements on pages 576 and 604 of this week's issue.

READERS' WRINKLES

(*Continued from preceding page*)

A Neat Dial Indicator

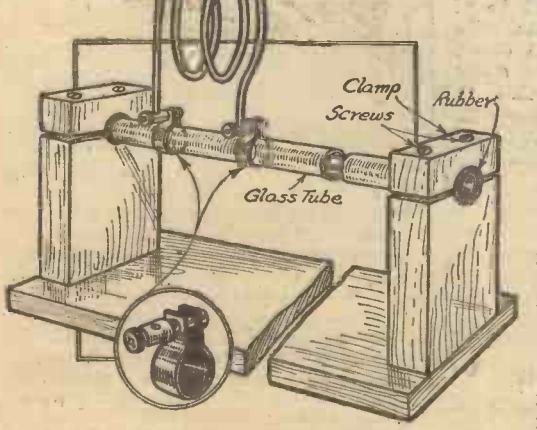
MANY readers still use three and four inch dials without slow-motion attachment for various apparatus and often find it difficult to obtain a precise indication of the dial reading, especially when they have to rely on a scratch mark on the panel. A very efficient indicator giving a very clear and accurate reading can be made from a small piece of aluminium scrap or an old condenser vane. It should be cut 1½in. long and not quite ½in. wide, pointed at one end, and two holes drilled as shown, one for bolting to the panel, and the other acting as a visor. This can be trimmed round or square, as desired, about ½in. across. A small piece of white bristle is fixed across this hole with a dab of Seccotine on the underside. The strip is then bent to the angle of the dial so that it is close to the surface. The pointed tip indicates the numbers and the hair line the degrees. This little gadget is surprisingly helpful in tuning.—H. P. ALDRIDGE (Barnsbury).



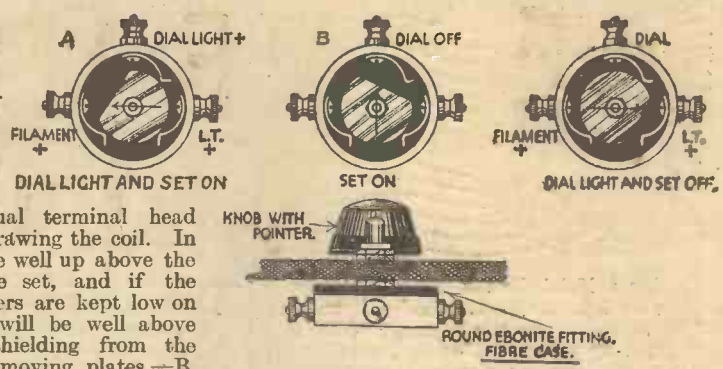
How to make a neat dial indicator.

Mounting Ultra-Short-Wave Coils

THE arrangement shown in the sketch is easily put together to hold short-wave coils when trying out various circuits and different coils. Two pieces of wood ½in. thick by 1½in. wide, as at A, support a length of ½in. diameter glass rod long enough to accommodate three coils, and to allow for changing the spacing between coils. Supports A may be fixed direct on to the set baseboard, or may have their own base. At 2½in. up a hole is made in each end larger than the glass rod, or tube, to allow for a piece of rubber being placed round the glass as shown. The ½in. wide slit is taken right across the hole, forming a cap, which is held down by two wood screws, but not so tight as to split the glass. Brass clips are bent round a rod less than ½in. diameter, and when complete with terminals and nuts are sprung on to the glass rod, set in position according to spacing of coil ends, and clamped tight; leads from the clips going to the other components of the circuit are soldered on. Coil changing is done by slacking the usual terminal head screw and withdrawing the coil. In use, the coils are well up above the baseboard of the set, and if the variable condensers are kept low on the panel, coils will be well above any end plate shielding from the condensers and moving plates.—B. PEDDER (Southgate, N.14).



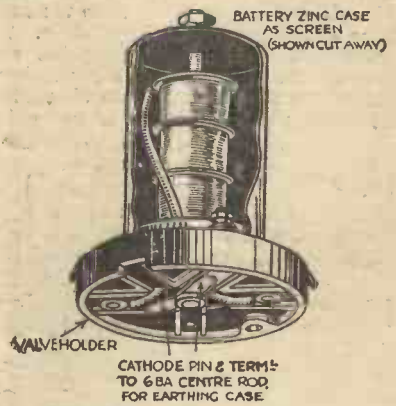
An efficient method of mounting short-wave coils.



Details of the rotary battery- and dial-light switch.

An Easily-Made H.F. Choke

THE accompanying sketch shows a home-made H.F. choke, which is made from odds and ends out of the scrap box. The base is a valve-holder, and the former is a piece of lead-in tube on a 6 BA rod, and is wound by wire from an old transformer. The cover is taken from a 3-cell torch dry battery. On test, the choke was very efficient.—W. COFFEY (Ashton-under-Lyne).



An easily-made H.F. choke.

Rotary Battery- and Dial-light Switch

A ROTARY type of switch that has a knob in harmony with the tuning knobs on the panel is shown in the accompanying sketches. It is easily made with a few odds and ends. The switch has three terminals; one going to the L.T.+ on accumulator, one to the dial light (if necessary), and the other to the + filament of the power valve.

The set is switched off when the knob points left, and on when the knob points right. The dial light is also on, but is turned off by pointing switch knob upright after having found the station required.

The materials required are: An old condenser spindle, bush and knob; a round piece of brass about 1in. diameter, and ⅛in. thick; a piece of fibre or ebonite tube about 1½in. diameter by ½in. to 1in. long, a round piece of ebonite to fit tightly into the tube or ring, three small terminals, and three contact springs.

Shape a piece of ebonite to fit tightly into the fibre or ebonite case, and fix with strong adhesive. Cut a small section from the ½in. brass disc, and shape it as shown in the sketches.

Drill a hole in the case to suit the bush, and fix same with a lock-nut. Drill three small holes on the side of the case, and fit terminals and contact springs in the manner shown. Put the spindle through the bush, and after drilling a suitable sized hole in the brass disc, secure it to the spindle with a lock-nut, or by solder. See that when turning the spindle the brass disc is touching the contact springs. When the disc is in the position shown at A, file a little notch in the brass for the + filament spring to engage. Turn disc to position B, and file another notch for the same spring to engage again. The two notches give a snap action in the three positions, and suggest stops. — CHARLES GREAVES (Birtley).

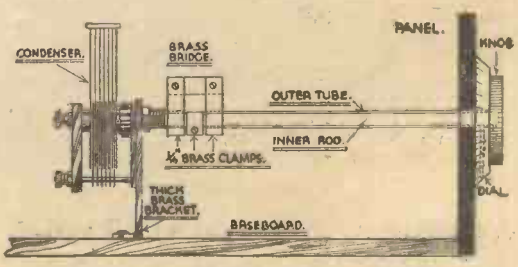
Extending Condenser Spindles

THE following is a good method of extending the spindles of condensers with slow-motion dials of the concentric spindle type.

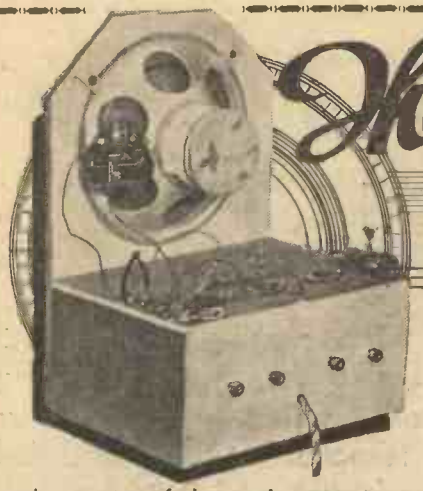
The parts required are: 1 length of ebonite or hardwood rod ½in. diameter; 1 length of ebonite tubing ½in. clear inside diameter, a few scraps of sheet brass, and nuts and bolts.

A bracket is first made with a piece of brass strong enough to support the condenser. This is screwed to the baseboard the required distance behind the panel, and the condenser mounted in the ½in. hole made at the top.

The illustration shows clearly how the other parts are made and mounted. The tube is slipped over the rod, and the latter is connected to the inner driving-spindle by means of a small brass clamp. The tube is coupled to the dial-carrying spindle by means of two clamps, connected by as short a "bridge" as possible. The smaller clamp must be able to revolve under this bridge. These condensers are particularly smooth in working, and therefore no difficulty will be experienced in getting the dial and knob to grip the spindles.—G. T. WOODGER (Farcham).



The method of extending condenser spindles with slow-motion dials.



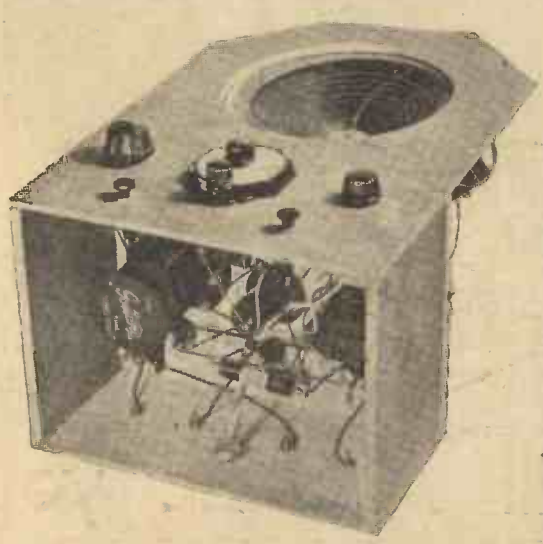
The 60/- Three

A rear view of the complete receiver.

THERE have been a number of requests for a simple and cheap receiver which will give good loud-speaker results from a fair number of stations, and yet which will not be hard to construct. We have given much attention to this problem, but have found that it is not possible to keep the price to a very low minimum without sacrificing a great deal of efficiency. Efficiency is required in any receiver, and it is true that a three-valve receiver could be constructed for a sum lower than three pounds, but so much would have to be sacrificed that it would not be worth while building up such a receiver. As an instance of the care which has been exercised in designing this particular receiver, it may be mentioned that a moving-coil loud-speaker has been included. The amount which has been mentioned does not, of course, include the valves nor the batteries, but these will not account for much.

The Circuit

An examination of the theoretical circuit (Fig. 1) will show that the old and tried arrangement of detector and two low-frequency stages has been incorporated, and although this cannot be classed as an arrangement designed for station getting there is no doubt that a detector valve, when properly handled, can give a really good account of itself. For instance, a circuit of this nature will provide in London no less than twelve stations at comfortable loud-speaker strength, and there is the added advantage that very little likelihood of instability will arise. In addition, the circuit arrangement does not require any great care in setting up in view of the absence of the high-frequency stage. The coupling between detector and first L.F., stage is by means of the resistance-capacity principle, and the anode resistance is of the variable type in order that it may be used to provide a volume control. The arm of the potentiometer which is used for this purpose is joined to the coupling condenser, and thus it may be moved to tap off any desired degree of the signal voltage for application to the first L.F. grid. A simple L.F. transformer couples the output valve to the first L.F., and the only point of note here is the inclusion of a high resistance between the grid terminal of the valve and the grid terminal of the transformer in order to remove possibility of oscillation. The loud-speaker is fitted with an input transformer and this is included direct in the anode circuit of the output valve, and thus removes the cost and necessity of providing an output-filter circuit. It will, of course, be necessary to choose an output valve which will not pass too great a current through the primary, although, with the majority of battery valves which are available, there is little risk of causing distortion of other troubles from this source.



This original view of the receiver shows how the components are arranged below the chassis.

The Layout

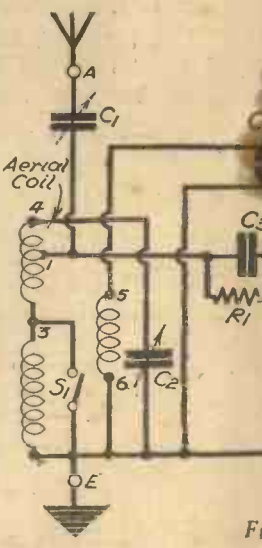
The photographs will show that the entire receiver, including the speaker, has been arranged on a form of cabinet chassis, which while complete in itself may yet be inserted into a cabinet of suitable design. Thus the receiver may be set up and tested, and when finally complete may be placed into any type of cabinet required. Alternatively, a framework may be placed round the chassis and the front of this may be cut out with some form of design instead of the plain hole which has been cut in the experimental model which is illustrated. The valves are the only components which are included on the top of the chassis, all other components, including the tuning coil, being enclosed in the lower portion of the receiver. The grid-bias battery has been left in this receiver in a readily accessible position, although there is really no need to adjust this after the preliminary setting-up has been carried out. Aerial, earth and pick-up terminals are fitted on the rear of the chassis, and these are fitted direct to the wood, a practice which can lead to no difficulties, provided the receiver is not placed in a damp position. The spacing between them will ensure that there is no loss.

Construction

The construction is best carried out in the following order. The front of the chassis should be cut from ¼in. ply-wood, no thicker material being used unless it is intended that the front will be kept in the finished receiver by enclosing the remainder of the chassis. If this point is not borne in mind difficulty will be experienced in passing the control spindles through the front of the cabinet at a later period. When the front has been cut the remainder of the wood for the chassis should be cut from three-eighths ply, whilst the rear portion is best cut from some thinner material. By using plywood all risk of warping is avoided, and the structure will be firm without being unduly weighty. A sufficient quantity of wood should be purchased for about one shilling. Drill the necessary screw holes for assembly, and from the wiring plan (Fig. 2) drill the holes through which the various wires pass, as well as those for the valve-holders. These latter are 1in. in diameter. Before assembling the chassis the valve-holders and other components should be mounted in their respective positions, and the loud-speaker fitted to the front portion, with the transformer in the lower corner, as shown by the illustrations.

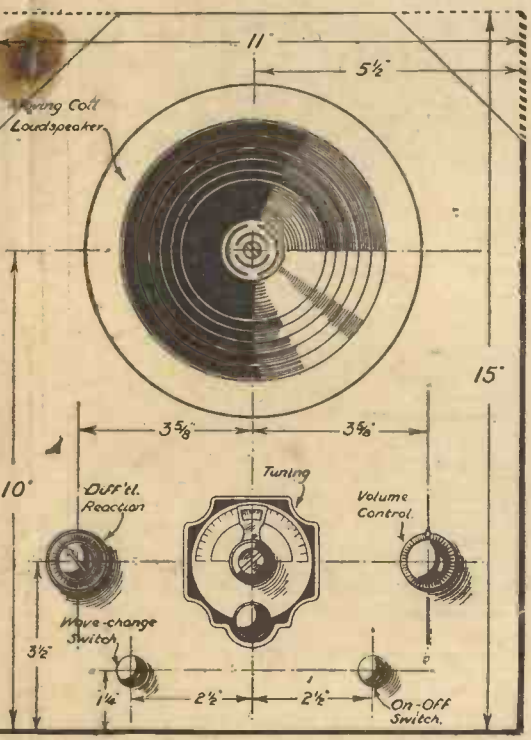
Wiring

The wiring will not be found difficult, but it is best to commence by putting in the filament leads, using the red and black wires if desired to denote the separate positive and negative circuits. Upon examination of the wiring plan, it will be seen that many wires couple components on the chassis, whilst others pass to the terminals and to the components which are mounted on the front of the chassis. Wire all those parts which are actually fitted to the chassis before

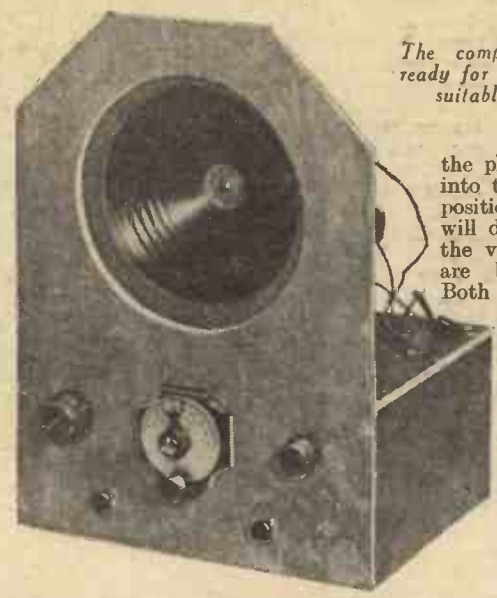


AN EASILY-MADE AND ULTRA EFFICIENT RECEIVER WHICH MAY BE BUILT AT LOW COST.

attempting to put the framework together, and when this has been completed screw the side of the chassis which is remote from the tuning coil to the front, and then place in position the upper portion of the chassis. Mount the tuning condenser, reaction condenser, volume control and switches, and carry out the wiring to these points. This will not be found difficult if you have followed the foregoing instructions. If, however, the chassis has been completely assembled, you will find great difficulty in getting at the terminals on the reaction condenser, for instance, and will probably only be able to complete the receiver by removing one side. The battery leads should now be passed through a three-eighths hole drilled in the centre of the rear section of the chassis, and a knot should be tied, as shown, to prevent the leads being pulled from their position. The position for this knot will easily be found by holding the back in position and roughly measuring the leads up to the on-off switch, which is the longest lead which is required. Now screw on the back and attach the battery leads to the various positions, using any colour of lead you desire. Attach the wires from aerial, earth and pick-up terminals and the wiring should now be complete. It will be noticed, of course, that soldering has to be adopted for the majority of the connections, but this is unavoidable where expense is being spared, and should occasion no difficulty to our readers by now. Many hints on soldering have appeared in our pages in the past, and provided the principal rule, "Keep the iron clean" is borne in mind, the work will be found extremely simple. Now before connecting up, the leads will have to be provided with the necessary plugs, and the wiring plan should be carefully followed to see that correct identification is given to the different leads. The short flexible leads for the grid-bias connections may be cut from a suitable length of twin flex, and, if desired, the red and black cotton covering may be retained for this purpose, or it may be removed and the plain rubber employed. The plug will offer sufficient identification.



Front dimensions of the chassis.



The complete receiver ready for insertion in a suitable cabinet.

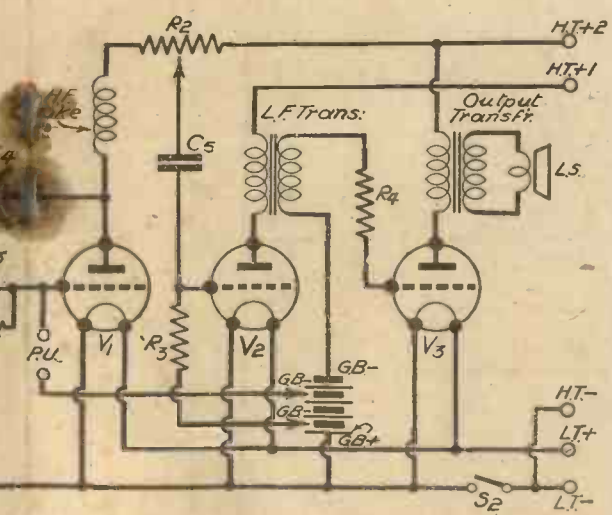
Adjustment

Plug a detector valve into the left-hand socket and an output valve into the socket at the other end of the chassis. Into the centre socket one of the L.F. types of valve should be used. The two flexible leads from the L.F. transformer and the anode terminals of the output valve should be joined to the centre and one outside terminal on the transformer on the speaker, and the grid-bias battery should be inserted in the clip and the plugs inserted into the requisite positions. These will depend upon the valves which are being used. Both switches should now be pulled out, when the receiver will be switched on and tuned to the lower wave-band. No difficulty whatsoever should be experienced in tuning in the local station, and it will be found that rotation of the right-hand control will bring volume up to maximum, whilst rotation of the left-hand control will introduce reaction for the purpose of bringing up the strength of weak and distant stations. The controls both work in a clockwise direction, so that the minimum position is obtainable by turning them both to the definite stop in an anti-clockwise direction. For the long waves the left-hand switch should be pushed in, when Daventry, Radio-Paris and the other long-wave stations will be found on the tuning scale. The volume control should not be left at its maximum position when receiving the local if this is situated fairly close, or distortion will be introduced due to overloading, and any poor quality should be corrected by reducing the volume on this control.

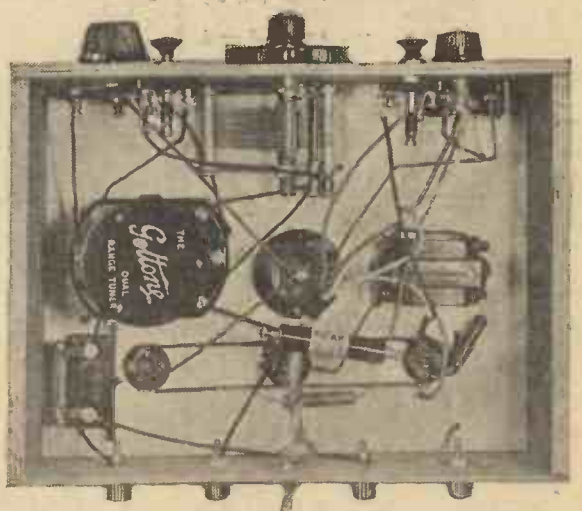
Gramophone Reproduction

For gramophone-record reproduction the

(Continued overleaf)



g. 1.—The theoretical circuit of the 60/- Three.



Sub-baseboard view to assist you in arranging the various components.

(Continued from previous page)

pick-up should be joined to the two pick-up terminals, and the plug marked G.B.3 should be inserted in a socket on the grid-bias battery at 1.5 or 3 volts. The tuning condenser should be set to its minimum position so that no interference is experienced due to the local station programme being heard above the gramophone record. No change-over switch has been incorporated on the ground of expense, and no trouble should be experienced, provided it is remembered that the grid-bias plug must be inserted for record reproduction, and must be removed for radio reproduction. The volume control (right-hand) will operate on both radio and gramophone records, and thus should a control be fitted to the pick-up this should be left at its maximum position and all the control carried out on the receiver. We are confident that this will prove a very useful family receiver, and when incorporated in a suitable cabinet will give trouble-free reception and will cost very little in maintenance fees.

LIST OF COMPONENTS FOR THE 60/- THREE

- One Goltone Type DW/8 Dual Range Coil
- One Graham Farish .0005 mfd. Tuning Condenser
- One Graham Farish .0003 mfd. Differential Reaction Condenser
- One Bulgin Type V.C.36, 50,000 ohms Volume Control
- One Bulgin Screened Midget H.F. Choke (H.F.8)
- One Ormond Type R/350/B Slow Motion Dial
- Two Bulgin Junior On-Off Switches (S.38)
- Three Chassis Type W/B Valveholders
- One Graham Farish Pip Transformer (3 to 1)
- One Goltone Type J Compression Condenser
- One Peak Type S Tubular .01 Condenser
- One Lissen 2 megohm Grid Leak
- One Lissen 1 megohm Grid Leak with wire ends
- One Lissen .0003 mfd. Fixed Condenser
- One Varley 100,000 Electric Resistance
- One Peto-Scott Moving Coil Loudspeaker
- One Bulgin Five-Way Battery Cable (B.C.3)
- Seven Clix Wander Plugs and Two Spades (One Red Spade, One Black Spade, One H.T.—, One G.B.+, One H.T.+1, One H.T.+2, One G.B.—1, One G.B.—2, and One G.B.—3
- One Bulgin No. 3 Grid-Bias Battery Clip
- Four Belling-Lee Junior Terminals (A, E, Pick-up and Pick-up)
- Two coils Bulgin Quickwyre, one red and one black
- Wood for framework, screws, flex, etc.

Top and sub-chassis wiring of the 60/- Three

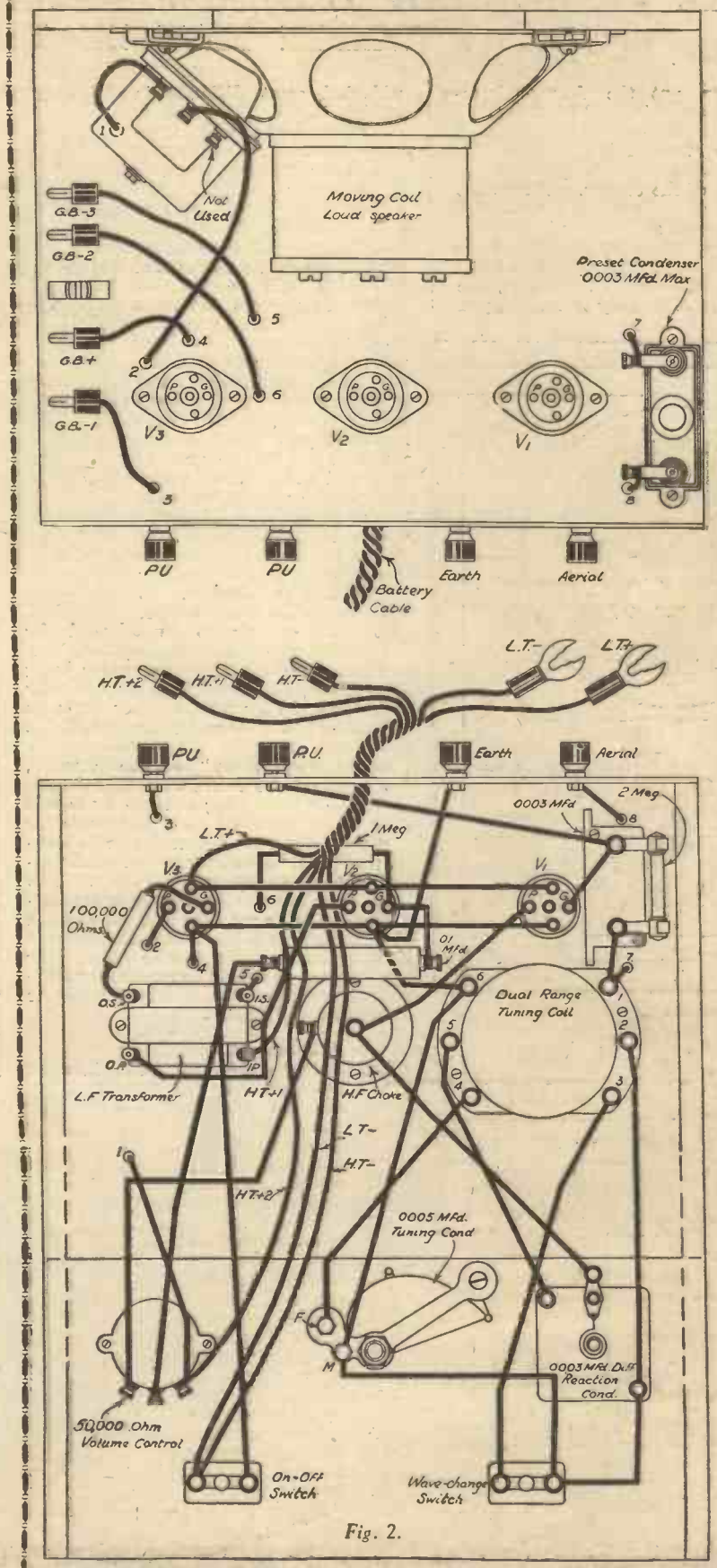


Fig. 2.

ONLY 22 WORKING DAYS TO XMAS ORDER YOUR RADIO NOW FROM PETO-SCOTT

READ THIS SATISFIED CUSTOMER'S LETTER . . . . .

Gentlemen,

Your letter of the 30th Oct. to hand. I think your **Extended Credit System"** a good idea and makes the public dealings with you a real pleasure; in fact, there is a personal contact observed between "firm and customer."

One way and another during the past 10/12 years I have obtained goods on the H.P. system from various firms, but never before have I had such a pleasure in dealing with a firm such as yours. For instance, the forms of agreement and pertaining letters I have received from other firms have been outlined in a stiff and (if I may call it) ah unfriendly manner, and one got the idea that these firms were conferring a blessing and privilege upon a customer in granting H.P. terms, which to customers does not go down very well.

I observed in your agreement with me it was stated that although the name of one's employer was given, the same would not be approached; now that is a sound idea.

I look up with you—an absolute stranger—received my form of agreement and a nice letter—I sent my first instalment, and almost by return received the goods (I at is another good oint in your favour—despatching the goods quickly).

Yours faithfully, J. A.

MANUFACTURERS KITS IN SEALED CARTONS

LISSEN KITS

NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL, complete kit comprising all components, including set of Lissen Valves. Cash or C.O.D. Carriage Paid, £5/12/6. Balance in 11 monthly payments of 10/3. Send 10/3 only

NEW LISSEN 7-VALVE SUPER-HET (Chassis Model), complete with Lissen Valves in Sealed Carton. Cash or C.O.D. Carriage Paid, £8/17/6. Balance in 11 monthly payments of 16/6. Send 15/- only

NEW COSSOR MODEL 341. S.G., Detector and Pentode, and Balanced Armature Speaker, complete with Cabinet. Cash or C.O.D. Carriage Paid, £6/7/6. Balance in 11 monthly payments of 11/9. Send 10/- only

MOVING COIL SPEAKERS

NEW BLUE SPOT 29 P.M. PERMANENT MAGNET MOVING-COIL SPEAKER. With input transformer. Cash or C.O.D. Carriage Paid, £1/12/6. Balance in 6 monthly payments of 5/-. Send 5/- only

NEW BLUE SPOT 45 P.M. MOVING-COIL SPEAKER with input transformer. Cash or C.O.D. Carriage Paid, £2/5/0. Balance in 7 monthly payments of 6/-. Send 6/- only

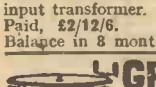
NEW LISSEN P.M. MOVING-COIL SPEAKER with input transformer. Cash or C.O.D. Carriage Paid, £1/5/0. Balance in 4 monthly payments of 5/6. Send 5/6 only

NEW W.B. P.M.4.A. MICROLODE PERMANENT MAGNET SPEAKER complete with switch-controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, £2/2/0. Balance in 7 monthly payments of 5/9. Send 5/9 only

ROLA F6P.M. PERMANENT MAGNET MOVING-COIL SPEAKER, with input transformer. Cash or C.O.D. Carriage Paid, £2/9/6. Balance in 8 monthly payments of 6/-. Send 6/- only

PETO-SCOTT CLASS "B" PERMANENT MAGNET MOVING-COIL SPEAKER. Complete with input transformer. Cash or C.O.D. £1/2/6. Balance in 5 monthly payments of 4/6. Send 2/6 only

NEW R. & A. "ALPHA" P.M. MOVING-COIL SPEAKER DE-LUXE, with tapped input transformer. Cash or C.O.D. Carriage Paid, £2/12/6. Balance in 8 monthly payments of 6/6. Send 6/6 only



GRAMO MOTORS AND PICK-UPS

B.T.H. MINOR PICK-UP AND TONE-ARM Cash or C.O.D. Carriage Paid, £1/1/0. Balance in 4 monthly payments of 4/6. Send 4/6 only

NEW GARRARD MODEL 202A. 12-in. Turntable. Electric Motor for A.C. mains. Cash or C.O.D. Carriage Paid, £2/10/0. Balance in 8 monthly payments of 6/-. Send 6/- only

PILOT AUTHOR KITS — Exact to Specification

SIXTY-SHILLING THREE

KIT "A" Exactly as Mr. Camm's Kit of parts including ready drilled wood for frame work excluding valves, Cabinet and Speaker Cash or C.O.D., Carriage Paid £2/7/0. Balance in 11 monthly payments of 4/8. Send 4/3 only

KIT "B" As Kit "A," including valves, but less Cabinet and Speaker. Cash or C.O.D. Carriage Paid, £3/9/9, or 12 monthly payments of 6/6. 6/6

KIT "C" As Kit "A," including valves and Peto-Scott M.C. Speaker, and Cabinet. Cash or C.O.D. Carriage Paid, £4/19/9. or 12 monthly payments of 9/-. 9/-

1 Set Peto-Scott wood parts for framework READY DRILLED and with holes cut for speaker and valve holder. Including Packing and Postage, ... 5/3

EXCLUSIVELY SPECIFIED

PETO-SCOTT PERMANENT MAGNET MOVING-COIL SPEAKER Cash or C.O.D. 15/-

PETO-SCOTT KOMPACT CABINET. A fine cabinet at a competitive price with vignetted front. Post and packing paid. 15/-

ORBIT

KIT "A" Author's Kit of FIRST SPECIFIED Parts, including Peto-Scott METAPLEX Chassis, but less valves, Cabinet and Speaker, Cash or C.O.D. Carriage Paid. **£5-5-0**

or by 12 monthly payments of 9/6.

KIT "B" As Kit "A" but with Valves only. Cash or C.O.D. Carriage Paid, £7/4/0. SEND ONLY 13/3 *Balance in 11 monthly payments of 13/3.*

KIT "C" As Kit "A" but with Valves and Peto-Scott Orbit Walnut Consolette Cabinet, but less Speaker. Cash or C.O.D. Carriage Paid, £8/5/0. SEND ONLY 15/3 *Balance in 11 monthly payments of 15/3.*

If W.B. P.M6A. Speaker required, add £1/12/6 to Cash or C.O.D. prices, or 3/- to each monthly payment.

EXCLUSIVELY SPECIFIED PETO-SCOTT CONSOLETTE CABINET.

Soundly constructed of the finest materials. Hand French polished. Selected and specified by Mr. F. J. Camm for the Orbit. Front ready drilled to take set. Cash or C.O.D. Carriage Paid 21/-

SEND FOR NEW CABINET CATALOGUE

IMPORTANT *Parts, Kits, Miscellaneous Components, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our System of Easy Payments. Send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent Carriage and Post Charges Paid, Great Britain only.*

PILOT CLASS "B" FOUR KIT

WITH COLVERN SCREENED COILS

Peto-Scott again triumphs with this up-to-the-minute CLASS "B" Battery 4 Kit at the right price. Provides super-selectivity and sensitivity with outstanding mains quality and seven times the volume of the ordinary battery set. Single-dial tuning; several coils; built on Metaplex. Comprises Variable-Mu S.G., detector, Class "B" power-driven and Class "B" output valves. Complete Kit (less valves) includes detailed "simple to build" instructions and Assembly Blueprint. A superlative Class "B" Kit with matched and tested components guaranteed for 12 months by Peto-Scott.

KIT "A" Cash or C.O.D., Carriage Paid. **£3-10-0** or 5/- deposit, and 12 monthly payments of 6/-.

KIT "B." As Kit "A," detailed above, but including 4 PETO-SCOTT matched and tested Valves. Cash or C.O.D., Carriage Paid, £5/5/6, or 12 monthly payments of 9/9.

KIT "C." As Kit "A," as detailed above, but including 4 PETO-SCOTT matched and tested Valves and Peto-Scott Consolette Cabinet, as illustrated. Cash or C.O.D., Carriage Paid, £5/18/0, or 12 monthly payments of 11/-.

YOURS FOR 5/-

Recommended PETO-SCOTT SPEAKER if required, add 22/6 to Cash Prices, or 2/- to each monthly payment.

NEW BLUE SPOT "CLASS B" OUTPUT STAGE As advertised. Complete with Osram B21 "Class B" Valve. Cash or C.O.D. Carriage Paid, 43/6. Balance in 11 monthly payments of 4/- Send 4/- only

ATLAS C.A.25 ELIMINATOR, for A.C. mains Class "B" or Q.P.P., four tappings: 60/80 50/90 120, 150 volt, 25 m.a. Cash or C.O.D. Carriage paid, £2/19/6. Send 6/- only

Balance in 10 monthly payments of 6/-.

ROLA & FERRANTI

NEW CLASS-B PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER, with Valve and Input Transformer. Two models: "A" for PM2B, PD220 and 220B; "B" for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid, £3/11/0 Balance in 11 monthly payments of 6/6. Send 6/6 only

FERRANTI CLASS "B" SPEAKER-AMPLIFIER Comprises Permanent Magnet Speaker, Class "B" Power and Output Transformers. Cash or C.O.D. Carriage Paid £4/4/0. Balance in 11 monthly payments of 7/9. Send 7/9 only

NEW FERRANTI CLASS "B" SUPER-POWER CONVERTER. Instantly converts your set to Class "B." Complete with Valves. Ready assembled. Cash or C.O.D. Carriage Paid, £3/3/0. Balance in 11 monthly payments of 5/9. Send 5/9 only

XMAS ORDER COUPON

PETO-SCOTT Co. Ltd., 77, City Rd., London, E.C.1
Telephone: Clerkenwell 9406/7.
West End Showrooms: 62, High Holborn, London, W.C.1. Telephone: Holborn 3248.

Dear Sirs:

(a) Please send me.....

(b) I enclose Cash/Deposit.....

NAME .....

ADDRESS .....

..... Pr.W. 2/12/33.

SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

The new Dario range is here!

Never before such value, such prices, such perfect reproduction as you now find with the new DARIO range.

Every new type and improvement.

2-VOLT BATTERY.

Screened Grid and Variable Mu S.G.	10/6
H.F. and Detector	5/-
Super Power	6/6
Class "B" Output	10/6
Pentode	10/6

DIRECTLY HEATED A.C. MAINS.

Output Pentode	12/6

INDIRECTLY HEATED A.C. MAINS.

Screened Grid and Variable Mu S.G.	12/6
Screened H.F. Pentode	12/6
Diode Tetrode	13/6
General Purpose	8/6
Output Pentode	12/6

POST THIS COUPON TO US

We will be pleased to send you our catalogue of the latest DARIO Valves. You will be astonished both by the completeness of the range and the very low prices.

PR.W.

Name.....

Address.....

.....

To IMPEX ELECTRICAL LTD., 47, Victoria St., Westminster, London, S.W.1. Telephone: VIC. 3914. Telegrams: Dariolect, Sowest, London.

Connecting & Using the Microphone

A Microphone is a Useful Adjunct to a Wireless Receiver, and This Article Simply Explains the Best Methods of Connecting it

NOVEL methods of providing entertainment, and new ideas for parlour games, are always in great demand at Christmas when parties are the order of the day. Those who have a wireless receiver, even of the very simplest type, are in a fortunate position in having at their disposal a ready means of introducing to their friends numerous forms of home entertainments which will prove of great interest to both technical and non-technical guests alike.

No end of amusement is to be obtained by using a microphone in conjunction with the standard receiver, and there are now on the market at least three microphones made especially for entertainment purposes. All three can be bought quite cheaply, despite the fact that they are extremely well-made; any reader can be recommended to make himself a Christmas present of one of them.

Connecting a Microphone to the Set

It is a perfectly simple matter to connect, a microphone to a wireless set in order to "broadcast" through the loud-speaker voices and music produced in a room away from where the set is installed. The actual method of connection depends partly upon the receiver in use and also upon the microphone employed. We will assume, in the first place, that the set is already provided with pick-up terminals (it does not matter in the least whether it is battery or mains operated) and that a microphone such as the G.E.C. "Home Broadcaster," which is equipped with a suitable input transformer and internal battery, is to be used with it. All that is required is to connect the two leads from the microphone to the pick-up terminals and *suitably position* the microphone and speaker in respect to each other. After that anyone can speak or sing into the microphone, or the instrument can be placed near to a piano or other instrument, when good reproduction of thespeech or music will be obtained from the loud-speaker. The two words "suitably position" used above in respect to the micro-

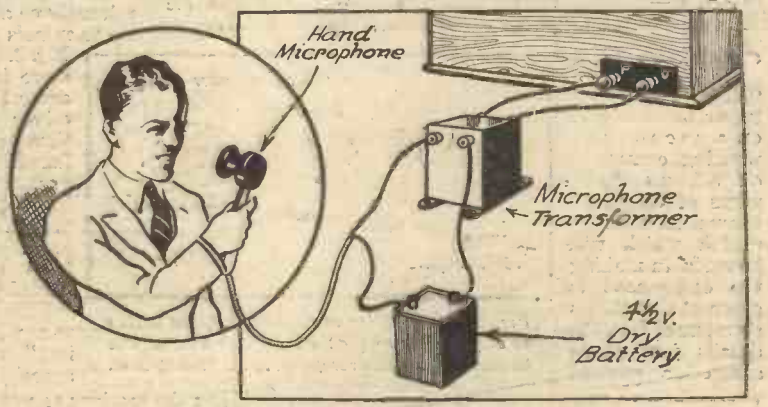


Fig. 1.—This sketch shows how a microphone, of the type not provided with a transformer and battery, can be connected to the pick-up terminals of the receiver.

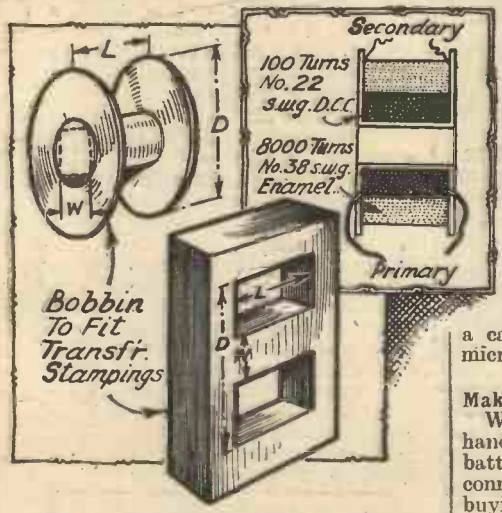


Fig. 2.—Some useful data in regard to the construction of a microphone transformer is given in the above sketch.

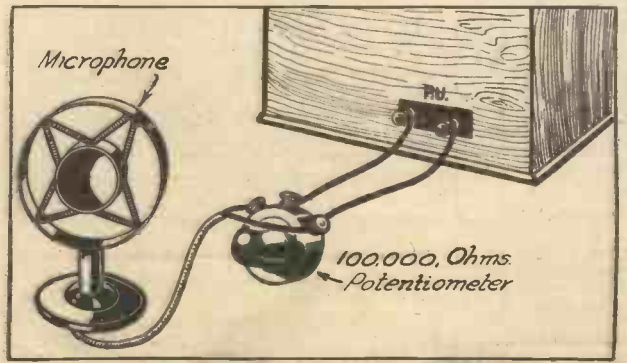


Fig. 3.—A simple method of connecting a volume control between the microphone and set.

phone might not be quite clear to some readers, but they are extremely important. The point is that if the microphone is placed within range of the speaker a most annoying "howl" will be set up due to the sound from the speaker returning to the microphone, passing through the amplifier to the speaker, and then being returned to the microphone again. For this reason it is generally preferable to place the microphone in one room and the set in another. If the leads attached to the "mike" are not already long enough for this purpose they can easily be extended by means of special leads which are sold for the purpose, or even with ordinary twin flex.

If, for some special reason, it is found desirable to have the microphone and speaker "within range" of each other, the former instrument should be screened from the latter by means of a sheet of cardboard or by a cardboard "trumpet" placed near the microphone diaphragm.

Making a Microphone Transformer

When using a "mike" of the ordinary hand type a separate transformer and battery are needed. These should be connected as shown in Fig. 1. When buying the microphone it is best to purchase a transformer of the correct type at the same time, but if you already have a decent instrument on hand, made by a firm that does not supply a transformer for use with it, an output transformer (intended for coupling the last valve of a receiver to a low-resistance loud-speaker, and having a ratio of not less than 65 : 1), can frequently be used instead with every satisfaction. The windings must be "reversed"; that is, the secondary must be used as primary, and the primary as secondary. Another alternative is to make a transformer, a little job which does not present much difficulty. For this purpose you can make use of the laminated core from an old L.F. transformer after removing the windings. Make a bobbin to fit the centre limb, and wind on this approximately 100 turns of 22-gauge double-cotton-covered wire, cover this with two layers of empire tape, oiled

(Continued overleaf)

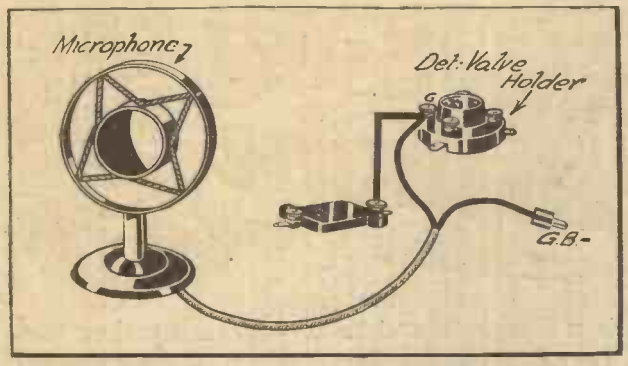


Fig. 4.—When pick-up terminals are not provided on the receiver, a microphone can be connected as shown above.

Continued from previous page.

silk or even waxed paper, and then put on a secondary winding consisting of about 8,000 turns of 38 gauge enamelled wire. A sketch which will be useful in making the component is given at Fig. 2. As a matter of fact, the details just given are of a general nature and will be correct for most types of the older microphones, but it is always advisable to carry out a few experiments in order to determine the optimum numbers of turns.

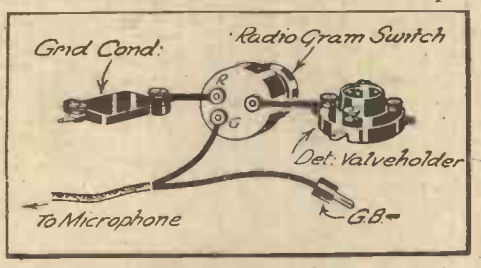


Fig. 5.—It is better to fit a radio-gram switch to the receiver so that an instant change can be made from radio reception to the microphone.

Volume Control

Very often it is desirable to have some control over the volume of output from the speaker, and if an L.F. volume control is not already fitted in the set a potentiometer should be connected between the microphone and the pick-up terminals as shown in Fig. 3. Even when there is already a control in the receiver the potentiometer just referred to is frequently desirable for the purpose of preventing the first amplifying valve from being overloaded (overloading is generally indicated when "blasting" is noticed on speech).

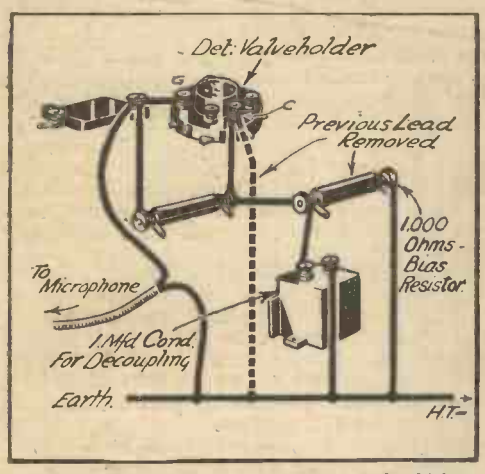
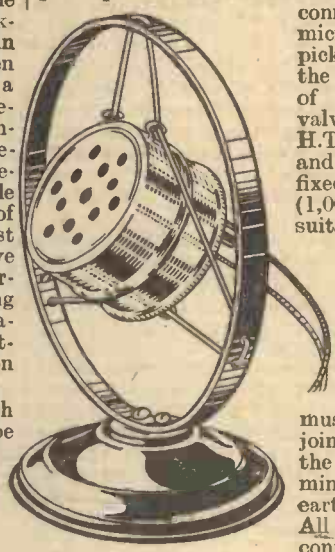


Fig. 6.—Showing how a microphone should be connected to a mains receiver which is not provided with pick-up terminals.

When the receiver is not fitted with pick-up terminals the microphone can be connected between the grid terminal of a valve-holder and a negative tapping on the G.B. battery in the manner shown in Fig. 4. The valve concerned will be the detector if the set has only a single L.F. stage or the first low-frequency one when two stages of low-frequency amplification are provided. The method of connection shown in Fig. 4 is very simple, but is inconvenient if frequent change-overs are to be made from radio reproduction to the microphone. For that reason it is better to fit a change-over switch in the position indicated in Fig. 5. The switch illustrated is one of the rotary radio-gram. variety, and although there are many other types which are equally effective I consider this to be the neatest. In mounting the switch on the receiver it is rather important to place it in such a position that the leads from it to the valve-holder and the grid-circuit component (grid condenser or L.F. transformer) are as short and direct as possible.

The above remarks apply only when the receiver is battery operated, and somewhat different connections are required in a mains set. With this kind of receiver it is nearly always best to connect the pick-up in the grid circuit of the detector valve, and that makes it necessary to provide some means of biasing the valve when the pick-up is in use. This can be done by connecting the microphone (or pick-up) between the grid terminal of the detector valve-holder and H.T. negative, and inserting a fixed resistance (1,000 ohms is a suitable value in practically every instance) between the cathode and H.T. negative. The grid leak must then be joined directly to the cathode terminal and not to earth, as before. All the necessary connections are shown in Fig. 6.



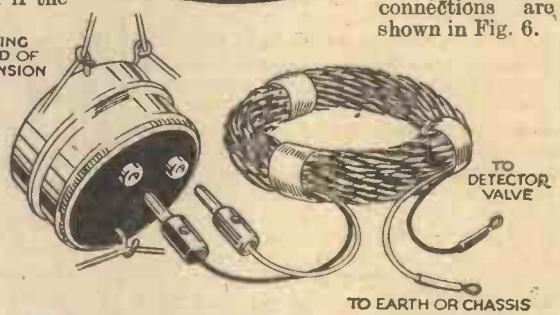


Fig. 8.—A new home microphone. This is the Scientific Supply Stores' model, and is available in two separate types. The Junior costs 12/6 and the De Luxe model, which has a greater output than the Junior, costs 17/6. The microphone is fitted with a liberal length of flexible connecting cord, and a bakelite disc is fitted to the end to simplify connection to the detector valve. The microphone is sensitive, and gives splendid results.

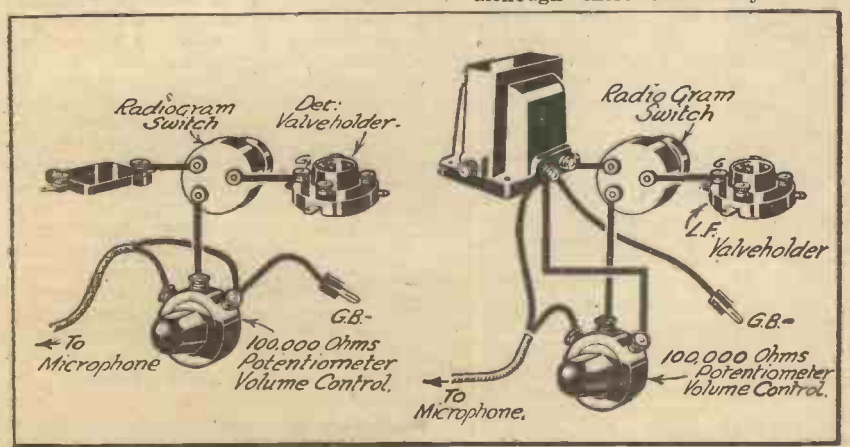


Fig. 7.—On the left the method of fitting both a change-over switch and volume control to the detector valve is shown. The method of making the same additions to an L.F. valve is shown on the right.

It is also a good plan to mount the volume control potentiometer on the receiver as well, provided that there is sufficient space without crowding, and the method of doing this is shown in Fig. 7. Where the valve concerned is the detector, the potentiometer should be wired as shown in the left-hand sketch, but if the microphone is being joined to an L.F. valve the right-hand sketch is the one that should be followed.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

MAKING A SCREEN-GRID ADAPTOR

THERE are, undoubtedly, hundreds of users of straight sets of the detector and two L.F. type, who feel the need for the extra range and selectivity associated with a screen-grid stage. They may not be prepared to scrap the old receiver and invest in a new screen-grid set, while at the same time the design of the old one may not readily lend itself to conversion. In a case like this the employment of an adaptor is probably the best solution to the problem.

The unit illustrated on this page is specially designed for this purpose, and is intended to be used in conjunction with any ordinary two or three-valve which has no H.F. stage. It is simple to construct and quite straightforward in operation. It also has the advantage that its use does not entail any alteration or modification to the receiver to which it is attached. It can be connected up in a moment and equally quickly removed, if necessary, leaving the old set "as you were."

The Circuit

The theoretical circuit is shown in Fig. 1. As you see, it consists of an ordinary dual-range coil and tuning condenser, followed by the S.G. valve, the output from which is fed through the condenser C.1 to the receiver. The aerial is disconnected from the receiver itself, and connected to the coil of the adaptor. In this way, the tuning coil and condenser in the adaptor forms the aerial circuit, while the coil and condenser in the receiver now becomes the tuned-grid circuit, as no earth connection is shown on the diagram; this is automatically obtained through the L.T.— lead. The earth connection to the receiver is thus undisturbed.

The valve is completely decoupled by the provision of the condenser C.2 between the screening grid and L.T.—, and the condenser C.3 and resistance R.1 in the anode circuit. These precautions, combined with the fact that a screened coil and screened choke are employed, reduce the possibility of back coupling from the adjacent receiver to a minimum.

Choice of Components

You will notice from the list of parts that the total cost of the adaptor is very reasonable, being in the region of 50s. (This includes the cost of the valve, which is, of course, the most expensive component.) But nevertheless, only parts of good quality are used. Needless to say, you should keep to the specification for optimum results, but at the same time, if the tuning coil in the receiver with which the adaptor is to be used is of an up-to-date pattern and screened, there is no reason why an identical coil should not be used in the adaptor. Also, the same pattern tuning condenser may be used. In this way, it may be possible to get the two dials to track together when tuning.

Construction

This is extremely simple, as you can see from the plan of the lay-out given in Fig. 2. The conventional panel and baseboard are used, as this is really the simplest arrangement for a small unit of this type, and allows of short and direct wiring.

The first thing to do is to mark out and

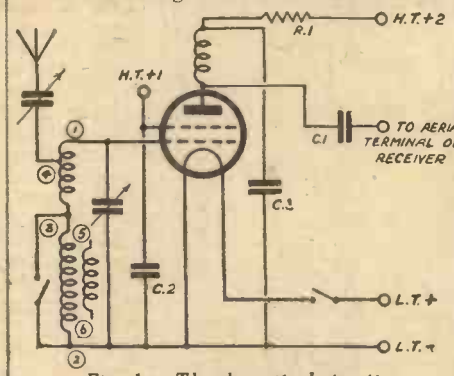


Fig. 1.—The theoretical circuit.

drill the panel, not forgetting three or four small holes along the lower edge to take the screws used for securing the panel to the baseboard. Of course, if desired, you could use panel brackets instead of merely screwing the panel to the baseboard, in which case a couple of holes will have to be drilled at each end of the panel to take the fixing bolts for the brackets.

Place the panel and baseboard together, temporarily using the brackets themselves as templates, and mark through the holes with a pencil. The holes can then be drilled, using the pencil-marked centres with the assurance that they are in the correct positions. When the panel is drilled the tuning condenser and the two switches are mounted in position, the complete panel is put aside while the rest of the components are mounted on the baseboard and wired up.

In preparing the baseboard, the first thing to do is to mount the ebonite terminal strip. This is 7in. long and 1in. deep, and is held in position with screws driven into the end of the baseboard. Six terminals, marked as shown, are mounted approximately 1in. apart. The rest of the components are now screwed to the baseboard in the positions shown in Fig. 2, and as much of the wiring is completed as possible. The wiring is carried out with stiff insulated connecting wire such as Glazite, and should follow the plan as closely as possible. When this is finished the panel and baseboard should be screwed together and the rest of the wiring, namely, the connections from the components on the panel to those on the baseboard, should be completed.

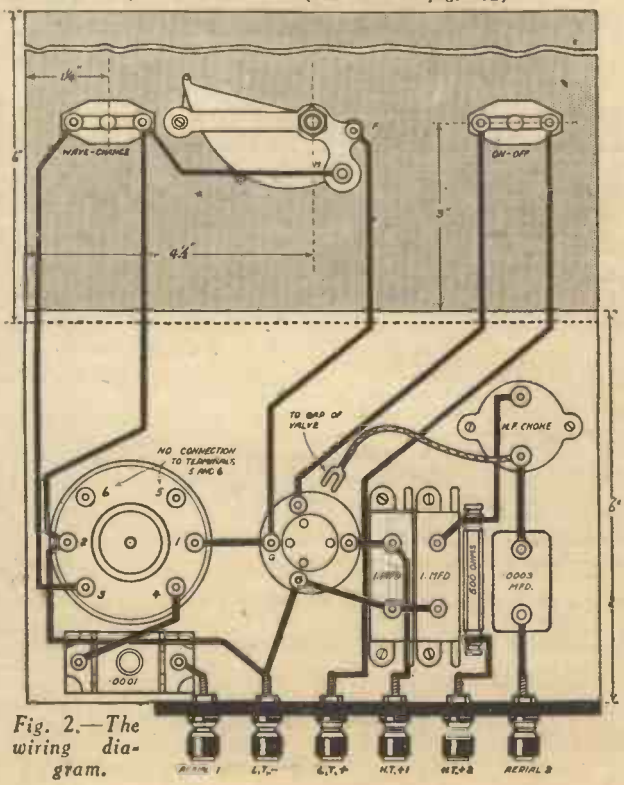


Fig. 2.—The wiring diagram.

How to Connect the Adaptor

The adaptor is now complete, and only needs a small cabinet. A conventional design for this is shown in Fig. 3. The unit slides in from the front, and if necessary, is held in position by a couple of screws passed through the panel, and driven into the small wooden bearers which are fixed to the inside edge of the cabinet. These bearers act as stops to prevent the panel sliding in too far.

Connections from the adaptor to the receiver are made with ordinary lighting flex or with a set of battery leads. If the latter method is adopted the lead from the terminal "aerial 2" on the adaptor must not be included with the battery cords. A separate piece of flex should be used for this, as it should be kept well away from the other leads. This lead from "aerial 2" goes to the aerial terminal on your set, while the aerial wire is disconnected from the latter and connected instead to terminal "Aerial 1" on the adaptor. The connections to the other terminals are as follows: "H.T.+2" joins on to the maximum voltage H.T. terminal on the set, while H.T.+1 is fitted with a wander plug and plugged in direct to the H.T. battery at about 60-80 volts. The terminals "L.T.+" and "L.T.—" are connected to the corresponding terminals on the set. There is one important point in connecting up these L.T. terminals. You

(Continued on page 602)

E.M. PLUS 4

Great New Development on the famous "EVERYMAN FOUR"

You remember the "Everyman Four"? Its amazing performance was obtained by using the most efficient coils that could be designed. Until now these coils have never been excelled or even equalled.

We set ourselves the task of adapting "Everyman" Coils to suit modern valves, and we succeeded. We claim, without fear of contradiction, that E.M. Plus Four Coils are the most efficient coils obtainable for modern H.F. amplification.

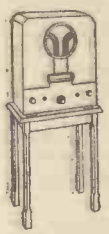
E.M. Plus Four Coils cost eight times as much to manufacture as any standard commercial coils. But, owing to their remarkable efficiency, the remainder of the set is simplified and the total cost is extremely low.

BETTER THAN A SUPER-HET

Compare the E.M. Plus Four with any other battery-operated straight set or super-het, using four, five, or even six valves. The E.M. Plus Four gives superior results without any of the usual super-het disadvantages.

Every valve contributes its full efficiency, so that signal strength is amazing whilst absence of complications prevent loss of quality.

Ease of handling, selectivity, signal strength, quality of reproduction, appearance, reliability—judge the E.M. Plus Four by any of these standards; compare it with any other set costing even twice as much, and you will choose the E.M. Plus Four.



Although the E.M. Plus Four is easy to build and operate, it is the only set that fully responds to the skill of the operator. The E.M. Plus Four is not only a set for domestic use; it is the set which every true constructor needs for serious work. Its scope is unlimited.

E.M. PLUS 4 MATCHED KITS

£4.17.6

OR 9/6 DOWN

and 11 monthly payments of 9/6.

(Complete kit, less valves, including everything you need to build the E.M. Plus Four exactly to specification, with full-sized chart and instructions.).

COILS OBTAINABLE SEPARATELY

For the benefit of constructors wishing to modernize their present sets, E.M. Plus Four Coils can be supplied separately at **27/6 per pair**

FULL-SIZED WIRING CHART FREE.
GO TO YOUR DEALER, OR POST COUPON NOW.

SPECIFIED MULLARD VALVES:
P.M.12V., P.M.2DX, P.M.1H.L., P.M.202 (or P.M.2).

CABINETS.

E.M. Plus Four Oak Consolette Cabinet with Moving-Coil Speaker £2.0.0

In Walnut, with Moving-Coil Speaker as illustrated £2.10.0

E.M. PLUS FOUR Pedestal, as illustrated, 15/- extra

READY RADIO

EASTNOR HOUSE, BLACKHEATH, S.E.3

Telephone: Lee Green 5678.

To READY RADIO, Ltd., Eastnor House, Blackheath, London, S.E.3.
Please send me a copy of the E.M. Plus Four Wiring Chart.

Name .....

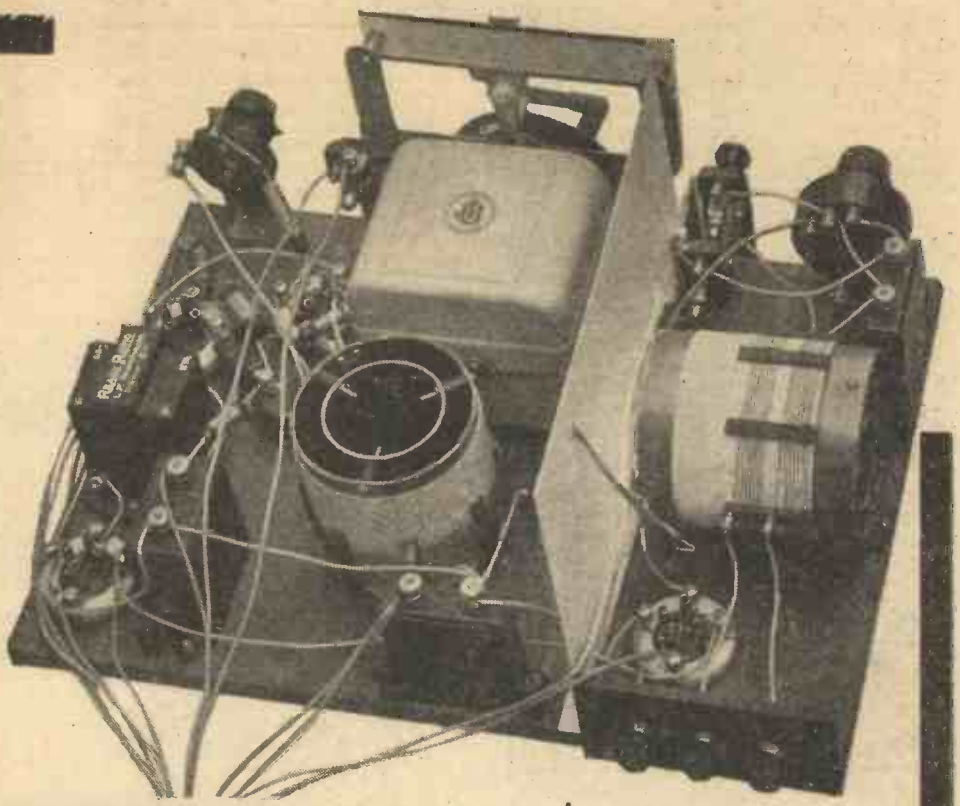
Address .....

.....

Pt.W.-1 Please enclose 1½d. stamp for postage, etc.

KIT

A serious contribution to radio Progress



SHEER COMMONSENSE

1. The length of a coil should not be greater than the diameter.	1. E. M. Plus Four Coils are 3ins. in diameter with a winding length of 2½ins.
2. Small coils mean small single-strand wire and increased D.C. resistance and "skin effect."	2. E.M. Plus Four Coils are wound with 27/42 gauge Litz wire, giving 90 per cent. greater efficiency than small single-strand wire.
3. Increased resistance means lower signal strength and selectivity.	3. E.M. Plus Four Coils introduce so little damping that signal strength and selectivity are extremely high.
4. Shields increase the distributed capacity and resistance.	4. E.M. Plus Four Coils are so designed that shields are unnecessary.
5. Losses in metallic cores increase as frequency increases. (Therefore, heaviest on medium-wave band.)	5. E.M. Plus Four Coils are air-cored, on low-loss formers, and give maximum efficiency on medium waves.
6. Band-pass tuners do not pass all the applied voltage, and losses are often as much as 50 per cent.	6. E.M. Plus Four selectivity makes band-pass tuning unnecessary, and maximum signal voltage is maintained.
7. In band-pass and multi-stage circuits slight discrepancies of tuning cause peaks of unequal strength with consequent loss of signal strength.	7. The E.M. Plus Four special trimming device gives constant accuracy at every setting.
8. By compressing the long-wave coil into small dimensions the losses and distributed capacity are increased enormously.	8. The Long-wave sections of E.M. Plus Four Coils are plain solenoids of large diameter.
9. Maximum voltage amplification is obtained with a tight magnetic coupling of low capacity.	9. The primary windings on E.M. Plus Four Coils are air-spaced and supported on ribs over the secondary windings.

Whether you built a set last year or last week you will build the E.M. Plus 4 sooner or later . . . . .

The set for the man who wants something better. The only set for the keen constructor and true experimenter.

FULL-SIZED WIRING CHART FREE

Our E.M. Plus Four folder contains full details of the complete set, with complete building instructions and full-sized chart. Ask your dealer for your free copy. If he is out of stock ask him to get you a copy. In case of difficulty post coupon.

Demonstrations at 159, Borough High St., London Bridge, or ask your radio dealer.

Advertisement of READY RADIO, Ltd., Eastnor House, Blackheath, S.E.3.

(*Continued from page 599*)

should first examine the circuit of your present set and see if the "L.T.−," "H.T.−" and "earth" terminals are all joined together. This is, of course, the usual practice, and if they are so connected, then all is straightforward, and you simply connect "L.T.−" on the adaptor to "L.T.−" on the set and "L.T.+" to "L.T.+." However, in some old circuits L.T.+, instead of L.T. −, is joined to earth. In this case, the connections from adaptor to set should be reversed, *i.e.*, "L.T.−" should go to "L.T.+" and "L.T.+" to "L.T.−." With the exception of the removal of the aerial from the aerial terminal on the set to that on the adaptor, as already explained, no other alterations are made to the existing connections to the set itself, the battery and earth connections being left unaltered.

Operating Notes

Having carefully connected up the adaptor the screen-grid valve may be plugged in and the cap connected to the flexible lead from the H.F. choke. An ordinary piece of flex with a spade terminal on the end will do for this. It should be only just long enough to reach from choke to valve cap.

When all is ready, both set and adaptor should be switched on. They should also both be switched over to the same wave-band. In the case of the adaptor the right-hand switch, viewed from the front of the panel, is the wave-change switch, and should be pulled out for medium waves and pushed in for the long waves. Before actually tuning-in, the pre-set condenser on the baseboard just in front of the coil should be screwed right down. This will give the loudest signals, and will help in finding stations when first handling the set. Later on, the screw may be slackened off slightly to obtain increased selectivity, if desired. Do not, of course, overdo the initial screwing down. There is no need to screw the knob home as hard as possible; just slacken off the locking nut, and turn it in a clockwise direction until just finger-tight. Tuning will now be carried out by means of the two dials—the one on the adaptor and the one on the set. Start by rotating them together from zero in each case. If the two coils and condensers are identical in pattern the dials should track round together almost degree for degree, but if they are not, then there may be a difference of several degrees between the setting of the one and that of the other when tuned to a station. Anyway, a little practice will soon determine the right position of the two dials for various stations. If you wish, you could make a list of the two dial readings for future use so that anyone else handling the set would immediately be able to log a required station by reference to the table. Incidentally, the readings of the receiver dial with the adaptor attached will not necessarily be the same as previously, so do not be surprised if a station which formerly tuned in at, say, 30 deg. on the dial, now comes in at 35 deg.

The reaction control of the receiver will still be operative with the S.G. adaptor in use. If the set oscillates too readily then the voltage on the screening-grid of the S.G. valve should be reduced by plugging in the lead from "H.T.+1" on the adaptor to a lower voltage tapping on the H.T. battery.

A Few Final Hints.

Don't forget, when switching on and off, that there are two filament switches to be operated. Force of habit may cause you merely to switch off from the set when you have finished listening without pushing in the filament switch on the adaptor. Signals will, of course, cease, but the adaptor will still be on and will consume both H.T. and L.T. current until switched off. Another point: Do not forget that in wave-changing there are also two switches instead of the former one. Naturally, they must both be set to "long" or "medium" at the same time. Leaving one switch in the medium wave position while the other is in the long-wave position will not cut out reception altogether, but will have a curious, topsy-turvy effect on the tuning, which may be very puzzling for a few moments until a glance at the position of the switches shows the cause of the trouble.

Regarding the use of the pre-set aerial condenser it should be remembered that alteration of its setting will not only vary the degree of selectivity, but will also slightly affect the setting of the tuning condenser on the adaptor. It will not in any way affect the setting of the other condenser.

The amplifier described above can be used in conjunction with any type of receiver, but it will prove most beneficial when the set is of the Det.-L.F. type. In that case the range of reception will considerably be increased, whilst tuning should be much sharper. Although the amplifier could be used with a set already having an S.G. stage, it will not improve results to such a noticeable extent. In addition to this, however, it is possible that a certain amount of instability may be introduced. Should that be the case, an improvement can generally be effected by reducing the voltage to the screening grids and by altering the anode voltage.

LIST OF COMPONENTS

One Cossor metallised S.G. valve, 215 SG.
One W.B. valve-holder.
One Colvern pre-set condenser, .0001 mfd.
One Lissen screened dual-wave coil.
One Bulgin screened super H.F. choke (H.F.10).
Two British Radiogram on-off switches.
One British Radiogram variable condenser, .0005 mfd.
Two T.C.C. fixed condensers, 1 mfd.
One T.C.C. fixed condenser, .0003 mfd.
Six Belling Lee terminals, marked as shown.
One Graham Farish Ohmite resistance, 500 ohms.
Ebonite panel 9ins. x 6ins. x 3/16in.
Baseboard panel 9ins. x 6ins. x 3/16in.
Ebonite terminal strip 7ins. x 1in.
Connecting wire, screws, etc.

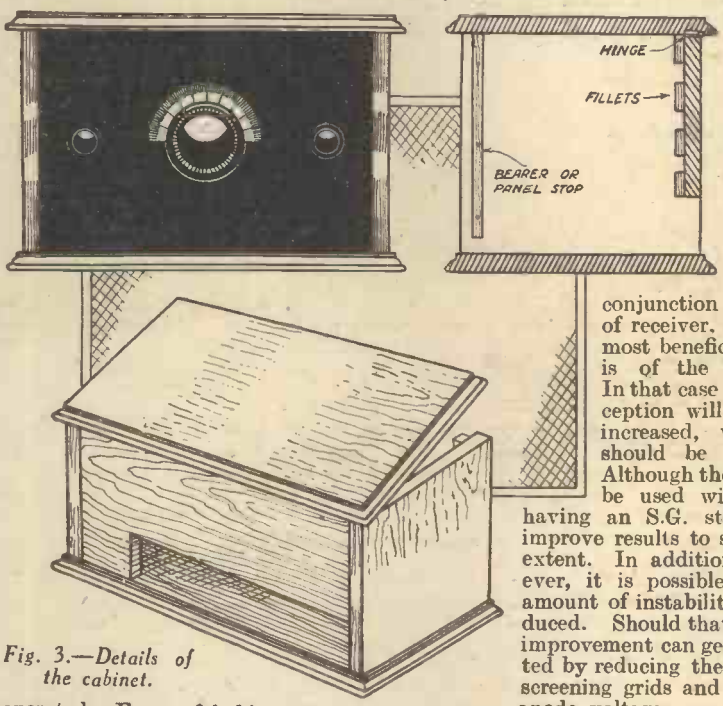


Fig. 3.—Details of the cabinet.

TOPICAL TECHNICALITIES

MEASURING THE WAVELENGTH OF AN AERIAL SYSTEM.

IT is often worth while knowing the natural wavelength (and sometimes the self-capacity) of an aerial system, especially if it is desired to carry out some transmitting experiments on an artificial or dummy aerial preparatory to using the outside aerial. The wavelength is usually taken as being roughly four times the length of the aerial in metres, and the simplest method of measuring it is to wind a small coil of two or three turns of wire and join this between aerial and earth and couple the coils to a simple wavemeter. Provided the turns are not too large, and the coupling is kept moderately loose, the wavelength ascertained by the wavemeter will be that of the aerial-earth system. The formula for ascertaining the correct wavelength of the aerial when loaded is

$$\lambda = 1884\sqrt{\left(L+\frac{L_A}{3}\right)C} \text{ metres,}$$

where L is the added inductance in μH,

L_A is the inductance of the aerial in μH

C is its capacity in μF.

The dummy aerial may be made up from resistance, capacity and inductance of the values ascertained by the above formula, under which circumstances it will behave exactly as in the case of the original aerial. Next week we will detail the method of measuring the capacity of the aerial in order that the above formula may be applied.

CUTTING OUT A SERIES AERIAL CONDENSER

THE accompanying illustrations show a method of cutting out the aerial condenser without the necessity for a switch. In the case of a pre-set type, a narrow strip of springy brass is soldered to the moving plate, and of such a length that when the adjusting screw is down to the full extent of its travel, the extension piece makes contact with the lock-nut of the screw holding the fixed plate, thereby shorting the condenser and giving direct connection of the aerial to set. Fig. 1 shows a section of a pre-set type condenser, with the brass strip and extension piece in position. The same principle applies where air or solid dielectric condensers are used, as shown in Fig. 2.—W. H. MORTON (Ebley).

Fig. 1.

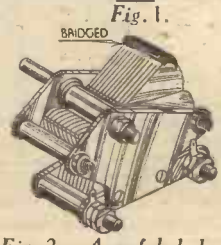


Fig. 2.—A useful dodge for cutting out a series-aerial condenser.

Automatic Volume Control Forms the Subject of This Week's Complete Article, and the Methods of Adding Different Forms of A.V.C. are Fully Described.

OUR "Progressor" has now reached a fairly advanced stage, being at present in the form of a very refined and efficient variable-mu three-valver. Before going on to add the Class B output stage, however, I feel that most of my readers would like to carry out a few

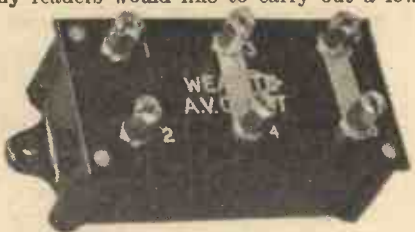


Fig. 1.—Photograph of A.V.C. unit.

experiments in connection with automatic volume control. A.V.C. is all the rage just now, not because it merely happens to be a passing fancy of set designers, but because it offers many very real advantages. No doubt the principal advantage, so far as the average listener and experimenter are concerned, is that A.V.C. very successfully overcomes the greatest difficulty in the way of pleasurable reception of long-distance stations—fading.

Principles of A.V.C.

The principles of A.V.C. have been explained in previous issues of PRACTICAL WIRELESS, but a brief résumé will not be out of place at this juncture. The object of automatic volume control, as the name implies, is to maintain the reproduction from the loud-speaker at constant volume, regardless of the station being received. This is achieved by so arranging the circuit that a portion of the signal voltage applied to the detector valve is used to bias negatively the grid of a preceding variable-mu amplifier. Thus, as the signal strength applied to the detector increases (due to a strong signal), a greater bias voltage is fed back to the preceding valve. As we have seen from previous experiments, an increase in V.M. bias voltage results in a falling-off in amplification, and thus, in volume.

From the above brief explanation it is not difficult to understand what happens when the set is tuned to a signal which is subject to fading. As signal intensity increases the degree of high-frequency amplification becomes less; on the other hand, when fading takes place, the high-frequency amplifier is allowed to operate at a correspondingly higher efficiency.

NEW COMPONENTS REQUIRED FOR THIS WEEK'S EXPERIMENTS.

One Wearite A.V.C. unit.
Two Clix Grid-Bias Wander Plugs; one negative and one positive.
One Bulgin Grid-Bias Battery Clip, type No. 2.
Short length flex, screws, etc.

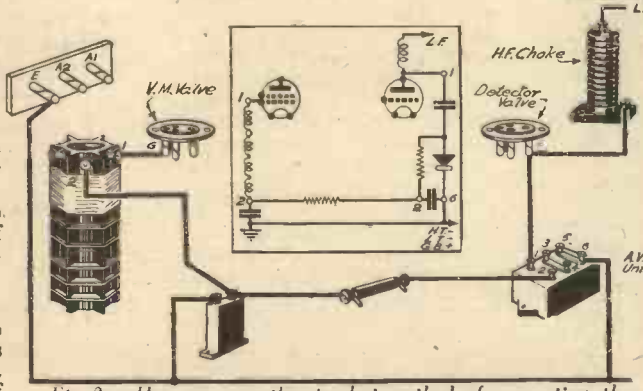


Fig. 3.—Here you see the simplest method of connecting the A.V.C. unit.

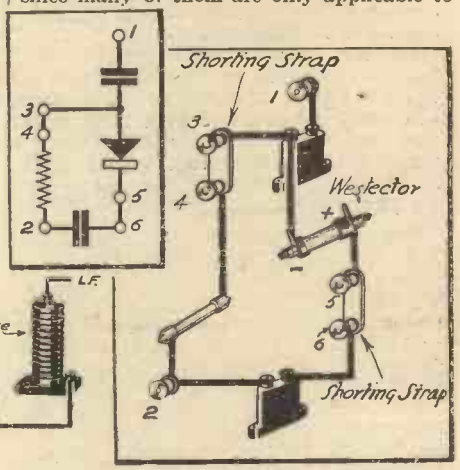


Fig. 2.—Showing the components of the A.V.C. unit and their method of connection.

Connecting an A.V.C. Unit

We need not consider for the moment all the various systems of A.V.C., especially since many of them are only applicable to more elaborate and sensitive receivers. Instead, we can concentrate on just one system, which will prove most convenient and efficient in the case of the "Progressor." The method of control I have in mind depends upon the use of one of the excellent little A.V.C. units which have recently been placed on the market. That which we shall use is made by Messrs. Wearite, and is particularly suitable for experimental purposes, due to the fact that it is designed for use in various alternative circuit arrangements. A photographic illustration of the unit is given in Fig. 1, whilst a pictorial sketch showing the connections of the components which it contains is given in Fig. 2. It will be seen that there are four components in the unit, these being a "Westector" high-frequency metal rectifier (the most important item of all), a fixed resistance, and two fixed condensers.

The simplest way of connecting up the A.V.C. unit is shown pictorially, and also in diagrammatic form, in Fig. 3. The "Westector" is connected in series with one of the fixed condensers between the anode of the detector valve and earth,

(Continued overleaf)

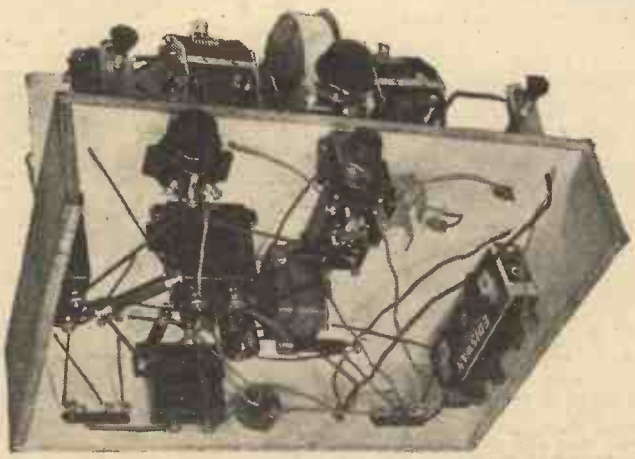


Fig. 4.—This photograph shows the position of the A.V.C. unit on the "Progressor."

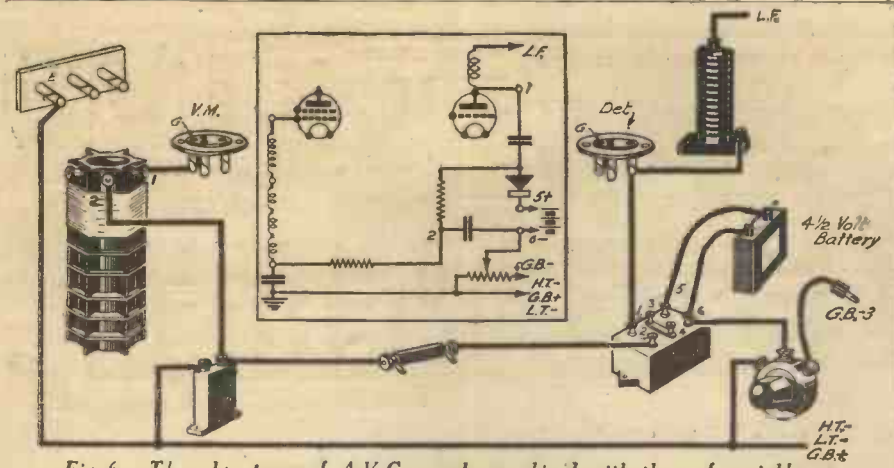


Fig. 6.—The advantages of A.V.C. can be combined with those of variable-mu volume control by employing the connections shown above.

THE PROGRESSIVE EXPERIMENTER

(*Continued from previous page*)

whilst a lead is taken from the "top" (negative) side of the rectifier through a fixed resistance to the lower end of the aerial coil. The second fixed condenser acts as a by-pass to the decoupling resistance. It is evident that the "A.V.C." connection on the unit replaces that which was previously made from the aerial coil to the variable-mu potentiometer. Actually, of course, the unit acts in a very similar way to the potentiometer by applying a varying bias voltage to the grid of the first valve.

How the Unit Functions

Before trying out the circuit shown in Fig. 3, you will no doubt wish to have some idea as to how the A.V.C. unit works. The principle is really very straightforward, and can easily be grasped when it is understood that a certain amount of the high-frequency current appearing in the anode circuit of the detector is diverted, by the H.F. choke, into the rectifier circuit. This current is immediately rectified, with a result that there is a difference of potential between the two ends of the rectifier; in other words, the "top" end of the rectifier is negative in respect to the "bottom" one. And as a lead is taken from the "top" end to the grid of the V.M. valve (through the decoupling resistances and coil), the grid is made negative in respect to the filament. The potential developed across the rectifier is dependent upon, and proportional to, the strength of the signals in the anode circuit of the detector. Thus, an increase in applied signal strength causes a proportional increase in negative bias to the V.M. valve; these two factors are inter-dependent, and automatically regulate themselves.

Very little explanation is called for in regard to the method of fitting the A.V.C. unit to the "Progressor," since it is only necessary to mount the unit on the underside of the chassis in the position clearly shown in Fig. 4. connect terminal 1 to the lower terminal on the H.F. choke, terminal 6 to the earthing bolt passing through the baseboard, and transfer the connection to the 50,000-ohm fixed resistance fitted last week from the volume control potentiometer to terminal 2. There are two shorting straps on the unit, and for the present these should be left across terminals 3 and 4, and 5 and 6.

If, after making the necessary connections, you tune to a station such as Fécamp, which normally fades rather badly, it will probably be found that a perfectly steady signal can be obtained. The maximum volume will perhaps be very slightly less than before, but the *average* strength of the signals will be greater and the broadcast will be more easily followed. After trying the effect of the automatic volume control on a station using a low wavelength, try it on others higher up the scale; it will be found that a greater degree of "correction" is provided on the higher wavelengths. This is quite natural, and is due to the higher efficiency of the rectifier at low frequencies.

With the connections as described, the unit is virtually in parallel with "one half" of the differential reaction condenser, and in consequence the full A.V.C. effect is not obtained. To prove this, and also to secure a greater amount of efficiency, you should therefore remove the lead which joins one terminal of the reaction condenser to the chassis.

Delayed A.V.C.

A form of "delayed A.V.C." can next be tried, as shown in Fig. 5, by removing the connection from terminal 6 on the unit and in its place connecting the flexible grid-bias lead (with wander plug marked "G.B.—3"), which was previously joined

(*Continued on page 614*)

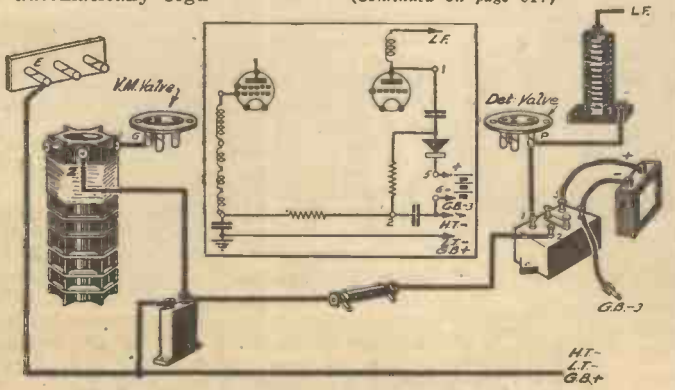


Fig. 5.—The connections required for delayed A.V.C.

Does a CONDENSER CONDENSE?

PART II.

In this Article the Author Deals with Capacity Ratings and the Principles Involved.

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

IN addition to differing greatly in construction, condensers also vary in their rating—in what is known as their "capacity." It is one of the problems which listeners often put—what difference does the amount of this capacity make, why is a condenser of a certain capacity specified for one job, and of a different capacity for another job? And just what does this capacity mean?

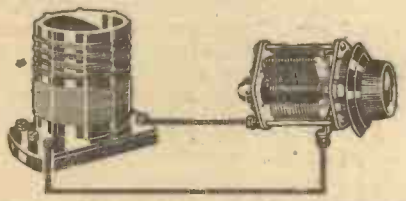


Fig. 1.—The use of the variable condenser for a tuning circuit.

What Does Capacity Mean?

Perhaps I had better answer the last question first. If you remember, in discussing condensers last time, we likened them to rubber partitions stretched across a water pipe. If we were really doing those experiments with the water pipes we could have used either a thick and stiff piece of rubber, or a thin and very "stretchy" rubber. The difference between the stiff rubber and the very elastic piece is exactly similar to the difference between a condenser of small capacity and one of larger capacity.

Or let me put it another way. Suppose we have one of those rubber balloons used at parties, and blow into it. It expands and holds a certain quantity of air. If we stop blowing and do not close the mouth of the balloon, the air will escape. We could describe the capacity of the balloon by saying that a pressure of one pound per square inch would force so many cubic inches of air into it. Of course, if we pumped it up to a pressure of two pounds per square inch, we should force twice as much air into it.

Units

Now you know that if you apply electric pressure—a voltage—to a condenser, electric energy flows into it, and the energy thus stored can be withdrawn by "discharging" the condenser. The "capacity" of an electric condenser is described as the amount of electricity which the condenser will hold if a pressure of one volt is applied to it.

The "quantity" of electricity so measured is expressed in "coulombs," and a coulomb is the amount of electricity represented by one ampere flowing for one second—one ampere second, in fact, or one three thousand six hundredth of our old friend the ampere hour in which the "capacity" of our low-tension accumulators is rated.

The unit of capacity is the capacity of a condenser which stores one coulomb of electricity when a pressure of one volt is applied, and is called a "farad" after Michael Faraday, to whom we owe so much of our knowledge of electrical science. A condenser of one farad capacity would be very large, and not of much service in radio work, so a smaller unit is used for everyday purposes. This is the microfarad and is equal to one millionth of a farad.

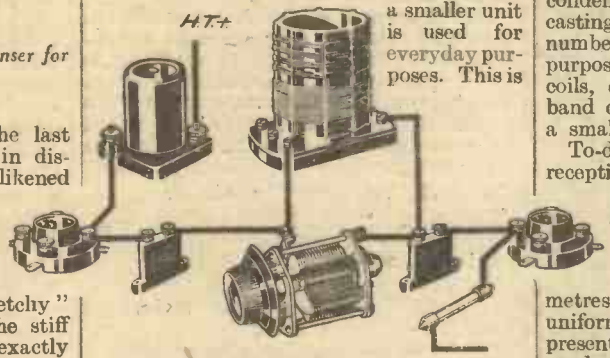


Fig. 2.—Small fixed condensers are used for coupling purposes.

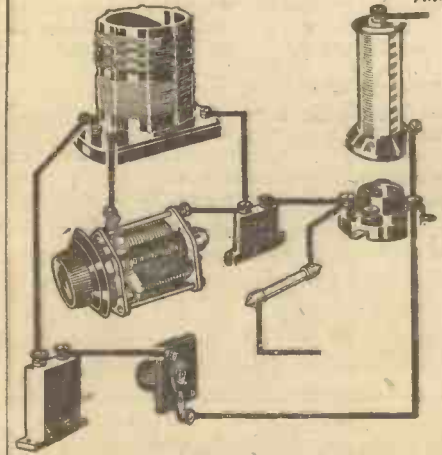


Fig. 3.—A large fixed condenser used as a safety device in the reaction circuit.

Fixed capacity condensers of one, two, four, eight and even sixty microfarads are used for many purposes in radio, but still smaller ones are also required. We all know the .0005 microfarad condensers commonly used for tuning. "Point three O's five" we often call them. We should remember that this popular way of describing them is really a lazy kind of shorthand for "one two thousandth of a microfarad, or 500 micro-microfarads."

Recently radio engineers have been recommended to use another term for the "micro-micro-farad," namely, the "pico-farad," so our .0005 condenser may henceforth be called "500 pico-farads."

Correct Ratings

Now let us see what importance is attached to the correct capacity for different condensers used in a set. First of all we will take the most familiar example, the tuning condenser. In the early days of broadcasting we used coils so designed that the number of turns could be varied for tuning purposes. Later on we had interchangeable coils, each one covering a fairly narrow band of wavelengths, and tuned by quite a small condenser.

To-day, in order to simplify radio reception, we use one coil and one condenser to cover the medium wave-band of from about 200 to 550 metres, and an additional coil, controlled by a wavechange switch for the long waves of 1,000 to 2,000 metres. To achieve a certain degree of uniformity between various makes of coils, present-day practice favours a tuning condenser of .0005 microfarads maximum capacity. Such a condenser in conjunction with a coil of about 180 microhenries inductance will cover comfortably the whole of the medium-wave broadcast band. The inductance of the long-wave coil must then be of the order of 2,000 microhenries.

For those who have a taste for mathematics and would like to work these figures out for themselves, there is the formula which connects the wavelength to which a circuit oscillates and the inductance and capacity.

$$\text{Wavelength in metres} = 1885\sqrt{L \times C}$$

where L = Inductance in microhenries
C = Capacity in microfarads.

Why Three O's Five?

Has it ever occurred to you why a .0005 mfd. condenser is invariably specified

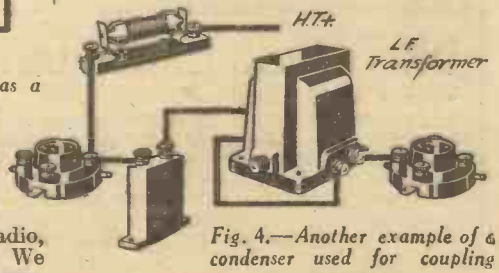


Fig. 4.—Another example of a condenser used for coupling purposes.

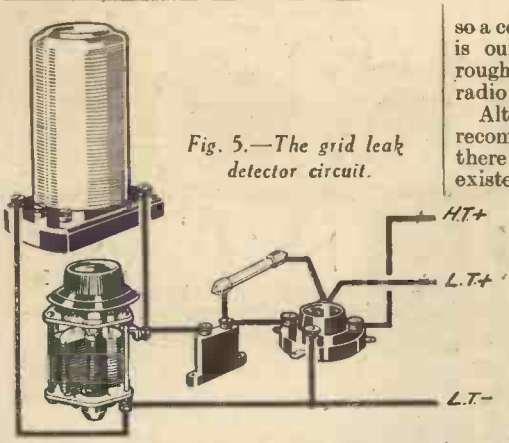


Fig. 5.—The grid leak detector circuit.

for the tuning circuits of modern sets? I am afraid that the value is just taken for granted in many cases and little thought given to it. Actually, the whole analysis of a tuning circuit such as we have shown in Fig. 1 is very involved and cannot be dealt with here, so I shall just content myself with explaining the matter briefly.

When a circuit has to be made selective—and of course that is the rule of the day at the moment—the "decrement" must be kept as low as possible. It is a factor which expresses the ratio of the peak value of one oscillation to the peak value of the preceding oscillation when the current is diminishing. The actual expression in mathematical terms is $\frac{R}{2fL}$. But we know at resonance that

$$\omega L = \frac{1}{\omega C}$$

where $\omega = 2\pi \times$ frequency (f)
L = inductance
C = capacity
R = resistance (high frequency)

Hence $\frac{R}{2fL} = \frac{\pi R}{\omega L} = \pi R \omega C = \pi R \sqrt{\frac{C}{L}}$

If the decrement is to be constant, then all these expressions must be constant, but when we tune with a condenser, C must vary. With C small (low wavelengths) and L constant, R is also increased and *vice versa*, so that over the whole of our tuning range we have the selectivity varying. If we made C large to start with, and hence L small to cover a certain waveband, the decrement would be large, and conversely with C small and L large the decrement would be reduced, which is what we want. Unfortunately, this latter condition prevents us from covering the wavebands we desire when using a single coil (or a double coil operated with a wave-change switch), so a compromise is struck. This compromise is our familiar .0005 mfd., and explains roughly why we choose that value for our radio work.

Although a .0005 mfd. condenser is recommended for use with standard coils, there are a number of home-built sets in existence which employ .0003 condensers with every success.

Other Purposes

Now we have to deal with the "fixed" capacity condensers, used for many different purposes in a receiver.

Blocking condensers and grid condensers used in radio-frequency and audio-frequency circuits are invariably made with mica dielectric, and are usually of small capacity. If the condenser is intended merely to isolate the anode (high-tension) circuit of one valve from the grid circuit of the next the capacity need not be small, nor is the value critical. Capacities of about .0002 are usual for high-frequency circuits (Fig. 2) up to .01 for a mere "safety" condenser, such as is frequently connected in series with a variable reaction condenser in order to safeguard the high-tension supply in the event of the reaction condenser shorting or breaking down (Fig. 3), while values up to 1 microfarad may be used for the feed condenser in a low-frequency fed transformer arrangement (Fig. 4).

In this connection it must be remembered that all condensers offer a certain opposition to the current, varying according to the frequency of the alternating current. To high-frequency currents, such as radio signals, the opposition is much smaller than to audio-frequency currents, the formula being as follows:—

$$\text{Capacity reactance of condenser} = \frac{10{,}000{,}000}{2\pi f C}$$

where $\pi = \frac{22}{7}$
f = frequency in cycles per second
C = capacity in microfarads

This explains why a larger condenser is necessary in a low-frequency circuit than in a high-frequency circuit, for a .01 mfd. condenser at radio frequency has a reactance of the same order as a 2 mfd. condenser at low frequency.

Special Cases

In cases like a grid-leak detector (Fig. 5) or a resistance capacity coupling arrangement (Fig. 6) where the coupling condenser operates in conjunction with a grid leak, two sets of conditions have to be complied with. In the first place, the condenser must be large enough to pass the signal on to the succeeding valve without serious loss. As just explained, this is not a difficult matter when dealing with radio frequencies, but in the case of audio frequencies the condenser capacity must be fairly high or its high reactance at the lower frequencies will result in loss of the lower register—bass notes.

The second condition is that the condenser is employed to charge the grid of the valve, and the grid leak to discharge it. A high-resistance leak naturally discharges the circuit more slowly than a low-resistance, and the respective values of condenser and leak must be chosen so that the grid circuit does not become "choked." In other words, the grid leak must discharge the circuit as rapidly as the condenser charges it; so that a large condenser must have a lower value grid leak than a small condenser.

The final types of condensers are those of larger capacity used for smoothing, and with them we can consider the by-pass condensers used in decoupling circuits. For capacities up to some 4 microfarads or over, "paper" condensers—*i.e.* condensers having a paper dielectric—are commonly used, while larger condensers are of the "electrolytic" type recently described in detail in this journal. For normal smoothing, 4 microfarads is sufficient, but it is customary to take advantage of the slightly better smoothing obtained with electrolytics in high-tension supply units. Condensers of 2 microfarads are recommended for decoupling in audio-frequency circuits. For output valve grid-bias decoupling, up to 4 microfarads can be employed with advantage, while for high-frequency decoupling 1 microfarad is ample.

Order next week's issue now! More Special Features.

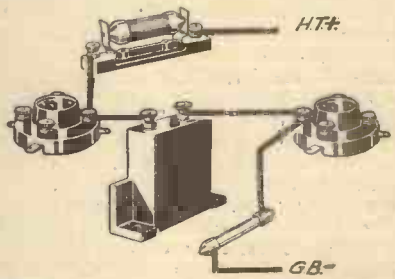
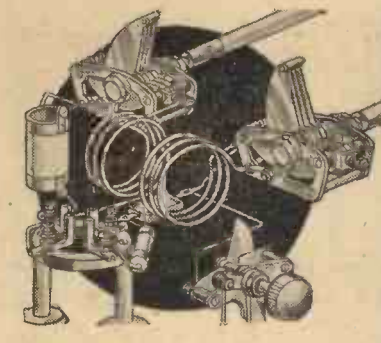


Fig. 6.—The resistance capacity coupled circuit.



Short Wave Section

SHORT-WAVE TUNED H.F. AMPLIFICATION

Points to be Considered in Order to Ensure Maximum Results

IN a recent article I discussed the use of an untuned H.F. stage in a short-wave receiver, and for general purposes this type of amplifier is undoubtedly completely satisfactory, but it has the one disadvantage that it does not improve the selectivity of the receiver to any great extent. When the H.F. amplifier is tuned, however, it does assist the selectivity very materially, and from this point of view is a very great improvement over the untuned stage; unfortunately, tuning the H.F. amplifier introduces rather severe complications both in construction and operation, and it is therefore not very satisfactory for the newcomer to short-wave work, but experimenters with experience of these high frequencies may care to try an arrangement of this sort.

Fig. 1 gives one satisfactory circuit; it will be seen that it is very similar to one of the circuits given for the untuned stage, with the difference that the H.F. valve grid circuit consists not of a simple untuned choke but of a coil L_1, tuned by the variable condenser C_2, the aerial being coupled to this circuit by the semi-variable condenser C_1, which has a maximum capacity of .0001 mfd. The H.F. valve is coupled to the detector by the H.F. choke Ch_1 and the .0001 mfd. fixed condenser C_4; this choke must be a good one of the screen-grid universal wavelength type, of which there are several examples on the market. The condenser C_3 is a .01 to .1 mfd. mica or non-inductive screen-grid by-pass condenser. The detector circuit is quite normal, and consists of the usual coil L_2 and variable condenser C_5. The ease of operation of the receiver will be considerably enhanced if the two dials operating C_2 and C_5 have as nearly as possible the same reading for any particular station, and in order to ensure this the two coils L_1 and L_2 should have the same number of turns and be wound on the same diameter formers. Any standard short-wave coils will do, though they should be small in diameter in order to minimize interaction; valve base coils are admirable. As a guide to making them at home it has been found that for coils space-wound with 24 D.C.C. S.W.G. wire on a 1½-in. diameter former, and tuned by a .00015 mfd. condenser, four turns tune from approximately 16.8 to 37.5 metres, and eleven turns tune from 27.3 to 65 metres approximately. .00015 mfd. is therefore a very good value for C_2 and C_5, although if a greater tuning range is required .0002 mfd. condensers may be preferred. The condensers must be of the same make and type if the two dial settings are to correspond at all wavelengths. The reaction coil L_3 is wound with 36 D.S.C. S.W.G. or some other thin wire, and contains about half the number of turns in the grid coil, depending on the valve and H.T. voltage. The reaction condenser C_6 is the usual .0002 mfd. component. Ch_2 is an ordinary short-wave reaction choke.

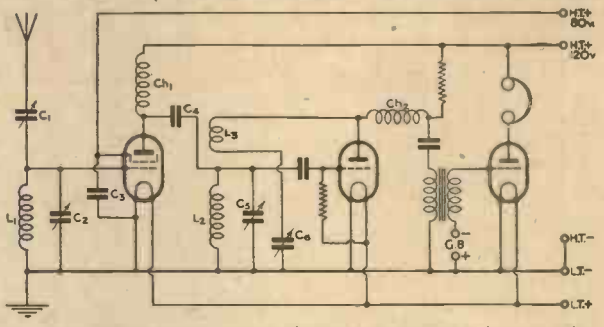
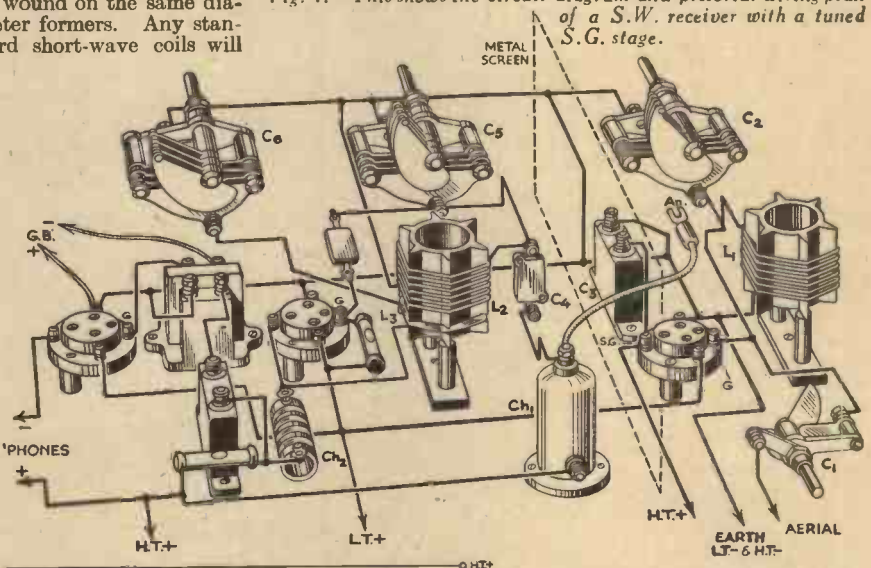
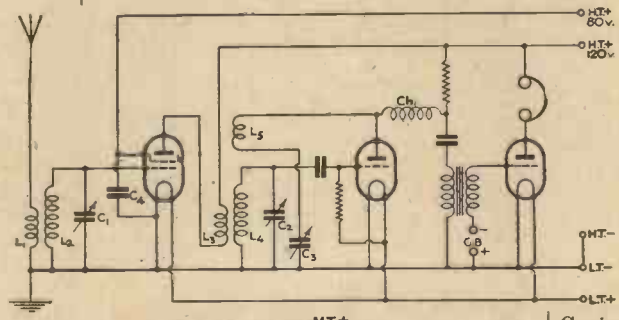


Fig. 1.—This shows the circuit diagram and pictorial wiring plan of a S.W. receiver with a tuned S.G. stage.





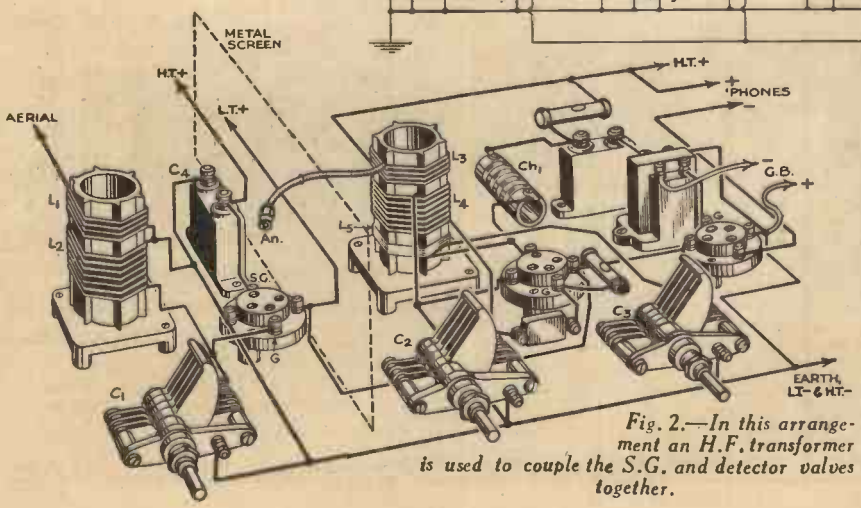


Fig. 2.—In this arrangement an H.F. transformer is used to couple the S.G. and detector valves together.

An Alternative Circuit

Another circuit is shown in Fig. 2 which has the advantage over the circuit shown in Fig. 1, that it is easier to avoid a trouble known as interlocking, by which is meant a tendency for the tuning of the screen-grid valve circuit to alter the tuning of the detector, and so make the adjustment of the receiver difficult since the two circuits are not truly independent. In Fig. 2 the coupling between the H.F. stage and the detector is by means of an H.F. transformer, of which L_3 is the primary and is untuned, and L_4 is the ordinary tuned secondary; L_5 is of course the reaction coil. The disadvantage of this arrangement is that

an extra winding is needed on the detector coil, which makes it impossible to use valve base coils, and also complicates the design of a dual range coil. Suitable six-pin formers are obtainable, however, and these can be used, but they may not be satisfactory if the diameter is over 2in. Since L_1 and L_5 perform the same function as L_2 and L_3 in Fig. 1, the same data as given for the latter will guide the constructor in making L_4 and L_5. L_3 is wound at the grid end of L_4 and in the same direction; it should consist of two-thirds or more of the number of turns in L_4, and quite thin wire (30 D.S.C. or thinner) may be used. Otherwise the circuit is the same as the last, except that the aerial is shown coupled by means of a coil instead of a condenser. This is merely to illustrate an alternative method of aerial coupling which may be used with either form of inter-valve coupling; L_1 should be similar in size to the primary winding L_3 of the H.F. transformer.

The Necessity for Screening

Although the circuits are simple, the construction of a short-wave receiver employing a tuned H.F. stage is rather complicated, owing to the need for shielding, It will be found impossible to get satisfactory amplification and at the same time avoid interlocking without considerable screening between the H.F. stage and the detector. Partial screening, consisting of a vertical sheet of aluminium or copper between the two stages, with the screen-grid valve protruding through a hole in the screen, together with a metal panel and baseboard, is the least that can be expected to give reasonable results, and even in this case it is necessary to space the two stages very widely apart. An alternative to this which might give better results would be to screen the detector stage completely by enclosing all its associated components in a screening box, and leaving the H.F. stage open, apart from a metal panel. In either of these cases it may be difficult to remove interlocking and instability, and probably the circuit shown in Fig. 2 will be found to work best. If really complete screening can be arranged, then Fig. 1 circuit is to be preferred because of its greater simplicity.

A completely screened short-wave receiver should be very stable, and permit the utmost to be obtained from the screen-grid stage, and with a little care in the making of the coils and choice of the condensers, it should be possible to gang C_1 and C_2 together, and so simplify the tuning of the receiver.

No decoupling resistances or condensers have been shown in either of the circuits, but they may be found necessary; should this be the case, the standard values will be satisfactory, *i.e.*, decoupling resistances of about 10,000 ohms together with 1 mfd. condensers. Another refinement that can be applied to this type of receiver is the use of band spread tuning, *i.e.*, tuning each coil with two condensers in parallel, one, the band-spreading condenser (which is the main tuning control), of very small capacity, about .00005 mfd., and the other (the band-setting condenser) of .0001 to .00015 mfd. The band of wavelengths upon which it is desired to listen is selected with the larger condenser, and then tuning performed on the smaller one. A band-spread system would make for easier ganging too, if the small capacity band-spreading condensers were ganged, and the band-setting condensers used as trimmers.

OUR VIEWS ON RECEIVERS

THE EKCO BATTERY MODEL 74

WE have at last found a battery-operated receiver which compares favourably with the best mains sets on the market. The Ekco Model 74 is a wonderfully efficient five-valve superheterodyne that is particularly economical of current and only slightly more costly to run than an all-mains instrument of similar capabilities. As a matter of fact, the average H.T. current consumption is a little more than 10 milliamps, whilst the valve filaments take .86 amp. from the accumulator. Expressed differently, the high-tension battery will last for approximately 250 hours and the accumulator requires to be recharged every thirty-five hours.

Superheterodyne Circuit

The five valves are arranged as (1) combined detector-oscillator, (2) variable-mu intermediate-frequency amplifier, (3) second detector, (4) driver and (5) economy Class B output. In considering this circuit arrangement we were of the opinion that the set would not have a particularly long range although it would give an ample signal output. We were mistaken in our first assumption—sadly mistaken—for on the very first test, made in broad daylight, no less than thirty stations were received at excellent strength and quality. Second channel interference (which produces a high-pitched whistle) was experienced at two settings of the medium-wave dial, but by adjusting a trimmer thoughtfully fitted to the rear of the chassis, the whistles could be almost entirely eliminated. The idea of providing a second channel adjustment, by the way, is one which we can heartily recommend; it removes one of the very few objections to the superhet type of receiver.

Simple Controls

There are only three controls on this Ekco receiver and they are conveniently placed for easy operation. The central knob—and this is no less than 3in. diameter—is for tuning purposes and operates an illuminated pointer moving behind the horizontal scale. This knob is indeed the largest we have ever seen on a wireless set, but it simplifies accurate tuning in a splendid manner; the idea is one that might well be copied by other manufacturers. The tuning scale itself is interesting in so far as it is of ample size, easily read and divided into two separate horizontal strips, one for medium and the other for long waves. When the left-hand knob is in the medium-wave position the upper scale is illuminated by a triangle of light, in the centre of which is the shadow of a pointer. By rotating the knob to the long-wave position the illuminated triangle moves to the lower scale, whilst when the knob is set to "gram" both scales are illuminated much more faintly. The control situated to the right serves as a combined on-off switch and I.F. volume control. It gives a very smooth variation of volume throughout the range, and our only criticism is that the switch is not quite so "positive" in its action as we should like; it functions perfectly correctly, but we would prefer to feel and hear a little click as it is turned off.

Sound Construction

Below the three main controls is a neatly recessed toggle switch which provides "local" and "distant" settings. By turning the switch to the "local" position when listening to a nearby station the possibility of overloading is removed and a dead silent background is obtained. This switch was found very useful and to add to the pleasure of listening.

This Ekco receiver will certainly please the reader who has mechanical inclinations, for it is soundly constructed on a rigid aluminium chassis and fitted into a neat "walnut" bakelite cabinet. The method

(Continued opposite)

(*Continued from preceding page*)

of driving the illuminated pointer over the tuning scale is noteworthy in that an endless belt of stranded phosphor-bronze wire is employed and this passes over two brass pulleys fitted at each side of the chassis. Spring tensioning is used for the belt, so that slackness or backlash in operation are impossible. It is also interesting to note that both high- and low-tension batteries not only fit into the container, but into compartments where they are firmly gripped and prevented from slipping about if the set is to be moved from one room to another (as it can be quite easily).

Features which have especial appeal to the lady of the house are the handsome cabinet of distinctly modern design, utter simplicity of operation, and the special arrangement made for replacing the silk which backs up the speaker fret. This latter feature is, so far as we remember, employed only by Messrs. E. K. Cole, Ltd., and it is certainly an excellent one. The idea is that the complete fret is detachable, and after it has been removed from the cabinet the silk can be detached by taking off a circular spring. The silk can therefore be removed for washing in an instant, or it can be replaced by different material which might be more in keeping with the room furnishings.

The receiver under review is fitted with two sockets for the insertion of plugs (provided) to which a gramophone pick-up can be connected. We tried the gramophone side and found that reproduction was excellent in regard both to quality and volume—just as good, in fact, as on "radio." Another interesting point is the provision of a plug and socket for the easy connection of an external speaker when required. The extra speaker must, of course, be of the Class B type to match the output valve.

Turning to some further tests we made on the Ekco Model 74 when using the set in conjunction with a good outside aerial and earth lead after dark, we can do nothing but praise the set for its phenomenal range and excellent quality of reproduction. The tuning scales are marked in metres and also with the names of thirty-six medium and ten long-wave stations, but we actually tuned in *at comfortable programme strength* no less than fifty medium-wave transmitters and twelve stations on the long-wave band. Generally speaking, we found the station calibrations very accurate, and the only divergence noticed was near to the bottom of the lower wavelength range; even there, the pointer was only a fraction "out." There was a fair amount of background noise when receiving distant stations for which the volume control required to be "full on," but apart from this reception was singularly free from extraneous noises. The set proved to be so sensitive that it was found desirable to turn the "local-distant" switch over to the former position when listening to several stations that could not by any stretch of the imagination be called "locals." With the switch in the "distant" position the last valve could easily be overloaded on at least five stations; this statement is more significant when it is added that the maximum undistorted output of the Class B valve, under the conditions in which it is employed, is in excess of one watt.

This photograph shows the excellent appearance of the Ekco Model 74 Battery Superhet.

The Ekco Model 74 is a modern and up-to-date set which we can strongly recommend to any reader who requires a really high-class instrument at a price which is by no means high when the quality of the article is taken into consideration.

In walnut finish it costs 13 gns., or finished in black and chromium the price is 14 gns.

By "PHOTON"

THE SUBDIVISION OF COPPER.

THE principle of the *Subdivision of Copper* is of great service to the designer of electrical apparatus, whether it be motors or dynamos or transformers. The fundamental fact in all such design is that the windings may be initially considered merely as belts of copper, and the subdivision concerned in adapting the design to any particular duty, and the number of turns, may be settled subsequently. It is true that the bulk (volume) of the insulation varies with the degree of subdivision, both on account of the greater multiplicity of insulation layers when the subdivision is increased, and the fact that the higher voltage corresponding to a higher degree of subdivision requires that each layer of insulation shall be thicker, unless, as where the E.M.F. does not exceed, say, 200 volts, an agreed minimum is used in all cases.

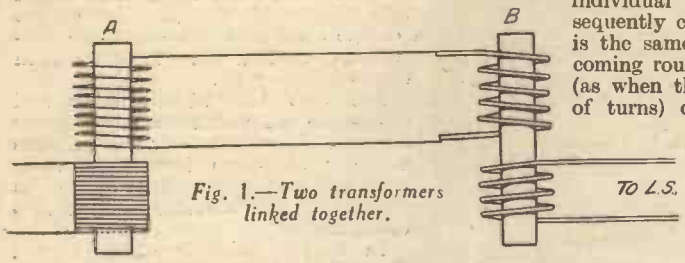


Fig. 1.—Two transformers linked together.

A good example for the purpose of illustration is that of two transformers functioning in series, Figs. 1 and 2. The coupling circuit comprising the secondary of transformer A and the primary of transformer B may consist of any number of turns we like, so long as the ratio between the two remains the same, and so long as the total cross section of copper is unaltered, without affecting anything. Let the number of turns, in one case, be eight in the secondary of transformer A, and four in the primary of transformer B (Fig. 1). Then we might substitute eighty in the secondary of A and forty in the primary of B, or we might use one turn only in the primary of B to two turns in the secondary of A, as in Fig. 2, and nothing in the circuit (say an output circuit) is changed, functionally the coupled transformers are the same, so long as the aggregate cross section of the copper is maintained.

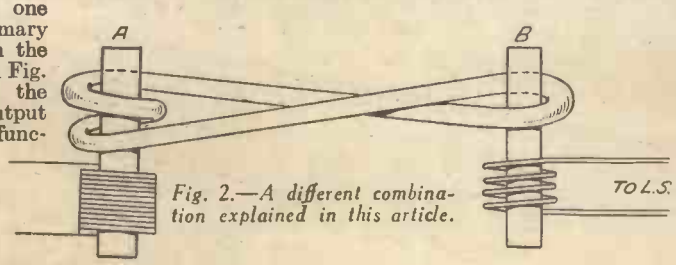


Fig. 2.—A different combination explained in this article.

It might be asked: How can this be, the inductance will be varied enormously, in the ratio of 80^2=6,400 in the extreme cases suggested above? Surely this cannot be without effect?

The criterion is not the inductance so far as concerns the coupling cricuit, *it is the time constant* t^c, and:—

$$t^c = \frac{L}{R}$$

Since a subdivision of the copper in the ratio N means that there will be N times the number of turns and 1/N the area of copper, the resistance varies as N^2 just as does the inductance, so L and R march together and the time constant t^c is invariable. This is in itself a result worth remembering, the time constant of any electro-magnet depends upon the size and geometry of the iron and copper layout and is independent of the number of turns, that is, it is independent of the subdivision of the copper. This is only true if the external resistance be maintained proportional to the internal resistance, which it is in the example given.

For those who feel uncertain as to the truth of the application of the principle of subdivision given above, the following argument may carry conviction. All the iron core cares about is the aggregate stream of electrons that circulate round it per second; if the iron were possessed of the attributes of a sentient being capable of watching the stream of electrons and counting them he is unable to identify individual electrons and consequently cannot tell whether it is the same group of electrons coming round time after time (as when there is a multiplicity of turns) or whether it is a much larger number coming round once only. In brief the only thing that matters to him is the *number of ampere turns*, whether supplied by one turn of wire or N turns.

In the above example the number of turns given to the copper is a matter of indifference; more often than not it is a matter of importance. For example, if one of the two transformers, say *A*, exists and the problem is to match it with a transformer *B*, then the number of turns in the primary depends upon the ratio required and so is determined or known, but the copper belt will need to have just the same area whatever that number may be.

Principle of Subdivision applied to Transformers, Dynamos, and Electro-motors

Likewise in the design of an output transformer in which there is no constant current (as when following a filter choke) if the windings are side by side, the best distribution of copper between primary and secondary is equality of aggregate sectional area, the *subdivision* demanded depends upon the circuit resistances and ratio required. The same applies approximately for the type of winding in which the secondary is laid over the primary or vice versa, but here the copper belt of the outer winding should have greater sectional area, in proportion to the relative mean length of the turns. In either case the *copper belts* may be settled as the basis of design and the subdivision specified (by the number of turns) for any particular duty. The copper space must be large enough to allow for insulation on the basis of a suitable co-efficient, that is to say, the area provided for the winding must be sufficient to allow of insulation as well as copper. The greater the number of turns the more allowance is required, so that the initial design must cover the possible range.

The same principle applied to dynamos and electro-motors, the ground-work design may be effected on the basis of output (watts) and the copper specified by its aggregate cross-sectional area; the same general design may, by the *subdivision of copper*, be adapted to any particular service, the number of turns being related to the E.M.F. required. Interpretation is necessary in this application owing to the fact that only certain numbers of turns are suitable in the specification of an armature winding.

There is a limitation in the case of high-tension circuits, more especially when associated with high frequencies; electro-static capacity then becomes of importance, and the principle of subdivision is no longer rigidly applicable.

THE PROGRESSIVE EXPERIMENTER

(Continued from page 604)

to the potentiometer. In addition to this, the shorting strap between terminals 5 and 6 has to be removed and two short lengths of flex fitted with grid-bias wander plugs connected to these terminals instead. A special 4½-volt grid-bias battery is needed to provide the "delay" action, and this is mounted in a separate G.B. battery clip, as shown in Fig. 4. The object of this battery is to counteract the effect of the A.V.C. voltage until it reaches a certain figure, after which it comes into effect in the normal manner. This system is better for some purposes, although, in the case of the "Progressor," it will not be found quite so satisfactory as the previous one until it is used in conjunction with a manual volume control in the manner to be explained later. You should try varying the negative voltage supplied to terminal 6 between the limits of the grid battery, at the same time trying the effect of moving wander plug "G.B.—3" into different sockets in the main bias battery. Optimum results will probably be obtained by applying 1½ volts negative to both wander plugs, but it will be interesting to vary the voltage over the widest possible range in both cases.

The greatest drawback to the forms of A.V.C. which we have so far tried is that they "cut out" our previous manual volume control. We can now combine the normal hand volume control with the A.V.C. device by changing to the connections shown in Fig. 6. The "G.B.—3" lead is replaced on the potentiometer and terminal 6 on the A.V.C. unit is connected to the centre terminal of this component. The delayed A.V.C. action is obtained exactly as before, whilst the potentiometer fulfils its normal purpose by acting as an excellent pre-detector volume control.

After experimenting with the two alternative systems of A.V.C. which I have described you will be able to draw your own conclusions as to which gives the better results. You can then make permanent connections for this system in readiness for next week's article.

This Columbia model is fitted with a hum-bucking coil to enable it to be used with synchronous turntables without interference.

This is the Belling-Lee "Clip-On" pick-up which can easily be fitted to any type of gramophone.

CHOOSING A PICK-UP

THE gramophone pick-up has now come to be recognized as a standard accessory to the wireless receiver, and even at the present time it is increasing in popularity by leaps and bounds. There is no doubt that the electrical reproduction of gramophone records through the medium of a wireless receiver, used as an amplifier is to-day well-nigh perfect. Moreover, the reason for this is principally because pick-ups are now being produced which will respond with a considerable degree of uniformity to the complete range of audio frequencies. The average amateur who knows the fairly simple principle upon which a pick-up functions (which is that the vibrating needle causes an armature to vibrate within a magnetic field so producing corresponding electrical vibrations) might consider that the task of designing an efficient pick-up is one of great simplicity. But this is by no means the case, since it must be remembered that an ideal pick-up must give a practically uniform response to all notes, notwithstanding the fact that all those notes cannot be given equal prominence in the recording process.

The Igranovox pick-up, showing the solid foot and gimbal mounting.

Frequency Response

In other words, the pick-up must *add* to the intensity of frequencies at some parts of the musical scale, and *subtract* from those at other parts. In addition to this, the unit must not give prominence to what are referred to as the "scratch" frequencies, although it must do justice to the higher musical notes, which are, as a matter of fact, not widely different in characteristics. These points will, perhaps, be better understood when it is explained that very low notes (less than 100 cycles, for instance) are not impressed upon the record anything like so well as are those higher up the frequency scale. On the other hand, the pick-up should show a gradually-diminishing response as the frequency rises up to a point equivalent to about 2,500 cycles, beyond which the response should show an increase up to some 3,500 cycles, at which point there should be a fairly sudden "cut-off," to reduce to a minimum the effects of needle scratch and record "surface noise." As a matter of fact, the figures just given are only average ones, and various manufacturers aim at producing a response curve somewhat different to that which would be shown by a pick-up having the characteristics mentioned.

Avoiding Hum

Yet another point that must be considered in designing a pick-up is that it must not have too great a "peak" at 100 cycles, since, if it has, it will emphasize mains hum to an undue extent. For this reason some of the pick-ups now on the market are fitted with what is popularly called a hum-bucking coil. This type of instrument is particularly suitable for use with mains receivers, and is a practical essential when an induction type of gramophone motor is employed. Two new and modern instruments which are provided with hum-bucking coils are the Columbia and the British Radiophone. The former unit has another interesting feature which makes for very easy needle replacement; when the pick-up is lifted from the record surface a spring comes into action and lifts up the unit until the track-arm occupies a vertical position.

Needle Pressure

There is another essential which applies to all pick-ups, which is that the pressure between the needle and the record must be as small as possible consistent with the needle being able to maintain contact with the record surface. The fact is, however, that if the needle pressure is too light it will be "jumped" off the surface on very loud low notes. Consequently, there must be a compromise between record wear and needle pressure. There are two ways of maintaining the compromise, and both are used by different manufacturers. One is to make the unit and track-arm of light material, whilst the other is to fit some kind of counterbalance to the track-arm. The counterbalance, in some cases consists of a weight fitted to the opposite end of the arm to the pick-up, and in others of a spring-loading device fitted between the pivot-mounted pick-up and the arm.

Examples of the former types of pick-ups are afforded by the Cosmocord, Belling-Lee, Lissen, Celestion, and Bowyer Lowe and A. E. D.; whilst the Marconiphone, Blue Spot, and Igranic are fitted with a counter-balance weight. Spring-loading is employed in the case of the Harlie. In some cases a combination of counter-balancing and spring-loading are employed, whilst in many others an adjustment is provided by means of which the position of the weight, or the tension on the spring, can be varied through fairly wide limits.

A pick-up and tone arm to which is fitted a very neat wire-wound volume control. This is the popular Blue Spot model.

Correct "Tracking"

A difference between present-day pick-ups and those of a few years ago is that all the modern instruments are fitted with integral track-arms to ensure that the needle traverses the correct arc on the record, and thus do not produce undue record wear. The arms take various shapes, and although the majority of them are quite straight, others, such as the B. T. H. Junior, are curved. A feature which is made use of in the Belling-Lee units is an extensible track-arm of the telescopic type, by means of which it can be varied in length to suit 10 or 12in. records, and to fit into existing cabinets. In examining pick-ups of various makes, it will be noticed that some have track-arms made of metal whilst others are made of bakelite or similar materials. Generally speaking, the bakelite ones are those which are designed to be extremely light in weight, and are not, therefore, provided with any counter-balancing device. The metal ones are naturally heavier but are usually fitted with a counter-balancing device of one of the types mentioned above.

Volume Control

With any pick-up the value of the volume-control potentiometer is rather critical, and for that reason it is important that the user should make quite certain of employing the exact resistance value specified by the makers. To overcome this difficulty in the easiest, and perhaps best, possible manner a number of makers now sell the pick-up already fitted with a suitable volume-control potentiometer. This is either fitted inside the mounting bush of the track-arm, or supplied ready to attach to the motor-board beside the pick-up. The following makes have the control fitted integral with the arm: Blue Spot, Harlie, Igranic, B. T. H. Junior, Bowyer Lowe and A. E. D., and Belling-Lee ("Clip-on" type), whilst the B. T. H. Senior, Lissen, and British Radiophone can all be bought complete with potentiometer. It should be mentioned, however, that every manufacturer who does not supply the volume control gives details in his instruction sheet in regard to the most suitable value. When purchasing a unit of the latter type, care should be taken that the control fitted in the set, or bought separately,

The Cosmocord "Universe" pick-up, which was reported upon in our issue dated August 12th. The compensating adjustment on the rear of the carrier arm may be seen in this illustration. This enables the weight on the record to be controlled. The price is 22s. 6d.

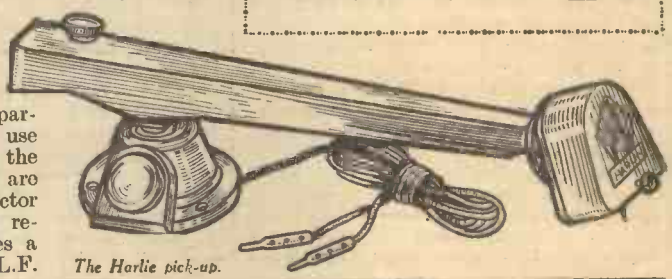
is of the correct type, for otherwise quality of reproduction is bound to suffer.

A Novel Idea

A particularly interesting pick-up which is in great demand is the Belling-Lee "Clip-on," which can be fitted to the side of an ordinary gramophone to enable it to be used in conjunction with the wireless set for electrical reproduction. This interesting unit consists of the standard Belling-Lee pick-up with extensible track-arm mounted on a small metal box which contains the volume control. There are two "key-holes" in the side of the box by means of which the unit can be rigidly mounted by sliding it over the heads of two wood-screws, fitted into the side of the cabinet. The unit itself is particularly light, despite the fact that it is housed in a metal case, and due to the design of the track-arm, it has not been found necessary to use any form of counter-balancing.

Although not exactly coming under the head of pick-ups, mention should be made of the tone-compensators which are made for use in conjunction with pick-ups when perfect quality reproduction is required. These compensators are intended to correct for the low-note cut-off, which is imposed in the recording room in order to enable the low notes to be accommodated in the standard sound-track spacing. It is claimed by some sound engineers that this system is preferable to that of attempting to design the pick-up to give the necessary compensation unaided. Tone-compensators of the type referred to are made by Messrs. Gambrell, under the name of "Novotone," and have a simple control by means of which emphasis can be given to either high or low notes at will.

Most modern pick-ups are designed to provide an R.M.S. voltage output of between .4 and 1.5, so that they can be used in conjunction with nearly any type of receiver without any danger of overloading the valves. These pick-ups are particularly suitable for use with sets in which the pick-up terminals are included in the detector grid-circuit, or in a receiver which provides a large measure of L.F. amplification. In some cases, however, where the pick-up is inserted in the grid-circuit of an L.F. or power valve which is not followed by further amplifying stages, it is better to employ a unit which provides a comparatively large output. Pick-ups of the latter type are the Cosmocord, British Radiophone, and Belling-Lee, and the first-named actually gives an output of no less than 4 volts R.M.S.



The Harlie pick-up.

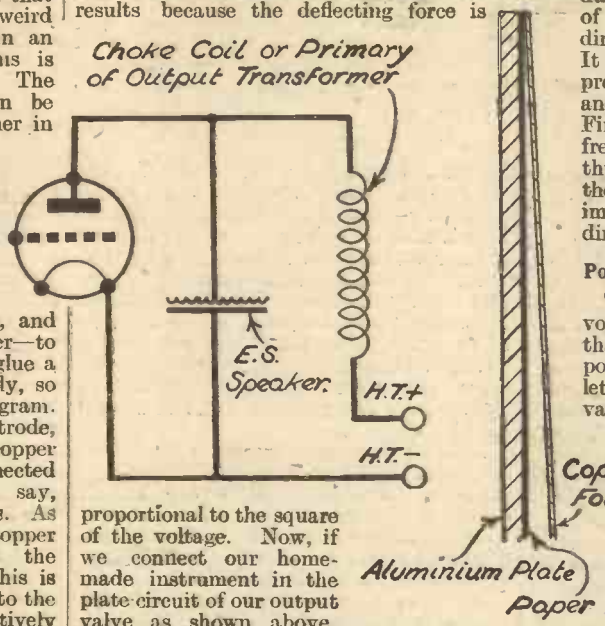
THE BASIC PRINCIPLES OF THE ELECTROSTATIC LOUD-SPEAKER

THERE are probably a large number of readers of PRACTICAL WIRELESS who are under the impression that an electrostatic loud-speaker is a weird kind of condenser which operates in an uncanny manner, and although this is partially true, it is not quite the case. The principle on which it operates can be easily grasped by the veriest beginner in radio.

Briefly, it may be looked upon as a condenser, one plate of which is free to move. Leaving the condenser theory, let us construct such a speaker from the simplest elements.

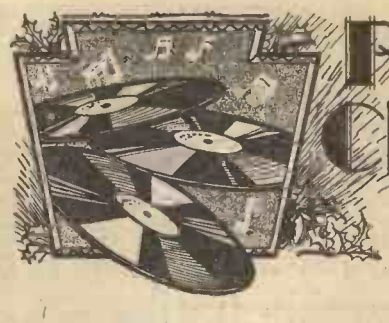
A Simple Experimental Model

Take a small piece of aluminium, and on top of this glue a thick piece of paper—to act as an insulator. On top of this glue a piece of copper foil, by one edge only, so that the strip is free to move, see diagram. A wire is then attached to each electrode, *i.e.*, the aluminium plate and the copper strip, and the ends of the wire are connected to a high-tension battery of, say, 200 volts or the direct current mains. As soon as the current flows, the copper strip will move slightly toward the aluminium plate. The reason for this is that directly we connect the wires on to the mains one plate becomes negatively charged, and the other positively charged; the positive charge attracts the negative charge and therefore the copper leaf moves towards the aluminium plate. A fairly high voltage is necessary to obtain these results because the deflecting force is proportional to the square of the voltage. Now, if we connect our home-made instrument in the plate circuit of our output valve as shown above, and provided that our output is sufficient for the purpose, we shall hear the broadcast, although this will be faint and "tinny" owing to the rough construction of our instrument. The sound thus produced is due to the varying amplitudes of voltage superimposed on the steady direct current by the output valve. It is necessary to connect the improvised speaker in the way shown, and thus polarize it, for two reasons:—Firstly, and most important, each frequency will otherwise be doubled, thus causing distortion, and secondly, the resultant sound will be greater, the impressed voltage being added to the direct current polarizing voltage.



Polarized Voltage

The advantage of using a polarizing voltage is evident when we consider that whereas the force F is proportional to V^2, V is high. Now, if we let v be the impressed voltage and vary this by a small amount, then the force is proportional to $(V+v)^2-(V-v)^2=4Vv$. We can thus see why the first electrostatic loud-speakers used voltages as high as 1000. Nowadays, commercial models are so efficient that it is possible, and quite satisfactory, to work them direct in the plate circuit of the output valve, thereby polarizing the loud-speaker automatically.



RECORDS for CHRISTMAS

A Selection of Some Bright Numbers for the Festive Season.

Orchestral Selections

THE latest big work is the *Tristan and Isolde Symphonic Synthesis* by the Philadelphia Orchestra. This is a clever description of the welding of the music of some of the big scenes into a very harmonious and connected whole. The three "movements" are the Prelude, Liebesnacht and Liebstod, well known to all serious music lovers. These four records (*H.M.V. DB*1911–4) will be welcomed by those who wish to have something of Tristan; for the performance is of a very high order.

Another Wagnerian record even better known is the *Overture to Die Meistersinger* (*H.M.V. DB*1924). Here our B.B.C. Symphony Orchestra gives a fine performance. The recording, too, is magnificent. Those who have a leaning for full-blooded, picturesque music will find it here.

Now to a record of very different character, a humble ten-incher, but none the less a masterpiece in its way. This is *Gounod in Vienna* (*Columbia DB*1201), a very attractive refurbishing of well-known tunes of this composer by the application of modern arrangement and the scenery of Vienna. A double task has been accomplished with brilliant success, and I recommend you to hear the Orchestra Raymonde in this record. It is very clever and delightful indeed. Musical reminiscences are always popular, and Joseph Lewis's Orchestra takes us pleasantly back with *Melodious Memories* and *Looking Backward* on *Sterno* 5006. A most tuneful selection and a lot of it, too.

The Commodore Orchestra always impress. One of the best they have ever done (and they are many) is *Lazy Pete* and *Gipsy Moon* on *Winner B*5602. There is a robustness about their playing of these very good tunes which is extremely satisfying. Whilst we are talking about light music, we must not overlook *The Knight on the Hobby Horse* and *The Cheeky Sparrows* on *Parlophone R*1663. Two of those crisp, bright affairs with splendid xylophone assistance. Quite a novelty.

It is quite impossible to get away from "The Gay Divorce" and Cole Porter. You will find a very typical and rich performance of *Cole Porter Hits* and *Night and Day*, played by Paul Whiteman's Concert Orchestra (*H.M.V. C*2606). It is embellished with bright vocals. In fact, the whole thing is "bright"—very! A "Strauss" must naturally appear regularly, so we have a *Gipsy Baron Fantasy* by Edith Lorand's Orchestra on *Parlophone R*1662. This is a very fine performance, played perfectly and with this fine band's usual sense of the occasion.

That good old overture, *Zampa*, has been resuscitated and played in robust fashion by the Scala (Milan) Orchestra on *Decca K*701. It is rumbustrial stuff with some elegant little passages. The performance is, on the whole, good; but the upper strings are rather weak. Anyway, it's a satisfying meal.

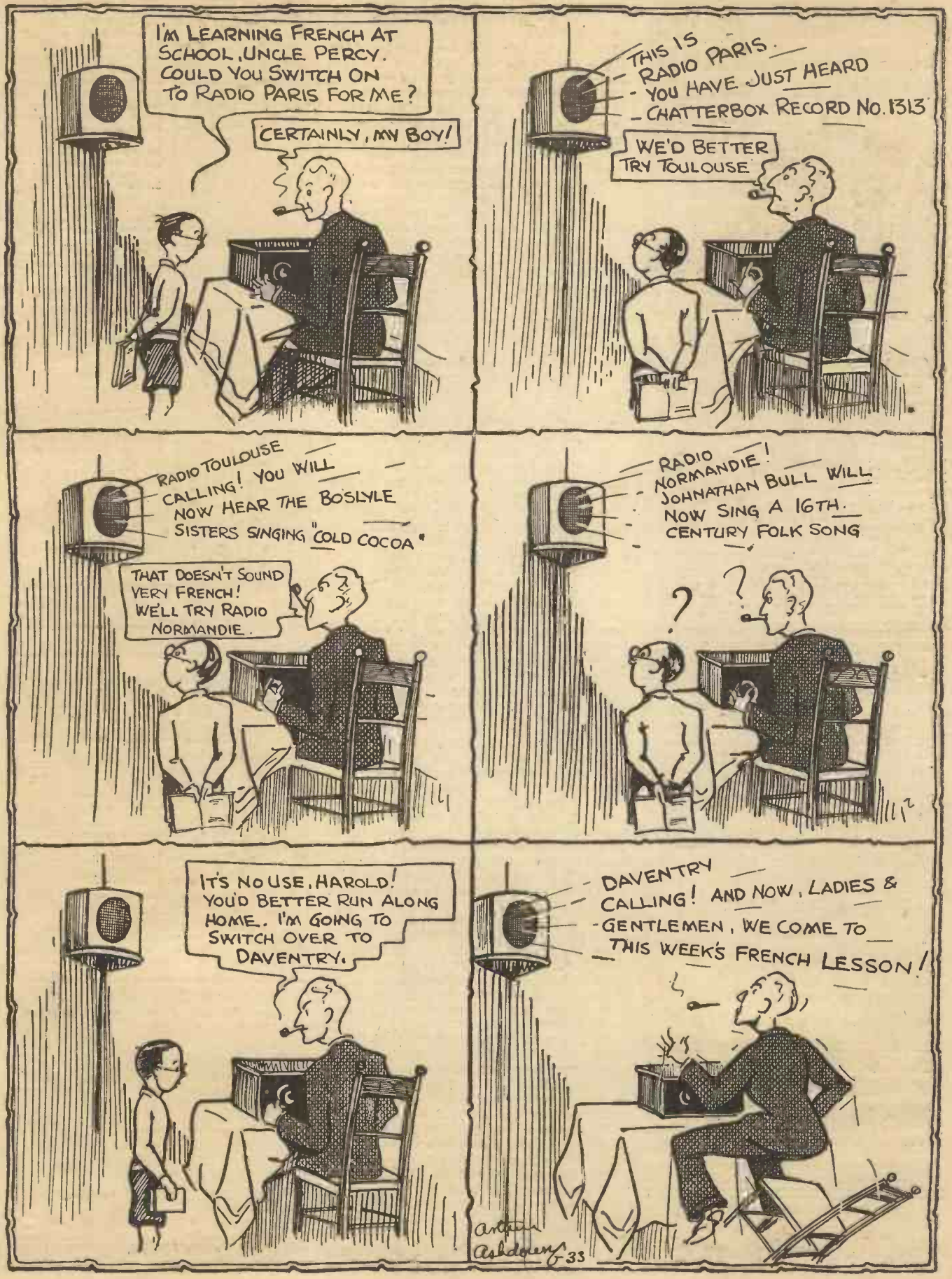
Songs

Really well-sung Scottish songs are not common, and a *Columbia* record (*DB*1274) of *The March of the Cameron Men* and *Kirkconnel Lea* is therefore welcome. The baritone is Hector Cox, an artist of very pronounced skill. They are both good songs, really well sung. That famous little song *Love's Roses*, associated with a pretty story of John McCormack and his daughter, has been sung by him on *H.M.V. DA*1341 with *My Moonlight Madonna*. It is interesting to hear the way in which this great singer can make something very delightful with the slenderest material, as he does here. And, talking of great tenors, on no account miss Tauber's *A Brown Bird Singing* and *I Love the Moon* (*Parlophone RO*20231). I shall not be surprised if this turns out his biggest seller. He sings in English, which is quite good, and certainly these lovely songs could never be heard better. The delicacy of his voice is wonderful: his understanding perfect. I know Tauber has long wanted to sing "A Brown Bird," and everybody who hears it will be glad he did so.

Roy Henderson is well amongst our best British baritones, and his last record, *Leanin'* and *The Fortune Hunter* (*Decca F*3665) is very pleasing entertaimennt. I have never heard the richness of his splendid voice more evident. Two somewhat diverse songs—*In Happy Moments* and *Bless This House*—are very nicely sung by George Hocking on *Sterno* 1282. He has a voice one would like to hear again in something more imaginative. Recently recorded in Glasgow was a magnificent performance of *Steal Away* and *Scotland Yet* by the Clydebank Male Voice Choir (*Regal Zonophone MR*1085). The singing of the spiritual is exquisitely done, and the attack on the other shows that nothing comes amiss to these accomplished singers.

Joseph Schmidt you know. He has an *H.M.V* record (*B*8033) which is quite startling. This record claims to contain the highest tenor note recorded (C sharp) in *Wenn du Treulos Bist*—a German tango-ish song. The other is a Spanish song *Espanola, Yo La Quiero*—vivid, highly coloured. His many admirers will enjoy this. I hope tenors will not compete in this striving for high notes, for since hearing Schmidt's record I heard a record which gives a semi-tone higher! This is by that splendid tenor Groh. His favourite (almost a signature tune!) is *Der Postillon Von Lonjumeau*—a very catchy thing, whilst he sings beautifully the *Italian Serenade* from *Der Rosenkavalier* (*Parlophone R*1674). Watch this singer: he is a coming man.

SPECIAL CHRISTMAS PRESENTS NUMBER NEXT WEEK!


I'M LEARNING FRENCH AT SCHOOL, UNCLE PERCY. COULD YOU SWITCH ON TO RADIO PARIS FOR ME?
CERTAINLY, MY BOY!
THIS IS RADIO PARIS. - YOU HAVE JUST HEARD - CHATTERBOX RECORD NO. 1313
WE'D BETTER TRY TOULOUSE
RADIO TOULOUSE CALLING! YOU WILL NOW HEAR THE BOSLYLE SISTERS SINGING "COLD COCOA"
THAT DOESN'T SOUND VERY FRENCH! WE'LL TRY RADIO NORMANDIE.
RADIO NORMANDIE! JOHNATHAN BULL WILL NOW SING A 16TH. CENTURY FOLK SONG
? ?
IT'S NO USE, HAROLD! YOU'D BETTER RUN ALONG HOME. I'M GOING TO SWITCH OVER TO DAVENTRY.
DAVENTRY CALLING! AND NOW, LADIES & GENTLEMEN, WE COME TO THIS WEEK'S FRENCH LESSON!
Arthur Ashdown '33

THE PICK-UP

(Continued from page 576)

Scratch Filters

If the receiver has been designed on sound lines it may be found that the high note response results in rather undue emphasis of the needle scratch, and it may therefore be necessary to reduce this in order to obtain good reproduction. A fixed condenser and a choke will be found most suitable for this purpose, and these are joined across the pick-up. The scratch itself is generally of some frequency above 3,000 cycles, and therefore the filter must be arranged to eliminate all frequencies above this value, although it must be appreciated that certain of the higher musical frequencies will also be removed by this means. However, it is not possible to remove the scratch without the musical frequencies of the same order, and therefore if the scratch cannot be tolerated, one must put up with the reduced high note response. The most suitable values for a filter are not exactly critical, as much depends upon the response of the receiver, the speaker, and the requirements of the listener. An ordinary type of H.F. choke, in conjunction with a fixed condenser, may prove satisfactory, and it is worth while to experiment with different values to find the most suitable combination. An ordinary plug-in coil of the old type may prove very satisfactory for the purpose, but it should not be placed where there is any possibility of hum or instability being introduced through interaction.

Long leads in this part of the circuit must be avoided at all costs, and if it is found impossible to keep the pick-up leads short they should be enclosed in the familiar metal braiding, and the outside metal surface connected to earth. For the same reason the actual carrier arm and case of the pick-up (if of metal) should also be joined to earth, and in the case of a mains receiver it will be found worth while to arrange a sheet of metal or metallized paper underneath the motor-board, connected to earth, in order to prevent hum.

BUILDING THE A.C. QUADPAK

(Continued from page 573)

take a comparatively long time to attain their correct working temperature, and a wait of some forty seconds is generally necessary after switching on before tuning can be commenced. Start by setting the volume control full on (clockwise rotation) and then turn the tuning knob until a station is heard. Provided that everything is in order you will probably receive something of a surprise due to the tremendous volume, and it will soon be necessary to slack-off the volume control. To change from one station to another you simply turn the dial and adjust the volume level, no other adjustment of any kind being called for. It should very soon be found that stations can be heard at real "concert hall" strength all round the dial.

Once you have become familiar with the set it will be best to try the effect of slight variations to the trimmer condensers mounted on the right-hand side of the gang assembly and operated by projecting hexagonal-headed bolts. Before doing this tune in a station that provides a steady signal and then reduce its volume to bare audibility. Next rotate the screw of the centre trimmer, first one way and then the other, with a long screwdriver, until volume attains a maximum. The same procedure can then be followed in regard to the other two trimmers. Once the best positions have been found no further adjustment of any kind will be called for.

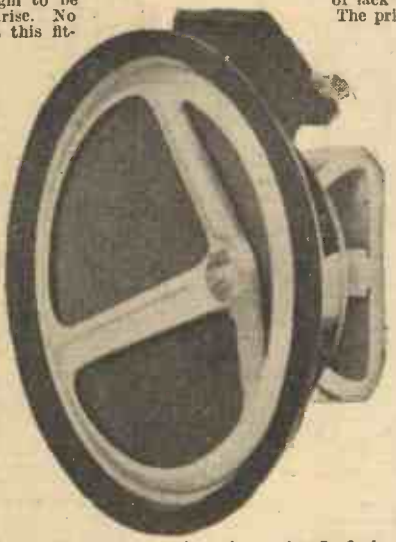
Facts and Figures

Components Tested in our Laboratory

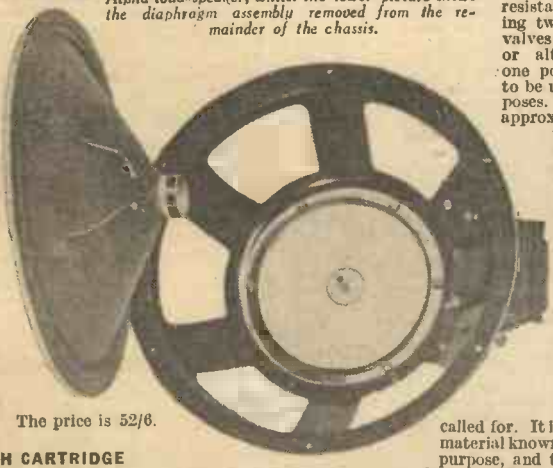
BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

R. AND A. ALPHA REPRODUCER

THE new design of loud-speaker known as the Alpha has now been received from Messrs. Reproducers & Amplifiers for review, and this possesses several new and interesting features. The main point of interest is the removable diaphragm and speech coil, which permits the user to take the complete speaker to pieces to clean out the gap should any foreign matter find its way into that part of the speaker. It also enables a new diaphragm to be easily fitted should damage arise. No skill is required to carry out this fitting, two small terminals only having to be loosened to permit of the speech coil leads being detached, when the nut in the centre of the diaphragm assembly is then removed and the complete diaphragm may be lifted out. The whole assembly is extremely rigid and obviously very carefully thought out. The magnet itself is of large dimensions, and the transformer which is fitted is of the usual high-class R. and A. type. This is provided with four terminals arranged in such a manner than six different ratios can be obtained. These range from a load of 1,500 ohms to 15,000 ohms, and the primary winding will handle a current up to 40 mA. A special model, type B, is manufactured for use with Class B or push-pull circuits. On actual test with the standard model sensitivity was found to be up to a high standard, whilst quality was very satisfying. The response curve was sensibly straight over the major portion of the frequency band, and no undue resonances appeared at any part of the scale. The bass was cleanly reproduced with absence of "boom," whilst the high notes in the scale had a brilliance which is not usually associated with a moving-coil type of speaker. Speech therefore appeared very natural. The power handling capacity of the speaker was ample for all normal domestic requirements, and this is altogether a very good example of what a moving-coil loud-speaker should be. The price is 52/6.



The upper illustration shows the complete R. & A. Alpha loud-speaker, whilst the lower picture shows the diaphragm assembly removed from the remainder of the chassis.



"SILTIT" EARTH CARTRIDGE

SOME time ago we reviewed the hygro-metallic material known as Siltit, manufactured by The No-Mast Patent Aerial Co. of Birkenhead. This material ensures that the earth connection is kept in a continual moist condition, and also possesses a certain amount of metal dust to reduce the resistance of the connection. Their latest production is known as an Earth Cartridge, and is a very ingenous method of using their special compound. A siort length of copper tubing about one inch in diaheter and six inches long is drilled round the surfacemith a number of holes. One end of the tube is plugged with metal and from this projects a number of strands of heavy gauge copper wire. The tube is filled with Siltit, and from the opposite end a length of stranded copper wire extends, the tube being sealed with a wax compound. A label round the tube protects the chemical against contact with the air, and thus preserves the material until the time has come for it to be used in conjunction with the wireless receiver. For this purpose the short wires at the lower end of the tube are opened out in the same manner as the roots of a tree, and the label is punctured over the holes. The tube is then buried a few feet in the ground and the lead attached to the earth terminal. The earth connection is thus soundly made up from metal and hygroscopic material and no difficulties from instability or lack of signal strength should arise. The price of the cartridge is 3s. 6d.

NEW IGRANIC TRANSFORMERS

TWO interesting transformers have been received from Messrs. Igranic, one a driver transformer for Class B working, and the other a resistance-fed transformer unit. The former is of substantial dimensions, being contained in a case similar to the well-known Acme Transformer. It is provided with terminals to enable a ratio of 1 to 1 or 1.5 to 1 to be obtained, and thus is fitted with seven terminals. The primary has a D.C. resistance of approximately 400 ohms, and the secondary winding has been designed to obtain the best results in the particular method of working known as Class B. It is up to the standard of all Igranic components and can thoroughly be recommended. The price is 11s. 6d. The Resistance-fed Transformer Unit is a smaller component, provided with six terminals of the screw type. It incorporates a transformer, condenser, and tapped anode resistance, this latter providing two different values for valves of different impedances, or alternatively permitting one portion of the resistance to be used for decoupling purposes. The total resistance is approximately 50,000 ohms, and the tapping point permits of an anode resistance of 30,000 ohms being employed, together with a decoupling resistance of 20,000 ohms. The price of this component is 10/6.

PEAK POLARIZER AND ANALYZER

THE mirror-drum method of television reception calls for the use of a Nicol prism, whilst for microscopy and other scientific pursuits the use of a polarizer and analyzer is also called for. It is customary to employ a material known as Iceland spar for this purpose, and the resulting product is rather dear. Messrs. Wilburn and Co., makers of the well-known Peak condensers, have developed and are now manufacturing an ingenious form of prism housed in a small brass cylinder applicable to any of the uses for which the standard prism is employed. The device appears to consist of a number of thin strips of glass arranged at an angle and held in position in the tube by wooden plugs. The device appears to work quite good enough for any of the standard requirements where a high degree of efficiency is not essential. Bearing in mind the cost, which in this case will be 17s. 6d. per pair, the efficiency is very good indeed.

NEW MULLARD I.H. RECTIFIERS

THE Mullard Wireless Service have recently announced the release of two new full-wave rectifying valves, type I.W.2 and I.W.3. They are rated to

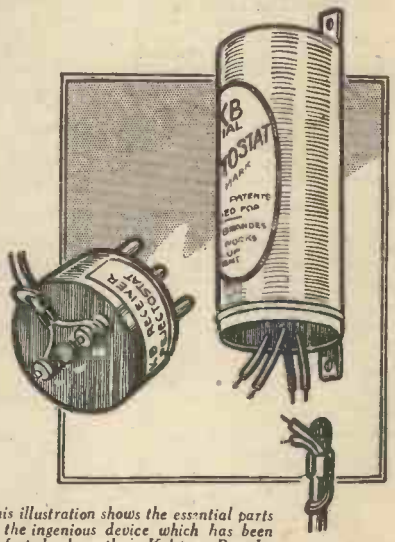
(*Continued overleaf*)

(Continued from previous page)

give rectified outputs of 60 mA at 250 volts and 120 mA at 350 volts respectively. This type of valve (indirectly-heated) is, of course, extremely valuable in a receiver which utilizes the same type of valve in the remainder of the circuit, as it avoids the sudden surge which occurs when directly-heated rectifying valves are first switched on. The heaters of these valves take 1.2 amps and 2.4 amps at 4 volts, and the former costs 12s. 6d., whilst the latter costs 15s. Standard four-pin bases are fitted, the cathode being internally joined to the heaters.

ROLA SPEAKERS

MADE in a well-equipped modern factory, Rola speakers are the outcome of ten years' acoustical research. The range of models now available combines brilliance of tone with unrivalled fidelity of reproduction, and the new Rola Class "B" amplifier unit is a remarkable instrument comprising a P.M. moving-coil speaker, with which is incorporated a complete properly matched Class "B" amplifier. This assembly when connected to any battery set converts it to Class "B" output. The price of the unit, complete with valve, is £3 11s. 0d., or without valve £2 17s. 0d. Among the other Rola permanent-magnet moving-coil



This illustration shows the essential parts of the ingenious device which has been perfected by the Kolster Brandes engineers for the elimination of static interference. It proves wonderfully effective in areas where this form of interference is experienced.

speakers are the new model FR5-P.M., a remarkable little speaker of high performance, and model F7-P.M., a speaker designed for the man who demands radio at its best. For brilliance of tone, this instrument is definitely in a class by itself. These two models are priced at 29s. 6d. and 60s. respectively. Another new Rola speaker is a mains energized model (F5), which is listed at the low price of 27s. 6d. There are also dual balanced pairs of speakers specially compensated so that the inherent frequencies and resonant points balance out, giving an almost perfect reproduction over the whole harmonic range. Further particulars and prices of this useful range of high-class speakers are given in an attractive folder, copies of which can be obtained from the British Rola Co., Ltd., Minerva Road, Park Royal, London, N.W.10.

McDANIEL PRODUCTS

A USEFUL range of valve and metal rectifiers, together with transformers for model railway use, is shown in a leaflet we have received from McDaniel and Co., 154, Hainault Road, Romford, Essex. There is also a range of units for both A.C. and D.C. model electric motors. The D.C. units in this field are supplied with forward and reverse switch, and four-speed control, while the A.C. units have four-speed control only. This firm also specializes in magnetizers working from a 12-volt supply, with or without rectifier, and heavy duty power packs for the L.T. and H.T. supply of large P.A. amplifiers. Interested readers should write to the above address for a copy of the leaflet.

"GOLTONE" METAL SCREENED DOWN-LEAD.

INTERFERENCE which reaches a set from exterior sources is usually picked up by the down-lead, but the "Goltone" screened down-lead effectively solves the problem. It is made up of a series of bakelite separators, which support the stranded down-lead itself. Outside the separators is a braided metal tube which provides the necessary screening. This form of construction gives a particularly low self-capacity, such as is required if results are not to be impaired by using the special anti-interference device. In use the central lead provides the actual aerial down-lead connection, whilst the outer braid is earth-connected. This screened lead is made in two patterns, for outside and inside aerials, the former having a braiding of galvanised steel, and the latter, of bright tinned copper, which gives a neater appearance.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY (HUDDERSFIELD BRANCH)

Fifteen members of this Society who visited the B.B.C. Leeds Studios last week had a very enjoyable time. They were present at the concert given by the York Old Priory Choir, and the items were much appreciated.

Mr. L. Goucher, the secretary of the Huddersfield branch, was made a vice-president last week.—L. Goucher, Vice-President, 10, West Grove Avenue, Dalton, Hudderfield.

SLADE RADIO

A lecture, "Recent Developments in Receiver Design," was given by Mr. A. F. Poynton at the meeting last week. During the evening the Multitone Deaf Aid was very ably demonstrated by Mr. J. V. Silverston, and raised considerable interest.—Hon. Sec. 110, Hillaries Road, Gravelly Hill, Birmingham.

RADIO, PHYSICAL AND TELEVISION SOCIETY

A very interesting lecture on Tungsram Barium Valves was given on November 10th, with demonstrations, to members of the above society, by Dr. C. G. Lemon.

The number of members of this Society is increasing very satisfactorily, but still further new members are cordially welcomed.—C. G. Lemon, Technical Adviser, 19, Lena Gardens, Hammersmith, London, W.6.

EXETER AND DISTRICT WIRELESS SOCIETY

"Short-Wave Work" was the title of a lecture recently given to this Society by Mr. Sydenham, M.Sc., of Torquay. The lecture was well attended, and members present were very interested in the array of 5- and 10-metre apparatus brought by the lecturer. The Society is well forward with its winter programme. On October 30th members were shown over the Exeter Automatic Telephone Exchange, and had the many intricacies of the dialling system simply explained to them. Regular lectures have been arranged for the winter on Short Waves, Television, Gramophone Reproduction, and many other subjects. The aim of the Society is to cater for all classes from the expert to the non-technical listener. If readers in the Exeter district would get in touch with the Programme Secretary, E. H. Ware, "The Beeches," Woodbury, nr. Exeter, he would gladly send a copy of the winter's programme and full details of the Society.

THE SOUTHALL RADIO SOCIETY

A lecture was given by Mr. Rapsey on Wireless Direction and Position Finding at last Tuesday's meeting of this society. He explained the difficulties experienced when using the simple type of frame aerial in removing the vertical component of the incoming signal, and obtaining a clearly defined minimum or zero reading. He followed with a description of the Bellini-Tosti system of directional reception, and the methods adopted at sea in ascertaining a ship's position by the aid of D.F. apparatus. The lecturer concluded with a description of his own experiences at sea and the trouble usually met with in obtaining a true bearing after sunset due to night errors.—Hon. Sec., Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

NEW RADIO SOCIETY AT NEW CROSS

A new Radio Society has been formed, and meetings are held at Goldsmiths' College, New Cross, S.E.5, each Monday evening at 7.30. Members of either sex are welcome. Popular lectures are given each week, frequently accompanied by demonstrations. Questions are invited at the conclusion of the lectures. Local radio enthusiasts are invited to apply any Monday evening to Mr. Albert L. Beedle, 15a, Fontenoy Road, Balham, S.W.12.

THE CROYDON RADIO SOCIETY

The two Societies of Croydon and Thornton Heath combined forces for a comparison of members' moving-coil loud-speakers on Tuesday, November 7th, at St. Peter's Hall, South Croydon. The comparisons were carried out on speech and music by radio and gramophone, as well as on the Croydon Society's home-made oscillator.

Mr. Vellacott's speaker obtained the verdict as having the best all-round performance.—Hon. Secretary, The Croydon Radio Society: E. L. Cumbers, Maycourt, Campden Road, S. Croydon. Hon. Secretary, The Thornton Heath Radio Society: G. T. Webber, 368, Brigstock Road, Thornton Heath.

Next Week—

Radio Christmas Presents.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication.)

Home-Made Components

SIR,—In the issue of PRACTICAL WIRELESS for November 11th, 1933, a letter appeared in the "Practical Letters from Readers" columns from Jas. N. Clark (Southampton), *re* constructing various components. I strongly endorse his views, especially with regard to tuning coils, as every new circuit that appears has a different make of coil, although I expect fundamentally they are the same. Take your "Orbit," for instance: there are thousands like myself who would like nothing better than to build it, but although we have the majority of the components on hand, and could obtain the others for a few shillings, we immediately come to a stop on finding that special coils are necessary at a cost of 25s.; and it is the same with all sets, the coils are never the same. Is it not possible for you to publish details of construction for two coils which could be used in place of those specified in the "Orbit"? I realize they are probably patented, but then all coils are made on a similar principle, and vary very little. If this could be done, I think a great many of your readers would welcome it with open arms, as coils are very easily made, and do not require the use of a lathe, or many other tools.—E. A. ARCHER (Chobham, Surrey).

[*We have in hand a practical article on coil-making which will be published in an early issue.*—ED.]

A DX'er's Appreciation and Suggestions

SIR,—Since I first bought a copy of your most excellent paper I have never missed a copy. As a keen enthusiast for over ten years, I find your articles, especially the short-wave section, extremely helpful. It is evident that a large percentage of your readers listen regularly on the amateur short-wave bands. A little time and trouble spent in learning the Morse code would be amply repaid by the thrill of logging the distant amateur stations which can only be heard using the Morse code. The present time is very favourable for "DX" stations, both on 7 m/c. and 14 m/c. bands (41-42 m., 20-21 metres). Australia (VK) and New Zealand (ZL) can be heard on 40 m. nearly every morning between 07.00-08.45 G.M.T. At midday, Philippine Islands (KA) and D. East Indies (PK) can also be heard, while after dark further Australians are heard between 18.00-21.00 G.M.T., and between 21.00. In the early hours of the morning the following countries can be logged: U.S.A. (W); VE, Canada; Argentine (LU); Panama (NY); Virgin Islands and Porto Rico (K4); Cuba (CM); and B. West Indies (VP). On the 20-metre band, between 14.00-19.00 G.M.T. (when conditions are favourable) dozens of U.S.A. amateurs, both on C.W. and telephony, are heard, and at dusk South Africans (ZS-ZT) are often picked up.

A proper log should be kept, and a thick exercise book costing a few pence is quite suitable for the purpose. The pages should be ruled in columns and headed: Date, Time, Station Heard, Location. Calling or Working, Frequency, Strength (R), Tone (T), Readability (QSA), and Remarks. This is a much better way than scribbling on odd scraps of paper, as it enables those who send reports to make them accurate. Wishing your useful paper every success.—E. F. BAKER (G.6.O.Q.) (Tunbridge Wells).

Pentodes: Curing a Faulty Connection

SIR,—The following hint may be of interest to some of your readers. I am using a 4-valve commercial receiver of a well-known make which gave every satisfaction for a while, and then it started with a noise in the speaker which I can only describe as an unpleasant din. I went through the usual procedure to test for slack joints, etc., and everything seemed O.K. until at last I found the cause of the trouble on two of the pentode valves. Where the tag connects, a little ring of bakelite was higher than the brass seating, so preventing the terminal making a firm connection. The cure was obvious. I pared it down with a penknife, with the result that the din disappeared.—C. IRWIN (Belfast).

Our Guarantee: Transfer Prints

SIR,—Your guarantee is excellent and what confidence it gives us all! I am glad there is at last a *reliable* Wireless Bureau for dealing with queries. Also, the Transfer Prints of circuits are excellent. I offer you my congratulations.—W. J. TYLER (Ipswich).

Our Transfer Print

SIR,—Your transfer print of the "Orbit" in the November 4th issue is a wonderful advance on all previous prints.—A. H. DETLOFF (Enfield Highway).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT when trimming a receiver employing a ganged condenser arrangement the adjustments should be carried out at the minimum setting of the condenser.

—THAT when trimming a receiver employing the superhet circuit the oscillator section of the ganged condenser should be trimmed only at the maximum setting of the condenser.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note, also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

MAINS TRANSFORMER AND HUM

"I recently built up a small mains unit for my receiver to work off the A.C. Mains, but I am troubled with rather bad hum. After spending a long time in trying to trace the cause I borrowed a transformer from a friend and used this for the time being instead of my own mains transformer. With this I got absolutely no hum, and unfortunately the makers of the transformer are not now in existence, so that I cannot change the transformer. Can you give me any hints as to why it causes hum and any cures."—S. D. W. (E.C.1).

The cause of the trouble may be such that you can do nothing, although it may be some slight structural defect. First of all see that all clamping bolts are really tight as hum may be caused through the laminations vibrating and setting up similar vibrations in certain windings, or even transferring the effect to other components through the baseboard. It may be, on the other hand, that the windings are arranged in such a way that hum is introduced from the primary, and most modern transformers now have a screen arranged between primary and secondaries, the screen being earthed. You may find it possible to insert a thin piece of copper sheet between primary and secondary bobbins and this could be earthed. Another scheme worth trying would be to connect a buffer condenser (two .1 mfd. high voltage test condensers with a common centre tap) across the H.T. winding. The centre tap should, of course, be earthed.

LOW ANODE VOLTAGE.

"I have built the Orbit receiver but cannot get very good results. I have tested the receiver all over, and the only point which seems doubtful is the anode circuit of the detector valve. With my meter I can only get a reading of about 8 volts here, and it seems that this is wrong. I cannot see from the theoretical circuit that there is any component which can reduce the total voltage to this figure, and I should like to know what may cause this very low reading, as it is probably that which is preventing the set from working properly." —H. A. L. (Teddington).

The low voltage may not exist on the anode, and you be due only to the fact that the meter which may employed was not of a type suitable for measuring this portion of the circuit. You must remember that the total current taken by the detector valve is very low, and therefore there is little voltage drop through the anode components. If you used one of the ordinary moving-iron meters you would impose a totally different load on the circuit and this would give you a false reading. On the other hand, if you used a really good high resistance meter and the voltage which you obtained was actually that applied to the anode of the detector valve it would point to a wrongly marked resistance, or a defective choke. Test the decoupling resistance (10,000 ohms), the coupling resistance (30,000 ohms) and the choke portion of the A.V.C. Unit (250 ohms). If these are quite O.K., then the reaction condenser and the by-pass condenser should be regarded as faulty and causing a partial short-circuit across the H.T. system.

MAINS AERIAL AND INTERFERENCE

"I live in a flat in the centre of London, and I am thinking of buying an all-mains receiver of well-known make. I have had three sets on approval, and have fitted up a temporary aerial on the small lead roof as well as two different types of indoor aerial. With these aerials I get most terrific interference practically all through the day, and at night time things are worse. Two of the sets were fitted with mains-aerial connections and these also proved very noisy. I asked the firms what could be done to stop the noise and they recommended a noise suppressor on the mains lead. I went to buy one to try it and the assistant in the shop, when I mentioned the trouble, told me that I should get no signals on the mains aerial if I used the suppressor. In view of the difficulty I should like your valued advice as to what to do next."—T. H. (Regent Street, W.1).

You are certainly in a difficult position so far as noise-free reception is concerned. The external aerial systems will naturally bring in some interference, although we think that you will find that most of this trouble comes *via* the mains. Obviously, the fitting of an H.F. filter on the mains leads will reduce the efficiency of these leads as an aerial system, and you must naturally expect a reduction in signal strength if you use these leads for an aerial with the suppressor. We think you will find that quite satisfactory reception can be obtained if you erect the short outside aerial with not more than, say, 10 feet horizontal portion, and use one of the commercial screened down-leads to connect to the receiver. Fit the noise suppressor to the mains plug, and obtain the receiver which gives you best signals with the minimum of noise. You will probably find that there will be very little difference between the various types of receiver with this arrangement, and interference will be at a minimum.

VOLUME CONTROL DIFFICULTIES

"I live just under a mile from the local Regional Station, and have finished building the Luxus Superhet. While this appears to be a marvellous set on the distant stations and proves a splendid acquisition during certain parts of the day, I simply cannot get the local without distortion. I have tried all sorts of adjustments but the local is accompanied by a terribly hard tone and speech is almost impossible to listen to. Can you give me any idea what is wrong with my set?"—F. H. (Hatfield).

Undoubtedly you are using a too efficient aerial for the reception of your local station. The receiver is fitted with A.V.C., but as the local is so close you are getting such a powerful signal that the whole receiver is overloaded. It would be worth your while, therefore, to fit a local distance switch to the set, consisting of either a single on-off arrangement, or a single-pole change-over switch. This should be arranged to bring into action a separate small aerial for the local, or the A.V. biasing circuit should be modified to apply a much greater voltage to the H.F. valves, and the extra resistance shorted out by the switch when distant reception is required. You should not find it difficult to arrange the best circuit for these requirements.

A.C.-D.C.2

"I have just purchased the kit of parts for the Universal Two-valve receiver, but find that the pentode valve is fitted with a seven-pin base the same as the detector valve, and not with a five-pin base. I should be glad if you would inform me whether this valve is suitable and also how to join it up. I am also uncertain regarding the smoothing condenser, which has one lead, marked C. I cannot see this on your Wiring Diagram." —S. T. D. (Balham).

The condenser block which you have got is quite in order, and the lead marked C is the common connection of all the condensers in the block assembly and is, therefore, the lead which is joined to earth and marked "E" in the Wiring Diagram. With regard to the seven-pin pentode valve, the leaflet accompanying this denotes the leads which are taken to the various pins on the valve base, and this is wired as in the original valve with the exception that this pentode has the suppressor grid taken to a separate terminal. This must be joined direct to the cathode. Drawings of this alteration are being made and will be published in a forthcoming issue.

DATA SHEET No. 63

Cut this out each week and paste it in a notebook.

USEFUL WIRE DATA FOR TRANSFORMERS, CHOKES, COILS, ETC.

Standard Wire Gauge.	Working Current in amps.	Enamelled. Winding Turns per sq. in.	Enamelled. Yds. per lb.	Double Cotton Covered. Winding Turns per sq. in.	Double Cotton Covered. Yds. per lb.
18	3.6	392	46.9	297	45.4
20	2.0	685	83.3	472	79.4
22	1.25	1,110	137	692	129
24	.76	1,770	221	977	203
26	.51	2,560	330	1,280	294
28	.35	3,760	488	1,630	422
30	.25	5,370	694	1,990	587
32	.18	6,890	915	2,550	755
34	.133	9,610	1,202	3,020	1,024
36	.1	13,500	1,840	4,110	1,477

The above figure for Working Current is based on a figure of 2,000 amps. per sq. in., which is a suitable normal figure for general working purposes.

FREE ADVICE BUREAU
COUPON

This coupon is available until Dec. 9th, 1933, and must be attached to all letters, containing queries.

PRACTICAL WIRELESS 2/12/33.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

R. AND A. LOUDSPEAKERS

THE secret of obtaining high quality of reproduction and sensitivity in a loud-speaker lies in design and accurate workmanship. The design of R. and A. loud-speakers, which enjoy world-wide popularity, ensures a quality of reproduction which satisfies the most discerning listeners. A useful range of these speakers is shown in an attractive folder just issued by Reproducers and Amplifiers Ltd. The models include the type "60," with improved differential armature unit; the "Bantam" P.M. moving-coil speaker, which is capable of handling an input of 2 watts; the famous "Challenger" P.M. moving-coil speaker, a remarkable reproducer selling at 35s.; the new "Alpha" P.M.M.C. model, incorporating a new principle of design and construction which permits the easy removal of the entire diaphragm and speech coil for inspection and cleaning purposes. There is also the "Victor" P.M. moving-coil 1934 model, an instrument for the connoisseur, having a degree of realism unsurpassed in radio reproduction. Interested readers should make a point of writing to the above firm for a copy of this folder. The address is Frederick Street, Wolverhampton.

"A HELPING HAND TO SET CONSTRUCTORS"

EXPERIMENTERS and constructors will find much to interest them in the new forty-eight-page catalogue just issued by Claude Lyons, Ltd. Several new types of the well-known "Clarostat" variable resistances are introduced in an entirely new range of ultra-high-resistance potentiometers. Another useful component listed is the "Hum-Dinger" for balancing out hum in A.C.-operated receivers. A full range of "B.A.T." fixed resistors are also listed, and, although small, are of particularly robust construction and are obtainable in standard tolerances of plus or minus two, five, or ten per cent. An addition to this range is a kit of motor-car spark suppressors and a condenser for use with car radio. The handy little components have the effect of cutting out all magneto interference. Another new line is a range of "B.A.T." microphones, of which several types of hand and stand instruments are shown, together with many accessories of interest to the experimenter. Also included in the catalogue are several patterns of "Q.M.B." switches, mains transformers, chokes, and "Wego" condensers. The catalogue is packed with useful information and diagrams, and every home constructor should apply for a copy. The address is 76, Oldhall Street, Liverpool, 3.

REPLIES TO BROADCAST QUERIES

W. C. MEACHEM (Bletchley): G5SR, S. Riesen, 35, Wood End Road, Sudbury Hill, Harrow (Middlesex); Regret, cannot trace ON4DO. We advise you to write to: *Réseau Belge, 33, Rue Alphonse Renard, Brussels (XI), Belgium.* E. A. A. HARDWICK (Misterton): Regret, but we are only able to trace the following two call signs: G6VI, W. MacCallum, 21, Park Place, Stirling, Scotland; G5GJ, advertised as J. Bevis, "Singlewell," The Rookery Estate, Stanford-le-Hope (Essex). NEWONE (Hull): W2AOE, Dana A. Griffin, 3, Oak Ridge Avenue, Summit, New Jersey, U.S.A. F. DE BURGH WHYTE (Co. Dublin): W9BUY, Clifford W. Johnson, 1305, N. 8th Street, Independence, Kans., U.S.A.; W2BYP, Dr. George A. Mack, Jnr., Aldridge Road, Chappaqua, New York, U.S.A.; W2AOG, Fred. L. Seufert, 30, Palmer Street, Bloomfield, New Jersey, U.S.A.; VE2EG, G. N. Booth, 7390, Christophe Colomb, Montreal (Que.); OH2PP, A. H. Eckstein, Engelaukea 2 A. 7, Helsingfors, Finland, OK2VA; Colonel Jaroslav Skala, Flying Field, Olomouc, Czecho-Slovakia; W2AWT, L. Kurshner, 188, Rivington Street, New York City, U.S.A.; W2WQ, Wm. Hotine, 394, Northern Blvd., Manhasset, New York, U.S.A.; W9BHT, W. P. Ingersoll, 251, East Chestnut Street, Canton (Ill.); W9DRM, Rudolph P. Michelis, 4824, Woodlawn Avenue, Chicago (Ill.). Regret, cannot trace call VP2YB (Fiji Islands). W. NORTHMORE (Askern): We can trace the following call signs but regret cannot give wavelengths: G2IP, C. J. Reed, 184, Henleaze Road, Bristol (Somersetshire); G6UH, H. E. Smith, "Arawa" Granville Road, Limpsfield (Surrey); G6JZ, C. Fenton, 18, Hill Top Road, Kells, Whitehaven (Cumberland); G5XH, L. W. Hooke, 104, North End, Croydon (Surrey). ROY OLIVER (Northallerton): G5SA, D. Price Jones, Western Electric Co., Ltd., Bush House, Aldwych, London, W.C.2; G5XA, H. Ransom, 86, Seymour Road, Hornsey, N.8; G5MA, R. Munday, 17, Malden Road, New Malden (Surrey); G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon (Surrey); G6OF, Malcolm Shaw, "The Hollows," Marton Road, Lichfield (Staffs). GRID BIAS (Merthyr Tydfil): G6HV, D. B. Large, 25, Park Parade, Roker (Sunderland), Co. Durham; G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon (Surrey); G6VI, W. MacCallum, 21, Park Place, Stirling (Scotland); G6PK, W. G. Pyke, 19, Grove Road, Surbiton (Surrey); G2AZ, L. Grech, 9, Stenhouse Gardens, Edinburgh (Scotland); G1HC, amateur transmitter, Northern Ireland, but regret cannot trace. TALER DE DANSK (Aberdeen): We can trace the following call signs: G2XO, A. Turner, 13, Elgin Avenue, Maida Vale, London, W.9; G2BY, H. A. Watley, "Lyndhurst," Great West Road, Lampton, Hounslow (Middlesex); G5PM, Royal Military College, Sandhurst, Camberley (Surrey); G6BW, A. B. Whatman, R.A.M.C. Mess, Tidworth (Hants); G5GU, J. O. J. Hudson, 107, Chedington Road, Upper Edmonton, N.18; G6LL, J. W. Mathews, 178, Evering Road, Clapton, E.5; G6NU, W. E. Nutton, 42, Richmond Road, Gillingham (Kent); G6DL, A. G. Lapworth, 86, Muntz Street, Small Heath, Birmingham; G5HK, H. S. Beckett, 55, Mona Road, Crookes, Sheffield (Yorks); G6OS, J. W. Gill, 37, Parkfield Drive, Hull (Yorks); G6XD, J. J. G. Taylor, "Willowby," Radford Road, Plymstock, Plymouth (Devon); G6LF, J. H. Goodliffe, 97, Sheaf Gardens, Sheffield (Yorks); G5BU, J. B. Kaye, 12, Close Hill, Lockwood, Huddersfield (Yorks); G6GS, W. B. Gilhespy, Bermuda Cottage, Warren Road, Guildford (Surrey); G6UH, H. E. Smith, "Arawa," Granville Road, Limpsfield (Surrey); G5UK, M. B. Buckwell, 114, Tankerville Drive, Leigh-on-Sea (Essex); G6SR, S. W. Rowden, "Rosebank," Pilrig Street, Edinburgh; G5VH, P. R. Chapman, "Bridgmont," Uppingham Road, Leicester; G5SA, D. Price Jones, Western Electric Co., Ltd., Bush House, Aldwych, London, W.C.2; G6OF, Malcolm Shaw, "The Hollows," Marton Road, Bridlington (Yorks); G6RL, R. F. Loomes, 14, Nursery Close, Wickham Road, Shirley, Croydon (Surrey); G5XH, L. W. Hooke, 104, North End, Croydon (Surrey); G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon; G5CU, J. A. Cuthbertson, "Dunromyn," Cross Lane, Burmeston Road, Scarborough; G6IA, T. H. Colbourn, "Ardchalligan," Selbourne Drive, Douglas (Isle of Man); G5YG, J. Wyllie, 31, Lubnaig Road, Newlands, Glasgow; F3CB, Robert Breton, 45, rue des Amandiers, Paris (20e), France; F8VU, Chamon, 73, Grande-Rue, Montrouge, Seine, France; F8VM, Michel, 53, avenue de Lyon Clermont-Ferrand (Puy-de-Dôme), France. R. P. SCASE (Bristol): We can trace the following call signs: OK1AB, Pravaslav Motycka, Hodkovicky, 90, Prague (Czecho-Slovakia); OK1AW, Alois Weinrauch, Mestec Kralove, 9, Prague (Czecho-Slovakia); HB9V, Jacques F. Brocher, Rue de Mont Falcon, 8, Geneva (Switzerland); EAR147, Rogelio Garrido, 16, Poblaciones, Baeza (Spain); for information regarding the other Spanish call signs write to: *Asociacione E. A. R. Apartado de Telegrafos, Santander*, Spain; PAOASD, W. F. Jacot, Euterpestraat, 73, Amsterdam (Holland). Cannot trace call PPRFB, but *PRFB* is a telegraphy station at Florianopolis (Brazil) on 30, 44.06, 44.71 and 89 metres. P9CH (Broadway): (1) Moscow (50 m.), Palais du Travail, Solianka 12, Moscow, U.S.S.R.; (2) Caracas (31.56 m.), Degwitz and Sibletz, Passage Ramella, Sur 3, No. 92, Caracas, Venezuela; (3) DJC Zeesen (49.83 m.), Reichspostzentral Amt, Templehof, Schoenebergerstrasse, Berlin 11, Germany; (4) Nairobi (49.5 m.), British East African Broadcasting Company, Nairobi, Kenya Colony; (5) W3XAL Boundbrook (49.18 m.), National Broadcasting Company, Radio City, New York, U.S.A.; for Jelöy (Norway) we advise you to write to the Oslo Broadcasting Company, Oslo, Norway. HOPEFUL (Wilts): (1) Surely this was Hilversum on 296 m., musical box interval signal; (2) LR4, Radio Splendid (Buenos Aires), on 303 m.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

PREMIER SUPPLY STORES Offer the following Set Manufacturers' Surplus New Goods at a fraction of the Original Cost, all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T., L.T. 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps. with 4v. 3-5 amps. C.T., L.T., 30/-; 200v. 100 milliamps. with 4v. 3-5 amps. C.T., L.T., 49/6; 300v. 60 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working, 2 mf. 3/6, 4 mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2 mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the Following Lines 6d. each or 5/- per dozen: 4- and 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; 0.02 condensers, 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd.; 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes 20 hys., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

HARLEY Pick-up, complete with arm and volume control; 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 5,000 ohms, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15. our price 18/6.

PREMIER British Made Meters, moving iron, flush mounting, accurate; 0-15, 0-50, 0-100, 0-250 milliamps., 0-1, 0-5 amps., all at 6/-.

ORMOND Condensers, 2-gang, semi shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v. 60 m.a., rectified, with 4v. 3-5a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 3-5a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms 1/- 250,000 ohms, 50,000 ohms and 500,000 ohms 2/6.

ROLA F7 MOVING COILS, 1000 Ohms. FIELD 20/-; MAGNAVOX 142. 1000 Ohms. FIELD 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

FOLLOWING VALVES USED FOR TEST ONLY. CALLERS ONLY. MS4B. MS4, DSB, DS, PT4, 84VB. ALL HALF PRICE.

MAGNAVOX, D.C.144, 2,500 ohms field, with humbucking coil, Pentode transformer, 17/6. Ditto D.C. 142. 1,000 ohm. Field 20/-, AC. Conversion Kit for either of above 10/- extra.

DOUBLE Spring Motors, made by Garrard, play five sides of 10in. record, complete with turntable and all fittings 17/6.

SPECIAL Offer.—Accumulator chargers, input 200-250v. A.C., to charge 2- and 4-volt accumulators at ½ amp.; owing to the high efficiency of the silver oxide rectifier employed charger may be used during broadcast; 9/6 each.

RELIABLE Canned Coils with circuit; 3/- per coil accurately matched; dual range.

PREMIER L.T. Supply Units, consisting of Premier transformer and Westinghouse rectifier, inputs 200-250 A.C. output, 8v. 1 amp., 11/6; 8v. 1 amp., 14/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6.

B.T.H. Induction Type (A.C. only) Truespeed Electric Gramophone Motors, 100-250 v.; 30/- complete.

PREMIER Mains Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., c.t. L.T., 2/- extra; Westinghouse rectifiers for above, giving 180 v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250 volts 60 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350 volts, 90 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400 volts, 100 m.a. 4v. 4-5a., 4v. 2-3a., with screened primary; 15/-.

PREMIER Auto Transformers, 100-110/200-250 volts or vice versa, 60-watt, 7/9; 100-watt, 10/-.

SPECIAL Offer of Manufacturers' Type Transformers, any input, output 250-0-250 volts, 60 m.a., 4v. 1a., 4v. 3a. (both c.t.), 8/6; H.T.8 transformer, with 4v. 3-4a. (c.t.), 8/6; with Westinghouse rectifier, 18/6.

WESTERN ELECTRIC Condensers, 250v. working, 1 mfd., 6d., 2 mfd. 1/-; 500v. working, 1 mfd., 1/-.

T.C.C. Condensers, 250v. working 4x4x1x1x.5 mfd., 3/6; 6x4x2x2x2 mfd., 375v. working, 6/11; H.M.V. 4x4x1x1x1x.5 6/-. 400v working.

SPECIAL Offer of Wire Wound Resistances.—4 watts, any value up to 10,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

MAGNAVOX P.M. M.C. Speakers, 7-inch cone, 18/6. Please state whether Power or Pentode Transformer required.

SPECIAL OFFER. Valves by World-Famous Continental Manufacturers. Fully guaranteed. All Standard Mains Types; 4v. 1 amp filament. HL. LSG. 350v. 120 mA Rectifier, 5/- each. SGVM Pentode Power 6/6 each.

A LARGE stock of all types of Radio Cabinets at very low prices for callers.

WESTINGHOUSE Rectifiers, 120v. 15mA., 6/6; 200v. 30 mA, 8/6; 200v. 60 mA, 10/-.

GRAMPIAN Moving Coil P.M. Speakers, 9in. Cone. Handles 4 watts, 18/6.

PREMIER SUPPLY STORES, 20, High Street, London, S.W.4. Macaulay 2188. Closed 1 o'clock Wednesdays, open to 9 o'clock Saturdays. Nearest Station, Clapham North Underground.

OUR ACCUMULATOR H.T. HIRE SERVICE is cheaper and better than dry batteries. Hundreds of testimonials.—Aneloy Radio, Hindmans Road, E. Dulwich, S.E.22. Oldham Service Station and charging contractors to Camberwell Council. 'Phone: New Cross 4074.

ERICSSON 3/1 L.F. Transformers, List price 17s. 6d. New and guaranteed. Our price, 2s. 3d. post free U.K.—Pioneer Radio, Coptic St., London, W.C.1.

REPAIRS TO ANY RADIO APPARATUS. Quick service guaranteed laboratory tested. Loudspeakers, transformers from 4/-. Blue Spots 5/. New Cones fitted to moving-coil speakers, Eliminators Volt/Amp meters, Mains transformers, etc. quoted for. Repair Dept. C.—Weedon Power Link Radio Co., 185, Earlham Grove, London, E.7. Maryland 4344.

EVERYTHING to make your own transformers (mains and push-pull), chokes and coils. Lists free.—Lumen Electric Coy., 9, Scarisbrick Ave. Litherland, Liverpool, 21.

THE following valves are guaranteed unused and perfect, and any valve differing from the makers' characteristics will be exchanged; and all latest types. A.C./Pens, P.T.4s. A.C.S.G/V.M.s, Pen. 4Vs, M.V.S.G.s, A.C.S.2/Pens, M.M.4V.s, P.T.625s, V.M.S.4s, D.C.2/Pens, D.P.T.s, P.M.24M.s, M.P.T.4s, V.M.4V.s, A.C.S.1/V.M.s, P.M.24B.s, D.C.2S.G./1V.M.s, 11/-; M.S.4s. M.S.4B.s, A.C.S.G.s, S.4V.A.s, S.4V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S./2s, D.C.2S.G.s, 9/6; U.14s, 10/-. "Class B": P.M.2B, P.D.220, 220.B, 8/6, M.L.4s, A.C./P.s, P.M.24s, 8/-; A.C./H.L.s, 164V.s, 354V.s, A.C.2/H.L.'s, 41M.H.L.s, U.10s, U.U.60/250s, M.H.4s, M.H.L.4s, 7/6; V.S.2s, 215S.G.s, 220S.G.s P.M.12s, P.M.12A.s, 9/-; 442B.U.s, D.W.3s, 8/6; 215 P.s, 220P.s, L.P.2s, 4/9; P.2s, 6/6; P.T.2s, P.M.22A.s, 9/-; H.L.210s, H.210s, L.210s, L.2s, 3/9. All Types of Brand New American Valves in Stock, first-class makes: 247s, 235s, 224s, 236s, 237s, 233s, 238s, 239s, 245s, 244s, 12/-; 227s, 226s, 280s, 9/6; 242s, 232s, 11/-; U.X.250s, 16/-; 281s, 14/6. Carriage Paid. Cash with Order or c.o.d.—Ward, 12, Tredegar Road, Bow, E.3. Advance 3668.

MANUFACTURER'S Clearance Lines: Cabinets for Radiograms, loud-speakers, and radio sets; hundreds to select from; send us particulars of your requirements, giving size of set, etc.—H. L. Smith and Co., Ltd., 289, Edgware Rd., London, W.2.

GRAMOPHONES. Radiograms, 64 page. How to Make 'm 3d. Motors, Arms, Pick-ups, Speakers, Horns, Springs, Repairs.—Regentprac, 120, Old Street, London, E.C.1.

LOUD-SPEAKERS, 4s. (Blue Spot a speciality, 5s.). All repairs remagnetised free. Moving-Coil and Eliminators quoted for. Discount for trade. Twenty-four hours service. Clerkenwell 9069.—E. C. Mason, 44, East Road, City Road, N.1.

RELAY OR WIRED WIRELESS.—Those interested in this industry should take the "RADIO RELAY REVIEW." Specimen copy post free from the Publishers: *Radio Relay Review*, Smithygate, Padiham, Lancs.

"UNIVERSAL" [Radio Bargains: Ready Radio 303 Kits, 17s. 6d., with Cabinet and Moving Coil Speaker, 35s.; S.T.500 Kits, 67s. 6d., in sealed cartons; D.X. Screened Coils, 2s. 11d.; Harlie Pick-ups with Arm and Volume Control, 11s. 3d.; Lotus Transformers, 2s. 11d.; H.M.V. Screened Chokes, 10d.; Amplion Speaker Units, 1s. 11d.; Record Valves from 3s. 3d.; Eliminators D.C., 15s. 6d.; A.C., 32s. 6d. Thousands of other Radio Bargains. Full range Telsen and Lissen Components and Kits at right prices. Stamp for our huge Bargain Lists and prints.—"Universal," 20, Victoria Rd., Peckham, S.E.15. New Cross 4933. Stockists Milnes H.T. and Spares.

SOUTHERN RADIO'S Wireless Bargains.—Set manufacturers' guaranteed surplus.

VARIABLE Condensers.—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; all ganged condensers are fully screened, with trimmers and boxed; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1, 1,000 volt test, 7/- each; 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd., Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor screen grid 3-valve kit, less valves, 26/-; with 3 Mullard valves (P.M.12a, P.M.2D.X., P.M.2a), 49/- (list £5/7/6); Universal Radio 3-valve kits, ready assembled on chassis, 12/6 (listed 45/-).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6 each (list £4/17/6); Mullard Radio for Million 3-valve battery kits, complete with 3 Mullard valves, £3/3 (list £6/2/6), all kits brand new in original sealed cartons.

MARCONI 1934 Pick-up No. 19, 26/- (list 32/6); Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/9 each (list 35/-); H.M.V. volume controls 1/6 each (list 12/6). We have purchased the complete liquidated stock of large northern Manufacturer and Factor and can offer the following special bargains:—Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each. 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each. Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each, 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. Assorted Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

ALL Goods guaranteed New and Perfect and sent Carriage Paid.

PLEASE Note.—We have opened branches at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle Street, W.C.2, where callers are cordially invited to inspect our large stocks of wireless bargains. Please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

NEW or secondhand sets, kits and parts bought, sold, exchanged. Best exchange allowances. Lots of first class secondhand goods in stock.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

RYALLS RADIO, 33, Chancery Lane, London, offer new Radio surplus, guaranteed, all post free: Radiophone 4-gang Condensers, straight type, split vanes and trimmers, 8/9. Triotron 8 mf wet electrolytic 450v. working 2/11. HMV 4 x 4 mf. condenser blocks, 3/6. TCC ditto, 4/-. HMV 4 x 4 x 1 x 1 x 4 mf., 4/-. Polar Star major 3-gang straight type, 14/9. R & A type output transformers, 18/23/32-1, 4/9. Pye 20H and 32H chokes, 4/9. Valves used for test only. MS4, S4Vb, DC/HL AC/P 41MP, 7/6. Mazda AC/SGVM, 10/-, MS4B, S4VA, MSGHA, AC/P1, 41MXP, 8/9.

SERADEX PRODUCTS, Full range of catalogues for stamp. Seradex Battery Chargers, models from £2 15s. Seradex Mains Equipment, Mains transformers and filter chokes new illustrated catalogue now ready. Specials delivered at short notice. Let us quote you.—Trevor Pepper, 575, Moseley Road, Birmingham.

NEW AND USED RADIO COMPONENTS., Cheap for Cash.—Arlin, 44, Ranelagh Road, Westminster, S.W.1.

TELEVISION CONSTRUCTORS GUIDE 1/3, illustrated catalogue free, notes 1d.—Ancel Television Co., 230, High Street, Camden Town.

WANTED good Modern Wireless Parts, Sets, Eliminators, Meters, Valves, Speakers, etc. Spot Cash Waiting. Send or bring. We pay more than any other Dealer. Open 9-8.—University Radio, 142, Drummond St., Hampstead Rd., N.W.1.

EXCEPTIONAL Offer. Hundreds of nearly new Fractional H.P. A.C. and D.C. Electric Motors, from 10/- to 65/- each. Urquhart, 58, Defoe Road, London, S.W.17

PEARL & PEARL BARGAINS

NEW model Famous Lincoln Stewart Permanent Magnet Moving Coil Speakers, with universal transformer matching all types output valves, including Class B. Over 2,000 already sold to PRACTICAL WIRELESS readers. List price, 47/6. Special price, 16/11.

BRITISH GENERAL Aerial Bandpass Unit, 10 K.C. tuning. Full constructional details for building Bandpass 3 receiver. List price, 14/6. Limited stock to clear, 3/11.

WEARITE Universal Mains Transformers, input 200-240 A.C., output 60 m.a., tappings 350-0-350; 2 volt 2 amps. C.T. and 2 volt 3 amps. C.T. shrouded. Made for set manufacturer. Worth 35/-; to clear, 12/11.

SURPLUS H.M.V. 3-gang .005 mfd. Variable Condensers with drum drive, beautifully made in one piece to avoid backlash. To clear, 7/11.

FAMOUS Lamplugh Silver Ghost Speakers. Limited number of D.C. mains energised models, 2,200 ohms, suitable for A.C. mains or 200-250 volts, using pot as choke. Original price, 34/-. Bargain price to clear, 10/9.

REVEAL A.C. Eliminators, 200-250 volt, input 25 m.a., output 3 positive and 1 negative tappings. List price, £2/19/6. Bargain, 29/6.

LINCOLN STEWART D.C. Eliminators, 25 m.a., 4 tappings, 1 variable. List price, 32/6. Our price, 16/6.

THE well-known Lincoln Stewart dual range shielded coils, 200-250 metres, and 800-2,100 metres. List price, 6/6. Our price, 2/11.

SPECIAL "FORMO" OFFERS

Formo Dual Gang screened condensers, complete with Dial and Escutcheon. List price, 16/6. Our price, 9/6.

Formo Triple Gang screened condensers, with trimmer, complete with Dial and Escutcheon. List price, 21/6. Our price, 11/6.

Formo Band Pass Dual Gang Assembly, comprising Dual screened condenser with trimmer, and 1st and 2nd Band Pass Coils mounted on aluminium base. List price, 33/6. Our price, 15/-.

THE Sovereign Permeability Tuner, complete with blue print for constructing 3-valve Permeability Tuned Receiver, complete with dial escutcheon. List price, 15/-. To clear, 7/11.

TRIOTRON MAGNA 4-pole balanced armature units, Type P, beautiful tone, well made. Listed at 27/6. Special offer, 9/3.

SLEKTUN Super L.F. Transformers, guaranteed 3 years, ratios 2-1 and 3-1. List, 8/6. To clear, 3/6.

LIMITED number Daptacon Pick-ups and tone-arms, specially designed to prevent wear and eliminate scratch. List price, 10/6. Reduced price, 6/11.

SOVEREIGN Dual Range Coil, panel or baseboard mounting. List price, 7/6. Special offer, 3/3.

REGENTONE Pentode 2-valve A.C. All-Electric Receiver. Original price, £6/15/0. Our price, £2/19/6.

LOTUS 3-1 and 5-1 L.F. Transformers, moulded bakelite case. To clear, 3/11.

SLEKTUN 2/9 short-wave choke, 12-100 metres. Our price, 1/6. Slektun Standard H.F. Choke. Usually, 4/-. Bargain, 2/6.

CAMCO 75/- Radiogram Cabinet, 24/11. (This item is carriage forward.)

READY RADIO 303 Three-valve receiver kit, with original Cabinet and Celestion or Philips Permanent Magnet Moving Coil Loudspeaker. Less valves. List price, £5/14/9. Our price, £2/3/11.

All goods sent carriage paid, cash or C.O.D.

PEARL & PEARL
190, Bishopsgate, E.C.2

BIRMINGHAM RADIOMART offers several unrepeatable snips, limited quantities. Perfect manufacturers surplus stocks. BARGAIN ONE:—Westinghouse HT8, with screened primary transformer having 4v3a., 4v1a., TCC. 4 x 4 mf. 37 wkg. The Lot, 26/-. BARGAIN TWO:—Radiophone straight 3-gang with trimmers and dust cover, 12/6. BARGAIN THREE:—Set three Lotus screened coils for bandpass chassis type, 5/- set. BARGAIN FOUR:—Lotus Heavy Duty 250 ma. smoothing chokes. Resistance 150 ohms. weight 4½ lbs., 5/6, postage. BARGAIN FIVE:—6 Different Lotus wirewound resistances 2 to 10 watt, 200 to 20,000 ohms. Lot, 2/6. BARGAIN SIX:—One each Hellesen 8 mfd. 435 v. electrolytic. TCC 50 mf. 1 2v. and 6mfd. 50v. 4/3 Lot. BARGAIN SEVEN:—Famous Lorenz Pickup and tonearm and 6ft. Lewcos twin screened pickup flex, 6/- Lot. Seven out of Hundreds similar bargains at The Square Dealers, Birmingham Radiomart, John Bright Street, Birmingham.

N.P. Battery Chargers for A.C. Mains. Lowest prices—largest outputs.

N.P. Make instruments for all needs from 62/6 to £17. Trade Lists.

N.P. take your old charger in part payment—give us details and value.

N.P. supply on 7 days' trial—satisfaction or cash refunded. State your requirements.

N.P. have a few slightly soiled models from 47/-. Send for Trade lists and photographs.—Nash Products Ltd. (PW), Stechford, Birmingham.

BANKRUPT BARGAINS. List free with 3v. diagram. ST500 kit 52/6, ST400 45/-, ST300 35/-, 3v. kit 17/6. Any kit supplied at cnt price. Triotron valves 3/6. PM.MC 12/6. Eliminators DC 12/-, AC 28/6. Screened coils 2/6. Iron cores 3/9. Part Exchange.—Butlin, 143B, Preston Road, Brighton.

THE new "Microlode" feature fitted to W.B. Moving Coil Speakers enables you correctly to match your output valve. Seventeen transformer ratios for really accurate matching to any power or pentode valve and four ratios for Class B or Q.P.P. all available on one speaker by a simple switch adjustment.—Write for details to Whiteley Electrical Radio Co., Ltd., Mansfield, Notts.

OPENINGS *for* ENGINEERS!

Never before has engineering offered such magnificent chances. With the rise of the depression, the industry is literally teeming with first-class opportunities. Our 250-page Hand-book, **"ENGINEERING OPPORTUNITIES,"** shows where the opportunities lie, and the easiest way to prepare for them. The Hand-book gives details of **A.M.I.Mech.E., A.M.I.E.E., A.M.I.C.E.,** G.P.O., etc. Exams., outlines Home-Study Courses in all branches of Civil, Mech., Elec., Motor, Radio, and "Talkie" Engineering, Building, etc., and explains our unique Employment Dept. Send for this valuable Hand-book to-day—FREE!

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 390, Shakespeare House, 29, OXFORD ST., LONDON, W.1.

ACCUMULATOR CHARGING IS A PAYING PROPOSITION.

Complete plant, incorporating Westinghouse Rectifiers, for A.C. Mains Supply, from **£4 4 0.**

Send for Descriptive Booklet.

MAINS' POWER RADIO, Ltd., Eastern Road, Romford.

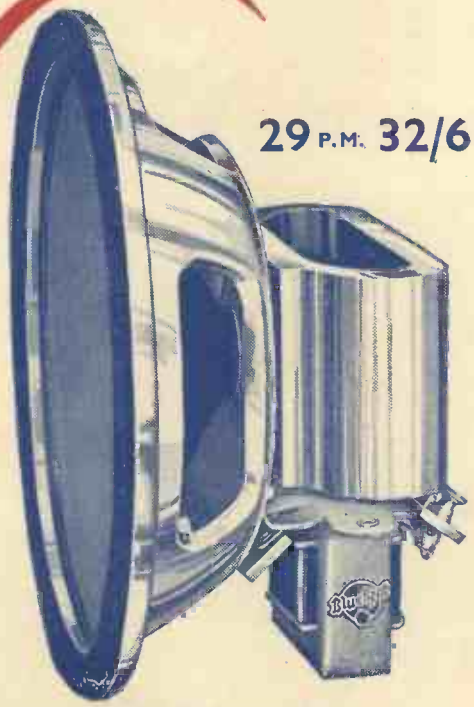
There is no substitute for Blue Spot Quality

BLUE SPOT SPEAKERS ADD TO CHRISTMAS JOYS

Quality is the keynote of enduring success. Whether in men, motor cars, racehorses or loudspeakers; it is only true-blue quality that ensures outstanding success and lasting satisfaction.

That is why Blue Spot stress quality above all else. And that in turn is why Blue Spot Speakers come as close to perfection as human ingenuity and care can achieve. In design, materials and workmanship the quality of Blue Spot Products is unmistakable. There is no room for surprise, therefore, that Blue Spot Speakers are singled out as individual—above and distinct from the ordinary run. You will recognise the superiority of Blue Spot Speakers best and quickest by testing them alongside other makes. Judge them on appearance, on construction, on performance, and you will find ample evidence to justify the Blue Spot claim to leadership and to underline it.

29 P.M. 32/6



MOVING COILS 32/6 - 87/6
also available without transformer.
OTHER TYPES 12/6 - 42/-
PICK-UP with wire wound volume control and rotating head, **35/-**

? WHY NOT INSTAL EXTRA LOUDSPEAKERS

and have music everywhere!

Your present set or your new Blue Spot will operate extra loudspeakers. Why not instal Blue Spot Speakers in your dining room, kitchen, nursery, etc., and brighten up the whole house for Xmas? Ask your dealer for details or send for Catalogue.

22 P.M. (with 29 P.M. movement), **45/-**

Blue Spot
REGISTERED TRADE MARK

THE BRITISH BLUE SPOT CO. LTD.
BLUE SPOT HOUSE, 94/96 ROSOMAN ST., ROSEBERY AVENUE, LONDON, E.C.1. *Telephone: Clerkenwell 3570.*
Telegrams: "Bluospot, Isling, London."
Distributors for Northern England, Scotland and Wales: H. C. RAWSON (Sheffield and London), Ltd., 100, London Road, Sheffield; 22, St. Mary's Parsonage, Manchester; 177, Westgate Road, Newcastle-upon-Tyne; 37, 38, 39, Clyde Place, Glasgow.

CUT COUPON for CATALOGUE
To receive illustrated Catalogue No. P.R.29.5 of all Blue Spot Products, write your name and address in the margin, cut out and post in open envelope (½d. stamp).

P. W. Gift Stamp No. 62

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11 Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

P. W. Gift Stamp
"Popular Mechanics" No. 6

INSIDE! "PRACTICAL TELEVISION" SUPPLEMENT

Practical Wireless

3D.

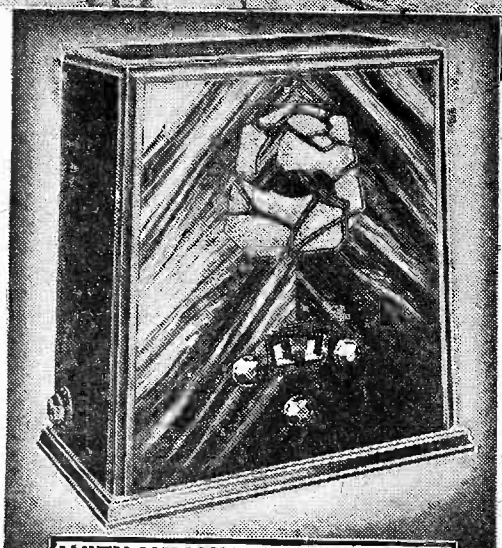
Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 3.——No. 64.
DECEMBER 9th, 1933.
Registered at the G.P.O. as a Newspaper.

EDITED BY F. J. CAMM.

Making Your Own SCREENED COILS

Yes! SHORT waves make it possible to get AMERICA *direct!*

...THEY BRING IN HUNDREDS OF STATIONS YOU CAN'T POSSIBLY GET ON ANY OTHER SET



WITH WALNUT CABINET AND MOVING COIL LOUDSPEAKER £8.2.6

ENGLAND-EUROPE-AMERICA-AUSTRALIA-ALL NOW ON MOVING COIL SPEAKER!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World Skyscraper 4 tunes from 12 to 2,100 metres. It gives you all the ordinary British and Continental programmes you can desire, and in addition stations all over the world which broadcast news and views and entertainment on the Short and Ultra Short wavelengths. These Short Wave stations are receivable on this Lissen All-Wave All-World Skyscraper at truly amazing ranges—Melbourne, Australia, at almost 12,000 miles, Johannesburg at 6,000 miles, Sydney, Australia, at 12,000, Pittsburg, Massachusetts, at 4,000 miles—these and many more of which the ordinary listener cannot hear even a whisper.

And remember you get these stations through Double Balanced Pentode Output giving brilliant reproduction on a Moving Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

The ONLY SET on which you CAN get SHORT WAVES as well as ordinary broadcast stations

Lissen have made this All-Wave All-World radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia direct on a set you have built yourself; it makes you an enthusiast to realise what a wonderful thing you have created!

And when you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations.

YOU BUILD IT YOURSELF!

CHART FREE

To LISSEN, LTD., Publicity Dept., ISLEWORTH.
Please send me FREE copy of All-Wave All-World "Skyscraper" Chart.
Name .....
Address .....
.....
P.R.1934

POST COUPON

The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!

LISSEN

"SKYSCRAPER" 4

SEE "PRACTICAL TELEVISION" IN THIS ISSUE!

ROUND *the* WORLD *of* WIRELESS

"Practical Television" Free This Week!

THE remarkable strides made recently in the development of television have lifted it from the realm in which it was but a qualified success to a stage where satisfactory transmissions are possible and probable. With the object of keeping our readers acquainted with the movements and the developments of this new industry we are presenting free in the centre of this week's issue a four-page supplement, entitled "PRACTICAL TELEVISION." This will be given free once a month and it will appear with its own issue and volume number, so that those readers particularly interested in television may lift out this separate little journal and have it bound up separately. As television develops, PRACTICAL TELEVISION will develop in size with it, but the position at present is such that four pages a month are adequate to cover practical developments and to keep the reader's knowledge up to date.

Manila on 50 Kilowatts

THERE would now appear to be a chance of hearing broadcasts from the Philippine Islands, as KZRM, Manila, has now developed into a 50 kilowatter. Its wavelength is 485 metres (618.5 kc/s). Programmes are transmitted daily from 06.30 local time, the main evening entertainment lasting from 17.00 till midnight or 1 a.m. Translated into G.M.T., this spells a careful search between 22.30—00.00, or, again, between 09.00 and 16.00, as local time in the Philippines is eight hours *ahead* of ours.

B.B.C. Stations and Lucerne Plan

ON January 15, the B.B.C. transmitters will change over to their allotted frequencies as under: Daventry National, 200 kc/s (1,500 m.); North Regional, 668 kc/s (449.1 m.); Midland Regional, 767 kc/s (391.1 m.); Scottish Regional, 804 kc/s (373.1 m.); London Regional, 877 kc/s (342.1 m.); West Regional, 977 kc/s (307.1 m.); North National, 1,013 kc/s (296.2 m.); Scottish National, 1,050 kc/s (285.7 m.); Belfast, 1,122 kc/s (267.4 m.); London and West National, 1,149 kc/s (261.1 m.); Aberdeen, 1,348 kc/s (222.6 m.); Newcastle, 1,429 kc/s (209.9 m.); and Plymouth and Bournemouth on a common wavelength of 203.5 metres (1,474 kc/s). Aberdeen may, however, be provided with another channel. It is noticeable that with the exception of Bournemouth the alterations in the wavelengths of the British stations are small, and, in consequence, cannot cause much inconvenience to listeners; they do not in any way complicate the tuning of modern wireless receivers.

Famous Casino Burnt Down

THE *Palais de la Mediterranee*, opened at Nice some two years ago, has been partly destroyed by fire. It is from this Casino that a number of concerts and other broadcasts were relayed to the Nice-Cannes-Juan-les-Pins transmitter. It is reported that, pending its reconstruction, the studio will endeavour to link up with Cannes or Monte Carlo.

More Interference for Kootwijk

ACCORDING to a report from Romania, the 20-kilowatt transmitter now under construction at Brasov will shortly carry out its initial tests on 1,875 metres (160 kc/s), the channel now used by the Dutch Kootwijk station. This wavelength was allotted to Romania by the Lucerne Wave Plan, much to the disappointment of the Dutch Broadcasting Authorities, who have used it for several years.

Christmas Relay from Bethlehem

ARRANGEMENTS are being made by the B.B.C. to give listeners on Christmas Day a relay of a sacred service held at the Church of the Nativity, Bethlehem. In previous years the idea was mooted by the United States and steps had already been taken in 1932 to carry out the project, but, unfortunately, fell through. If permission can be obtained from the Patriarch of the Greek Orthodox Church to effect this unique transmission, the National Broadcasting Company of America will take it from England and distribute it throughout its vast network.

Berlin and Hamburg

THE construction of these two high-power stations is rapidly nearing completion, but although the Berlin 100-kilowatt transmitter will not be ready as early as anticipated, it is now fully expected that its tests will be made during the Christmas holidays. In these circumstances both Berlin and Hamburg will launch their new stations on the other in January next. No alterations in the wave-lengths of Berlin, Mühlacker, and Stuttgart, contrary to previous statements to that effect, will take place before January 15, 1934.

Eiffel Tower to Remain

AS apparently only that part of the Lucerne Plan dealing with the medium-wave band will be brought into operation on January 15th, Eiffel Tower will retain its channel for the time being. Broadcasts will therefore continue from this station until further notice. As regards the long-wave band, in view of the fact that no agreement could be reached at the recent Amsterdam Conference, there is every possibility that until some practical solution may be found, stations working on wavelengths between 100 and 2,000 metres will retain their present positions.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

A New German Station

IN the beautiful forest of Tagel, in Germany, a new broadcasting station has been built which incorporates the latest improvements in design. Instead of the usual masts of steel, huge wooden towers are being erected with the aerial running vertically through the centre. The illustration on this page shows one of these towers which has progressed to a height of 100 metres. When completed, it will be 160 metres in height.

Fate of Belgian Private Transmitters

THE number of small privately owned broadcasting stations erected in Belgium during the past three years is such that the Government finds itself compelled to suspend licences in order to prevent mutual interference. They are scattered over the country, and include such towns as Antwerp, Binche, Charleroi, Liége, and have also even invaded the capital. In Liége alone five are operating daily. As their power is very small, it has been suggested that they should be grouped, and that a limited number be required to work on one of two common wavelengths.

Municipal Elimination of Interference

BADEN-BADEN in Germany is anxious to become a model radio city. In order to secure perfect reception of wireless programmes, the inhabitants have induced the council to install free of charge over 9,000 interference suppressors on electric motors which have been judged guilty of marring the radio entertainments.

Radio Version of *The Three Musketeers*

ALEXANDRE DUMAS' famous masterpiece has been specially adapted for broadcast, and will be heard in two parts, the first from the National stations on December 20th and the second in the Regional programme billed for December 21st.

Telephony on Cross-Channel Steamers

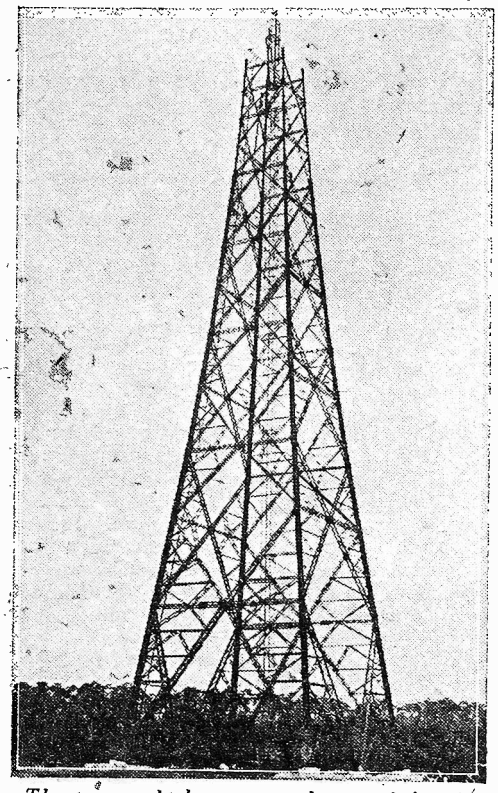
INTERESTING experiments have been carried out in two-way wireless telephony transmissions between the Dover-Ostend mail steamers, and the Belgian and English coasts. The s.s. *Princesse Astrid*, one of the new boats, has already been equipped for the service, and passengers travelling on this sea route will shortly be able to communicate by telephone with any subscriber in any city or town in Belgium. The Ostend radio station picks up these messages, and passes them through the ordinary telephone network.

Europe's Model Stations

MOST European transmitters in the course of their broadcasts are found to deviate in varying degrees from their allotted frequencies. Some, in this respect, are good, others bad, and yet others very bad. If the reports of the U.I.R. through the Brussels checking station are studied, the average deviation in cycles for one working month may be noted. Should prizes be awarded, however, it would appear that the two most conscientious transmitters are Scottish National (Falkirk) and Vienna, on respectively 1,040 and 580 kilocycles. Plus or minus deviation in cycles from their standard frequency has been shown as 0 in recent charts. If only all European stations could attain this excellent result!

INTERESTING and TOPICAL PARAGRAPHS

A VERTICAL AERIAL



The tower which contains the aerial for the new German station in the forest of Tagel.

New 10 kW U.S.A. Short Waver

THE Crosley Radio Corporation has resumed broadcasts with its new 10 kilowatt transmitter W8XAL at Cincinnati (Ohio). The station sends out a daily programme between G.M.T. 11.00-15.30, 18.30-20.30, and from 23.00-06.30 on 49.5 metres (6,060 kilocycles). The radio entertainments are relayed from the WLW, Cincinnati, studios of the N.B.C. network, working on 428.3 metres (700 kilocycles),

SOLVE THIS!

Problem No. 64.

Smith found that he had most of the parts required for the A.C. Quadpak, and he decided to try this out. He made up a rough chassis from plywood and carried out the construction as described in the Christmas number of PRACTICAL WIRELESS, but when finished, all that he could get was most pronounced hum. Why was this? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 64, and should be posted to reach here not later than December 11th.

SOLUTION TO PROBLEM No. 63.

Jackson had made the coils so efficiently that on the long waves the detector valve broke into parasitic oscillation. A simple resistance included in the reaction circuit cured the trouble. The following three readers gave correct solutions to Problem No. 62, and books have, therefore, been forwarded to them: E. Gray, Trinity Cottage, Costessey, Norwich. C. R. Willis, 53, Salisbury Road, Everton, Liverpool, 5. L. I. Butler, The Vicarage, Annerley Woodhouse, Notts.

Budapest's Ether Giant

THE super-power transmitter under construction near the Hungarian capital is nearing completion, and the famous aerial tower, vying in height with the Eiffel Tower, is nearly finished. It is reported that Budapest will carry out its initial tests this month. The station at present in use will adopt another wavelength, and will be utilized for the transmission of an alternative programme.

Piano Tuition by Loud-speaker

IN the United States, pianoforte lessons are broadcast through the microphone. Listeners are requested to place a printed chart on the keyboard and to carefully follow instructions given out by the music teacher. Each corresponding printed note bears a number which, according to the melody, is called out in rotation, with the result, no doubt, that the murdered composition resounds throughout the streets of innumerable cities.

Radio Rennes P.T.T.

FOLLOWING a temporary close-down for reconstruction of the plant, the Rennes P.T.T. transmitter is again on the air on 271.4 metres. It will be found that the signals are now heard at better strength in view of increased power in the broadcast. Rennes is only roughly 250 miles from London, and consequently provides a favourable alternative channel for the Paris *Ecôle Supérieure* concerts.

Ship-shore Telephony in Mediterranean

A SERVICE of wireless telephony is being established between the s.s. *Djenné* and Casablanca (Morocco) and Marseilles (France). The wavelengths adopted for the purpose are 92 metres for the steamer, and 68 and 74 metres respectively for the land stations at Rabat and Tangiers. Further developments will shortly permit similar service on the Casablanca-Bordeaux route.

An Ethereal Harp

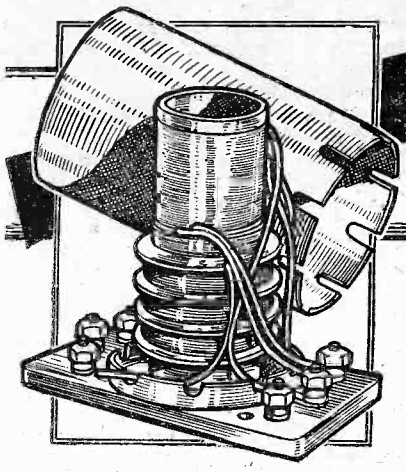
PRAGUE, similar to its neighbours, has finally chosen a characteristic signal to identify itself to its listeners. It has taken the harp motive from the Czech composer Smetana's poem *Wyschehrad*, and, having recorded it, broadcasts a few bars during all intervals of more than one minute duration. A melodious signal, which will be quickly recognised after you have once heard it.

Radio and Bootleggers

THE smuggling of alcoholic liquor during the past few months in the Baltic countries, and in particular Finland, has been assisted, according to a Swedish newspaper, by a pirate wireless station which the Finnish Customs officials are endeavouring to locate. Swedish amateur experimenters report having picked up morse messages destined to the smuggling ships, the search for which is proving an exciting pastime.

A Crop of Small Spanish Broadcasters

PENDING the reorganisation of the Spanish broadcasting system, permits have been granted for the installation of a number of small privately-owned stations. Following the opening of a transmitter at Bilbao and at Huesca, Radio Murcia (EAJ17), Gandia (EAJ23), and Onteniente (EAJ30) have been launched on the ether. These stations are stated to be working on 203 metres and their power does not exceed 200 watts.



MAKING YOUR OWN Screened Coils

This is the First of a Short Series of Articles in which the Construction of Different Types of Highly Efficient Screened Tuning Coils will be Described.

By FRANK PRESTON

DESPITE the extremely low prices at which efficient tuning coils can now be bought, there is an insistent demand from readers of PRACTICAL WIRELESS for some really practical information regarding the design and construction of tuners which can be made at home. As a matter of fact, a good deal of information in respect to coil construction has been given in these pages before, but all the coils described have, of necessity, been of the unscreened type. The reason for that is very simple, and is that the constructor has been unable to buy screening cans in ready-made form. To make these cheaply at home is well-nigh impossible unless the amateur has a fairly well-equipped workroom, but the difficulty has now entirely been overcome by the introduction (by Messrs. Peto-Scott, Ltd.) of well-made screening cans, which are supplied in conjunction with a paxolin former and the necessary dividing washers. By making use of these sets of coil materials, units of extreme efficiency and compactness can be made by using no other tool than a small drill. Additionally, a screened air-core coil of excellent design and high efficiency can be produced for a little over half a crown.

It is hoped in the course of a few articles to deal with the construction of tuning units of all the types which are required for a modern wireless set, but this particular article will refer only to one type which can be used satisfactorily in any normal receiver of the Det.-L.F. or S.G.-Det. types.

A good idea of what the finished component looks like can be gained from the photograph at Fig. 1, whilst all the necessary materials are shown grouped together in Fig. 5. The overall size of the complete tuner, including the baseplate and terminals, is only 3in. by 2in. by 3¼in. high, so it can easily be accommodated in any kind of receiver.

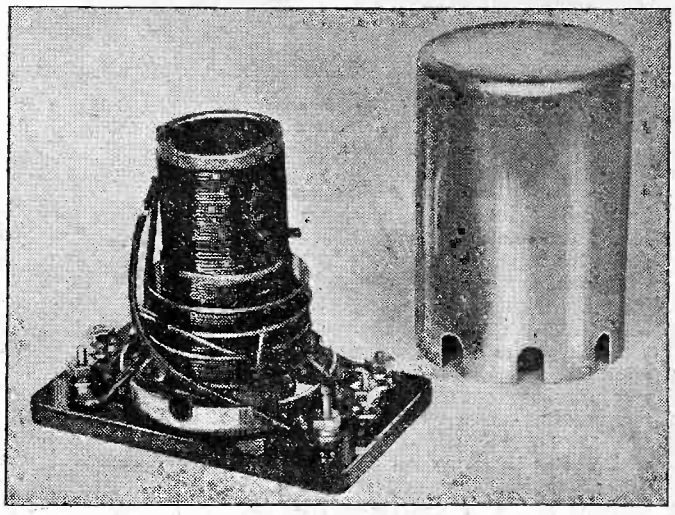


Fig. 1.—This photograph shows the finished coil and screen.

The Materials Required

The set of parts supplied by Messrs. Peto-Scott includes a cylindrical screening can, a "lid" for the can, a 1in. diameter paxolin tube, a number of paxolin dividing washers, and a "U"-shaped metal bracket for mounting purposes. The only additional materials required are six 6 B.A. terminals, an ounce of 34 gauge single-cotton-covered wire, a piece of 3-16in. ebonite measuring 3in. by 2in., an odd piece of insulating tape, and a short length of systoflex sleeving. Most of the latter will be found in the constructor's junk box, but if not they can be bought for less than eighteenpence.

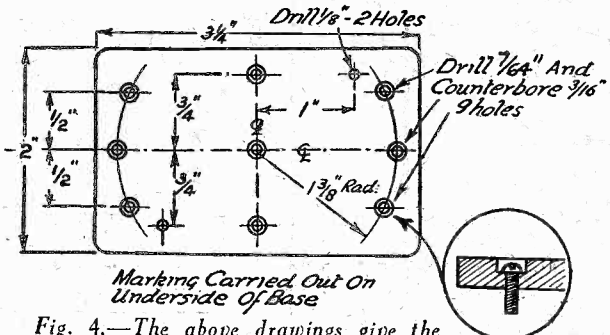


Fig. 4.—The above drawings give the necessary dimensions for making and drilling the ebonite base-plate

Fig. 2 shows the theoretical and practical arrangement of the windings for the coil I am going to describe first of all, and it will be seen that this is a rather unusual one. I can assure you, however, that it is one which I have proved to be extremely good, most especially in receivers of the Det.-L.F. type, where the maximum degree of selectivity is required from a single tuned circuit. The medium-wave winding

(Continued on next page)

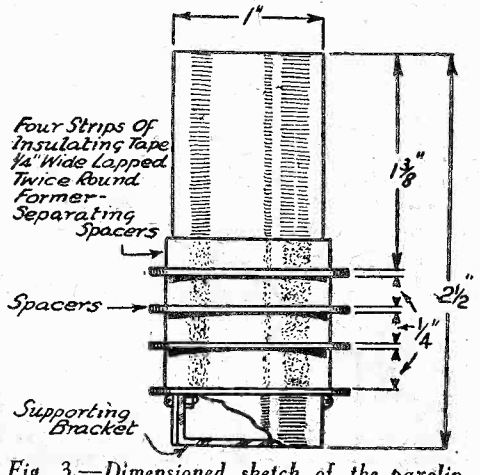


Fig. 3.—Dimensioned sketch of the paxolin former, showing how the washers are spaced by means of insulating tape.

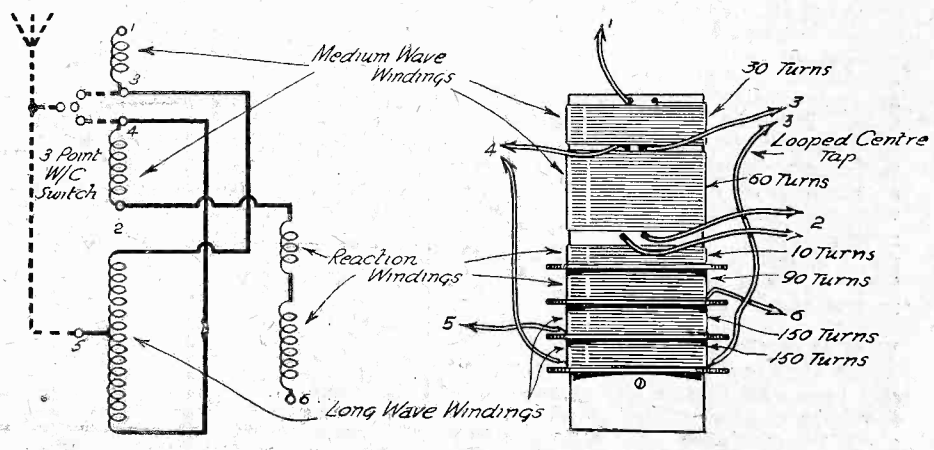


Fig. 2.—This sketch shows the theoretical and practical arrangement of the windings for the tuner described. Connections for the 3-point wavechange switch are indicated by broken lines.

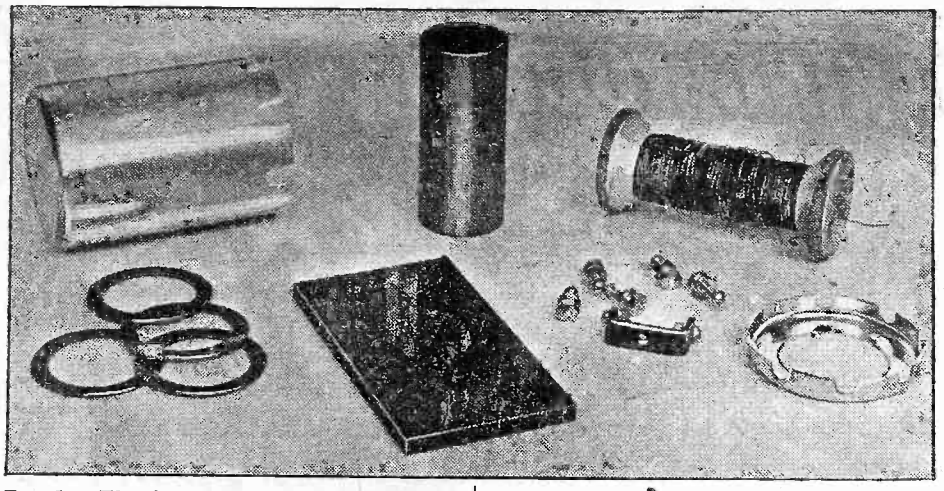


Fig. 5.—The few and simple parts required for making the complete screened coil are illustrated above.

(*Continued from previous page*)

is "split" into two sections, and the long-wave one is connected between them. A centre tapping is provided on the long-wave winding and the aerial is normally joined to this, but when the knob of the three-point wave-change switch is pulled out the long-wave section is short-circuited and the aerial is connected to the junction between the two sections of the medium-wave winding. By dividing the latter winding into two parts, one of which has half as many turns as the other, sufficient selectivity is obtained without reducing the sensitivity to any marked extent. Experiment has proved that best results are obtainable on long waves by taking the aerial tapping from the exact centre of the winding.

A reaction winding is also provided, and the size and position of this have been so determined that it provides an almost uniform effect over the whole of both wave-bands. This result has been secured by winding ten turns side by side near to the medium-wave windings, and placing the remaining ninety on a bobbin next to the long-wave windings.

Preparing the Former

Before commencing to wind on the wire, the paxolin former must be prepared by fitting the mounting bracket and paxolin-spacing washers. The bracket is fitted into one end of the tube by making two 7/32in. holes and passing the small bolts provided through them. Next slip one washer over the tube and push it down until it is against the heads of the bracket-fixing bolts. Now cut a strip of insulating tape ¼in. wide and wind this round the tube close to the washer for about a couple of turns. The second washer can then be fitted on the tube and pushed tightly against the insulating tape. Put on a second strip of tape and then another washer, repeating the operation once again and finishing off by winding a fourth strip of tape outside the last washer to keep it in place. The spacers should then be quite securely held in position, but if any doubt is felt on this score, a coat of shellac varnish or thin glue may be applied as a check.

Winding on the Wire

The winding is easy enough to carry out, and before starting, a pair of small holes should be made about 3-16in. from the end of the tube with the point of a compass or a thin pricker. Pass the end of the wire through one hole and back again through the other, leaving a length of about 5in. projecting for making a later connection to a terminal. Carefully wind on thirty turns of the wire, keeping a steady tension on the wire the whole time and arranging the turns neatly side by side. After that, make two more small holes in the tube in line with the end of the winding and anchor the wire in these, again leaving a length of 5in. projecting. So that this connection can easily be identified at a later stage a piece of stamp edging should be stuck on to it and marked with the terminal number (3). The second portion of the medium-wave winding can now be put on, and the end of the wire should be anchored in the two holes already made. Wind on sixty turns and make quite sure that they go in the same direction as the previous ones. Make a third pair of holes and anchor the wire, labelling the end with a figure 2.

The reaction winding comes next, and the end of the wire is secured by passing it through the pair of holes just made. Leave a gap of ⅛in. and then wind on ten turns, again in the same direction, pass on to the first slot and complete the remaining ninety turns. Cut off the wire and secure the end with a dab of sealing-wax or by looping it under the previous turn where it passes from the tube to the slot. Label this end of the wire with a figure 6.

Lastly we come to the long-wave winding, which consists of a total of 300 turns, half of which are placed in the two lower slots. The beginning of the winding need not be anchored, since it will be held in place by the following turns. Again, make quite sure that the turns are wound in the same

(*Continued on page 668*)

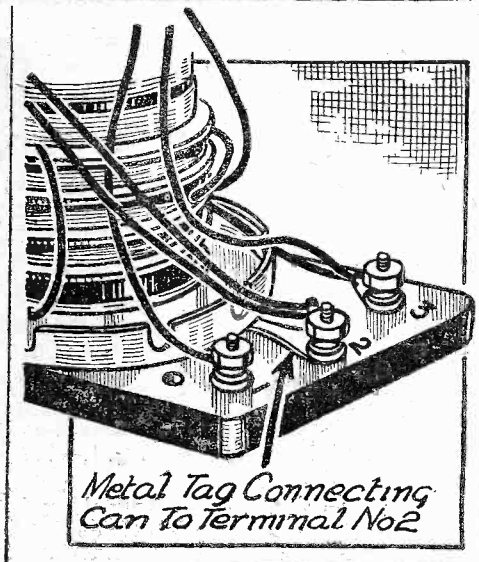


Fig. 6.—(Left) This sketch shows how the screening can is earthed by being connected to terminal 2 by means of a soldering tag.

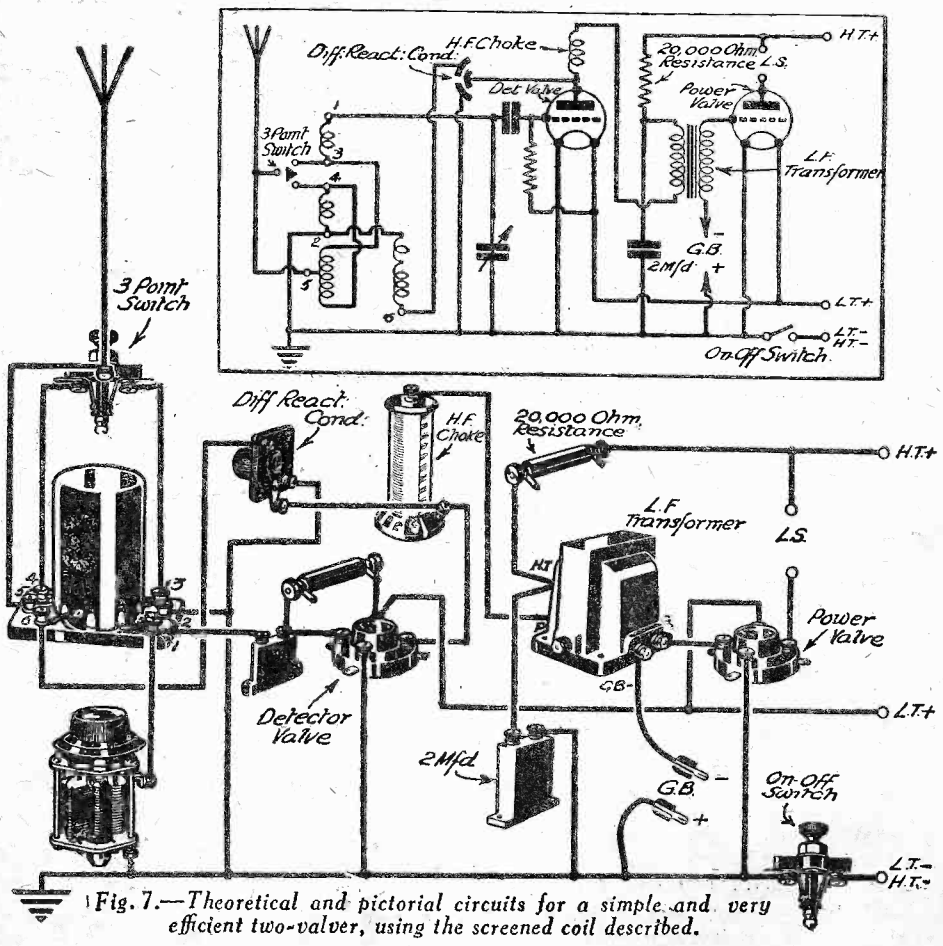
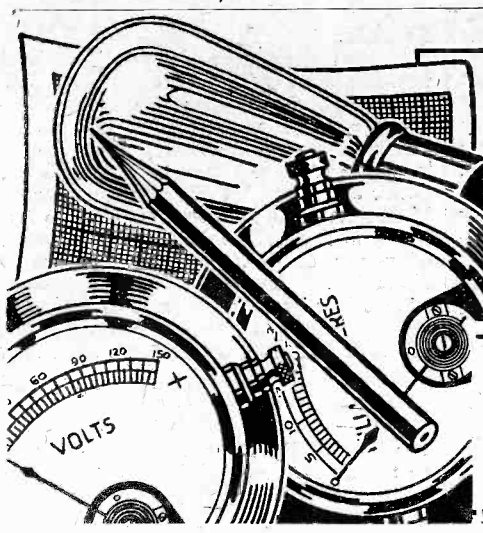


Fig. 7.—Theoretical and pictorial circuits for a simple and very efficient two-valver, using the screened coil described.



Power Output

In This Article the Author Discusses Output Valves, and the Methods Employed to Ascertain the Power Output of the Last Valve in a Receiver

By "LAMBDA"

THERE are four important units of measurement with which every wireless enthusiast is familiar. He knows to what they refer, and they are always cropping up in everyday conversation between radio enthusiasts. They are volts, ohms, amperes, and watts. For the present, however, we are interested in the last unit—watts, with particular reference to output valves. How often have you heard a friend say his power output was two, five, or even twenty-five watts? Now be very careful. There is a distinct difference between anode dissipation in watts and power output in watts, so you must be sure that you are both talking about the same thing. We will discuss anode dissipation in connection with power output later, for sometimes, when dealing with the latter, anode dissipation has to be taken into consideration.

Now, what is this power output, and how is it calculated? Is it just one of those common, everyday calculations such as amperes × volts equals watts, or is it something a little more complicated? Yes, it is! But if you follow this explanation carefully you will have at your finger-tips a method of approximately calculating the power output of a valve, and, therefore, be enabled to select the most suitable valve for your particular purpose. For instance, if you wish to operate a mains receiver at reasonable volume in a medium-sized room, about 2 to 2½ watts output is quite ample. This, of course, is the writer's own opinion, others may not agree. If you want something still nearer realism, and have no neighbours who would object, employ a 5-watt output valve. After all, many constructors like that extra reserve of power even if not constantly employed. If you are interested in public address work, then you can go higher still and use an output valve giving 10 or 25 watts, or even greater power output. However, our chief interest at the moment lies in ascertaining how this power output is calculated.

Necessary Factors

In order to make the necessary calculations, all that is necessary is the anode volts-anode current curves of the output valve, together with the load impedance in ohms. These curves are obtainable for the majority of output valves, and are supplied by the valve manufacturers in their catalogues.

The writer happened to have a spare 2-volt power valve, so decided to take the necessary curves himself, and calculate the power output in order that readers might have an opportunity of following through the whole process from a concrete example. Take a glance at the circuit shown in Fig. 1. This will show you the circuit of the hook-up required in order to obtain the necessary data.

You will notice that this is quite a simple arrangement, and for ease in operating it was assembled on a small baseboard. All that was necessary was a valve-holder and a few terminals, and every wireless

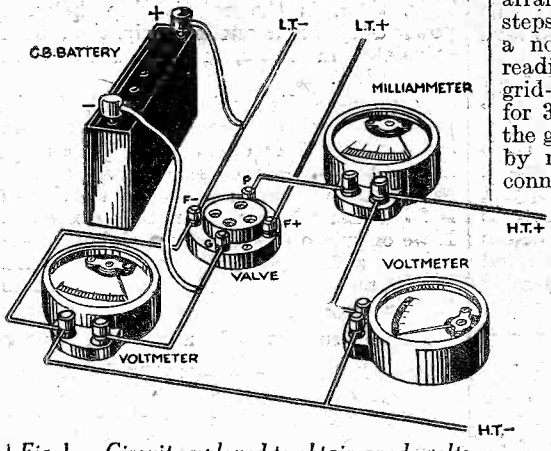


Fig. 1.—Circuit employed to obtain anode volts-anode current curves of an output valve.

man usually has these at hand. The necessary connections can then be made to the batteries and meters. The voltmeter should be capable of reading up to 250 volts, and for accurate results should be of the high-resistance type. Actually, the voltmeter employed had a resistance of 1,000 ohms per volt, while the milliammeter was a first-grade instrument. If the milliammeter only reads up to 10 milliamps it will be necessary to extend the range, and this can be carried out quite easily by following the instructions given in earlier articles on increasing the range of meters.

GRID VOLTAGE ZERO.	
Anode voltage.	Anode current milliamps.
20	0.4
40	2.3
60	5.6
80	9.6
100	14.0
125	21.0
150	26.0

GRID VOLTAGE 3 VOLTS NEGATIVE.	
Anode voltage.	Anode current milliamps.
20	0
40	0
60	0.6
80	2.3
100	5.6
125	10.5
150	16.5

Taking a Reading

Having fixed your valve in the holder and connected up your batteries and meters, arrange the first set of readings with zero grid-bias. This can be done by connecting the grid and filament together, or, preferably, by disconnecting the grid-bias battery, and connecting a piece of wire across the battery terminals. Now arrange to adjust your anode voltage in steps of 20 volts or thereabouts, and make a note each time of the anode current readings obtained. Next connect your grid-bias battery in circuit, and arrange for 3 volts negative bias to be applied to the grid of the valve (this can be checked by means of the low reading voltmeter connected in parallel with it). Repeat the process outlined above and again jot down the readings; this will give you data somewhat similar to that in the table of meter readings. Of course, different types of valves will give different readings. Continue increasing the grid-bias potential until you have applied approximately twice that recommended by the valve manufacturers.

The writer completed the series of readings up to 14 volts negative grid-bias, but only two sets of the readings are shown in the table mentioned.

Our next step is to plot these readings on squared paper, and the graph reproduced in Fig. 2 shows the resultant anode current and voltage curves, which is what we require.

The Load Line

We now have the anode volts-anode current curves, and our third requirement is the load line. It is well known that in order to obtain any amplification a valve must be operated with a load in its anode circuit. In the case of an output valve, the most suitable load is recommended by the manufacturers, and in this particular instance was 7,000 ohms. Knowing the optimum load, it is fairly easy to arrange our load line. First of all assume the 7,000 ohms resistance be placed in series with the anode of the valve. Then, if the grid voltage recommended by the manufacturers be 7 volts at a maximum anode voltage of 150, and the anode current be 6 milliamps, there will be a voltage drop across the load of 42 volts; add this voltage to the maximum anode voltage, making the total 192 volts. This will compensate

(*Continued overleaf*)

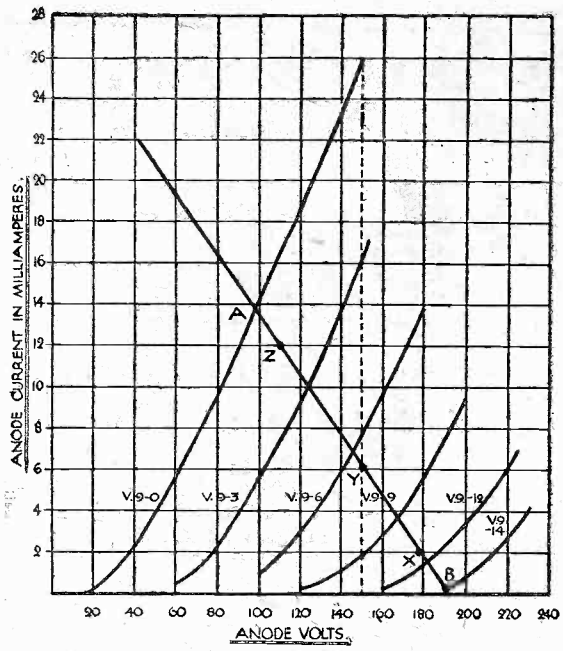


Fig. 2.—Anode volts-anode current curves of 2-volt power valve.

(Continued from previous page)

for the drop in voltage across the load resistance. Now, any change in anode voltage will be accompanied by a corresponding change in anode current; this would not be the case if there was no load in the anode circuit of the valve.

Next calculate the various voltages for variations in anode current. At 2 milliamperes 14 volts will be dropped, which, subtracted from 192 volts, will leave 178 volts. Mark this point on the graph. At 6 milliamperes 42 volts will be dropped, leaving 150 volts, and at 12 milliamperes 84 volts, leaving 108 volts. These points should be marked on the graph as indicated by the letters x, y, z. Draw a line passing through these points, and this will represent our load line, when the optimum load is 7,000 ohms.

The next thing is to assume a signal of 14 volts peak value being applied to the grid of the valve when it is biased, say, 7 volts negative. The grid will then swing backwards and forwards from zero to 14 volts negative, between the points A—B, which are marked on the load line where it cuts the grid-bias curves at zero and 14 volts respectively. At these points ascertain the anode current and voltage, which in this case will be: At zero grid volts 13.6 milliamps 98 volts, and at 14 volts grid-bias 0.4 milliamps 188 volts. Subtract the smaller figures from the larger and this will give us 13 milliamps and 90 volts.

Our next step is to multiply these together and divide by 8, and the result will give us the power output in milliwatts.

$$\frac{13.2 \times 90}{8} = 148.5 \text{ milliwatts.}$$

Therefore the undistorted output of this particular valve is roughly 150 milliwatts, not very great, but quite suitable for use as an output valve in a portable receiver.

"Yes, all very simple," you exclaim; "but where do you get the figure 8 from, and why should we divide by this particular number?" Let us see!

It has to be borne in mind that the values of anode current and voltage with which we have been dealing are maximum values, and what we require is the R.M.S. values. To obtain these we divide both current and voltage by $\sqrt{2}$. Now $2\sqrt{2}$ multiplied by itself will give us 8, which is, of course, so much simpler to employ and gives precisely the same results.

Anode Dissipation

In order to appreciate the importance of anode dissipation and how it differs from power output, although both are expressed in watts, we will examine the curves of a large output valve with an undistorted output of about 4 or 5 watts. This is shown in Fig. 3. You will notice the curved dotted line which at one point touches the load line, but never crosses it. If the slope of the load line were such that it cut the dotted line, greater power output might be obtained, but the life of the valve would be endangered, as the anode dissipation limit fixed by the valve manufacturers would be exceeded. Therefore a compromise has often to be made in order to keep below the anode dissipation line. This, then, is the relationship between power output and anode dissipation, both calculated in watts, mentioned earlier in this article.

The anode dissipation in watts is the product of anode voltage and anode current at any particular operating point on the anode volts-anode current curve, and in the example given in Fig. 3 the maximum is 25 watts, which must not be exceeded. If we calculate this at the maximum anode voltage and anode current recommended by the manufacturers our result will be as follows:—

Anode current 63 milliamps, anode voltage 400 volts—$\frac{63}{1{,}000} \times \frac{400}{1} = 25$ w.

At the point O, therefore, the maximum anode dissipation in watts is reached. In determining the position of the load line in Fig. 3 the maximum anode dissipation had to be considered.

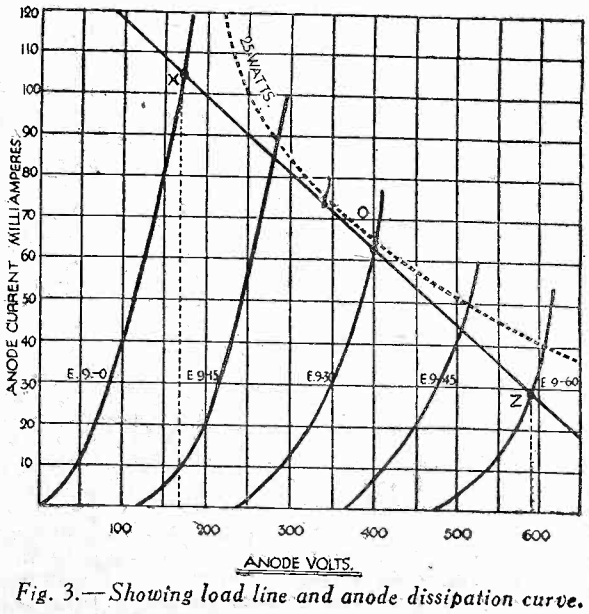


Fig. 3.—Showing load line and anode dissipation curve.

Distortion

If load lines were drawn through the working point O (Fig. 3) at different slopes, assuming for a moment no limit due to maximum anode dissipation, OX and OZ would become more nearly equal as the load line become nearly vertical, but the power output would fall off rather rapidly. If, however, the load line were made more nearly horizontal there would be an increase of power output, resulting in increased distortion. Theoretically, distortionless output is only obtainable when OX equals OZ, but in actual practice a certain amount of distortion can be tolerated, as it is not aurally appreciable. In deciding the best position for the load line, not only has the maximum undistorted output to be obtained, but the load line must not cut the anode dissipation curve. In calculating the amount of distortion which is permissible it is laid down that the distance between OX and OZ should not exceed the ratio of 11 to 9. If the ratio should exceed this amount the quality of reproduction will suffer. The valve manufacturer, therefore, fixed the load line so that the above conditions are complied with.

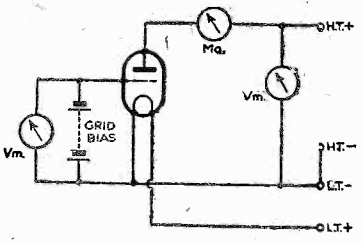


Fig. 4.—The theoretical circuit of the arrangement shown in Fig. 1.

Now take a family of curves of an output valve, and calculate the undistorted output for yourself. It is extremely interesting, and you will gain a lot of useful information on the operation of your output valve.

Books Received

B.B.C. YEAR BOOK FOR 1934. 480 pages, 2s. Published by The British Broadcasting Corporation, Broadcasting House, London.

THIS is a remarkably interesting volume, crammed with facts, figures, and biographies, details and data about everything and everybody connected with British Broadcasting. Special sections deal with Programmes, The Regions, Empire and Foreign Sections, Technical Matters, etc. The new wavelength plan is explained in detail, and the keen listener should purchase a copy at the earliest moment. There is something of real interest on every page, and the illustrations considerably add to the value of the work. It is on sale at all newsagents.

CHRISTOPHER STONE SPEAKING, 6s., 250 pages. Published by Ivor Nicholson and Watson, Ltd.

I HAVE never worshipped at the shrine of gramophone record announcers. To me it has always seemed that the mere playing and announcing of gramophone records is hardly a task in which one could leave footprints in the sands of broadcasting history. To me the interest, or lack of it, is in the record itself, and not in the announcer. But I am prepared to concede that I am among the minority and probably wrong. In this volume, somewhat egregiously and at the same time, self-deprecatingly written by Christopher Stone himself, he manages to fill 250 pages in an interesting style, by suitably enlarging upon small incidents. And I must admit that the book *is* interesting, and will appeal enormously to Mr. Stone's large following. He explains the technique of record announcing in great detail.

DICTIONARY OF WIRELESS TERMS, by Ralph Stranger, 2s. 6d. 160 pages. Published by Geo. Newnes, Ltd.

A HANDY volume of definitions of the technical terms used in wireless. F.J.C.

DISTORTION FROM A NEW VIEWPOINT

In This Concluding Article the Author Deals with Lack of "Attack," Decoupling, Microphonic Tendencies, and Leaking Condensers. The First Article Appeared on Page 537 of Our Issue Dated November 25th.

By W. B. RICHARDSON

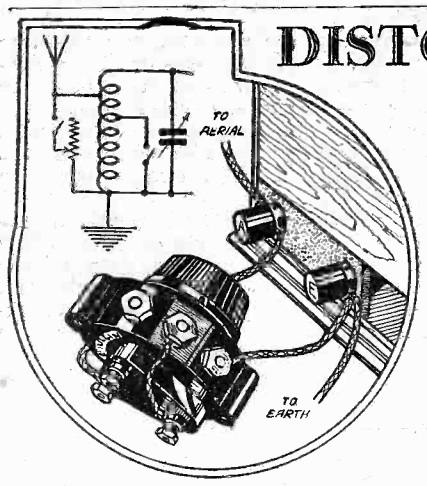


Fig. 1.—A resistance connected across the aerial circuit to obviate overloading of the detector, thus preventing distortion.

Selectivity and Tone

THE opposite effect of resonation, namely, a falling-off in the response to some frequencies, may be due to a variety of causes. When it is the high notes which are lacking, the most obvious cause is that the tuning is too selective. It is well known that to sharpen the tuning beyond a certain degree means a loss of the higher notes. The popular *band-pass* tuning arrangement was introduced for the express purpose of overcoming this defect.

The transmission from a broadcasting station, although stated as being radiated at one definite frequency, say 1,000 kilocycles (300 metres), actually occupies a band of frequency extending over about nine or ten kilocycles, so that to get proper reception the receiver must not tune too sharply or some of the side bands will not be received. On the other hand, if the tuning is too flat, there will be interference from other stations. A band-pass tuner gives a more or less even response over a band of frequencies of about nine kilocycles, while on either side the response drops off sharply. In this way the demands of both quality and selectivity are satisfied.

Compensating for Loss of High Notes

If your set is not provided with band-pass tuning, and the tuning is very selective, then some means should be provided to compensate for the cutting off of the higher notes which will naturally result. One method is to use an L.F. transformer which has a rising characteristic, that is to say, one which provides greater amplification of the high notes than the medium and low ones.

An even better arrangement is to use a tone control transformer, such as the "Multitone." Most careful designers will specify something of this sort in a set with ordinary tuning, but if your receiver is not so provided or if it is lacking in high-note response for some other reason, then a simple tone control, consisting of a fixed condenser with a variable resistance across it, should be connected in series with one of the speaker leads, as has been shown before. The effect of this will be to reduce the response to the low notes and so level matters somewhat. Naturally it is not an ideal arrangement, since for one thing it robs the set of a certain amount of power by cutting down the fully amplified frequencies to the level of the weak ones.

A point worth mentioning in connection with high-note cut-off is that reaction can introduce noticeable distortion. As the reaction control is advanced, so the tuning becomes more selective. Reaction should never be used to any great extent with band-pass tuning, as it immediately alters the shape of the response curve from a flat topped one to a pointed one, and so defeats the whole object of the system.

If a receiver suffering from poor upper frequency response is fitted with a triode as the output valve, then its substitution with a pentode will, in a large measure, restore the brilliance of the original transmission. Matching of the impedances of the speaker and the new valve is usually necessary. If a multi-ratio speaker is used, then the adjustment can easily be carried out. Failing this an output choke with suitable tappings for a pentode should be used.

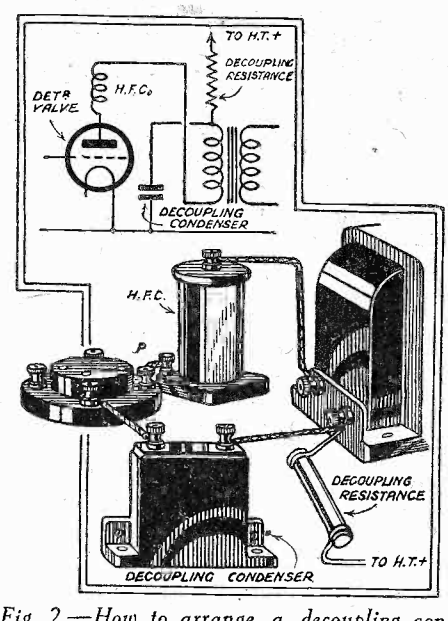


Fig. 2.—How to arrange a decoupling condenser and resistance to prevent distortion.

We have already dealt with distortion due to resonating effects, and also that due to the falling off in the response to certain frequencies. We now come to what is known as lack of "attack." This, as I have already explained, is a slurring of reception caused by the inability of the moving elements of the speaker to follow the rapid fluctuations of the speech current. It is due, of course, to the inertia of the reed or the moving coil (as the case may be) together with that of the cone. This may sound rather technical, but it simply means that the moving parts are too heavy and do not "jump to it" as they should do.

Unfortunately, if a speaker suffers from this defect to any marked degree the only course open is to substitute another one. Naturally nothing can be done to the receiver itself since the cause of the trouble lies entirely with the speaker. Obviously it is unwise to try to lighten the reed (moving iron) or the moving coil, as this will probably do more harm than good. The use of a lighter cone may help matters, but here again care must be taken that rigidity is not sacrificed for the sake of lightness. Incidentally, with good-class moving-coil speakers the weight of the moving coil is kept very low by the use of the lightest materials including aluminium wire for the coil, so that if the reproduction from your present speaker lacks sparkle, try the effect of substituting another of modern design.

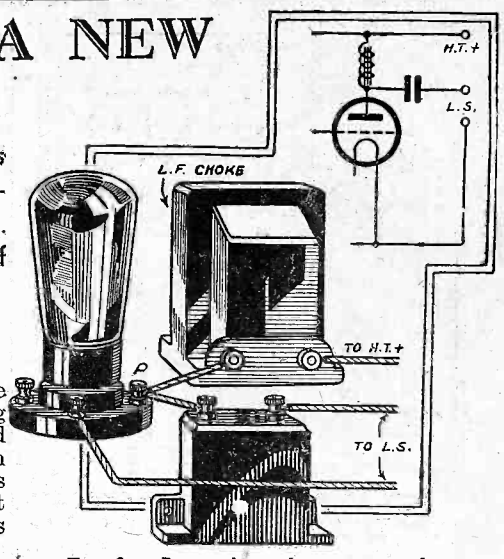


Fig. 3.—Decoupling the output valve.

Wave-Form Distortion

In the first part of this article I indicated how various forms of distortion might be recognized, and in the following pages I have endeavoured to show how some of the causes might be diagnosed and the necessary remedies applied. Now in the case of distortion resulting from deformation of the wave-form, there are so many different causes giving much the same effect that it is almost impossible to say, by listening to a receiver suffering from this form of distortion, to what particular cause it is due. We know the results are characterized by blurred, muffled, or rough reproduction, but it must be left to the reader to find out, by the process of elimination, the actual cause or causes. I am giving here some of the most likely ones, together with hints on suitable remedies. Distortion of this type is most frequently associated with the incorrect use of valves, such as under and over-biasing, overloading, etc.

Let us take an elementary case of incorrect bias causing distortion in a battery set. Suppose the H.T. battery has been in use for some time and its voltage has dropped considerably. Distortion sets in. This may be partly due to the increased internal resistance of the battery resulting in a certain amount of back coupling, but it may also be very largely attributable to too much bias. Naturally when the battery was new the bias would be set to the maximum figure for undistorted reproduction, but it must not be forgotten that as the H.T. voltage drops so the grid bias needs lowering, since the amount of bias necessary depends on the anode voltage supplied to the valve. The higher the anode voltage the higher the grid bias required, and *vice versa*.

(Continued on next page)

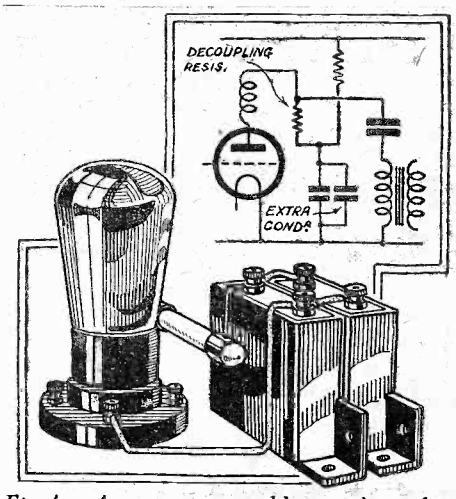


Fig. 4.—An easy way to add extra decoupling. Join another condenser in parallel with the existing decoupling condenser.

DISTORTION FROM A NEW VIEWPOINT

(*Continued from previous page*)

Therefore, if the setting of the grid bias was left unaltered it would be too high after the H.T. battery had been in use for some time. In such a case reducing the setting of the bias tappings will usually improve matters considerably and so give the H.T. battery a new lease of life.

Overloading the Detector

Overloading a valve is quite a common cause of distortion. With modern receivers employing high-magnification valves in the H.F. stages it is very often the detector which causes the trouble. Detector overload is not always easy to diagnose, as the resulting distortion is not of a very blatant nature. However, if it is present it will spoil the reproduction, although in a somewhat intangible manner. The symptoms to look for are over-emphasis of the high notes and a marked double-hump effect in the tuning of loud transmissions, the maximum signal strength being obtained just slightly on either side of the true wavelength. Another feature is that the reaction control or any predetector volume control will appear insensitive on powerful transmissions, quite a large movement of the control making but little difference in the volume. A screen-grid valve used as a detector is particularly liable to overloading.

To increase the power-handling properties of the detector it is always worth while trying an increase in anode voltage, at the same time using a grid leak and condenser of suitable values. The leak should be about ½ megohm to 1 megohm and the condenser .0001 mfd. For short-wave work the leak may be increased to 3 megohms. If overloading still occurs then some form of predetector volume control must be fitted and brought into operation on the strong transmissions. The ideal form of control is provided by the use of variable-mu valves in the H.F. stages. Another good scheme for reducing the input to the detector, in the case of a straight tuned circuit, is the connection of a variable resistance between the aerial and earth terminals of the set. The resistance should either have a definite "off" position or else be fitted with a switch to cut it out of circuit when maximum sensitivity is required. A suitable value for the resistance is 50,000 ohms. One of the combined volume controls and switches now on the market can be recommended for this purpose. (See Fig. 1.)

Distortion Due to Back Coupling

I mentioned just now distortion caused by high internal resistance of the H.T. battery. The reason for distortion in this case is two-fold. Firstly, there is the obvious reason that the anode current of the various valves is lowered below the optimum figure, and, secondly, there is the question of back coupling. Obviously, since the anode circuit of all the valves is completed through the high-tension battery, the internal resistance of this is common to each anode circuit, and thus forms a coupling between one valve and another. In this way fluctuations in the current passing through the later valves will cause corresponding fluctuations in that passing through the earlier ones. These fluctuations, owing to the time taken for the currents to travel through the succeeding stages, will be out of step, or out of phase as it is called, with the fluctuations of the original current. This will produce a howl. Sometimes, instead of a howl, the noise produced is of so low a pitch that each separate beat can be distinguished. It is then called "motor-boating."

The way to cure L.F. howls and motor-boating is to get rid of the undesirable coupling by *decoupling*. First of all, a resistance and condenser connected in the plate circuit of the detector valves, as shown in Fig. 2, should be provided. If

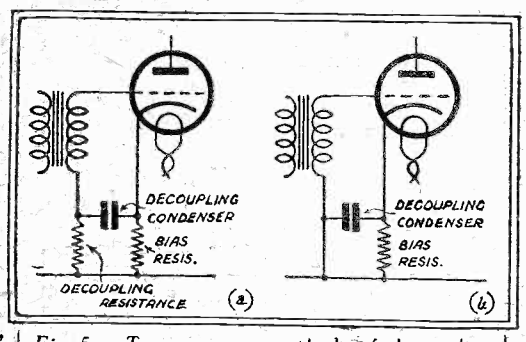


Fig. 5.—Two common methods of decoupling the grid circuits when using automatic bias.

this fails, then further decoupling of a similar nature should be employed in the intermediate L.F. stages (if any) and the last valve should be decoupled by using choke output, if it is not already fitted, as in Fig. 3. A very old dodge for curing motor-boating consists of changing over one pair of leads to the L.F. transformer. Either the wires to the terminals marked "H.T.+" and "P" are changed round or else those to terminals "G" and "G.B."

Of course L.F. howling and motor-boating are of so blatant a nature as to hardly come under the heading of distortion at all. On the other hand, there may be just sufficient back coupling in the L.F. stages of a receiver to introduce distortion without actually causing a definite howl. The reproduction will be characterized by a certain roughness. Where it is due to a run-down H.T. battery there is also loss of volume. The use of a pocket voltmeter will soon determine if the battery is getting low. If so the remedy is obvious. Of course, the use of adequate decoupling, and the readjustment of grid bias, as already explained, will help to increase the useful life of the high-tension battery.

Adding Extra Decoupling

It is quite possible to get distortion, due to L.F. back coupling, in a receiver in which the H.T. battery is quite O.K., or in a mains receiver even although decoupling arrangements are provided. In this case the existing decoupling should be supplemented. The best way to do this is to either fit larger decoupling condensers (say 2 mfd. in place of existing 1 mfd. components) or else to connect extra ones in parallel with the present ones, as in Fig. 4.

In an all-mains set, where grid bias is obtained by utilizing the drop in voltage across a resistance, decoupling of the associated grid circuits is necessary and this is usually carried out by using a resistance and condenser as in Fig. 5 (*a*). In some receivers, however, the resistance is omitted, the condenser only being used as in Fig. 5 (*b*). In the latter case, a resistance may often be included with advantage.

Microphonic Tendencies

A frequent cause of distortion which is sometimes overlooked is that produced by microphonic feed-back. The sound waves from the speaker travelling through the air, and also, in the case of a combined receiver and speaker, through the cabinet and chassis, set up vibrations in the valves and vanes of the variable condensers, etc. In extreme cases a loud, sonorous howl will build up, which drowns everything. However, this condition is not often met with, but a receiver will frequently be found to be working in a state where a microphonic howl almost manifests itself on loud passages, the result being a rough jarring kind of reproduction.

The most usual cause of the trouble lies with the detector valve, this valve being particularly susceptible to any vibrations transmitted to it through the holder or through the air. The use of an anti-microphonic valve-holder, and the enclosure of the valve in a cardboard tube lined with cotton wool, as in Fig. 6, are two recommended devices for curing this trouble.

Condenser-Vane Vibration

The vanes of variable condensers, especially if they are thin and unsupported at the tips, are liable to start vibrating when sound waves from the speaker impinge on them, or are transmitted to them through the chassis. The remedy here consists of mounting the condensers on rubber buffers. This is easily done with ganged condensers as a soft rubber washer can be placed under each foot of the condenser. With panel-mounted condensers of the one-hole-fixing variety it is rather more difficult, but the mounting of the panel or even the whole chassis on pieces of sponge rubber will prevent the direct transmission of the vibrations through the cabinet and panel to the condensers.

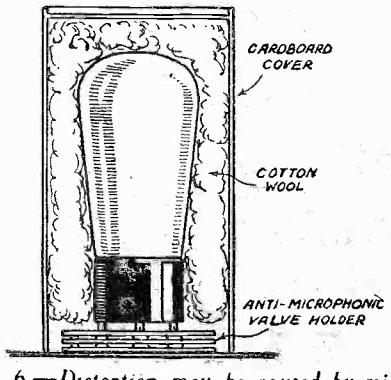


Fig. 6.—Distortion may be caused by microphonic feed-back. Protecting the detector valve as shown here may effect a cure.

The LANCHESTER-JONES "Class B" CIRCUIT

How It Diminishes the Current Consumption of the Driver Valve.

By F. W. LANCHESTER

IN conjunction with Mr. A. H. Jones, the writer has developed a modification of a "Class B" circuit directed to secure a still greater economy in the aggregate plate current than is obtainable in the "Class B" amplifier as hitherto known. The object of the improved circuit is to diminish the demand of the driver valve, and so increase the life of the H.T. battery.

It is perfectly well known that the great advantage of adopting "Class B" amplification is that the demand on the H.T. battery, more especially under static conditions, or small signal loads, is reduced, and the advent of "Class B" has had the effect of giving a new lease of life to the battery-driven set. The bugbear hitherto has been that the driver valve is too greedy, and either it has to be biased down to a point at which a certain amount of distortion comes in under heavy load, or, alternatively, the plate current is excessive, and takes away much of the advantage secured by the "Class B" output valve. The reason for this is that the driver valve and its transformer, having to take charge of the grid current, necessitates the drive circuit being treated as a power circuit in a small way of business. In the improved circuit the driver valve is normally biased down to a point at which it only takes a very small current, say half to one milliamp, but when the heavy signal comes through the bias is automatically diminished so that the necessary A.C. signal can be passed without distortion.

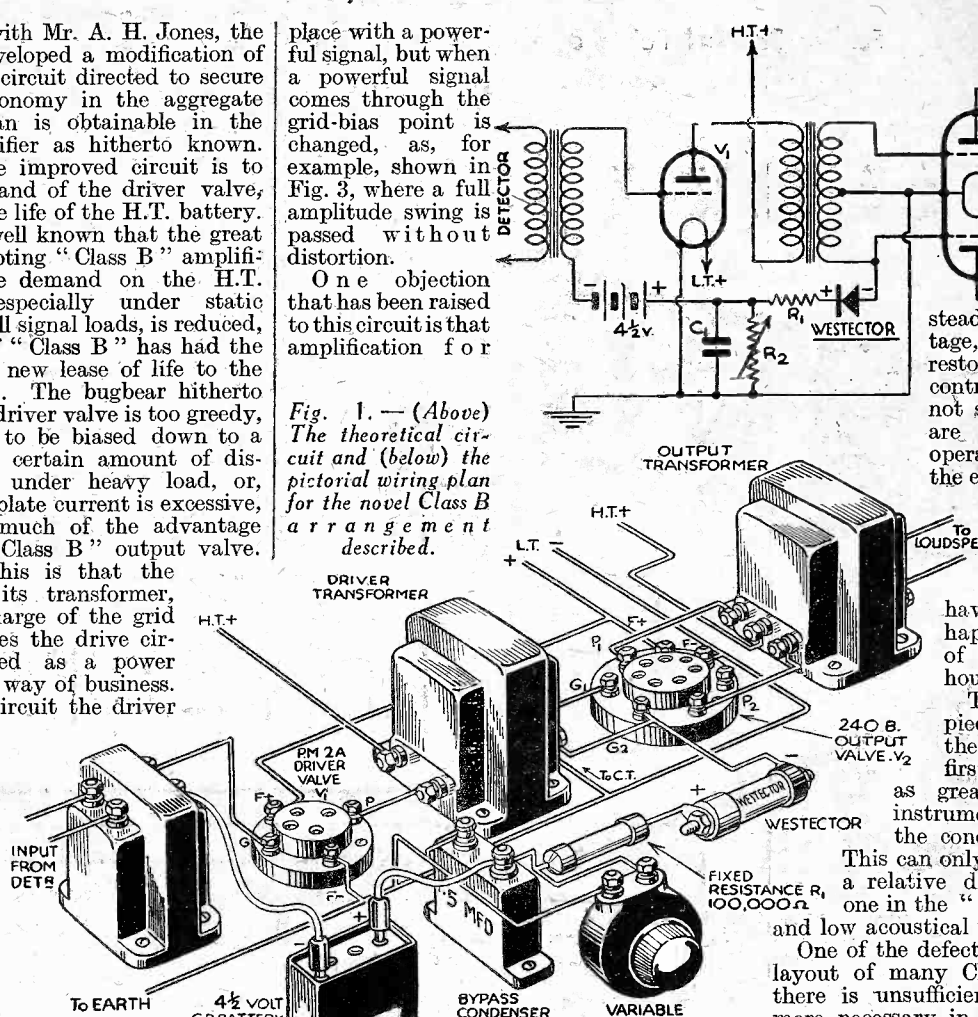


Fig. 1.—(Above) The theoretical circuit and (below) the pictorial wiring plan for the novel Class B arrangement described.

The diagram of the circuit is as given in Fig. 1, where it will be seen that when there is a heavy signal the voltage from the power circuit is fed back to the grid-bias battery of the driver valve after undergoing rectification, for which latter purpose a metal or other rectifier, such as a Westector, is used. The action of this system is illustrated by the valve diagrams shown in Figs. 2 and 3. Under static conditions, or when the signal is quite small, the drive valve is biased right down on to its anode bend, where, under normal conditions, considerable distortion would take place with a powerful signal, but when a powerful signal comes through the grid-bias point is changed, as, for example, shown in Fig. 3, where a full amplitude swing is passed without distortion.

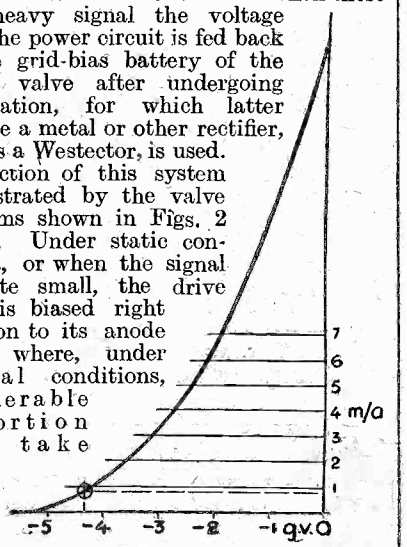


Fig. 2.—Showing how the driver valve is biased right down to the "bottom bend" of its characteristic when signals are not being received.

One objection that has been raised to this circuit is that amplification for small signals would be very much less than for heavy signals, and consequently there will be an exaggerated contrast between pianissimo and fortissimo passages. But this apparent disadvantage is really an advantage, because in recording, as in studio transmission, it is common that the singer or instrumentalist is instructed to diminish the contrast. In the case of a gramophone record this is to avoid the pianissimo being drowned by the mechanical noise; moreover, extreme pianissimos tend to get lost in the recording, so that really the new "Class B" circuit, instead of being a disadvantage, in many cases acts to restore the desired degree of contrast. Even were this not so, as when broadcasts are being made from the opera house or concert hall, the extent of the exaggerated contrast is not noticeable to the ordinary listener.

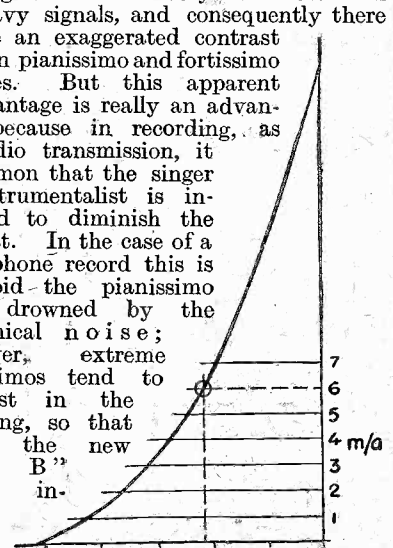


Fig. 3.—The bias on the driver is reduced to its normal figure when signal voltages are applied to it.

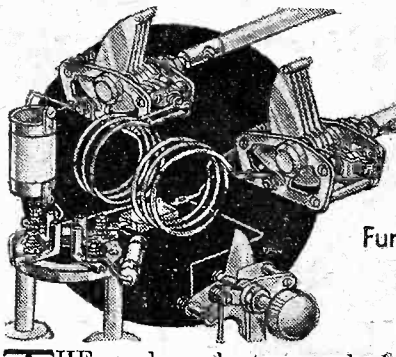
In proof of this statement we have only to consider what happens in the auditorium of a concert hall or opera house.

There are positions occupied by listeners in which the distance from the (say) first violins is three times as great as from the bass instruments, and others where the conditions are the reverse. This can only result in a difference, a relative difference, of eighty to one in the "reception" of the high and low acoustical frequencies.

One of the defects most prevalent in the layout of many Class B circuits is that there is unsufficient decoupling. This is more necessary in the case of an H.T. dry battery being employed than where an accumulator battery is used owing to the higher resistance of the former. The distortion due to inadequate decoupling comes into prominence when the tone volume increases; for low-signal values the absence of decoupling (unless there is motor-boating) is little noticed.

We have much to learn in the practical working of the Class B circuit, and it is of great value to provide milliammeters, both on the power valve and on the driver valve, as indicators of what is taking place. It is most entertaining to hear nearly perfect reproduction with the milliammeter needles dancing all over the place, when he has become accustomed in his previous experience to regard needle flick as taboo.

[*We are requested to announce that the patentees have no intention of asking for royalties from bona fide amateurs (readers of* PRACTICAL WIRELESS*) putting up sets according to the description given in the present article. To avoid uncertainty, any amateur wishing to make use of this concession is requested to send in his name and address to Messrs. Lanchester's Laboratories, Ltd., Spring Road, Tyseley, Birmingham, marking the envelope "free licence," and enclosing postage or a stamped envelope, when he will receive a formal authorization.*—ED.]



Short Wave Section

Further Practical Points on the Technical Side

THE modern short-wave dual range coil provides a very efficient answer to the problem of arranging short-wave tuning on comparatively efficient lines without having to use plug-in coils. However, problems commence when one or more H.F. stages have to be used. Certainly we can use various forms of ganged switching, but the efficiency of these arrangements on short waves is doubtful. The simplest method of controlling two dual-range circuits with one switch is shown in Fig. 1, where we have a more or less conventional screened-grid high-frequency amplifier and detector of the type suitable for short-wave operation. The switch S is of the three-point type, with the centre point earthed and the remaining two contacts connected to the appropriate coil taps. If the two stages are screened by means of a single metal screen, the more efficient arrangement is to cut away a portion of the screen where it comes up against the front panel, and mount the switch in the middle of this portion so that one half of the switch is on either side of the screen where it will be possible to take wires direct from the coils without either wire having to enter the wrong side of the screen. The other alternative to this arrangement is to use two separate switches for each coil. It is also possible to use two mechanically ganged switches so that each switch is on the correct side of the screen.

Adding a Superhet Stage

Actually, if one wishes to add amplification to a short-wave receiver, apart from that provided by the detector and the low-frequency stages, the very most efficient method of doing this is to use the superheterodyne arrangement. We can add as many stages of amplification at intermediate frequency as we wish, and still retain a single switch to do all our wave-changing. The diagram of such an arrangement is shown in Fig. 2, where, although we have a stage of powerful screened-grid amplification (V_2), the only tuning control is that of the oscillator-detector condenser C_1, supplemented by the wave-change switch S. Compare these two diagrams and note the differences between the two systems.

A point which many amateurs apparently do not appreciate is that a superheterodyne receiver which is to be used for short-wave reception *only* can be a very much simpler affair compared with the normal type of superheterodyne receiver used on the medium and longer waves. I am not saying that a receiver of this type even is a very complicated affair, but the short-wave version is much simpler because of the fact that, providing the intermediate frequency is kept sufficiently low, one tuned circuit can do the work which is normally done by two, three, or even more circuits in the longer wave receivers. Admittedly, in the superheterodyne arrangement we have to use two detector valves (V_1, V_3), but the final degree of amplification will be very considerably greater than that provided by the other arrangement and the receiver will also be very much easier to tune. One has actually to tune a short-wave superheterodyne receiver before it is possible to realize the very great advantages of having a reaction control which is constant all over the dial (the reaction in this case is at intermediate frequency, of course). The reaction control can be set just below the point of oscillation and left there from one end of the dial to the other, and the degree of reaction coupling will remain constant.

A Question of Tuning

The tuning of a short-wave receiver of this type, therefore, becomes very similar to that of one of the modern large superheterodyne medium and long-wave receivers with which one can travel from one end of the dial to the other with stations coming in at good strength without so much as even bothering about a reaction control. Of course, for the reception of weaker stations, it is sometimes necessary to "spill over" the reaction control to the actual oscillating point, and this is also necessary in order to receive code stations, although unfortunately so many code stations suffer either from hum-modulation or key-clicks that some so-called C.W. stations can be heard without the second detector valve being near the point of oscillation.

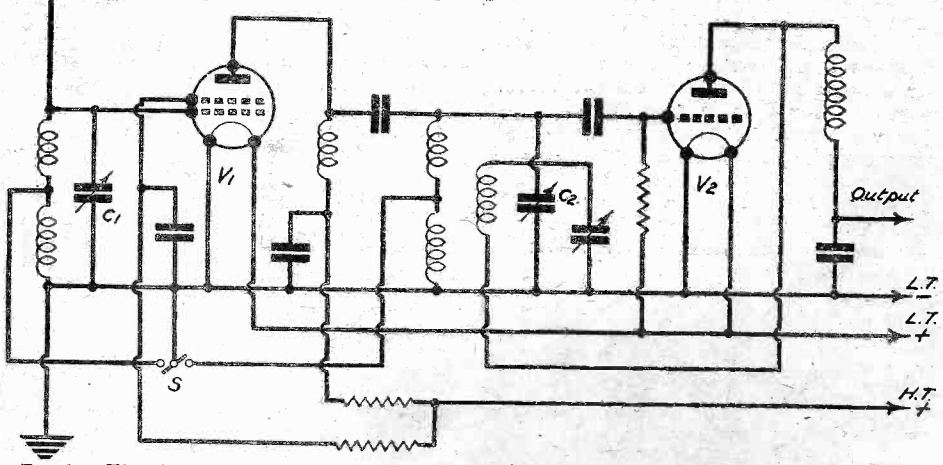


Fig. 1.—This diagram shows how the two dual-range short-wave coils may be operated from one switch where a single screened grid H.F. stage is used.

In the diagram shown (Fig. 2), further amplifying stages can be added between valves V_2 and V_3 without complicating the tuning at all, as the condensers C_2 and C_3 are only trimmers, and once set they can be forgotten, and this, of course, applies to all further stages which may be added here. Actually, if the receiver is well designed and well made, a second stage of I.F. amplification will be rarely necessary, the arrangement of Fig. 2, in conjunction with two stages of L.F. amplification, being quite capable of providing great volume when required.

The short-wave superheterodyne is an exceedingly interesting type of receiver, and in a future article it is proposed to deal more closely with the practical construction of receivers of this type. A short-wave superheterodyne need not necessarily be a costly affair, and the results obtainable with a receiver of this type can be truly excellent.

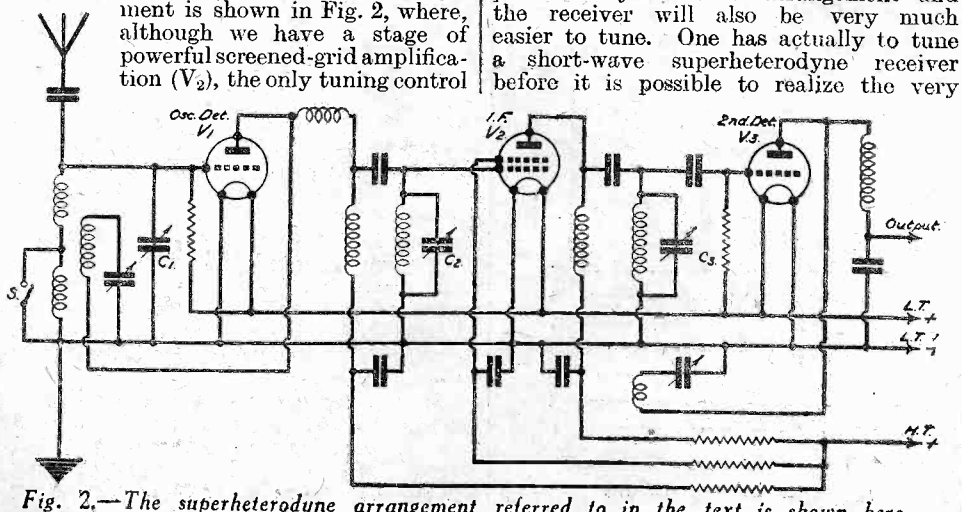


Fig. 2.—The superheterodyne arrangement referred to in the text is shown here. Compare this diagram with the arrangement shown in Fig. 1.

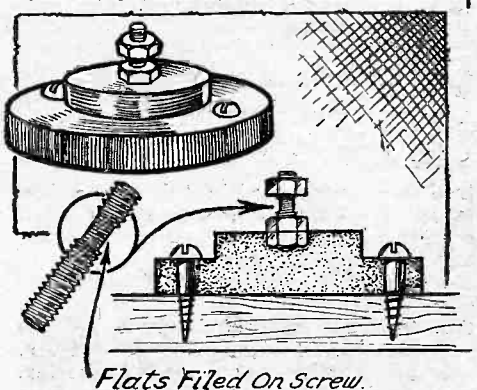
READERS' WRINKLES

THE HALF-GUINEA PAGE

Easily-made Insulating Blocks

INSULATING blocks have a variety of uses, especially in short-wave work, for the mounting of coils, etc., and can easily be made from moulded ebonite knobs which have been dismantled from old components.

The knob is laid flat on its front face and

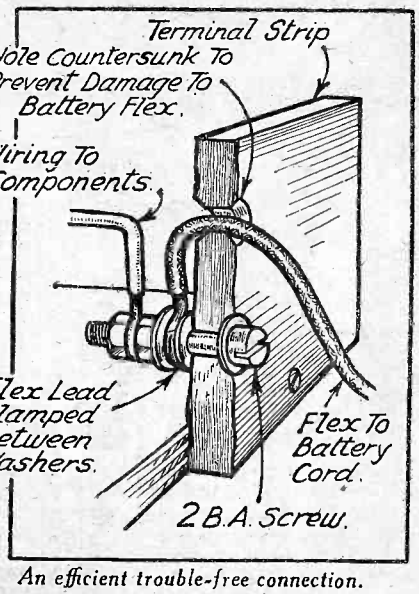


Easily-made insulating blocks made from bakelite knobs.

two ⅛in. holes drilled through the flange and diametrically opposite. Care must be taken when drilling, as too much pressure on the drill may cause the edge of the knob to break away. A piece of screwed rod about ⅝in. long is screwed into the recessed nut in the knob, and a lock-nut screwed on to prevent turning. Two flats are filed on the rod just above the lock-nut, as indicated, to accommodate spade connections, and another nut is screwed on the rod to facilitate gripping connections.—Mr. F. ALLEN (Sunderland).

Trouble-free Connections

MANY times I have experienced those annoying crackles in my set caused by loose connections, and traced them to the connection strip upon the rear of my baseboard. Terminals with screw tops, I find, are apt to work loose, and tags upon battery cords are inclined to become damaged during household cleaning, and other necessary movements of the set. Therefore, I have, as far as possible, discarded the usual terminal and adopted the following method. The diagram will give a good idea of the arrangement; No. 2 or 3 B.A. bolts are used in place of terminals, and the individual leads are passed through the rear panel, looped and bolted directly under the nut and washer upon the rear panel. The rear panel is drilled, and well countersunk on both sides to prevent the rubbing of the cord covering, and it will be obvious that this scheme relieves the connection of the strain that may be caused by the movement of the cord. The connection to the apparatus is locked on the inner side of the panel, and thus a sound and thoroughly efficient termination results, which proves more satisfactory than the usual highly-priced terminal. An important point is that these semi-permanent connections should be made at the correct end of the cords. That is, the end of the cord where there is least possibility of short circuits, etc., which may result in damage to the apparatus—the set end of all battery cords and the speaker cord connections upon the speaker itself.—W. A. HARRISON (Aintree).



An efficient trouble-free connection.

Improving Short-wave Control

TUNING a short-wave receiver for the clear reception of low-power transmissions thousands of miles away can never be truthfully termed "child's play," even when the operator has had years of experience and has an almost perfect receiver. Failure to receive any but the more notable transmissions can usually be traced to lack of patience or slip-shod dialing on the part of the operator. The latter fault is almost always due to the unsuitability of the tuning controls for this essentially precise work.

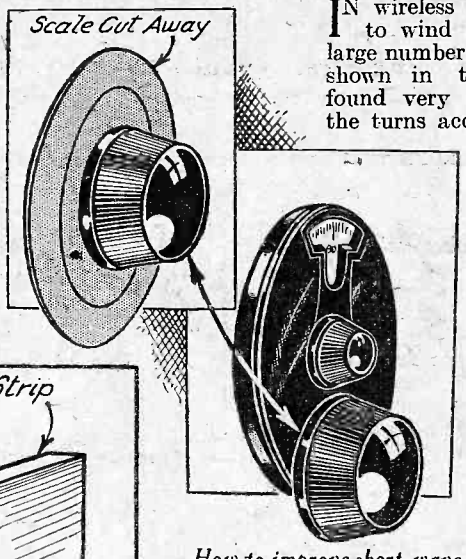
Many home-constructors use their discarded components in a short-wave receiver, particularly the old-type S.M. dials which, having only small operating knobs, make short-wave tuning accuracy impossible. Dials of this type can always be made more suitable for short-wave work by fitting a large tuning knob, which may be cut from a discarded 4-inch dial with the aid of a fret-saw. Not only is tuning made more accurate, but the large knobs enhance the appearance of the receiver; and of course, the improvements cost nothing.—F. J. GOUGH (Ellesmere).

THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

A Simple Revolution Counter

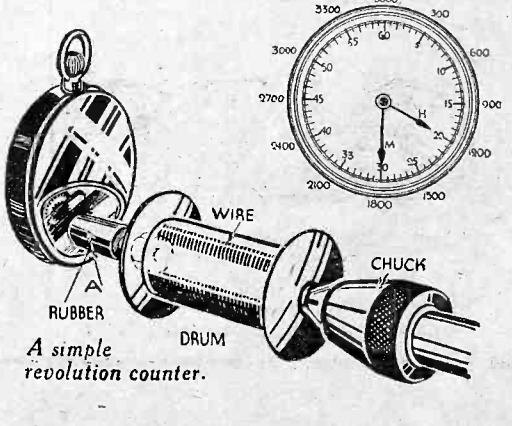
IN wireless work one often has to wind coils which have a large number of turns. The counter shown in the sketch will be found very useful for recording the turns accurately.



How to improve short-wave control.

It can be made from an old watch which has the escapement removed, with the "second" shaft reversed so that its extension protrudes from the back of the watch instead of the dial. A piece of round rubber is pressed on to the shaft end, so as to form a definite drive, and the counter is then held against the chuck of a geared hand drill or lathe centre. A new dial should be made and marked out as shown. Before winding a coil the watch hands should be set at zero, the counter held lightly, so that shaft A is rotated until the required number of turns are recorded on the dial.

Sixty turns of A=1 revolution of hand M. 3,600 turns of A=1 revolution of hand H. Higher values should be recorded by hand H —K. A. VARTY (Alnmouth).

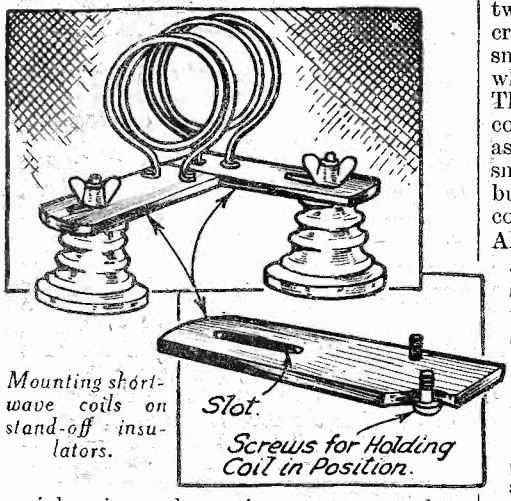


A simple revolution counter.

Mounting Short-wave Coils on Stand-off Insulators

A SIMPLE method of using stand-off insulators for mounting short-wave coils is shown in the accompanying sketch.

A slotted strip of ebonite is fitted with two screws at one end, to which the looped ends of the inductance are secured. For a 3-coil tuner the two end coils, *i.e.* aerial series and reaction, are arranged as shown with the insulator to the left of the coil and the reaction coil in line, but with the insulator to the right of the coil. The tuned-grid coil has the insulator placed on the right-hand side, the coil being mounted the other way round on the end of the strip. Adjustments of spacing between coils is thus easily arranged.—B. PEDDER (Southgate).



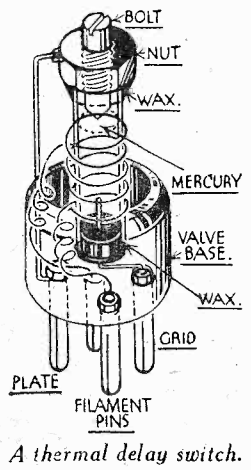
Mounting short-wave coils on stand-off insulators.

A Thermal Delay Switch

A GOOD thermal delay switch can be made from parts taken from the "junk box." The mercury can be obtained from your local chemist.

The parts required are: An old valve base; an inch of glass tubing; about 2d. worth of mercury; a nut and bolt, and some fine wire.

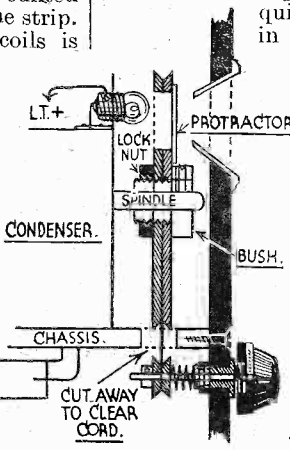
Having connected a piece of the wire to one filament, coil it around the glass tubing several times, and then take it to the other filament pin; then from the grid pin take a wire to the bottom of the glass tubing, pass it a little way inside and then seal with wax. Now fill the tube three-quarters full with mercury, take the nut and bolt and solder a piece of wire to the nut. Seal this to the top of tubing with the wax, then by screwing the bolt up or down you can adjust the switch to suit your requirements. —H. W. NICHOLS (Amersham).

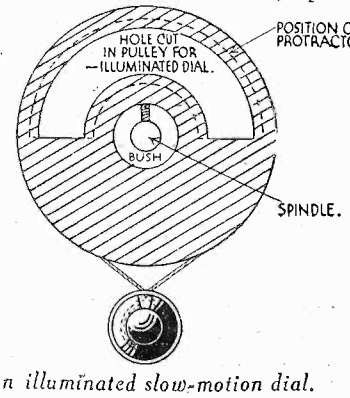


A thermal delay switch.

An Illuminated Slow-motion Dial

THE accompanying illustrations of a home-made illuminated slow-motion dial may be of interest to other readers. The large pulley was made from two thin discs of wood (cut from a cigar box), sandpapered to a bevel of about 45°, and glued together with the bevels inside. A hole was cut, as shown, and a celluloid protractor was seccotined over this, after inking in the graduations with indian ink. A hole was cut to take the bush, and the whole disc mounted on the condenser spindle. The small pulley was mounted on a $\frac{3}{16}$in. spindle, and was held in place by spring washers. The cord is cobblers' twine, lightly rubbed with resin and crossed. Besides keeping the cord on the small pulley this gives an easy tension which considerably facilitates slow tuning. The device can be adapted to suit varying conditions, no measurements being given, as these will vary with the size of the small pulley and the ratio desired. A bulb is mounted on the condenser, or other convenient place, to illuminate the dial. Altogether this makes a very neat arrangement. If desired, the condenser spindle can be mounted to project through the panel to take a knob for a direct drive.—W. LOWENS (Manchester).





An illuminated slow-motion dial.

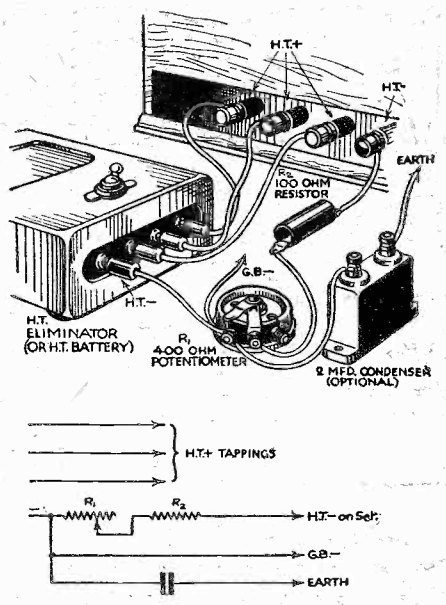
Auto Grid-bias from an H.T. Eliminator

THE accompanying illustration shows a simple and convenient method of obtaining automatic grid-bias when using an H.T. eliminator for power supply purposes.

The +GB connection will normally be effected through L.T.— on set. R_1 is a 350 or 400 ohm grid-leak potentiometer. The value of the series resistance R_2 will depend on the grid-bias required by the output valve in use. Using a Mullard P22A with 4v. G.B. and total current m/a on all valves being 10 m/a, then total resistance $R_1+R_2=400$ ohms, so in that case R_2 should be 100 ohms. Thus the bias on particular stage may be varied to suit conditions. When using a power valve with 6 volts G.B. and the total current consumption of all valves in set is 6 MA (for example),

$$R_1 + R_2 = \frac{6}{.006} = \frac{6{,}000}{6}$$

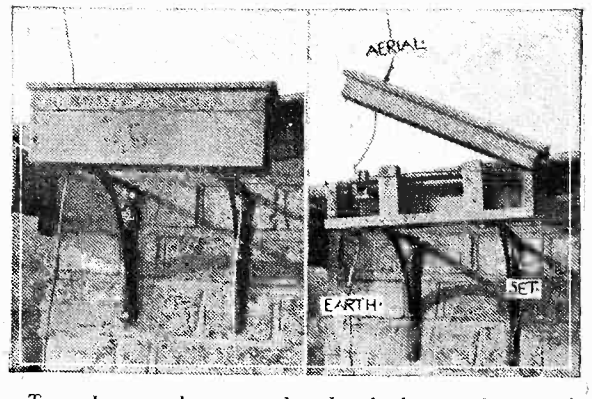
$=1{,}000$ ohms, hence R_2 would be about 750 ohms. When using the connections shown, the G.B. battery can entirely be dispensed with.—J. M. DAVIES (Chingford).



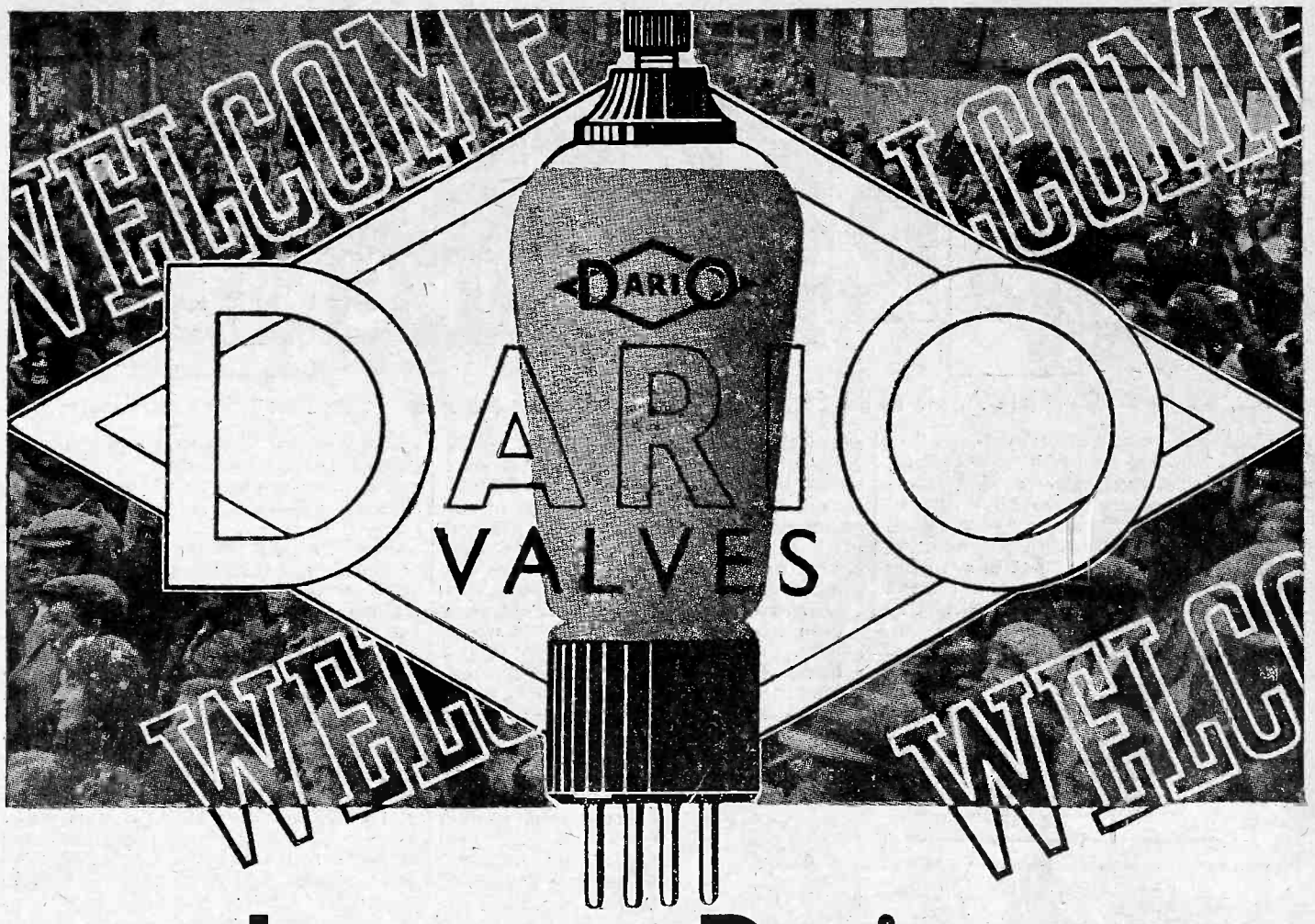
Auto grid-bias from an H.T. eliminator.

A Weather-proof Lead-in

THERE are probably many readers who still suffer from dirty contacts on the aerial-earth switch, or who find it inconvenient to open a window to switch on and off. The trouble can be remedied by fitting a lead-in tube incorporating a lightning arrestor, and suitably housing it outside the house. The accompanying illustration shows a lead-in tube, in a box mounted on brackets, which has been outside a house for over four years, during which time it has required no attention. The contacts are still clean, and it efficiently serves a 40ft. high aerial. The tube is 9in. long and is held in place by two supports $2\frac{3}{4}$in. high, $1\frac{1}{2}$in. wide and 1in. thick, so that it does not touch the casing. A hole was bored $\frac{3}{4}$in. from one end, equal to the diameter of the tube, and the wood was then sawn through the hole, making two halves. The tube is laid in one half and the other is screwed down on top. The supports are in turn screwed to the base from outside. The overall dimensions of the box are 11in. long, $3\frac{1}{2}$in. high, and 3in. wide. The top of the lid is a length of capping $11\frac{1}{2}$in. long and $3\frac{1}{2}$in. wide, all the wood being $\frac{1}{2}$in. thick. The three holes through which the covered wire leads pass were filled in with putty and the whole box was then painted. The lid, of course, is hinged at one end and a suitable clasp is fitted at the other.—R. E. WILLIAMS (Winchmore Hill).



Two photographs giving details of the weather-proof lead-in described.



—to the new Dario range

Insist on DARIO Valves next time. You will be rewarded with increased volume, wider range, faultless reception and perfect quality of tone. There is a DARIO Valve for every purpose and every make of set, at exceptionally moderate price.

DARIO VALVES

EVERY NEW TYPE

2-VOLT BATTERY

Screened Grid and Variable Mu S.G.	10/6
H.F. and Detector	5/-
Super Power	6/6
Class "B" Output	10/6
Pentode	10/6

DIRECTLY HEATED A.C. MAINS

Output Pentode	12/6

EVERY IMPROVEMENT

INDIRECTLY HEATED A.C. MAINS

Screened Grid and Variable Mu S.G.	12/6
Screened H.F. Pentode	12/6
Diode Tetrode	13/6
General Purpose	8/6
Output Pentode	12/6

POST THIS COUPON TO US

We will be pleased to send you our catalogue of the latest DARIO Valves. You will be astonished both by the completeness of the range and the very low prices.

Name.....

Address .....

.....

To IMPEX ELECTRICAL LTD., 47, Victoria St., Westminster, London, S.W.1. Telephone: VIC. 3914. Telegrams: Dariolect, Sowest, London.

In this, the Eighth Complete Article of the Series, the Author Describes the Addition of Class B to the "Progressor."

LAST week we left the "Progressor" as a "de-luxe model" three-valver, having a variable-mu H.F. stage followed by a detector (providing delayed and controlled A.V.C.) and a power output valve. Practically the only useful addition that can now be made is that of a further low-frequency amplifying stage, which will increase the available output volume. One

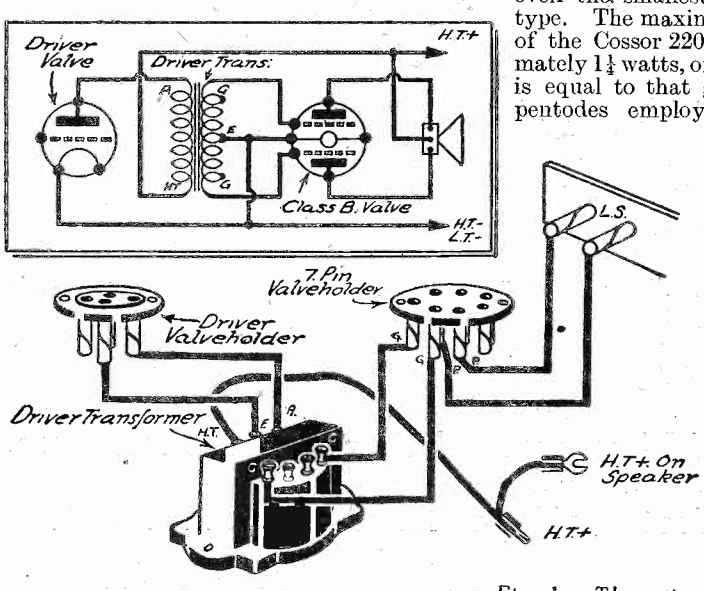


Fig. 1.—Theoretical and pictorial circuit of the Class B amplifier of the "Progressor."

L.F. valve is provided, so the best course to follow is fairly obvious; a Class B output stage must be added.

Class B Advantages

Class B amplification has many advantages over the older and more conventional systems, and for the benefit of new-comers to wireless, and also to refresh the memories of those who by now take Class B for granted, I will briefly summarize those advantages. In the first place a Class B valve provides a considerably greater volume of sound than any other type of battery valve, although it consumes only slightly more current than even the smallest one of the "power" type. The maximum undistorted output of the Cossor 220B specified is approximately 1¼ watts, or 1,250 milliwatts, which is equal to that given by several of the pentodes employed in powerful mains receivers. Even when providing such an output it consumes an average H.T. current of some 6 milliamps, whilst its filament takes only .2 amp. of current from the accumulator. I stated that the "average" current was 6 milliamps, that adjective being used because the actual anode current varies between about 2 milliamps (when the set is not tuned to a signal) to a figure as high as 30 milliamps when dealing with the loudest passages of speech or music from the local station. Between the two limits the current constantly fluctuates in intensity. It will be seen from this that an economy can always be effected by reducing the volume, since the current consumption is proportional to the average output.

The Class B valve really consists of two separate three-electrode valves placed side by side in a single glass bulb, and these two function on the push-pull principle, each dealing with alternate half waves of the signal voltages. Moreover, the valve is so designed that it works without any grid bias, for each of the triodes passes practically zero anode current when its grid is "returned" to H.T. negative. When a signal is tuned in, however, the positive halves of the signal voltages bias the grids positively, and then anode current flows. It should also be explained that the negative half-waves have practically no effect at all, because they merely tend to reduce the anode current still further, so rendering the valve irresponsive to them.

The Driver Transformer

Due to the fact that the Class B valve operates on the positive portions of the signal voltages, it will be seen that, as the grids become positive, current must flow from the filaments to the grids. Were it not for the fact that a special feed transformer were used prior to the Class B valve this would result in hopeless distortion. But the preceding transformer (called the driver transformer) is just the opposite of an L.F. transformer and gives a voltage "step-down" instead of a "step-up" effect. Additionally, the secondary of the transformer has a very low D.C. resistance, so that the varying currents flowing through it do not produce any appreciable voltage

(*Continued on page 650*)

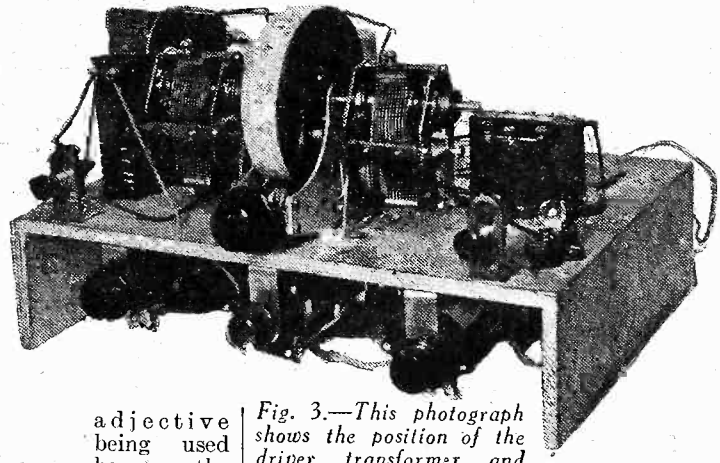


Fig. 3.—This photograph shows the position of the driver transformer and tone-control resistances.

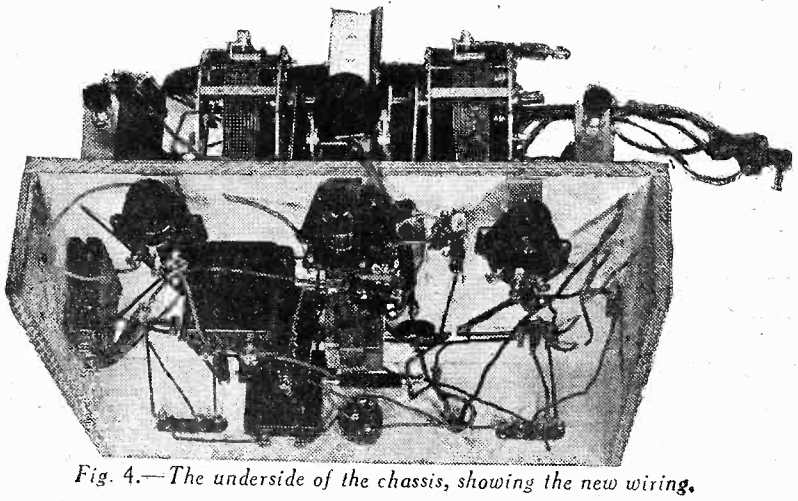


Fig. 4.—The underside of the chassis, showing the new wiring.

THE PROGRESSIVE EXPERIMENTER.

(Continued from page 648).

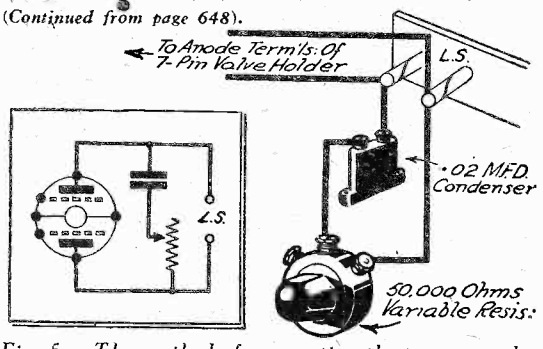


Fig. 5.—The method of connecting the tone control components between the anodes of the Class B valve.

drop across it. The driver transformer really supplies power to the output valve, and in order that it may do this it must be fed from some source or other. The feeding source is the driver valve which must be used between the detector and Class B valves. As a matter of fact, the driver valve is purely and simply a low frequency amplifier connected to the Class B valve by means of the driver transformer just mentioned.

The above explanation will probably be understood more easily by making reference to the pictorial and theoretical circuits, shown in Fig. 1, which depict the arrangement of components in a straightforward Class B amplifier. They also show the arrangement which we shall employ in the "Progressor," of which the new wiring plan is given in Fig. 2. The new components have been shaded for easy reference, whilst the few extra wires are indicated by broken lines to contrast with the previous wires, which are represented by full lines.

Mounting the Class B Components

It is a perfectly simple matter to add the Class B amplifier to the "Progressor," and the first thing is to make a fourth hole in the chassis for the 7-pin valve-holder. This hole is larger than the previous ones, being 1⅛in. instead of 1in. diameter. If a bit of the correct size is not available, you can make a 1in. hole and enlarge it by means of a half-round file. In any case care must be taken to ensure that the valve legs cannot make contact with the metallized surface of the chassis—if they did a short-circuit would be introduced which might "blow" the fuse, or otherwise prevent the set from working. In order to safeguard against the latter possibility it is rather a good plan to slightly chamfer off the edge of the hole with a file.

The position of the driver transformer can easily be determined from Fig. 2, and also by examining the photograph at Fig. 3. No explanation need be given in regard to the new wiring, since this is clearly shown. It might be added, however, that a few slight modifications have to be made to the original connections to the third valve-holder, but these are indicated as new wires to avoid the possibility of your overlooking them. You will notice also that a new flexible lead, with spade terminal attached, is used and passed through the back edge of the chassis near to the loud-speaker terminal-socket strip. This is the third loud-speaker connection and must be connected to the centre (red) terminal on the speaker.

Alternative Ratios

It will be noticed in the wiring plan that the grid connections to the Class B valve are taken to the terminals on the driver transformer marked "G"; these two terminals provide a ratio of 1 : 1, but by transferring the leads to terminals "G.1." a 1.5 : 1 ratio is obtained. When using the 215 P. power valve specified as driver, the former ratio should produce best results, but if you have on hand an ordinary L.F. valve this might be tried as driver, and in that case the higher ratio will prove somewhat better. No matter what valve you are using it will be interesting and instructive to experiment with the two alternative ratios.

Tone Correction

One of the peculiarities of Class B amplification is that it tends to produce an over emphasis of the higher musical frequencies, and in this respect the Class B valve is rather like the ordinary pentode. Because of this, reproduction is liable to be "screechy" and high-pitched unless some form of tone-correction is introduced. With a pentode the usual method of curtailing the higher frequencies is to connect a fixed condenser and fixed resistance in series between the loud-speaker terminals. The same idea can be applied in the case of Class B when the "tone-corrector" components are joined between the two anodes of the valve. It is better, however, to employ a variable resistance in conjunction with the fixed condenser so that a certain amount of control over the tone of reproduction can be obtained. Suitable values for the condenser and resistance respectively are .02 and 50,000 ohms, and these components should be connected, as shown in Fig. 5. In fitting the parts to the set itself the potentiometer specified (it is used as a variable resistance by leaving one of its terminals disconnected) should be mounted on the component bracket in a position which balances with that of the V.M. potentiometer control.

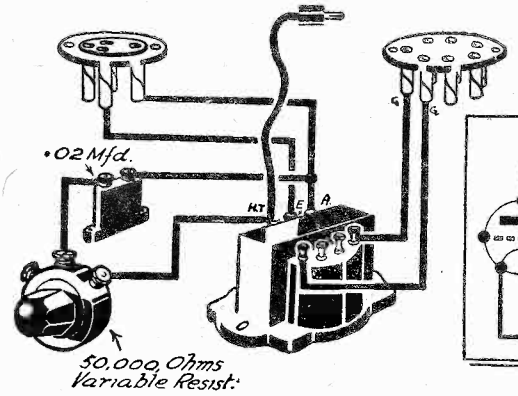
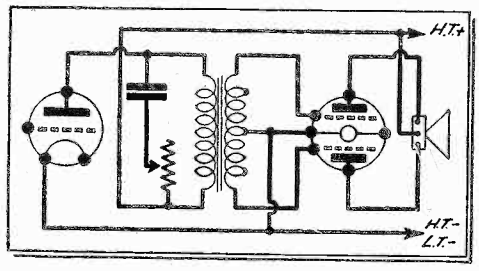


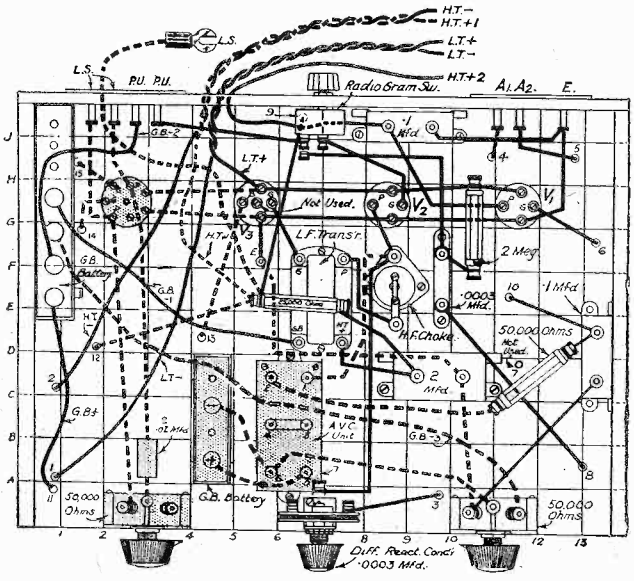
Fig. 6.—A better method of tone control, where the variable resistance and fixed condenser are connected in series across the primary of the driver transformer.



A Better Method

There is an objection to this very simple system of tone control since, by acting on the output circuit, it diminishes the strength of high notes which the Class B valve has amplified. In other words, it is wasteful, and in trying it you will probably notice a reduction in signal strength, especially when the resistance is turned to that position which gives maximum high-note cut-off. The difficulty is most easily overcome by transferring the tone-control components from the positions illustrated in Fig. 5 to the new ones shown in Fig. 6. In the latter case they are wired in parallel with the primary winding of the driver transformer, and so the correction effect is obtained before the signals are finally

(Continued on page 668)



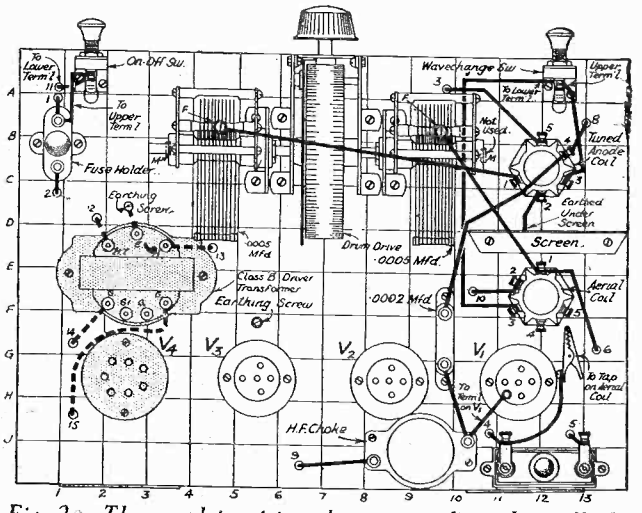


Fig. 2.—The complete wiring plans given above show all the new components (shaded) and new wires (in broken lines) which are added during this week's experiment.

Practical Television

PUBLISHED MONTHLY.
Presented Free with "Practical Wireless."

NOVEMBER, 1933. Vol. 1. No. 1.

In the Following Article the Author Deals with the Working of Neon Lamps, and Synchronizing.

By H. J. Barton Chapple,
Wh.Sch., B.Sc., A.M.I.E.E.

IN ordinary radio reception it is common knowledge that the full quality and benefit of a good loud-speaker is never realized unless it is connected correctly to a first-class radio receiver. The same axiom holds good in television reception, and no matter how good your television and radio receivers may be, the full value of the apparatus cannot be appreciated unless the proper link is included between the two sets of equipment. Except under special circumstances, it is not just a case of disconnecting the loud-speaker and replacing it with television apparatus joined across the same terminals, and from past experience I have found that many amateurs have been disappointed when this simple expedient has failed to give the anticipated images.

Cases not Similar

In articles published in PRACTICAL WIRELESS I have described how to build up a simple disc-type television machine using a neon lamp, and have stated that the incoming radio signals broadcast from the television transmitter are passed to the neon lamp in order to modulate or regulate the magnitude of its glow. The signals do not start or stop the glow in a manner similar to a loud-speaker, being made to operate by the varying audio signal. The object of the signals is to modulate an existing neon lamp glow—that is to say make it glow brighter or darker, according to whether high lights or dim shadows are to be portrayed. It is the initial neon glow which has to be given to the lamp that provides so often the stumbling block and leads to subsequent misunderstandings. With our loud-speaker we generally find it a better policy to isolate it from any steady D.C. current that may be passing in the output valve anode circuit, but not so our neon.

According to the type of lamp used in the television apparatus, so it requires a definite voltage across its terminals before it will glow with normal brilliance. For example, the ordinary beehive lamp requires about 110 or 220 volts, according to rating, before it will glow, and then it passes a current of from 5 to 8 milliamperes. On the other hand, a special flat plate neon lamp designed for television purposes requires about 180-200 volts across its electrodes, and then it passes a current of 25 milliamperes.

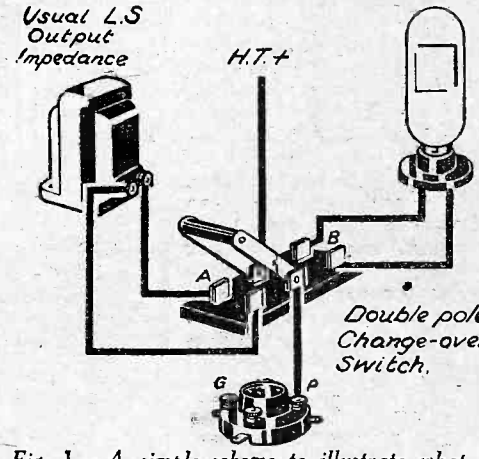


Fig. 1.—A simple scheme to illustrate what happens when the neon lamp replaces the loud-speaker.

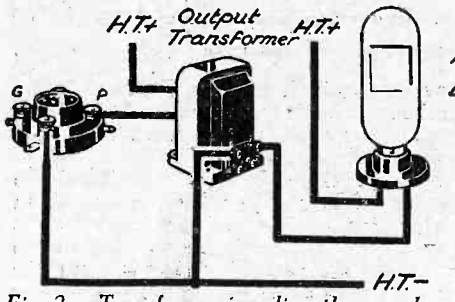


Fig. 2.—Transformer coupling the neon lamp to the output stage.

An Example

To make my meaning clear, let us refer to Fig. 1. Here we have the output valve of a radio receiver which normally has applied to it a voltage of 150. Imagine a double-pole double-throw switch inserted in the manner shown. In position A we have inserted the normal output choke, output transformer primary or loud-speaker itself. There is a drop of voltage of, say, 30 volts across this form of anode impedance, and in consequence the remaining 120 volts is applied to the valve anode. With correct grid bias a current of, say, 10 milliamps flows, and all is well for loud-speaker working.

Changing the switch over to position B, however, and using a small type letter or beehive neon requiring, say, 100 volts for it to strike and glow normally, what happens? If the neon lamp absorbed its required 110 volts, only 40 volts would be applied to the valve anode. The current flowing under these conditions would be very small, and in consequence the scheme would fail. Whereas A position gives a 30-volt impedance drop, B requires 110, so if we still require this B scheme to work, the applied voltage must be increased by the difference between these two figures, that is, 110 minus 30, equals 80 volts, giving a total applied voltage of 230 to restore the balance.

Neon Lamp.

It can be taken as a general rule that if it is desired to work the neon lamp in series with the anode of the output valve, then the applied voltage must be increased by about 100 to 200 volts, according to the type of neon lamp used. The anode current passing through the last valve must then be equal to that required for normal neon glow.

Alternatives

There are many cases where this scheme is inconvenient or will not even work satisfactorily (an exception rather than the rule, however), and to meet this there are several alternatives open to the choice of the individual. The first is shown in Fig. 2. Across the normal "direct" output terminals is placed the primary winding of an output transformer. One side of the secondary winding passes to H.T.— while the other side goes to the neon lamp and thence to H.T.+. In this way a direct current flows through the neon lamp and secondary winding, and by properly adjusting the value of H.T. the correct voltage and current conditions for the "polarized" state of the neon lamp can be obtained. The high-tension feed to the neon lamp can be

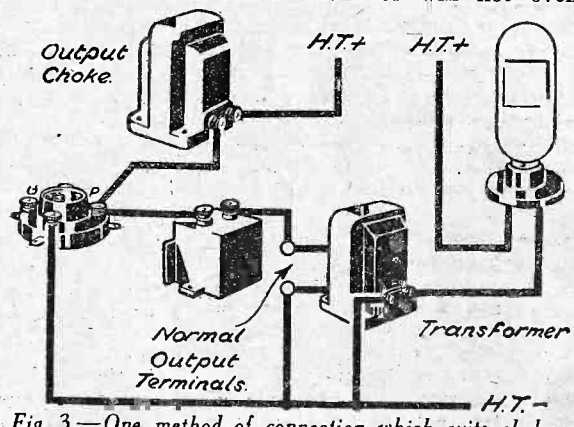


Fig. 3.—One method of connection which suits choke capacity coupled output stages.

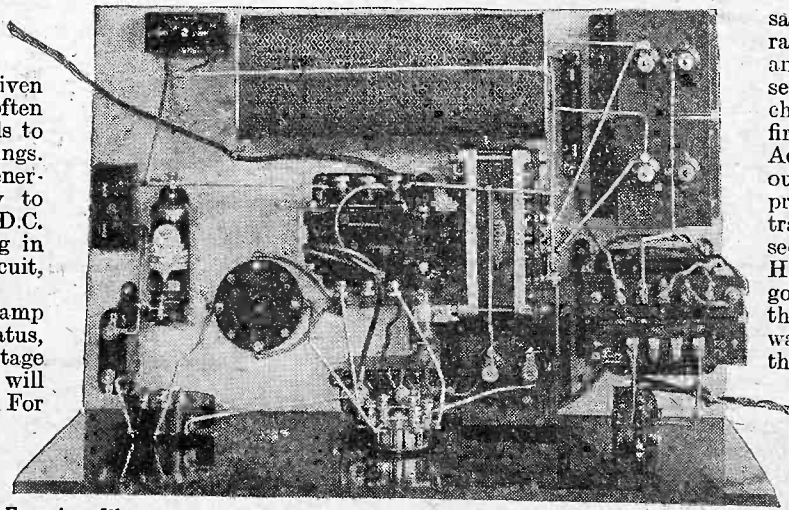


Fig. 4.—Illustrating a combined power output stage and eliminator unit for television working.

taken from the same source as feeds the radio set, provided it can furnish the voltage and additional current required without overloading. If not, then a separate eliminator or battery feed must be employed, the H.T. negative of each source being made common. Full neon lamp brilliancy is secured in this way, and

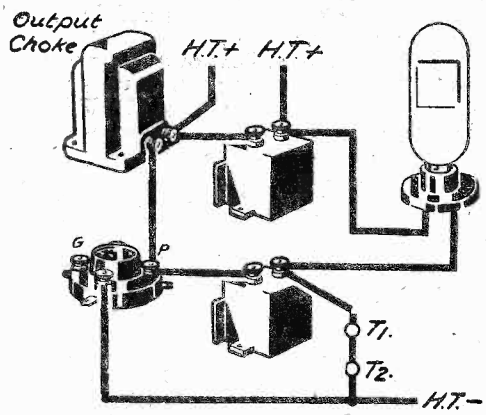


Fig. 5.—An alternative to the Fig. 3 method of coupling.

the incoming radio television signals, after amplification in the wireless set, produce fluctuations in the normal steady neon glow, this being observed through the apertures of the rotating scanning disc, to build up the desired television image in the usual way. The output transformer ratio for the best results generally is found to be one to one, but it is often interesting to experiment with other ratios to find what effects take place.

Choke Feeding

In several of the radio sets which may be used by readers for receiving the television signals, a "choke feed" output may already be incorporated. If so, one way to connect the television apparatus is illustrated in Fig. 3. The same type of

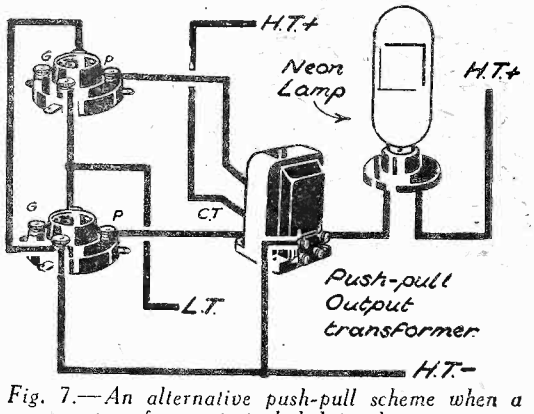


Fig. 7.—An alternative push-pull scheme when a transformer is included in the set.

output transformer must be used in the position indicated, and the adjustments of voltage are the same as in Fig. 2. It should be noted that "iron" is now introduced twice into the circuit, so very careful consideration must be given to the use of both a first-class choke and a transformer having the largest possible inductance. Poor quality material will only impair or spoil the resultant television image.

A combined power output valve stage and mains eliminator feed unit, using the choke capacity transformer connection to the neon lamp, is shown in Fig. 4, and exceedingly good results have been obtained with apparatus of this nature when the output power from the radio receiver has not been sufficient to fully modulate the neon lamp glow. It must be borne in mind that a flat plate neon lamp requires about 1½ watts undistorted output for the best results, but if a beehive or lettered neon lamp is used, then a much smaller output wattage will suffice, but the final television image is not so large or as bright.

Another way of using a choke capacity feed output is illustrated in Fig. 5. Here the usual output terminals T_1 and T_2 are shorted out, and a second condenser joined to the H.T. side of the anode choke, the neon lamp being connected between the two fixed condensers, the voltage and current adjustments being exactly as before.

Push-Pull or Class "B" Cases

A radio receiver incorporating push-pull low-frequency amplification is extremely good for television reception. As a matter of fact, this is the type of set used by Mr. Camm when he looks-in with the aid of a Baird "Televisor" receiver, and, according to the type of output, two methods may be used for joining the television apparatus to the set. The first is shown in Fig. 6, and is almost the same as Fig. 5, except that the output choke is centre-tapped in the usual push-pull fashion.

Then we have the arrangement of Fig. 7, where a push-pull output transformer is used. This is essentially similar to Fig. 2 (except for the centre tap), and gives very satisfactory results.

The advent of Class "B" amplification has enabled those experimenters who are forced to use batteries to obtain an output from their set amply sufficient for modulating the neon lamp, and yet not expensive from the battery cost point of view. The output scheme here is really the same as for push-pull, and is illustrated in Fig. 8. Another alternative is to use the primary winding of the output transformer as a centre-tapped L.F. choke, the connection to the neon lamp being as shown in Fig. 9, two fixed condensers (2 or 4 mfd. capacity) serving as the feed to the neon lamp. Incidentally, this method, shown in Fig. 9, can be used in lieu of Fig. 7 if preferred for ordinary push-pull. An advantage of this arrangement is that by means of simple switching the loud-speaker may be joined across the transformer secondary winding for tuning in the television note first of all, and then isolating the speaker when reverting to the feed to the television apparatus.

Separate Synchronizing

Another useful piece of apparatus to use in conjunction with the neon lamp is a milliammeter to measure the actual current passing through the lamp. In this way an exact adjustment of H.T. potential can be made, and, if desired, a variable resistance may be included in the circuit so that variations in brilliance can be made at will. A little unit made up specially for this purpose is illustrated in Fig. 10, together with a disc model television receiver and a power L.F. amplifier.

So far I have made no mention of the synchronizing gear. This usually takes the form of the popular cogged wheel method working in conjunction with two field coils, which need to be polarized with a direct current of the same order, or even more than the neon lamp current. In view of this fact, the synchronizing coils can, if desired, be wired in series with the neon lamp in every case which is illustrated in the preceding diagrams. On the other hand, for three reasons, it is found preferable to work the synchronizing separately. First of all, there are occasions when it is advisable to reduce or even increase the neon lamp polarizing current, and yet keep the coil current constant, and this is not possible if the two are in series. In addition, to keep the image steady a very strong synchronizing signal

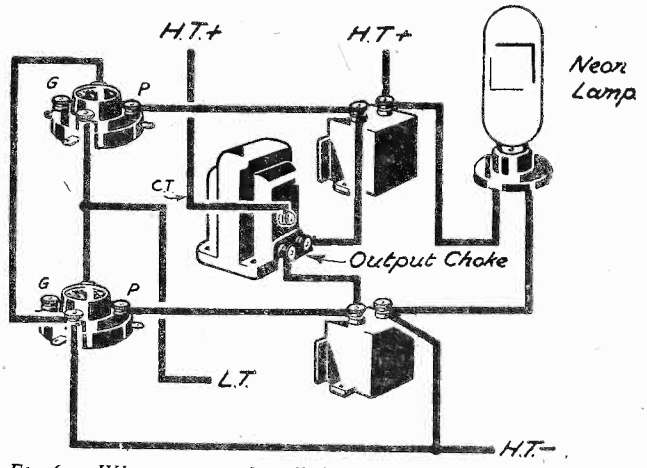


Fig. 6.—When using push-pull the reader can employ this scheme.

may be required, whereas the modulation on the neon lamp may be desired at a lower level. This again cannot work under the series conditions.

Thirdly, since I have mentioned the quality of any "iron" circuit used in conjunction with television reception, it may be thought advisable to exclude the iron-cored synchronizing circuit from the neon lamp so as to obtain a more perfect image. To meet these cases it is necessary to have a separate synchronizing valve. The arrangement is shown in Fig. 11, and consists merely in adding another resistance

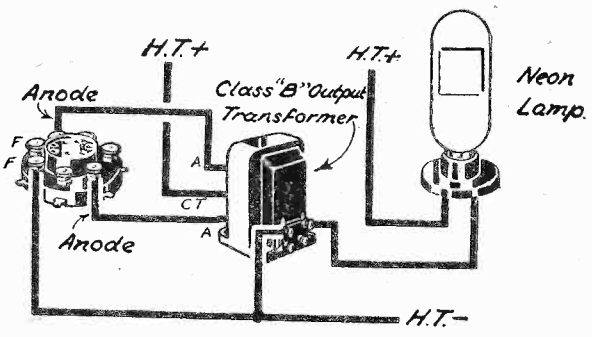


Fig. 8.—Class B working for television is really very similar to ordinary push-pull.

capacity coupled stage, joined to the grid circuit of the output valve feeding the neon lamp. Adjustments in both circuits are then quite independent, and a per-

Linking Radio & Television Receivers

fectly steady image is possible under these conditions.

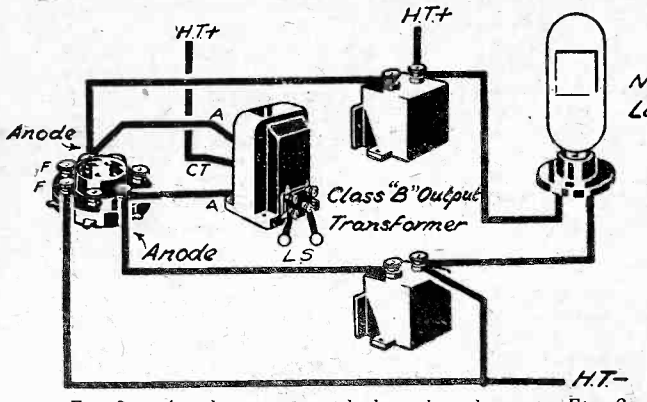


Fig. 9.—An alternative method to that shown in Fig. 8.

OBTAINING A POSITIVE IMAGE.

WE can well remember the astonishment shown by lookers when the first experimental transmission of television took place from the Brookmans Park station on September 30th, 1928. Sir Ambrose Fleming appeared on the television screen just as if he was a nigger, and, until the mistake was rectified, it looked very weird to see this eminent scientist in such a strange colour.

Technically speaking, he had been transmitted as a "negative image," and it is necessary to warn the television novice of this likelihood, and show how it takes place. In a negative image all the dark sections appear light, and all the light sections dark, bearing the same relation to the true image as a photographic plate does to the print which is taken from it. The illustration on page IV shows what is meant, so let us consider for a moment what happens in our television process. With spot light scanning, the reflected light causes an increase in current in the photo electric cell circuit when the spot is exploring the light sections or highly reflective parts of a televised subject, while correspondingly there is a current decrease for poorly reflective surfaces.

Current Direction

The resultant signal conveyed to the receiver, and after amplification to the light modulating device for reconstruction into an image, must, of course, be made to follow the same order. Taking, for example, the simple case of a disc machine working in conjunction with a neon lamp, the lamp brilliancy must increase for the high lights and decrease for the dark patches to give the true positive image.

Now in the radio set used for receiving the television signals this current direction must be studied. As far as sound reception is concerned, the matter is really of no consequence. Transformers, resistance capacity units, or combinations of the two, are used generally without a single thought as to current direction, for the ear does not detect the phase when the loud-speaker is in operation. Current reversals are definitely taking place, however, as witness the case of the detector stage.

With a grid-leak and condenser arrangement, the advent of the incoming radio signals brings about a decrease in the mean anode current, whereas, if an anode bend detector was used the mean anode current under similar circumstances shows an increase in value. Obviously there are other parts of the set where similar reversals happen, but the reader has not found it necessary to give them more than a passing thought. If, for example, you have two transformer coupled low-frequency stages, then the signal on the plate of the detector valve is in the same direction as that on the plate of the output valve at the same instant. A combination of a stage of resistance capacity coupling preceding a transformer, however, brings about a signal reversal. Other instances could be quoted, but enough has been said to indicate to the reader that he must watch these matters carefully if negative images are to be avoided.

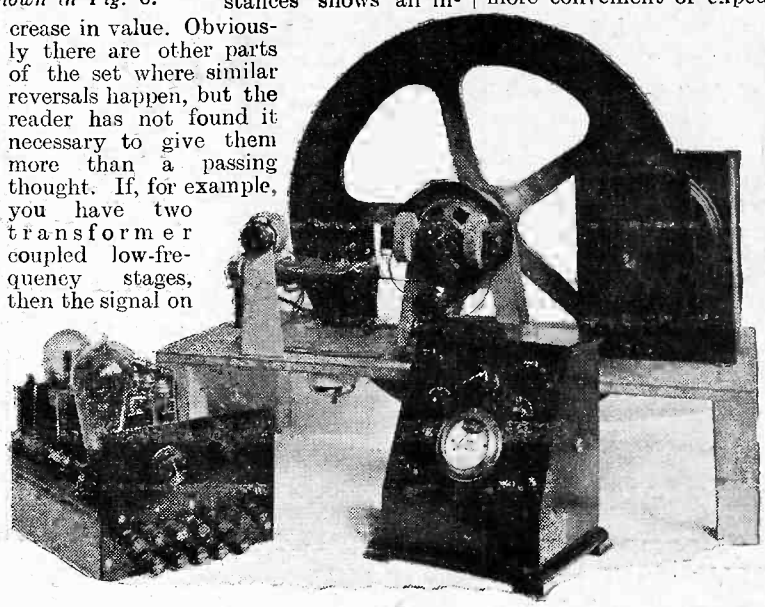


Fig. 10.—A meter to measure the actual current flowing through the neon lamp is a useful device.

A Clue

With the standard television signals as now sent out by the B.B.C., a positive image is given at the receiving end with an anode bend detector valve, followed by an *odd* number of resistance capacity coupled stages, or a grid-leak detector valve having associated with it an *even* number of resistance capacity coupled stages.

This piece of information gives the clue to one method for reversing a negative image into a positive one. Either change the method of rectification, or add or subtract a stage of R.C.C., whichever is more convenient or expedient. There are other ways in which this current reversal may be carried into effect, and if a low-frequency transformer is included in the set, then it is quite in order to reverse the connections to *either* the primary or the secondary windings, preferably the latter. Alternatively, if an output transformer is used for linking to the television receiver, then the same expedient of reversal of either winding will rectify matters. This

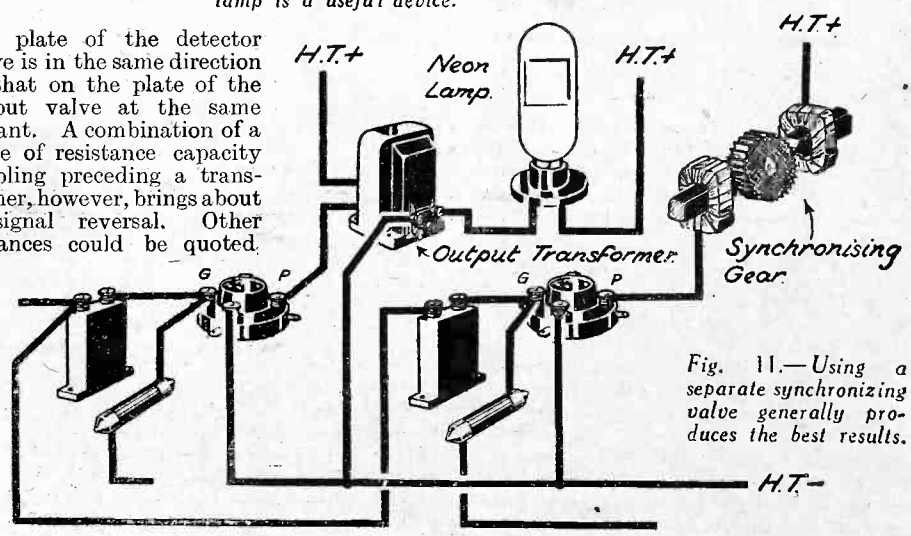


Fig. 11.—Using a separate synchronizing valve generally produces the best results.

also applies when a choke-transformer feed is used.

Any device which brings about a reversal of grid voltage can cause a negative image, and, in the course of many tests we have made with radio sets designed specifically

Reversal of light and shade in a negative image.

for the reception of the television signals, we have found several instances of this happening. In the days when neutralizing was popular, it was noticed that over-neutralizing brought about a reversal, while curious reaction or bypass feed backs gave similar results. If the grid voltage adjustments are incorrectly made, so that both anode bend and grid-leak rectification take place, this also causes a combined positive and negative image, while, strangest of all, on one occasion a run-down filament accumulator gave a negative image. These cases which have just been cited are, of course, of somewhat rare occurrence, but if you bear in mind the points emphasized earlier, and apply the cures suggested, then negative images will not be a source of worry.

THE BAIRD MIRROR DRUM "TELEVISOR."

THE Baird Mirror Drum Televisor, complete with its radio receiver, is housed in a modern and distinctive cabinet of natural walnut, with dark brown fittings and mouldings. In the top section is accommodated the television projector and screen. This is a mirror drum revolving about a horizontal axis and driven by a small universal mains motor. The motor support also has a rectangular and hollow housing to which is screwed the Baird grid cell unit complete with its projector lamp.

Image Building

A light beam from the 100-watt projection lamp is modulated by the cell, and after being reflected from an inclined mirror is focused on to the drum mirrors by a 3in. diameter double-convex lens. Since each mirror on the drum surface is canted (with reference to the drum axis) by an amount of one-sixth of a degree with reference to its neighbour, the drum, when revolving, allows each mirror face in turn to take charge of the light beam and project a spot of light on to a front screen. This spot moves vertically, building up thirty strips of light laid side by side, the screen itself being pulled out similar to a camera bellows, for focusing purposes. When this is done the resultant active light area for showing the television image is 9in. high by 4in. wide.

The incoming radio television signals are fed to the grid cell after being amplified in the radio receiver, graduations of light and shade being produced on the screen to create an image which has the characteristics of a *wash drawing*, and not one made from dots, as in the print of a half-tone illustration.

Radio Side

Coming now to the radio side, we find a mains-driven set having a single high-frequency stage, anode bend detector, and three stages of resistance-capacity coupled L.F. The output valve is a large D.O.24, and this feeds the cell from a resistance-capacity output, the cell, of course, being a voltage-operated device. The appropriate voltage bias on the cell is furnished from a resistance network joined between the main positive high-tension feed and H.T. negative.

To maintain the projector apparatus in synchronism with the television transmitter, the familiar thirty-toothed cogged-wheel components are added to the motor at the end remote from the drum. The field coils of this synchronizer are fed from another D.O.24 output valve, which is R.C. coupled to the other D.O.24 valve. In this way a separate synchronizing feed is secured whose strength is adjusted by a potentiometer control on the grid of the D.O.24 valve. Finally, we have a D.W.4 rectifying valve furnishing the required current and voltage for the valve anodes. One of the accompanying illustrations gives an idea of the "solidly" built receiver.

Operation

A striking feature of this receiver is the comparative ease with which reception is accomplished. This once and for all kills the hitherto prevalent impression that working television apparatus is a tricky and difficult operation. First of all, the motor is switched on and allowed to build up to speed, and in order to "see" whether the motor is running at its correct speed of 750 r.p.m. a stroboscopic indicator is mounted on the motor shaft, being illuminated by a small neon lamp fed from the A.C. mains. The lines of the stroboscope appear to remain stationary when the speed is correct, any movement clockwise or counter-clockwise being checked by adjusting the variable resistance in the motor feed. It is advisable to "warm up" the motor by running it for about fifteen minutes before the television transmission starts.

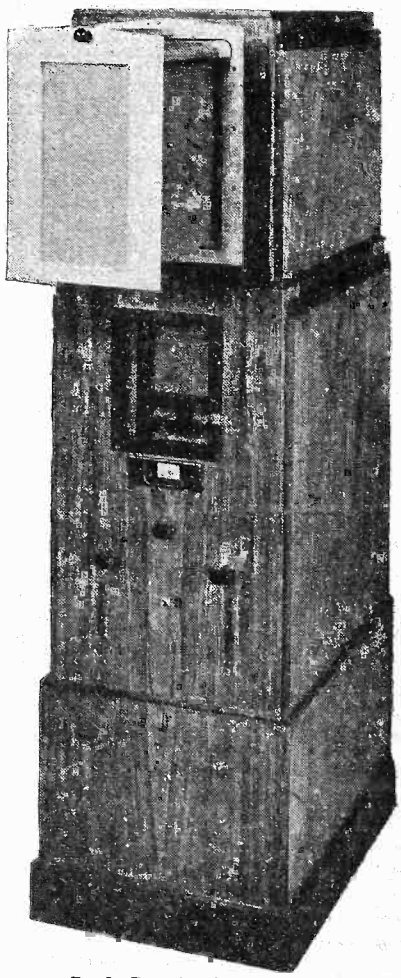
Only the medium waveband is covered by the coils in the set, as there are no television transmissions in this country on the long waveband, and since the signals emanate from the London National station on 261 metres, tuning is a very simple process. A loud-speaker is incorporated so that the "sound" of the signal may be heard, and when correctly tuned in, a changeover, *via* a switch at the back of the cabinet, is made to the vision equipment. If synchronism is correct the image will appear immediately on the screen, but if inclined strips of light having black patches are noticed, the motor rheostat must be altered slightly until the heavy black synchronizing lines, which border the image top and bottom, lie horizontal.

The image even then may be displaced vertically and horizontally from the centre of the screen frame, but matters are soon rectified by rotating the large knob on the left of the cabinet. This turns the carcase of the driving motor and so produces both a vertical displacement of the image, as well as a slight side drift to left or to right.

Results

Compared with the earlier "Televisors" the image remains very steady. One reason for this is the flexible coupling between the drum and the motor shaft, this providing a mechanical filter to damp hunting, while, in addition, the strength of the synchronizing signal is adapted readily by the potentiometer control to the grid of the D.O.24 valve feeding the synchronizer. A slight vertical swing may be noticed, but the image does not run away several times during the course of the half-hour's transmission, as was found in the earlier apparatus. Occasional reframing may be necessary, but this arises from the nature of the signals emanating from the transmitter.

Close-ups are remarkably good, it being possible to recognize easily any familiar face. On the long shots detail is, of course, not so pronounced, but here we are concerned more with rhythm of movement, shown, for example, by dancing, or special acrobatic turns. It is necessary to sit at least six feet away from the screen to get the best effects, and the black and white images are extremely bright, and may be seen by a whole roomful of people at the same time.



The new Bush-Baird television receiver, complete with sound apparatus. The loud-speaker fret is situated immediately below the viewing screen, and this is adjustable in the same manner as the focussing screen of a camera. There is no need to dim the lights of a room with this receiver.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

THE DIFFERENTIAL CONDENSER.

How and Why It is Used.

THERE are two general types of variable condensers used in radio reception—the ordinary kind, with one set of fixed and one set of moving vanes, and the *differential*, which has two sets of fixed and one set of moving vanes. Fig. 1 shows the arrangement of the vanes of this latter type. You will see that, from the theoretical point of view, it is really two condensers in series. By rotating the spindle attached to the moving vanes one of these condensers gradually increases in capacity while the other one decreases. The moving vanes are semi-circular in shape, so that when the spindle is half-way through its total arc of rotation each condenser is of the same value, that is, half its maximum value. This position of the moving vanes is shown in the centre diagram in Fig. 2. The other two drawings show the position of the vanes at the fullest extent of the rotation of the spindle in first one direction and then the other. When the capacity of one condenser is at a maximum, that of the other is at a minimum.

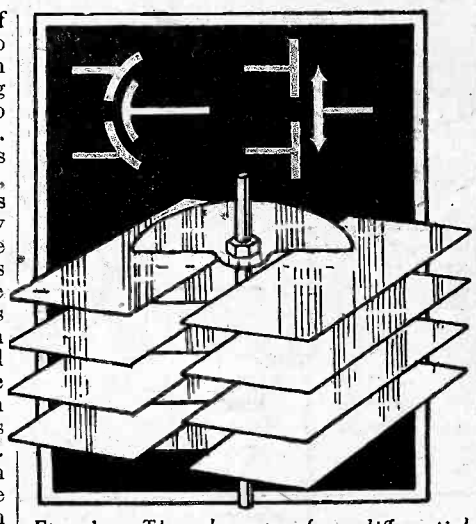


Fig. 1.—The elements of a differential condenser. Above, two ways of representing a differential condenser diagrammatically.

Now there are several uses to which a differential condenser may be put, but we will deal first with its most common application, namely its use as a reaction control.

By-passing the H.F. Currents

For many years now the standard method of controlling reaction has been by using a reaction coil with a fixed number of turns of wire and fixed coupling, and to vary the current through this by connecting it in series with a variable condenser. This method is illustrated in Fig. 3. However, as shown here, it has certain drawbacks. The most obvious is that when the reaction condenser is set at a minimum there is no easy path for the H.F. component of the anode current of the detector valve.

The anode current of the detector valve may be considered as consisting of three separate parts. There is the steady direct current from the high-tension supply, the rectified speech current, and the amplified H.F. impulses. It is the last-named which are used for reaction purposes. They are fed back by means of the reaction coil, and superimposed on the input current. Now, apart from its use for reaction purposes, this H.F. part of the anode current is not really wanted. If it finds its way to the grid of the next valve it will cause distortion and possibly actual howling. Again, if it is allowed to pass on round the anode circuit when an H.F. stage is used before the detector, then it is possible for it to cause undesirable back coupling through the medium of the common impedance of the H.T. source.

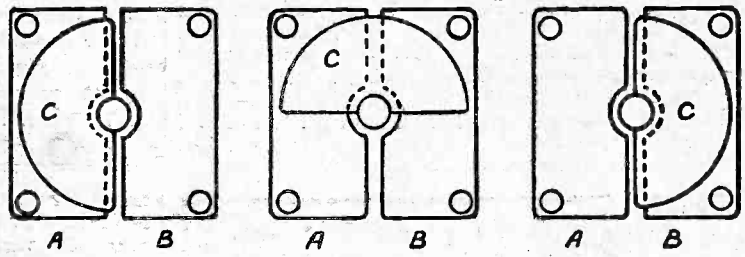


Fig. 2.—Plan of the vanes of a differential condenser, showing three different settings of the condenser.

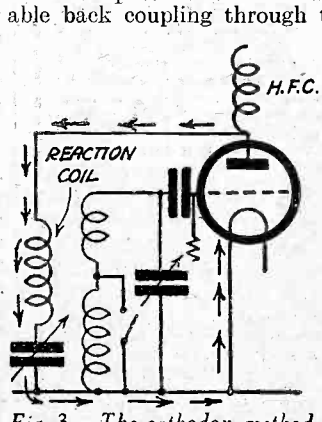


Fig. 3.—The orthodox method of controlling reaction, using an ordinary variable condenser.

The usual thing to do with this unwanted current is to impede its progress by including an H.F. choke in the anode circuit of the detector immediately following the anode itself, as shown in Fig. 3. This choke acts as a barrier, and prevents it travelling farther than the anode of the valve. However, the choke is not in itself sufficient, and the "unwanted current" may be strong enough to force through this barrier unless some alternative path is provided. In Fig. 3 this alternative path is through the reaction coil and reaction condenser to the filament. It is indicated by the arrows. Now when the reaction control is "turned on fully," that is, when the reaction condenser is set somewhere near its maximum capacity, this path offers a very easy exit, but when the reaction condenser is set to its minimum position it presents a very high impedance, and the "unwanted current" has no escape.

This is where the differential condenser comes in. It is connected as in Fig. 4. Now a moment's consideration shows us that whatever the setting of this condenser the by-pass effect is always constant. When the condenser is in the "full-on" position then the H.F. currents travel from the anode *via* the reaction coil, the fixed vanes A, and the moving vanes C, to the filament, as shown by the arrows in the left-hand diagram in Fig. 4. When the reaction is "turned-off," then the path of the H.F. impulses is from the anode to the fixed vanes B, thence *via* C, to the filament. In any intermediate position the currents follow a divided path—partly through the reaction coil and A C, and partly through the path B C.

High Note Cut Off

It may be argued that if the only drawback to the ordinary reaction condenser is that it does not provide an alternative path for the H.F. component when it is set at zero, then a fixed condenser between anode and filament, as in Fig. 5, is all that is needed. Admittedly, this often provides a solution of the problem if the value of the fixed condenser is carefully chosen, but even so it has not quite the same advantages as the differential method. For one thing the value of the fixed condenser must be sufficiently large to by-pass the H.F. current when the reaction condenser is at zero. However, this value may be *too* large when a reaction condenser is all in, for the total value of the by-pass condenser and the reaction condenser may be such as to by-pass some of the higher audio frequencies and thus mar reproduction by loss of the higher notes. It is also found in practice that the use of the differential condenser provides a smoother control of reaction. It certainly provides a greater *range* of control than an ordinary condenser of equivalent value used in conjunction with a by-pass condenser, for when the differential is in the "full-on" position nearly 100 per cent. of the current passes through the reaction coil, while when it is in the "off" position practically all of the current passes direct to the filament *via* B C. (see Fig. 4), and only the smallest fraction (due to the minimum capacity between A and C) passes through the reaction coil. This is an advantage with

(Continued on page 656)

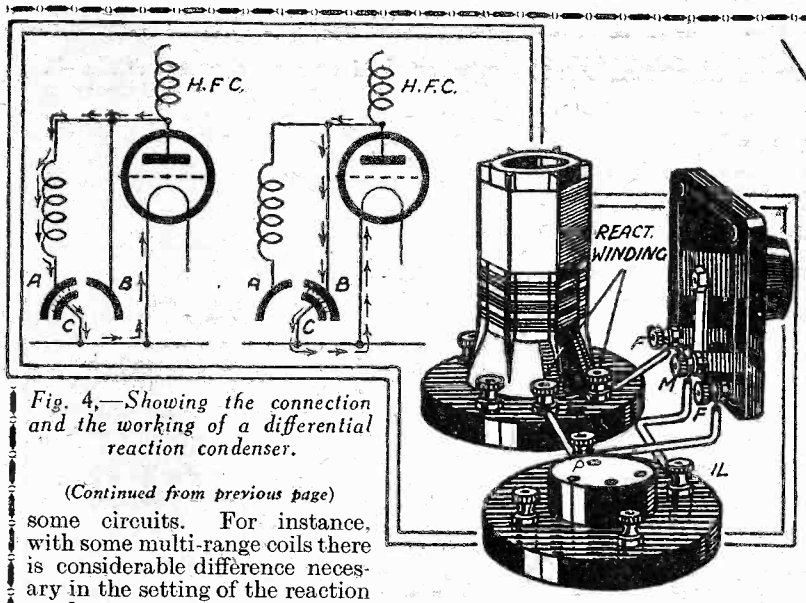


Fig. 4.—Showing the connection and the working of a differential reaction condenser.

(*Continued from previous page*)

some circuits. For instance, with some multi-range coils there is considerable difference necesary in the setting of the reaction condenser on one wave-band compared with another.

The "Differential" as a Volume Control

The connection for a differential reaction condenser, shown in Fig. 4, is not the only possible arrangement. Another version is shown in Fig. 6. Differential condensers are also used for a variety of other purposes besides reaction control. One of the best known is as a volume control which works by varying the aerial input. The circuit is shown in Fig. 7. When the moving vanes of the condenser are completely interleaved with the fixed vanes marked A, then the input to the tuning coil is at a maximum and loudest signals result As the moving vanes are rotated towards the other set of fixed vanes, so the input *via* C A is reduced and at the same time the aerial currents find an alternative path direct to earth *via* C B.

This type of volume control has the advantage that it is very simple, noiseless in operation, and covers a large range, it being possible to cut down the most powerful stations to a whisper. Its disadvantages are, firstly, that even at the full volume setting there is some slight reduction of input owing to the fact that there is still a small minimum capacity existing between C and B. Secondly, that variation of the control means slight variation in the wavelength of the aerial circuit, so that when the volume control is operated it may be necessary to readjust the aerial tuning condenser. If this latter is ganged this will naturally be impossible. Incidentally, with this form of volume control the selectivity will be increased as the volume is reduced.

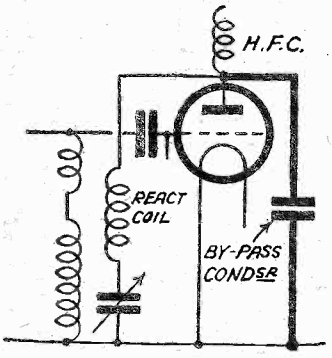


Fig. 5.—The use of a by-pass condenser. See text.

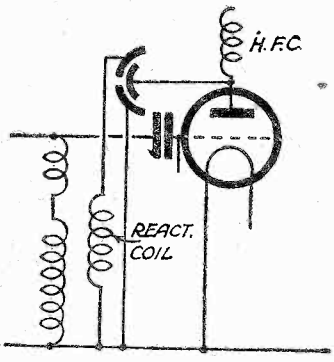


Fig. 6.—Alternative connections for a differential reaction condenser.

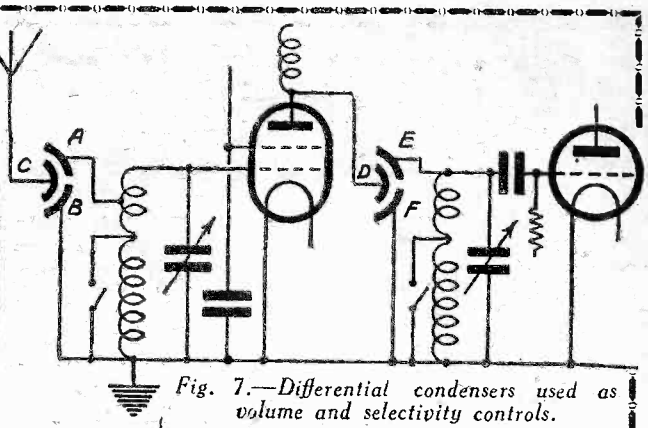


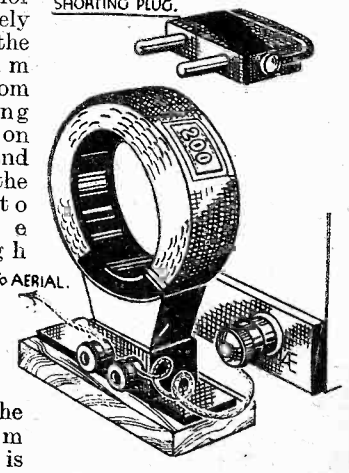
Fig. 7.—Differential condensers used as volume and selectivity controls.

A similar use for a differential condenser is as a variable coupling between the H.F. valve and the following grid coil in a tuned-grid circuit. This is also shown in Fig. 7. The condenser used as a variable coupler is represented at D E F. Here the action is precisely similar to that of the differential condenser A B C. In the same way that A B C controls the input to the first valve so D E F controls that to the next valve (in this case the detector). In practice it is hardly necessary to include both devices in the one circuit, as in Fig. 7, as more than sufficient control can usually be obtained with either one or the other. The variable coupler, however, is sometimes used, in conjunction with an ordinary pre-set or variable condenser, in series with the aerial as an additional selectivity control.

A Simple Anti-break-through Dodge.

THE references to anti-break-through devices in recent issues of PRACTICAL WIRELESS contain no mention of the following simple expedient. It is not everyone who would care to go to the trouble involved in making up the device mentioned in "Wrinkles" of November 4th issue; nor go to the expense of buying a special choke, so that perhaps my own simple but efficient method of preventing break-through may prove of interest to others, especially those who have on hand a number of old plug-in coils.

I recently changed my coils for a dual-wave iron-cored tuner, and am immensely pleased with its performance. The one snag, however, was break-through, as I am rather near to Moorside Edge. I thought of buying one of the special chokes intended to prevent this nuisance, but before doing so I decided to try out the following experiment. I mounted an ordinary plug-in coil-holder on a small square of half-inch thick board, and then connected one of its terminals by a short length of flex to the aerial terminal of the set, and took the aerial lead to the other terminal. I then plugged in various sized coils, and eventually found that a No. 200 did what I wanted, for it effectively blocked the medium waves from breaking through on the long, and allowed the latter to come through without any interference. On switching over again to the medium waves it is only necessary to pull the coil out of its holder, and insert a shorting plug in its place.—A. J. WOOD (Manchester).



TOPICAL TECHNICALITIES

The Carrier Wave and Side Bands.

AS might be imagined, the name carrier wave is applied to the wave sent out by a broadcasting station for the purpose of "carrying" the modulation or sound frequencies. It is the carrier wave which takes the frequency or wavelength upon which the station is said to transmit, and thus the carrier-wave is of constan. frequency. For example, the wavelength of London Regional is 355.9 metres, and the frequency, 843 kilocycles. By this it is meant that a constant oscillation of 843 kilocycles is emitted by the station. But this is not the only series of oscillations to be sent out, for others, corresponding to the audible frequencies (generally taken as ranging from 10 to 10,000 cycles per second) are also transmitted. As a matter of fact, it is the latter series of frequencies which are actually employed to drive the loud-speaker, the carrier-wave serving merely to transport the audible frequencies from the transmitting aerial to that used for receiving.

The audible frequencies are generally referred to as side-bands, because they occupy a band of frequencies on each side of that representing the carrier wave. For instance, suppose a note of frequency 1000 cycles were being sent out from London Regional the frequency of that station would not be just 843 kilocycles, but would be 843 kilocycles plus and minus 500 cycles (half of 1,000 cycles.) A tuner giving 9 kilocycles separation will give full response to all audio-frequencies up to 9,000 cycles (9 kilocycles).

ONLY 15 WORKING DAYS TO XMAS ORDER YOUR RADIO NOW FROM PETO-SCOTT

MANUFACTURERS KITS IN SEALED CARTONS

LISSEN KITS

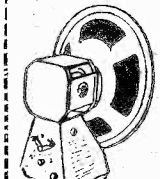
NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL, complete kit comprising all components, including set of Lissen Valves. Cash or C.O.D. Carriage Paid, **£5/12/6.** Balance in **11** monthly payments of **10/3.** Send **10/3** only

NEW LISSEN 7-VALVE SUPER-HET (Chassis Model), complete with Lissen Valves in Sealed Carton. Cash or C.O.D. Carriage Paid, **£8/17/6.** Balance in **11** monthly payments of **16/6.** Send **15/-** only

MOVING COIL SPEAKERS

NEW BLUE SPOT 45 P.M. MOVING-COIL SPEAKER with input transformer. Cash or C.O.D. Carriage Paid, **£2/5/0.** Balance in **7** monthly payments of **6/-.** Send **6/-** only

BLUE SPOT 99P.M. PERMANENT MAGNET MOVING-COIL SPEAKER. Complete with tapped input transformer. Cash or C.O.D. Carriage Paid, **£2/19/6.** Balance in **10** monthly payments of **6/-.** Send **6/-** only



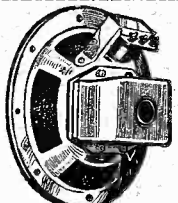
NEW W.B. P.M.4.A. MICROLODE PERMANENT MAGNET SPEAKER complete with switch-controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, **£2/2/0.** Balance in **7** monthly payments of **5/9.** Send **5/9** only

W.B. P.M.6 PERMANENT MAGNET SPEAKER. With input transformer. Cash or C.O.D. Carriage Paid **£1/12/6** Balance in **6** monthly payments of **5/-.** Send **5/-** only

ROLA FR6 P.M. CLASS "B" MOVING COIL SPEAKER with input transformer. Cash or C.O.D. Carriage Paid **£1/19/6.** Balance in **7** monthly payments of **5/6.** Send **5/6** only

R & A "CHALLENGER" PERMANENT MAGNET MOVING-COIL SPEAKER, with special Ferranti multi-ratio input transformer. Cash or C.O.D., Carriage Paid, **£1/15/0** Balance in **5** monthly payments of **6/6** Send **6/6** only

PETO-SCOTT CLASS "B" MOVING-COIL SPEAKER



Complete with input transformer for power or pentode output. Cash or C.O.D. Carr. only Paid, **£1/2/6** Balance in **5** monthly payments of **4/6** Send **2/6**

Power or Pentode Output Model, or **2/6** down and **4** monthly payments at **5/-.** **19/6** Cash or C.O.D.

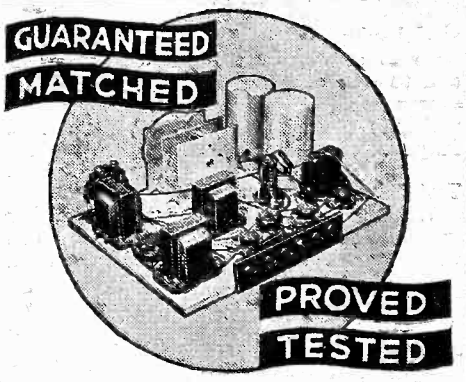
FERRANTI CLASS "B" SPEAKER AMPLIFIER. Comprises M.C. Speaker, Class "B" Power Output Transformer with Class "B" valve. Cash or C.O.D. Carriage Paid **£4/4/0** Balance in **11** monthly payments of **7/9.** Send **7/9** only

BLUE SPOT 66R.B. CLASS "B" LOUDSPEAKER, with input transformer. Cash or C.O.D. Carriage Paid, **£1/10/0.** Balance in **5** monthly payments of **6/-.** Send **6/-** only

NEW GARRARD MODEL 202A. 12-in. Turntable. Electric Motor for A.C. mains. Cash or C.O.D. Carriage Paid, **£2/10/0.** Balance in **8** monthly payments of **6/-.** Send **6/-** only

ATLAS C.A.25 ELIMINATOR, for A.C. mains, Class B and Q.P.P., four tappings: 60/80, 50/90, 120, 150 volt, 25 m.a. Cash or C.O.D. Carriage Paid, **£2/19/6.** Balance in **10** monthly payments of **6/-.** Send **6/-** only

PILOT CLASS "B" FOUR KIT



WITH COLVERN SCREENED COILS

Peto-Scott again triumphs with this up-to-the-minute CLASS "B" Battery 4 Kit at the right price. Provides super-selectivity and sensitivity with outstanding mains quality and seven times the volume of the ordinary battery set. Single-dial tuning; several coils; built on Metaplex. Comprises Variable-Mu S.G., detector, Class "B" power-driven and Class "B" output valves. Complete Kit (less valves) includes detailed "simple to build" instructions and Assembly Blueprint. A superlative Class "B" Kit with matched and tested components guaranteed for 12 months by Peto-Scott.

YOURS FOR **5/-**

KIT "A"
Cash or C.O.D. Carriage Paid, or 5/- deposit, and 12 monthly payments of 6/- **£3-10-0**

KIT "B." As Kit "A," detailed above, but including 4 PETO-SCOTT matched and tested Valves. Cash or C.O.D. Carriage Paid, £5/2/6, or 12 monthly payments of 9/6.

KIT "C." As Kit "A," as detailed above, but including 4 PETO-SCOTT matched and tested Valves and Peto-Scott Consolette Cabinet, as illustrated. Cash or C.O.D., Carriage Paid, £5/15/0, or 12 monthly payments of 10/6.

Recommended PETO-SCOTT SPEAKER if required, add **22/6** to Cash Prices, or **2/-** to each monthly payment.

ORBIT

KIT "A" Author's Kit of FIRST SPECIFIED Parts, including Peto-Scott METAPLEX Chassis, but less valves, Cabinet and Speaker, Cash or C.O.D. Carriage Paid. **£5-5-0**
or by 12 monthly payments of 9/6.

KIT "B" As Kit "A" but with Valves only. Cash or C.O.D. Carriage Paid, £7/4/0. SEND ONLY **13/3** *Balance in 11 monthly payments of 13/3.*

KIT "C" As Kit "A" but with Valves and Peto-Scott Orbit Walnut Consolette Cabinet, but less Speaker. Cash or C.O.D. Carriage Paid, £8/5/0. SEND ONLY **15/3** *Balance in 11 monthly payments of 15/3.*

If W.B. P.M6A. Speaker required, add £1/12/6 to Cash or C.O.D. prices, or 3/- to each monthly payment.

EXCLUSIVELY SPECIFIED PETO-SCOTT CONSOLETTE CABINET.
Soundly constructed of the finest materials. Hand French polished. Selected and specified by Mr. F. J. Camm for the Orbit. Front ready drilled to take set. Cash or C.O.D. Carriage Paid **21/-**

SEND FOR NEW CABINET CATALOGUE

SIXTY-SHILLING THREE

KIT "A" Exactly as Mr. Camm's Kit of parts including ready drilled wood for frame work excluding valves, Cabinet and Speaker. Cash or C.O.D. Carriage Paid £2/7/0. Balance in 11 monthly payments of 4/3. Send **4/3** only

KIT "B" As Kit "A," including valves, but less Cabinet and Speaker. Cash or C.O.D. Carriage Paid, £3/9/9, or 12 monthly payments of **6/6**

KIT "C" As Kit "A," including valves and Peto-Scott M.C. Speaker, and Cabinet. Cash or C.O.D. Carriage Paid, £5/4/3, or 12 monthly payments of **9/6**

1 Set Peto-Scott wood parts for framework READY DRILLED and with holes cut for speaker and valve holder. Including Packing and Postage 5/3

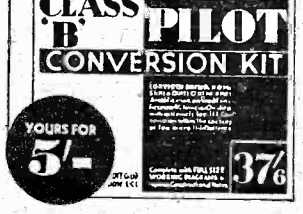
EXCLUSIVELY SPECIFIED

PETO-SCOTT PERMANENT MAGNET MOVING-COIL SPEAKER. Cash or C.O.D. **19/6**

PETO-SCOTT KOMPACT CABINET. A fine Cabinet at a competitive price with vignetted front. Post and packing paid. **15/-**

PILOT CLASS "B" CONVERSION KIT

Converts your present Battery Set to Class "B" Amplification. Complete with all necessary components, **including driver transformer, Class "B" output choke, W.B. 7-pin valve-holder, B.V.A. 240B valve,** wire and screws, etc.



Full-size Blue-print, assembly instructions, and diagrams. **Cash or C.O.D. 37/6.**

Balance in 7 monthly payments of 5/6.

Peto-Scott Class B Speaker, Cash or C.O.D., Carriage Paid, **£1/2/6.** Or **2/6** deposit, balance in **5** monthly payments of **4/6.**

IMPORTANT *Parts, Kits, Miscellaneous Components, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our System of Easy Payments. Send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent Carriage and Post Charges Paid, Great Britain only.*

XMAS EXPRESS DELIVERY COUPON

PETO-SCOTT CO. LTD. 77 CITY ROAD, LONDON, E.C.1.

Telephone: Clerkenwell 9406/7

West End Showrooms: 62 High Holborn, W.C.1. Telephone: Holborn 3248.

Dear Sirs,—Please send me, CASH/C.O.D./H.P. .....

for which I enclose £.....s.....d. CASH-H.P. Deposit.

NAME .....

ADDRESS ..... Pr.W. 9/12/33...

SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

OUR VIEWS ON RECEIVERS

Ready Radio E.M. Plus Four

IN this receiver we have what was at one time a most popular circuit, but which ceased to have appeal principally owing to lack of long-wave tuning facilities, and also owing to the fact that it was designed for the valves which were then obtainable, and which were later much improved. Thus it became possible to obtain better results with a simpler form of circuit and, in addition, to obtain long-wave signals. Messrs. Ready Radio have been experimenting with the various circuit details of this receiver and have succeeded in incorporating long-wave tuning, together with other modifications which have enabled the modern screen-grid valve to be employed in the H.F. stage, and have thus introduced a very fine example of a receiver which does not embody some of the points which have been thought essential in modern receivers. For instance, no screens are included for the coils, a simple vertical metal partition sufficing to separate H.F. and succeeding stages. The coils themselves are wound on 3in. diameter ebonite formers, Litz wire being employed for the grid tuning circuit and the coupling coil in the aerial circuit, and the primary of the H.F. transformer being wound with very fine wire on ebonite spacers arranged over the former winding. The fine wire offers a maximum of inductive coupling with a minimum of capacity coupling and has several beneficial points. The long-wave winding on both coils is arranged on a smaller ebonite former fitted inside the first-mentioned former, and is rigidly held in position with ebonite spacing tubes. Obviously the external field of this type of coil is very extensive, and the receiver in question has been designed with the H.F. section occupying quite a large portion of the chassis. A two-gang condenser is employed for tuning the two circuits, and this is of the totally screened type, having a concentric trimming knob for accurate matching of the two circuits. The remaining controls on the front of the cabinet are for volume (operating on the S.G. valve), reaction, and wave-change and on-off switches.

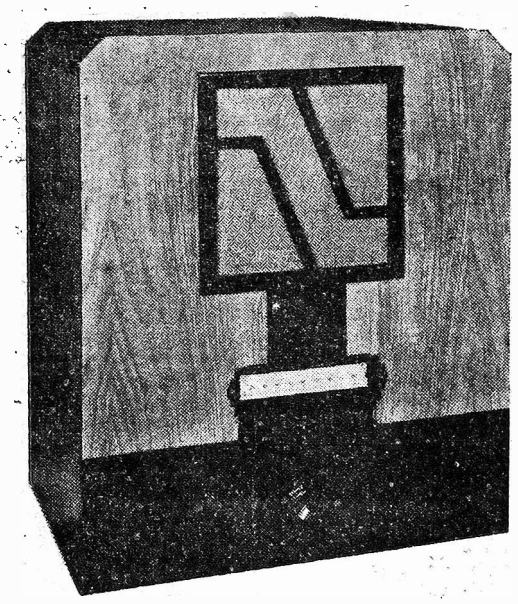
The Layout

We have already mentioned the arrangement of the chassis, and the only other point of importance is the connection to the anode of the S.G. valve. This is of the metal-braided type and is passed through a hole in the screen and is also connected to earth to avoid instability. The receiver is mounted in the lower portion of the cabinet, no sub-chassis form of construction being employed. A shelf is fitted across the centre of the cabinet and this is intended for the batteries. Unfortunately, in the particular model submitted to us it was found impossible to connect a standard L.T. battery and to place it on this shelf owing to the shortness of the battery leads. The speaker which is fitted in the upper portion is a Magnavox moving-coil.

Test Report

When testing the receiver we were rather surprised at the large number of connections which were necessary, no less than seven separate H.T. and G.B. adjustments having to be made. Perhaps this could have been modified by using voltage dropping resistances in the circuit, although doubtless the designer had in mind the possibility of getting that little bit extra from a more accurate adjustment of H.T. voltage. However, that is a personal prejudice, and no doubt many listeners prefer to have every adjustment at their finger-tips in order that they may satisfy themselves that they are getting the last ounce from a receiver. The voltages were adjusted according to the makers' recommendations and the necessary valves plugged in. The receiver was very lively and quite a number of stations could be obtained as the tuning dial was rotated. To get the best from the receiver, however, a certain amount of care was necessary to enable selectivity to be adjusted to suit the local conditions. Thus the volume control and the reaction control are adjusted together to obtain the desired volume and separation of stations. Under average conditions the receiver should prove highly satisfactory from every point of view.

The receiver is obtainable as a kit at £4 17s. 6d., and cabinets, complete with loud-speaker, are obtainable from £2 upwards.



The finished receiver in one of the neat cabinets which Messrs. Ready Radio also supply.

IMPROVING SUPERHETERODYNE PERFORMANCE

(*Concluded from page 573, Dec. 2nd issue*)

An article dealing with adjustments necessary to ensure maximum results.

By P. E. BARNES, B.Sc.

THE adjustments necessary can be considered under three headings: firstly, the adjustment of the trimmers to balance up the stray capacities in the circuits; secondly, the fixing of the relative positions of the coils so as to give the desired band width; and lastly, the adjustment of the oscillator to ensure that the intermediates are fed with the correct frequency.

The first of these points is simple, and the trimmers are simply set by ear to give the maximum signal strength. If this should involve one trimmer being set at its extreme position, then the remaining ones should be moved slightly in the opposite direction, and this continued until all trimmers are adjusted, without any one being at either its maximum or minimum position.

Selection of the Intermediate Band Width

This adjustment, too, can be made by ear. In general, the further apart the coils in each intermediate are set, the more selective the set, but the side-band cutting may become so severe that the tone control will not be able to cope with it. The intermediate immediately preceding the second detector may be so adjusted, as it is usually fairly heavily damped. The remaining ones must be set to give the best compromise between sensitivity, selectivity, and quality.

If a separate oscillator is available, or if one can be rigged up out of parts already on hand and calibrated, then it would be possible to set the intermediate stages to give any desired degree of band-pass action at the particular intermediate frequency chosen, but this is rather a difficult operation for the ordinary constructor, and, furthermore, is usually unnecessary.

Adjusting the Oscillator

The adjustments necessary to the oscillator cannot very well be described in detail, as the many different methods of tuning render any general discussion too vague to be practical, and the instructions of the designer must be followed.

There are, however, one or two points which can be mentioned.

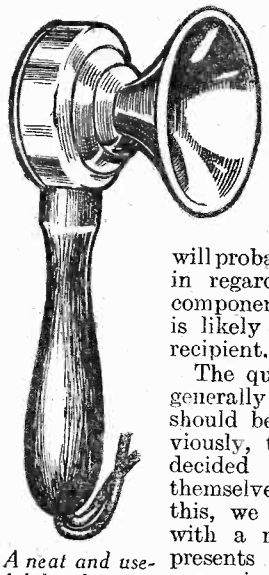
In general, the preliminary adjustment should be made on the tuning coil trimmers, on a low-wave station such as Fécamp. If the oscillator is tuned by one section of a ganged condenser with specially shaped vanes, its trimmer should be adjusted at a station near the top of the medium wave-band, such as Munich or Brussels No. 1, swinging the ganged condenser slowly over a few degrees until the optimum setting of the trimmer is found. A slight readjustment may then be needed on the tuning trimmers at the lower waves. Repeat the procedure to make absolutely sure that the settings are correct, for care here will be well repaid in operation. The long-wave adjustments should be made by means of another semi-variable condenser which is introduced in series with the oscillator condenser, known as a "padding" condenser, and the trimmers already set must on no account be touched.

All this procedure demands accurate matching of the coils, which is why many

(*Continued on page 672*)

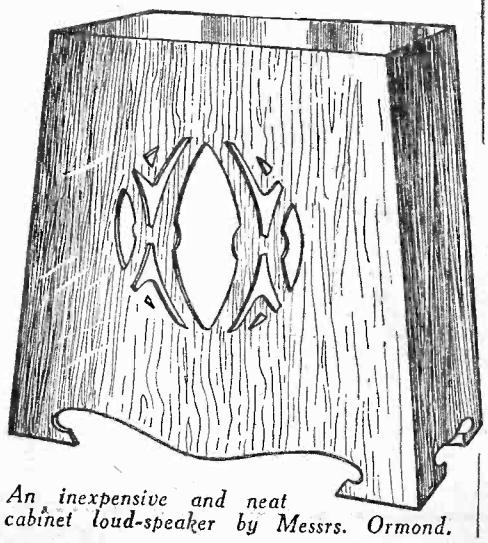
By THE TECHNICAL STAFF.

THE problem of deciding what Christmas presents are to be given to one's friends and relations is always a difficult one, which sorely taxes the resources of the buyer and not infrequently results in the purchase of a neck-tie or a pair of socks which are never worn. But when buying a present for a wireless "fan," there is a very wide choice, and the intending buyer need never run the risk of giving a useless present. At the same time, a few suggestions will probably be appreciated in regard to the type of component or gadget that is likely to appeal to the recipient.

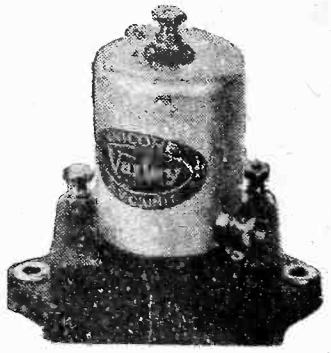


A neat and useful hand microphone, made by Messrs. R. C. and Wilson Electric Ltd.

The question of price is generally the first that should be settled, and obviously, this can only be decided by our readers themselves. In view of this, we propose to deal with a range of suitable presents in order of their approximate prices. For instance, the first section will refer to components that can be bought for less than five shillings, whilst in the following sections, gradually increasing price levels will be considered. We might point out here that should further details be required in connection with any of the items referred to, they can be obtained from the makers concerned or by making reference to our advertisement pages. As an additional help to readers, however, it ought to be mentioned that catalogues dealing with the products of our advertisers can be obtained by addressing a postcard to: "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton Street, Strand, London, W.C.2. The names of the firms whose catalogues are required should simply be stated on the card.



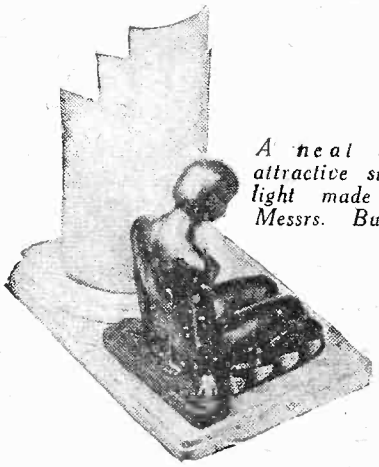
An inexpensive and neat cabinet loud-speaker by Messrs. Ormond.



This is the interesting Varley A.V.C. Unit, which was specified for the "Orbit."

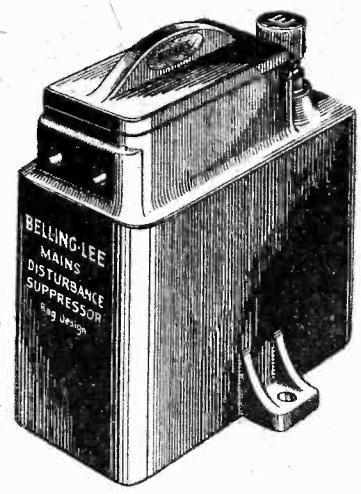
Under Five Shillings

Even if you wish to spend only a small amount on your present, something really useful can be bought. For instance, a friend might have a receiver of rather an old type which is at present insufficiently selective to enable the local station to be eliminated in favour of more distant ones. In such a case, a pre-set aerial condenser of the type made by Messrs. Ward and Goldstone, Sovereign Products, Wingrove and Rogers, and several other firms will be useful; a value of about .0003 mfd. maximum is most convenient and can be bought at prices between a shilling and two shillings. On the other hand, the friend might be suffering from medium-wave break-through when listening to long-wave stations; an anti-break-through choke, as made by Messrs. Lissen, will be much appreciated by him, and it can be bought for four shillings.



A neat and attractive signal light made by Messrs. Bulgin.

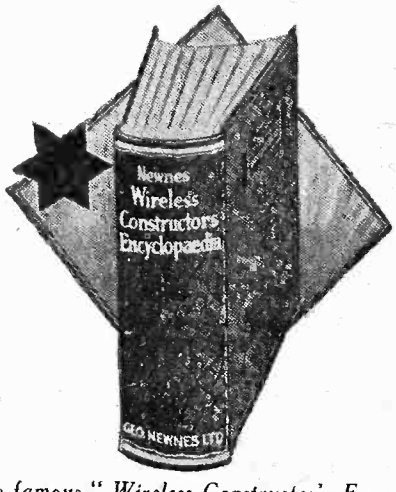
Whilst on the subject of increasing selectivity, mention should be made of the "Airclipse" "Auto-Inductive Aerial," which sells for five shillings. This gadget can be used by itself to replace an elevated aerial, or it may be used in conjunction with the aerial to reduce static interference.



A Belling-Lee Mains Interference Suppressor.

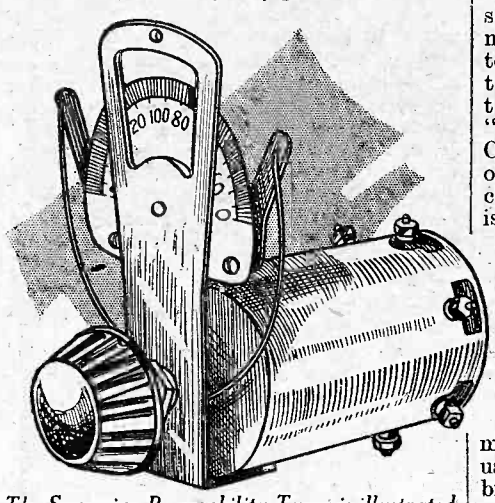
There might be a friend who has recently purchased a pick-up or microphone and whose receiver is not at present provided with a switch for changing over from "radio" to "gram," and he would certainly appreciate a neat radio-gram switch, such as is made by a number of firms in various patterns. A neat rotary switch

(Continued on page 663)



The famous "Wireless Constructor's Encyclopædia," which is so well known to our readers.

(Continued from page 660)

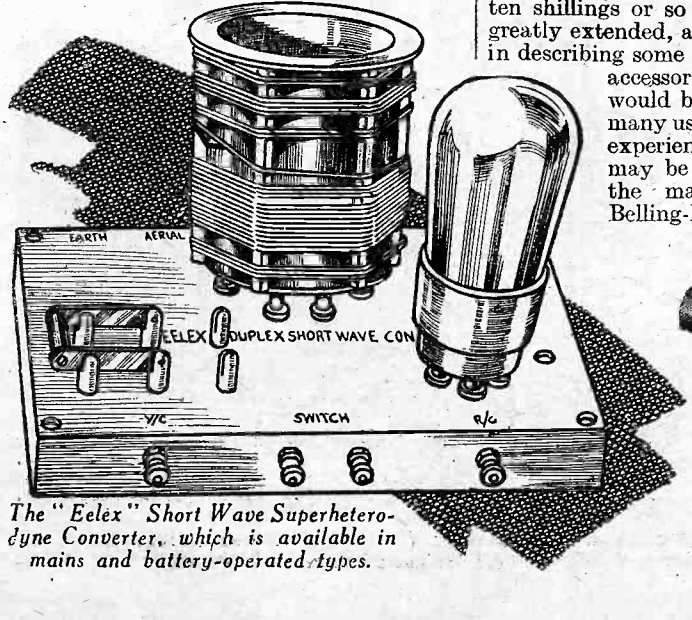


The Sovereign Permeability Tuner is illustrated above.

of this type is made by Messrs. Bulgin, and can be bought for 1s. 9d., whilst another, of rather similar pattern, is sold by Messrs. British Radiogram at 2s. The same friend might have a set which is already provided with such a switch, but which has no volume control device, and it may be found useful to provide him with a volume control, which may be attached to the motor-board of the radiogram or fitted to some convenient position on the receiver. Typical volume controls are made by Messrs. Watmel, Igranic, Bulgin, British Radiophone, Graham Farish, and so on, and the prices will vary between 3s. and 5s.

Tone control devices may be thought useful for the purpose of modifying the tone of a loud-speaker, and although there are only one or two complete controls, such as the Bulgin Controlatone, a variable resistance of a value of 50,000 ohms, in conjunction with a fixed condenser of .01 mfds., may be purchased separately and used for the purpose.

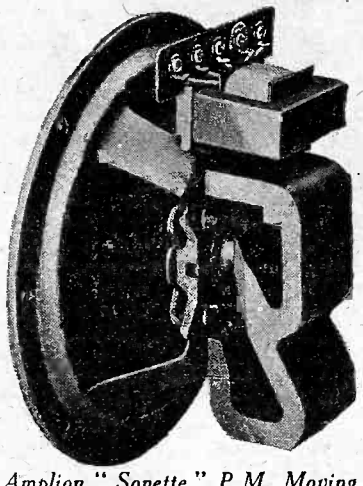
In addition to all the above small accessories there are, of course, variable condensers, transformers, and other parts of the actual receiver which may be provided to replace those which are being used but which are of old design. It may be possible to make quite an appreciable difference in a set's performance by replacing an old part in this manner.



The "Eelex" Short Wave Superheterodyne Converter, which is available in mains and battery-operated types.

It is scarcely necessary to mention the fact that the "Wireless Constructor's Encyclopædia" is undoubtedly one of the most acceptable presents that any enthusiastic amateur could possibly receive. This is a most thorough and comprehensive guide to practical wireless matters, and contains a greater amount of useful and practical information on all branches of wireless than any other book ever published. Arranged in alphabetical order are every term, expression, and name used in connection with wireless. The original Encyclopædia was published in September, 1932, but since that time more than 100,000 copies have been sold, and the revised book is now in its third edition.

The Graham Farish "Aeroficient" Aerial-earth Kit.



The Amplion "Sonette" P.M. Moving Coil Speaker.

The "Wireless Constructor's Encyclopædia" is published by Messrs. Geo. Newnes at 5s., or 5s. 4d. post paid.

Ten Shillings

When it is desired to spend a sum of ten shillings or so the choice is naturally greatly extended, and pages could be filled in describing some of the extremely handy accessories which this sum would buy. The trouble which many users of all-mains receivers experience, due to noisy mains, may be cured by fitting one of the mains suppressors. The Belling-Lee, for instance, is fitted into a neat bakelite box and is easily fitted, even by a non-technical person, and costs 10s. 6d. Other interference removers are obtainable in the form of screened aerial leads and special transformers which fit to the ends of this lead. There is, for instance, the Ward and Goldstone Statoformer, which will cost 4s. 6d. and may be used in conjunction with the receiver Statoformer at 5s. The screened down-lead must be used in conjunction with these, and costs 15s. for 10ft., with bracket, etc. Ten shillings and sixpence will also buy an efficient power output valve, and this will no doubt be very acceptable to a listener who is still carrying on with valves which are near the end of their useful life, or which are of obsolete pattern. A new accumulator, such as the Oldham, the Ediswan, or the Anodex, or a small H.T. battery (for a small receiver, of course), chosen from the extensive range of Ediswan, Anodex, Drydex, or Lissen lists, will also prove useful.

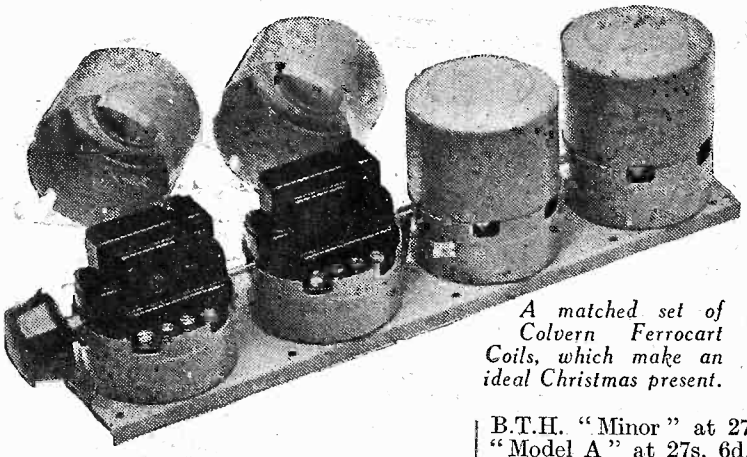
Again, there are the numerous small accessories of the receiver proper, such as L.F. transformer, coils, condensers, tuning dials, etc., which may be purchased to add pleasure to the ease of tuning or to improve the quality of performance set up by a receiver which is not of recent design.

Up to a Pound

If you are prepared to spend up to twenty shillings or so on a present you have a very wide range of components from which to choose. For instance, a new moving-coil loud-speaker unit, such as the Peto-Scott, selling at 15s., would be very acceptable to a listener who is still "carrying on" with an old moving-iron or balanced armature type of instrument. On the other hand, your friend might be contemplating the addition of a

(Continued on page 664)

This is the interesting Belling-Lee "Clip-on" Pick-up Unit.



A matched set of Colvern Ferrocart Coils, which make an ideal Christmas present.

(*Continued from page 663*)

Class B stage to his receiver, in which case a Class B speaker unit, also made by Messrs. Peto-Scott and retailing at 15s., would prove extremely useful. To the experimenter friend, one or more iron-cored coils would be particularly valued, and one from the Colvern "Ferrocart" range could be bought for 12s. 6d., or a pair of Wearite "Junior" iron-core coils could be bought for 17s. 6d.

A present that will be highly prized by any radio "fan" is a measuring instrument of some type. Messrs. Bulgin do a wide range of milliammeters and voltmeters at 12s. 6d. each. These are of the moving-iron pattern, but they are accurately calibrated and suitable for measuring either A.C. or D.C., and have thus a variety of uses.

One of the newest types of microphone will have a strong appeal to almost any wireless set user, and in this direction mention might be made of the G.E.C. "Home Broadcaster," which consists of a neat microphone combined with a stand fitted with a volume control and battery. Another useful microphone is the Roberts, which is sold complete with a stand. This has the noticeable advantage of being non-directional; it is also very light and can either be held in the hand or stood on a table.

A third microphone, which has many unique features, is the hand microphone made by Messrs. R. C. and Wilson Electric, Ltd., and sold for 7s. 6d., or complete with transformer, for 13s. 6d.

The idea of mounting an electric clock on the panel of the receiver is now very popular and in this respect we might suggest that the clock made by the Riverside Manufacturing Company and costing only 12s. 6d. would make an admirable present. This efficient little clock is worked off a small battery (self-contained) on which the current drain is so small that a useful life of at least twelve months can be expected from it.

Another excellent suggestion for a present suitable for any wireless amateur is an Automatic Volume Control Unit, a splendid example of which is made by Messrs. Varley and sold at 15s. 6d. This unit combines all the A.V.C. components with a "Nicore" H.F. choke, whilst it can easily be fitted into any receiver by following the complete instructions supplied with it. Another A.V.C. unit, in this case without H.F. choke, is made by Messrs. Wearite; this component costs 12s. 6d.

By paying up to thirty shillings for a present you can buy a complete cabinet loud-speaker, such as the Ormond "Junior," at 22s. 6d., in oak, or 25s. in mahogany, or a variety of moving coil speaker units, like the Amplion "Sonette," R. and A. "Bantam," Epoch "Super-Dwarfe," Baker Selhurst "Permag," Celestion "Soundex," Igranic "D9," and many others. A gramophone pick-up is another item which will make an acceptable present, and the "Cosmocord" at 20s., B.T.H. "Minor" at 27s. 6d., Belling-Lee "Model A" at 27s. 6d., might be mentioned, as well as a number of other makes which were referred to in the article entitled "Choosing a Pick-Up" published last week.

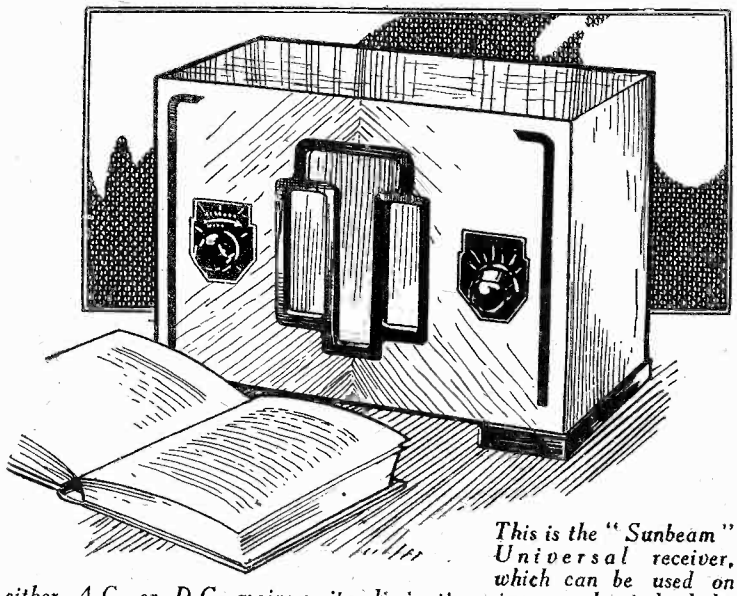
This Ekco console receiver, mounted on a chromium stand, strikes a very modern note.

To the amateur who has a receiver of comparatively old type, and who has valves which have been in use for two years or more, a new set of valves will make an ideal present. Naturally, the cost of these will depend upon the number required, the types and the make decided upon, but where the set has, say, five valves, and the price of these would come to more than you are prepared to spend, it is a good plan to buy a power or pentode output valve and adjust the expenditure by buying a detector, and as many of the others as it is thought fit. The power valve is the one which "ages" most rapidly, and also the one which has most effect upon the quality of reproduction whilst the detector comes next in importance. Power valves made by "Ring" firms, such as Cossor and Mullard, vary in price from 8s. 9d. for a small power valve of the battery-operated kind to 14s. for an A.C. indirectly-heated one. For the friend who runs a mains set with valve rectifier, a new rectifying valve should prove very acceptable, and there are various types available at prices from 12s. 6d. to 20s.

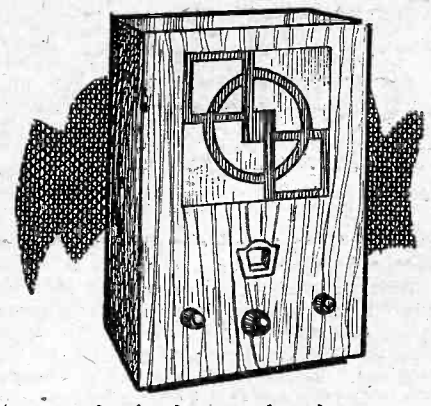
Loud-speakers provide excellent presents, and one of a type which can be used in conjunction with that normally fitted in the set without affecting correct matching is particularly useful at Christmas time and during the party season. A new speaker of this particular kind is the W.B. "Equilode," which is designed solely for use as an "extension," and it is claimed by the makers to be the first and only moving-coil instrument which will work perfectly from the "extra speaker" terminals of any set, no matter what the make or type. It is well known that the lack of standard practice among set manufacturers has caused some confusion in the minds of both public and trade where the fitting of an extra speaker is concerned, and it is this inconvenience which the W.B. Equilode has been designed to remove.

A single switch arm is used to adjust the impedance to the required value. Suitable adjustment of this arm also provides a volume-control effect independent of the volume control in the set itself. There is an "off" position, switching out the extension speaker only. The price is moderate, and the "Equilode" will be a boon to those who are racking their brains for unusual and acceptable Christmas presents. The makers guarantee that there is no set from which it will not work perfectly as a moving-coil extension. The price is 33s. 6d. in chassis form and 48s. 6d. in walnut finish cabinet of characteristic W.B. design. "Equilodes" are available during the next few weeks in a special "Christmas Gift" carton.

Another interesting extension speaker which has recently been introduced is the R. and A. "Multex." This is designed to



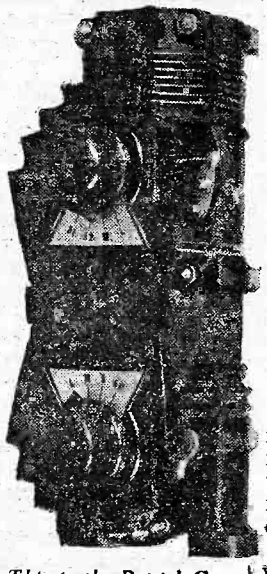
This is the "Sunbeam" Universal receiver, which can be used on either A.C. or D.C. mains; its diminutive size can be judged by comparison with the book.



An example of a low-priced modern receiver.

correctly match up to any type of receiver, whether it employs a power valve, Class B, or Q.P.P. in the output stage. This speaker is an excellent instrument having an 8in. chassis with Reflex diaphragm and a powerful 15 per cent. cobalt-steel magnet. The price is 30s. for the chassis only, or 45s. mounted in a beautiful walnut cabinet.

Many battery set users would like to obtain an increased output from their receivers, and for them a speaker of the type fitted with a matched Class B amplifier would prove a welcome present. There are now several speakers of this type available, among which might be mentioned the Peto-Scott, Ferranti, Sound Sales, Rola, Epoch, and Celestion. This type of speaker is extremely useful for use as an extension to the ordinary receiver, since it can be used in one room to provide sufficient volume for dancing, whilst the speaker normally connected to the set remains in another room, where the older folks wish to listen and talk.



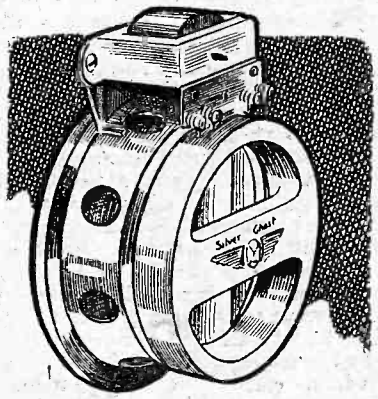
This is the British General All-Wave Tuner, which covers all the important wavelengths, from 14.5 to 2,000 metres.

In addition to the Class B speakers mentioned, there are also a number of neat Class B units which are interesting and extremely useful. One of these is the Sound Sales one illustrated, whilst others are made by Messrs. Multitone, Burton, Ferranti, Baker's Selhurst, and Peto-Scott. All these units can be fitted to practically any type of battery receiver with a minimum of trouble and merely by fitting a plug-adaptor into the output valve-holder. In the same way they can instantly be disconnected when a lower volume level is called for, and a saving in H.T. and L.T. current consumption can thereby be effected.

Miscellaneous Presents

Quite apart from components and accessories directly associated with the receiver, there are a number of other items of especial interest to the buyer of Christmas presents. The aerial-earth system is one of particular importance, although it is so frequently neglected, and a complete kit of parts for the "external" equipment is an item which is bound to appeal to a large number of enthusiasts. A very comprehensive and efficient kit of parts for the aerial and earth is made by Messrs. Graham Farish and sold complete in an attractive cardboard box under the name of the "aerofficient" kit. This includes an ample length of insulated aerial wire, insulators, lead-in tube, "Gard" lightning arrestor, "Filt" chemical earth, and Insurance Policy covering damage by lightning, a tuning chart, and full instructions for erection. Despite the completeness of the kit, the price is only 6s. 6d.

The "Gard" lightning arrestor included in the above kit can be bought separately for 1s. 6d. This is a real safety device which, when connected in series with the aerial lead-in, offers complete protection against lightning and powerful static discharges. It is easily fitted, and is so small as to be quite inconspicuous. In the same way, the "Filt" chemical earth, which is perhaps too well known to our readers to require a full description here. This comprises a small copper container in which is enclosed a glass tube of deliquescent chemical which has to be emptied into the container, which is then buried in any convenient spot. Connection to the container is made by means of a terminal, and this provides a highly efficient earth connection.

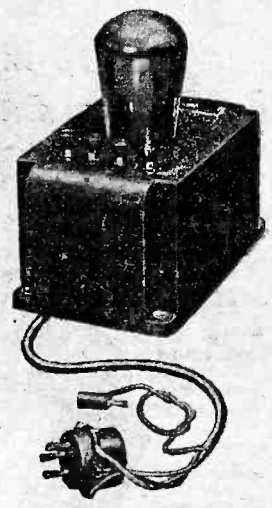


The Lamplugh "Silver Ghost" Moving-Coil Speaker.

Another ideal Christmas Gift for the wireless constructor is Henley's "Solon" Electric Soldering Iron, which helps him to wire up his receiver in the simplest manner. This useful little tool simplifies soldering, so that even the beginner can make a neat and satisfactory repair or join, whilst those accustomed to soldering will welcome its efficiency and entire absence of mess. It is only necessary to plug in to any lampholder, switch on, and in four minutes the Solon is ready for continuous use. The price, complete with flex, plug, and a supply of special resin cored solder, which requires no flux, is only 7s. 6d. It is obtainable from the big stores, ironmongers, and wireless shops, everywhere.

Modern Cabinets

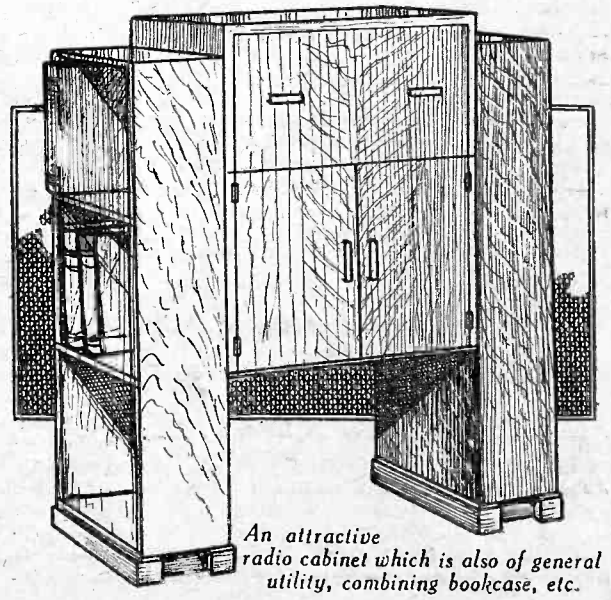
The home-constructor often makes his own cabinet, and therefore a ready-made cabinet, designed not only to house the receiver, but also to provide some form of storage for, say, gramophone records, or even books, may also prove very acceptable, and there are a number of such cabinets, ranging in price from a few pounds to quite substantial amounts. The illustration at the foot of this page shows one of the more elaborate cabinets which houses, in addition to the articles above-mentioned, a cocktail bar. Messrs. Osborn, Peto-Scott, Carrington Manufacturing Company, Smith's, Stenibac and Picketts are names quite familiar to our readers as designers of high-class cabinets, and many of their products have been utilized in housing receivers which have been described in these pages. The firms mentioned, together with others who specialize in this type of work, are quite prepared, if required, to design or build cabinets to suit individual requirements.



A neat Class "B" Adaptor, made by Messrs. Sound Sales.

Complete Receivers

Although we are primarily concerned with home-construction, there are many who for some reason or another are unable to make a receiver, or who prefer the general appearance and performance of a ready-made receiver. It is possible to obtain such a receiver for £5 upwards, and they may be obtained for either battery or mains operation. The choice of the latter type of receiver is rendered difficult when the recipient is situated at some distance, and the knowledge of the particular type of mains (either A.C. or D.C.) is uncertain. The Universal type of receiver will, of course, solve this difficulty, as it may be used indiscriminately on either type of mains. A glance through our advertisement pages will reveal many very good types of receivers.



An attractive radio cabinet which is also of general utility, combining bookcase, etc.

GETTING THE BEST RESULTS FROM THE "A.C. QUADPAK"

Hints on Adjusting the Powerful A.C. Receiver which was described Last Week.

I ASSUME that by now you have completed the constructional work and given your "Quadpak" a preliminary trial. No doubt it has been found that an almost unending string of stations can be received at full loud-speaker strength, although at first it might be found that the degree of selectivity is not quite sufficient to make it an easy matter entirely to separate some of the signals that come in at "full blast" within a degree or so on the tuning dial. If that is the case it will merely be an indication that the three trimmers on the gang condenser have not been correctly adjusted. You should therefore tune to a point on the dial where some interference is experienced, setting the condenser so that the desired station is received at maximum strength. Then reduce the volume by means of the potentiometer control until the signals are as weak as they can be made without the interfering station vanishing altogether. After that, the trimmers can be set with perfect accuracy, commencing with that on the middle section of the condenser. Incidentally, it might be found necessary slightly to vary the setting of the main tuning control whilst carrying out the trimming operations in order that the set may be kept constantly in tune with the station.

Final Trimming Adjustments

Once the interference has been eliminated in the manner just described the volume should be increased slightly, and if the interference then returns, the trimming adjustments should be repeated. This process should be continued until all trace of interference vanishes. From the above explanation it might seem that the method outlined is somewhat long and laborious, but actually it is perfectly simple to put into operation and will not occupy more than a few minutes.

Theoretically it would seem possible to do the trimming in a single stage by leaving the receiver in its most sensitive condition—with the volume control full on—but in practice this is scarcely a practicable system, due to the fact that the volume of output is so tremendous that the interference might easily be "hidden" by the much greater strength of the required signal. At this juncture I would say that you should not be satisfied with your trimming adjustments until they are such that no signs of interference can be detected at any point on either wavelength range. I know the "Quadpak" to be extremely selective, and it is up to you to make sure of obtaining the very best from it. Of course, it cannot separate stations which heterodyne each other, that is, which together produce a constant whistle. There is no receiver in the world that can perform such a feat, and the only cure for interference of that nature is at the transmitting end.

If you remove the cover from the gang condenser you will see that the end vane in each section has a number of radial cuts, and that the sectors so formed are bent to various angles. Please do not, through curiosity, try to alter these in any way, because they were very carefully set before leaving the maker's laboratories to ensure that all three tuned circuits would keep exactly in step over the whole of both wavelength ranges. It is certain that no improvement would be obtained by making alterations, and it is almost equally certain that the receiver's selectivity would be impaired. When replacing the cover see that it is properly fitted and take care not to bend any of condenser plates with it.

Using a Mains Aerial

The "Quadpak" is not at all critical in regard to the aerial with which it is employed, and consequently good reception can be obtained by using anything from a 6ft. length of wire tied to the picture moulding to a "regulation" 100ft. outdoor aerial. This is because a loose-coupled aerial winding is fitted to the first tuning coil. At the same time it cannot give of its best if the aerial is not reasonably good and at least 20ft. long; nor can the full benefit of its selectivity be obtained if the aerial is more than some 75ft. and situated near to a roof or trees, which increase its self-capacity. The ideal arrangement has been found to be a 60ft. outside wire erected clear of all obstructions, although wonderfully good results have been obtained from at least fifty stations by making use of a 20ft. length of indoor-aerial wire attached to the picture moulding.

It is not essential to employ an earth lead, but if this connection is not used there is some slight liability of mains hum being present as a background to loud-speaker reproduction. Additionally, of course, the I.E.E. recommend that an earth connection should always be used in conjunction with a receiver taking its supply from the A.C. mains, in the interests of safety.

In many cases it might be desired to operate the "Quadpak" without any aerial at all, and this can certainly be done with the greatest of ease by making use of a "mains aerial" connection. To do this a .0003 mfd. Dubilier type 670 fixed condenser should be mounted on the chassis immediately behind the fuse-holder. One terminal of the fixed condenser is connected (along with one lead from the mains flex) to the mains transformer, whilst the other is joined to the aerial terminal. When it is frequently wished to change over from an outside aerial to the "mains aerial"—for example, when moving the set from one room to another—it is a good plan to make the lead from the fixed condenser to the aerial terminal of flex and to fit a spade terminal to the end so that quick connection can be made at any time.

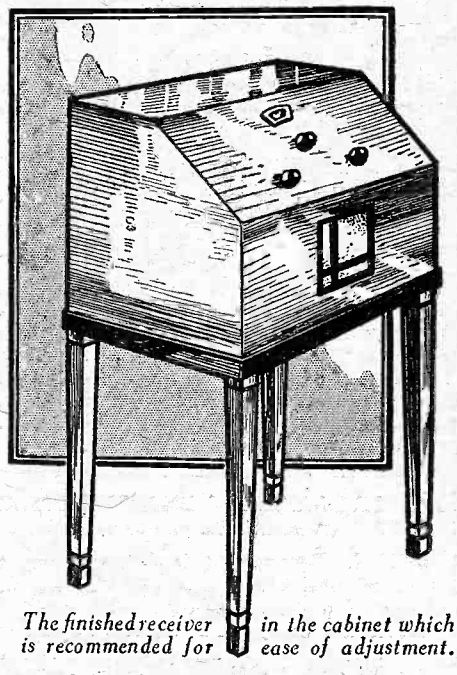
Pick-up Connection

Some readers have asked if the "Quadpak" can be used in conjunction with a gramophone pick-up. The set was not originally designed for this purpose, but there is no difficulty whatever in modifying it. All that is required is to connect the pick-up leads to the terminals marked "Grid" and "G.B." on the "transcoupler." In order to prevent the possibility of "radio breakthrough" the volume control should be turned to its minimum position, or else the aerial lead should be disconnected. It

(Continued on opposite page)

(Continued from previous page)

will be appreciated that by connecting the pick-up in this way there will not be a very great amount of amplification given to record reproduction, since only a single valve is used for this purpose. For that reason it is preferable to employ a pick-up of the type designed to give a large voltage output; the Belling-Lee is one that I can specially recommend for this particular set. There is another point which must be considered in connection with some types of pick-up, which is that the secondary winding of the "transcoupler" is in parallel with the pick-up when the connections above-mentioned are adopted. As this would adversely affect the performance of some makes, it is a good plan to try the effect of disconnecting the lead from the "grid" terminal of the "transcoupler" to the grid terminal of the valve-holder and connecting the pick-up lead directly to the latter point. In that case it would be more convenient to fit a Bulgin rotary radiogram switch between the grid of the valve, the corresponding terminal on the "transcoupler," and the pick-up lead. Whatever



The finished receiver in the cabinet which is recommended for ease of adjustment.

method is adopted, it will be more convenient to fit pick-up terminals, and a pair of Belling-Lee terminals and a terminal mount can easily be accommodated just behind the pentode valve-holder.

The Cabinet

Our artist's impression of the "Quadpak" in its unusual, though attractive, cabinet can be seen above. The height of the cabinet is 2ft. 10in. to the lower edge of the sloping front, and the controls can thus be manipulated with perfect ease whether the operator is sitting or standing. A further advantage of the sloping front is that the dial can be seen very easily and clearly from any position.

There is no difficulty in fitting the receiver chassis into the cabinet, since the latter is supplied with the sloping panel ready drilled with holes for the three control spindles and for the dial escutcheon. The first thing is to fit the escutcheon by means of the two bolts with which it is supplied. Then remove the knobs, fit the chassis on the inclined runners and replace the knobs. The speaker unit is attached to the baffle by means of ¼in. wood screws.

MAKING YOUR OWN SCREENED COILS

(Continued from page 634)

direction, and after putting 150 in the first section make a twisted loop (to form a centre-tapping) and continue with the rest of the winding. The end can be secured in the same way as the end of the reaction winding.

Mounting the Coil

That completes the windings, so the next step is to mount the coil and arrange for suitable terminal connections. If desired, the tuner can be mounted directly on the baseboard or chassis of the receiver and connected to the appropriate points by means of the projecting leads, but a much neater method is that illustrated in Fig. 1. An ebonite baseplate measuring 3in. by 2in. by 3-16in. thick is employed, and should be marked out and drilled, as shown in Fig. 4. It will be observed that all the terminal holes are recessed on the underside so that the heads of the round-head terminals cannot short-circuit on to the metallized chassis (if used). The recesses are made after drilling the 7-64in. holes, by running a ¼in. drill half-way through the ebonite.

When the base has been prepared, the "lid" of the screening can should be mounted, after which the coil itself can be fixed in position. Next, fit the terminals, and place a soldering tag underneath the collar of each. A second soldering tag is fitted under the collar of terminal 2, and this makes contact with the "lid" of the screen, so earthing it.

The method of connecting the finished tuner in circuit will be fairly evident from Fig. 2, but I give a suitable Det.-L.F. arrangement in Fig. 7, and this will be found to produce excellent results. I have indicated the most suitable values for all the more important components, but I would say that this circuit is offered as a suggested one for experimental use.

THE PROGRESSIVE EXPERIMENTER

(Continued from page 650)

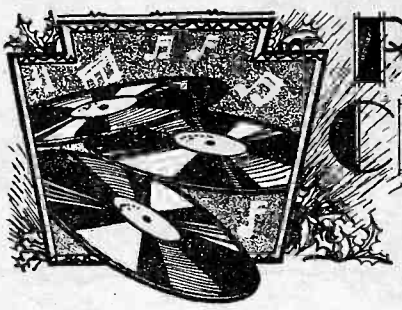
amplified. Because of this, the arrangement is more efficient, and a slight saving of high-tension current is effected.

Different effects can be obtained by using various condenser capacities between about .01 mfd. and .5 mfd., and if you have any spare condensers on hand it will be found quite interesting to try them and observe their effects.

When using the power valve as driver its grid-bias voltage can generally be increased by at least 1½ volts, and this will result in stlil greater economy of working, without in any way affecting the set's performance. You should, therefore, try various positions for the wander plug marked "G.B.—" just as you did in some of the earlier experiments. Do not forget to switch off the receiver before each alteration to the G.B. voltage.

LIST OF COMPONENTS REQUIRED THIS WEEK.

One Igranic Driver Transformer.
One Clix Chassis Mounting 7-pin Valveholder.
One Bulgin "Compact" 50,000 ohm Potentiometer.
One T.C.C. .02 mfd. Fixed Condenser.
One British Radiogram Component Bracket, Type No. 22.
One Clix Spade Terminal, marked H.T.—, length of flex, connecting wire, screws, etc.
One Cossor 220 B Class B Valve.



RECORDS for CHRISTMAS

A Selection of Some Bright Numbers for the Festive Season

AMONG the November releases of the British Homophone Co. appear a fine number of records that will appeal to all tastes. The popular hit tune, *Night and Day*, from the musical comedy, "Gay Divorce," at present running in London, is obtainable on *Sterno* 1288, played by Sydney Lipton's Grosvenor House Band. On the other side of this record the same band play *Blue Prelude*, a slow blues. You should get this record. *The Day You Came Along* and *Thanks*, *Sterno* 1286, two popular numbers from the film, "Too Much Harmony," played by the Casani Club Dance Band, directed by Charles Kunz, are well worth hearing. Other dance tunes all equally good are *Did My Heart Beat ?* and *The Last Round Up*, the latter being a rather touching cowboy song, *Sterno* 1271, played by the Casani Dance Band, *Trouble in Paradise* and *Good Night Little Girl of My Dreams*, *Sterno* 1274, played by Sydney Lipton's Band, *Dinner at Eight* and *The Song That You Gave Me*, *Sterno* 1270, played by the Casani Dance Band. Of outstanding interest is a record by the Barnstormers (the ten boys who left Jack Payne's Band and who are now performing at the Barn Club Roadhouse), who record for the first time on *Sterno* 1292. They play two up-to-the-minute tunes in *Dinner at Eight* and *Reflections in the Water*, and this record is undoubtedly a fine piece of recording.

H. Carmichael, the composer of that famous tune, *Lazy Bones*, gives us a new tune in *Snowball* that may well rival the popularity of his former hit. This is played by Sydney Lipton's Band on *Sterno* 1273, who also record on the other side *That's What Life is Made of*.

Novelty Records

The Wedding of Mr. Mickey Mouse and *Who's Afraid of the Big Bad Wolf* are two tunes that are both novel and laughable. The former is an excellent example of a dance tune that can only be produced with the aid of a microphone. Unless played on a record most of the effects produced would be lost. All the amusing sounds associated with a Mickey Mouse film are re-created on this record. The latter tune is a musical arrangement of another Walt Disney film, "The Three Pigs," which is both amusing and entertaining. Make a careful note of the number of this record, *Sterno* 1287, both tunes being played by Sydney Lipton's Band. Another riot of comedy is *The Wedding of the Grave-Diggers' Daughter*, Parts 1 and 2, played by Billy Seymour and the Boys on *Sterno* 1291.

More Dance Tunes

George Glover and his Band give us four popular dance numbers in *Blue Moments* and *It's the Talk of the Town*, *Sterno* 1290, and *Yvonne* and *Symphony of the Breeze*, *Sterno* 1289. For those who like accordion bands, Zigano's records, *June Nights*, a waltz, and *Good Old Times*, a polka, on *Sterno* 1279.

Most of the dance tunes previously mentioned are also recorded on the Homochord Records. *Night and Day* and *I've Gotta Get Up and Go To Work*, played by Al Gold and His Band, Homochord *H.R.*16, and *Remember My Forgotten Man* and *Shadow Waltz*, which are two of the numbers from the film, "The Gold Diggers of 1933," played by Dick Rose and His Band on Homochord *H.R.*18 are rather catchy tunes. *Oh, Johanna* and *Dear Stranger*, Homochord *H.R.*19 the former tune, which is a quick step, gives us something rather novel in a step dance which is both clever and amusing.

Vocal Records

Patsy Donovan, the well-known tenor, who records for this company, sings two popular Irish ballads in *Sweetheart Darlin'* and *I'm Away in Killarney With You* on Homochord *H.N.*12. The two duettists Best and Best make yet another fine record in *I've Found the Right Girl* and *I Like To Go Back In the Evenings* on Homochord *H.R.*23. Two amusing numbers, *My Girl Ran Away* and *Yodel-o-de-ay*, the latter being a yodelling song, are recorded by Billy Weston and his Pioneers on Homochord *H.R.*25.

Plaza records, which are wonderful value for money at 6d. each, and play as long as the ten-inch records, have Fergus Kelly, tenor, singing *Rose of Tralee* and *I'm Away in Killarney With You* on *Plaza P*158.

Of Outstanding Note

I Cover the Waterfront, *Let's Call it a Day*, *Isn't it Heavenly ?*, and *Learn to Croon* are four tunes that are both popular and well known to most readers, and they are included in "Popular Tunes," *Plaza P*154, played by Alf Bertram and his Band. On the other side is an accordion band playing *Oh Ella*; don't forget to hear this record. A companion record to this is *Plaza P*155, *All the Winners*, including *I've Found the Right Girl*, *In the Valley of the Moon*, *Hold Me* and *Don't Blame Me*, on the other side being *Romany Blues*, both played by Alf Bertram and his Band. Other tunes include *Never Too Old* and *Them Good Old Times*, by the Hill-billys, *Plaza P*146; *That's What Life is Made Of* and *Trouble in Paradise*, by Alf Bertram and his Band, *Plaza P*141; *Oh, Johanna* and *Darling Boy*, by Ben Fields and his Band, *Plaza P*143, *Night and Day* and *Give a Cheer*, by the Plaza Dance Band, *Plaza P*157, and *The Last Round Up* and *Wasting the Evening Away*, by Eddie Walters' Dance Band, *Plaza P*156.

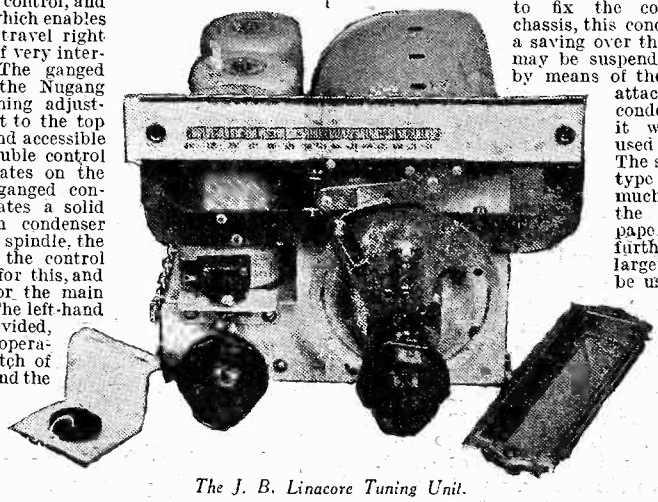
For those readers desirous of obtaining any of the above records the price of Sterno are 1s. 6d., Homochord 1s., and Plaza 6d., all of which are wonderful value for money.

FACTS & FIGURES

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

J. B. LINACORE

THE illustration below shows the new tuning unit which has been developed by Messrs. Jackson Bros., and which is obtainable for battery or mains-operated receivers. There are a number of very interesting features incorporated in this unit, one of the most striking being the ingenious tuning scale. This is of the straight-line, full-vision type, and in place of the customary pointer a thin strip of celluloid with an engraved hair-line moves across the scale and thus provides very exact indication of the condenser setting. As can be seen in the photograph, the scale ends above the centre of the control, and the mechanism which enables the indicator to travel right out to the left is of very interesting design. The ganged condenser is of the Nugang type, with trimming adjustments brought out to the top in a convenient and accessible position. The double control knob which operates on the spindle of this ganged condenser also operates a solid dielectric reaction condenser fitted to the same spindle, the small portion of the control knob being used for this, and the large knob for the main tuning control. The left-hand knob is similarly divided, the large portion operating an on-off switch of the Q.M.B. type, and the small knob operating on the wave-change switch. This is an ebonite rod extending for the whole length of the unit and engaging with a number of spring fingers connected to the various circuit tappings, and provides a very firm and certain contact at each position. Owing to the manner in which these fingers are bent a slight rubbing movement is imparted to the contact points, and there should thus be no trouble from dirty or corroded contacts. The actual coils are of the iron-core type, of small diameter, and giving very efficient tuning throughout the range. The provision of pick-up terminals shows that the entire arrangement has been very well thought out, and it receives our entire approval. The price is 69s. 6d. complete.



The J. B. Linacore Tuning Unit.

NEW G.E.C. BATTERY PENTODE

WE are informed by the General Electric Company that the new battery pentode, V.P.21, is now available. This is the first high-frequency pentode to be placed on the market for the home-constructor, and is of especial interest in that it is of the variable-mu type, requiring a 9-volt biasing battery only for a full range of control. The main advantage of this type of valve is that much lower anode voltages may be employed than with the standard S.G. valves, with no risk of distortion, and by utilizing one of these valves an admirable automatic volume-controlled receiver may be constructed to operate from a standard 100-volt H.T. battery with increased amplification and greater range. The standard 7-pin base is fitted, and the metallized coating is joined to one of the pins for earthing purposes. The price is 15s. 6d.

THE WESTRIC CHARGER

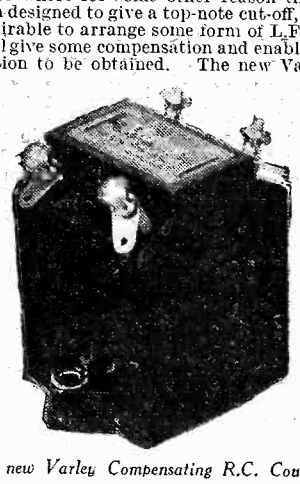
ALTHOUGH intended for the car user, this ingenious charger will find many applications with the wireless enthusiast. It is a simple accumulator charger designed to plug into the electric-light mains and to give sufficient output to put the standard-car battery in good condition. One model provides an output of six volts at 2 amps, and the other is designed for twelve-volt accumulators charging at 1 amp. A special charging socket is supplied with the device, and this is fitted to the dashboard of the car, the charger being provided with a plug which fits into this socket. Thus, when it is desired to charge the accumulator, the charger is connected to the mains and the plug inserted into the socket on the dash. There are still a number of listeners who use a six-volt accumulator for operating their receivers, and experimenters and others who require a current of the order given by either of these models will no doubt find them of use. The price is 75s. for either the six or the twelve-volt model.

NEW DUBILIER ELECTROLYTIC CONDENSER

A NEW type of electrolytic condenser is announced by the Dubilier Company, a cardboard container being used in place of the standard aluminium case. Wire ends, suitably identified, are employed for connection purposes, and the ends of the container are sealed with hard wax. Where it is not found necessary to fix the condenser to the chassis, this condenser represents a saving over the older type, and may be suspended in the wiring by means of the leads or firmly attached to a fixed condenser with which it will normally be used in conjunction. The smoothing of this type of condenser is much better than with the usual type of paper condenser, and, furthermore, a much larger capacity may be used with a saving in space. The 10 mfd. 100-volt test condenser costs 3s. In addition to this particular specimen, there is a large number of other values obtainable with various voltage ratings, and the prices range from 2s. Details of these will be found in the exhaustive Dubilier Catalogue, obtainable post free from the makers at Ducon Works, Victoria Road, North Acton, W.3.

VARLEY COMPENSATING R.C. COUPLER

THE modern receiver is usually fairly sharply tuned, and the result is quite naturally a reduction of the higher frequencies. Where extreme selectivity is desired, or where for some other reason the circuits have been designed to give a top-note cut-off, it may be found desirable to arrange some form of L.F. coupling which will give some compensation and enable brilliant reproduction to be obtained. The new Varley R.C.



The new Varley Compensating R.C. Coupler.

Unit is designed on the lines of a standard resistance capacity coupling unit, with the addition of a special resonant circuit to provide a rising characteristic. The usual type of anode resistance is fitted, together with a coupling condenser and grid leak, but the latter is shunted by a fixed condenser, whilst an iron-core choke is inserted between the coupling condenser and the grid connection for the succeeding valve. The complete apparatus is housed in a bakelite case similar to the well-known Nicore transformers. The unit was tested in a standard receiver, which was adjusted to

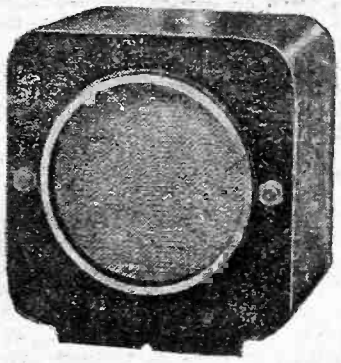
provide a noticeable cut-off, and when compared with a standard R.C. unit the reproduction was very noticeably improved. In a standard receiver it was found possible to use a simple tone-control device across the speaker, and thus make full use of reaction on distant stations whilst preserving full brilliancy, and wh n the local station was received the tone control enabled the extra high-note response to be suitably modified. The device is most useful and works very well indeed. The price is 11s. 6d.

FURTHER TUNGSRAM VALVES

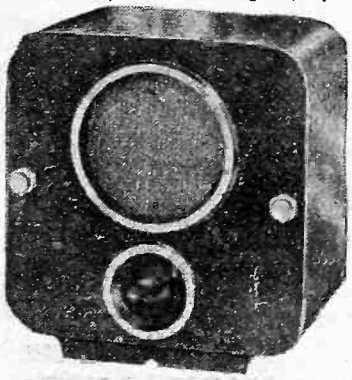
A SPECIALIZED range of high efficiency A.C. mains type valve has been designed by Tungsram with the particular purpose of what might be called "revitalizing" the performance of old-mains sets. These are known as Tungsram Symphonic valves. The idea behind the design is, in simple terms, to associate volume and quality in their correct proportions, permitting side-by-side team-work instead of a compromise. A remarkable degree of extra volume is thus achieved with a corresponding brilliance of tone. The range compromises Symphonic straight or variable-mu screen-grid, Symphonic straight or variable-mu high-frequency pentodes, Symphonic indirectly-heated multi-grid output valves, and Symphonic detectors. For battery users there is a new high-efficiency valve, type SV.220—a variable-mu, high slope screen-grid valve of exceptionally high sensitivity. It gives a remarkable high-frequency amplification. The S.220 corresponds to the above, but is a straight slope type. For moderate power output with extraordinary low consumption (ideal in these days of lean purses) there is the PP.220—a multi-grid valve. There is also a fine Class B valve—in Tungsram's new chatterproof, dome-shaped structure. Two new completely non-microphonic midget valves are the HR.210 high impedance and the LD.210 low impedance—for either detector or high and low-frequency amplification respectively. Tungsram are also making a speciality of Universal A.C./D.C. valves, and also valves of American type for the many American sets in this country that will not operate on English valves.

NEW BAKER SPEAKERS

THE two speakers illustrated below are from Baker's Selhurst Radio and, as may be gathered from the size of the switch fitted to one of these, they are of



The new Baker's Selhurst Midget Speakers.



extremely small dimensions. The lower model is fitted with a tone-control switch and is, in other respects, similar to the upper model. We hope to have an opportunity of testing one of these models and giving a test report at an early date.

IMPROVING SUPERHETERODYNE PERFORMANCE

(Continued from page 658)

designers prefer to use a separate oscillator condenser, sacrificing a little of the ease of control in the cause of efficiency.

There remains one further type of oscillator control to be considered, namely the use of one section of an ordinary ganged condenser, using padding condensers on both wavebands in order to give the correct characteristic. This is seldom done except where the receiver is largely constructed from parts already on hand. The procedure is generally similar, the tuning coil trimmers being adjusted for maximum response at a low wavelength, and the "padding" condenser (instead of the oscillator trimmer), being set at the higher point, rocking the ganged condenser a few degrees as each alteration is made in the capacity of the padding condenser, until the point for maximum response has been found. The tuning trimmers may now be reset if necessary, and then the settings should be checked. A few extra minutes spent here will often make a considerable difference in the performance of the set.

On the Long Waves

On the long-wave band, the adjustments are, as a rule, carried out by means of a trimming condenser in parallel with the long-wave portion of the tuning coil, and this should be adjusted for maximum response.

In making all these adjustments it is preferable to tune the receiver to a weak station, or to use the volume control to reduce the station to a low sound level so that alterations in volume are more easily detected.

Economy in Anode Current

There is one final point in the use of a set employing several screen-grid valves which is of importance, and that is the fact that such a valve will take only a fraction of the anode current, but without anything like the same decrease in amplification. This feature is of most importance to battery users, or those who have eliminators which are working at their maximum output. If the H.F. and I.F. valves, or any of them, are not of the variable-mu type, it will be advisable to arrange for the screen voltage to be low (say 40 volts instead of 70). It can always be raised on the rare occasions where the set is worked at absolutely its maximum sensitivity. It is quite possible to operate a six-valve battery superhet at 11 or 12 milliamps, and obtain a good volume output.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication.)

"Still Coming Along in Leaps and Bounds."

SIR,—I thank you for the book "Not so Quiet . . ." awarded me in connection with Problem 58. I have just finished reading this, and I think it is a fine book. PRACTICAL WIRELESS is still coming along in leaps and bounds, and for any other wireless paper to try and beat, or even equal it, seems to me to be a sheer waste of their time.—A. COOK (Manchester).

S.S. "Jacob Ruppert" Call Sign: A Correction.

SIR,—With reference to paragraph entitled "Radio in the Polar Regions" (under section "Round the World of Wireless, November 18 issue, page 459), I would inform you that the call sign of the S.S. *Jacob Ruppert* (Byrd's Antarctic Expedition II) is K T J Y and not K J J Y as stated.—F. POSTLETHWAITE (Goodmayes).

A Radio Enthusiast's Appreciation.

SIR,—I nearly wrote "The Editor, Britain's Leading Wireless Weekly," not doubting it would find you. I have been keen on radio since I can remember. That was the time when we talked half a mile with a Ford ignition coil and carborundum crystals and got quite a kick out of it. Being also in the radio trade and having to be on the spot with every new phase and gadget, I find PRACTICAL WIRELESS equal to every emergency. Having held important positions in radio, I know what a keen amateur wants. However, continue the good work. I for one have cancelled all the other weeklies for the simple reason they are not like PRACTICAL WIRELESS, which I have had from No. 1, and it has stayed the same every week; Wednesday is a day to look forward to.

I have one suggestion to make: why stop, after describing how to make transformers, chokes, etc. Surely some of your technical staff can give us some more "How to Make" articles.—J. M. DAVIE (Chingford).

Design for Universal All-Mains Set Wanted.

SIR,—Having been a reader of your valuable paper since its first publication, I must say you do your best to keep up to date. What I should like to see, however, is a good set designed for both A.C. and D.C. mains. Foreign designers seem to have got over this difficulty, so I am certain English designers can. There must be thousands of listeners like myself situated in a D.C. district that must eventually come under the grid system and then have to change over to A.C. I know commercial sets can be bought incorporating this idea, but there are still a good many constructors who would like to build their own universal all-mains sets.—J. R. REEDS (Barnes).

Replies of Broadcast Queries.

SIR,—With reference to the portion of your publication dealing with Q.R.A's. of various stations, I may say that these replies prove quite interesting, as they show what station has been coming in at a certain spot. Probably the information would be of more use to the amateur if the waveband and date received could be added where known. I have a Radio Amateur Call Book Fall 1933, and keep a small log of 3.5 stations heard here, and am a member of the R.S.G.B. Group for that band. The addition of the information I here suggest would be of particular interest to stations that are over 900 miles away, or that are on very low power nearer than that to the receiver.—H. O. CRISP (Forest Gate).

An Ideal Circuit?

SIR,—I also have been a reader of PRACTICAL WIRELESS since No. 1, and am certainly very interested in its contents. There is a letter in the November 11th issue from "F. G. P." (London, N.W.) which greatly interests me, because I think he has got hold of an ideal circuit. There is no doubt whatever that a straight Det. and 2 L.F. set is not selective enough these days. Where I am situated (about 20 miles from Washford Cross) the interference with both wavelengths is beyond control, the power also is so great that other stations are simply drowned out.—F. G. THORNE (Weston-super-Mare).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT an H.F. metal rectifier can be used as an economizer of high-tension current.

—THAT a thermal delay switch is unnecessary when using an indirectly-heated rectifying valve.

—THAT a portion of a tuning coil or frame aerial may be employed in the dual capacity of tuning coil and reaction coil.

—THAT all by-pass condensers in H.F. circuits should be of the non-inductive type to ensure correct working.

—THAT when choosing a condenser for a circuit the peak voltage should be considered and not the actual working voltage.

—THAT aerial systems consisting of two or more wires spaced apart are inefficient unless the spacing is greater than three feet.

—THAT an H.F. choke should always be included in the anode circuit of a detector valve, even although a high resistance is used in that portion of the circuit.

—THAT all metal casing, etc., in a receiver should be joined to earth, a separate lead being taken to each part and a common connection not relied upon when instability is experienced.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

Arrangements have been made to demonstrate television apparatus at future meetings of this Society, and lectures, social functions, etc., will shortly be organized. Full particulars from Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge.

A branch of the above Society has recently been formed in Manchester and is open to receive new members. Membership is free and should be an inducement to the many short-wave amateurs in the district. The Society deals with most branches of radio work, including Short Wave, Ultra Short Wave, and Television. During the next fortnight we shall have secured a local hall or club room where we can hold our demonstrations and lectures, etc. Will interested amateurs please write for particulars (enclosing a stamp for reply), to Henry B. Shields, 39, Hardman Lane, Failsworth, Lancs.

The High Wycombe branch of the A.-A. R. & T. S. held its first meeting recently. Particulars from the organizing secretary, "Carriers Arms," Wycombe Road, Marlow, Bucks.

INTERNATIONAL SHORT-WAVE CLUB, LONDON

The meeting of the London Chapter held at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, 17th November, provided a very interesting evening for the short-wave listener. Mr. A. E. Bear opened the meeting by a talk on the thrills and fascination of short-wave listening. He said he looked forward to the day when the ordinary listener would take interest in short-wave reception. This was followed by a short-wave demonstration by Mr. F. R. Hornby. Among the receivers demonstrated were a Philco 16B, which is an 11 valve allwave receiver, and a 3 valve short-wave converter. World-wide reception was obtained and it was agreed that these were exceptionally fine receivers. A recital of records of short-wave reception overseas then followed, and members heard how the British Empire Station at Daventry was received in far distant lands. We have several ladies among our members, and we invite any ladies who are interested in short-wave reception to attend our meetings.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of this Society, Mr. Shaw, of the Marconiphone Co., Ltd., gave a lecture on "Multi-electrode Valves." In tracing the development of the new valves, the lecturer pointed out that in every case there was a definite purpose behind the addition of each new electrode. He dealt briefly with the S.G. valve and L.F. pentode, and went on to consider the H.F. pentode, the pentagrid, and "Class B" valves. Coming to the double diode-triode, Mr. Shaw described the construction of the valve and gave the fundamental circuits (with explanations) for simple A.V.C., delayed A.V.C., amplified A.V.C., and "Squelch Control."—Hon. Sec., Mr. E. Fisher, 33, Freeth St., Oldbury, nr. Birmingham.

THE SOUTHALL RADIO SOCIETY

A lecture, entitled "Mains Transformer Design," was given by Mr. Swan, at the meeting of the above Society held last week. He explained the various factors which have to be taken into account in order to avoid hysterisis and eddy-current loss, and also the various methods adopted to prevent excessive temperature rise and to obtain good voltage regulation under load.—Hon. Sec., Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

THE CATFORD RADIO AND TELEVISION SOCIETY

The first of the practical evenings arranged by this Society for the winter session was held at 257, Bromley Road, on Wednesday, November 15th. As the chairman, Mr. H. S. Ryland, pointed out, all practical work must be based on measurement, and he proceeded to describe a simple and inexpensive form of universal meter which could be used with a reasonable degree of accuracy for all the work likely to be encountered by the members in the course of their experiments. Starting with one milliammeter as a basis, it was shown that by means of the appropriate shunts and multipliers it was possible to carry out measurements over a wide field with a degree of accuracy comparable with that of an expensive multi-range instrument. Mr. Ryland did not neglect the problems connected with the measurements of A.C. current, for not only did he show how this could be done, he also gave away small metal-oxide rectifiers suitable for the conversion of a D.C. meter for this purpose. As, on this occasion, it will be the object of these practical evenings to assist the ordinary amateur to understand the construction and operation of his receiver, members and non-members alike are welcome to come along with their own particular problems to any of the Society's meetings. Particulars of the Society's future programme may be had on application to the Hon. Secretary, at 38, Como Road, London, S.E.23.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.

(2) Suggest alterations or modifications a receivers described in our contemporaries.

(3) Suggest alterations or modifications to commercial receivers.

(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

THE LUXUS A.C. SUPERHET.

"I am constructing the Luxus receiver, but am in doubt regarding the values of certain resistances. I see on the wiring diagram on page 203 that there are two 25,000 ohm resistances used, and two of the resistances on the under surface of the chassis are very indistinct in my copy of "Practical Wireless." I have left over one 25,000 ohms resistance, one 250,000 ohms, one 1,000 ohms, and one 100,000 ohms, and I should like to know exactly where these go."—T. B. C. (Hampstead, N.W.).

If you obtain the full size Blue Print you will find that the resistances are quite clearly indicated. You have, however, apparently wired the receiver from the small diagram reproduced in the pages of PRACTICAL WIRELESS, and, therefore, we give you the positions for the four resistances which you are unable to locate. The resistance on the top of the chassis which is joined to the arm of the potentiometer and passes through hole No. 14 is 250,000 ohms. The resistance of 100,000 ohms joins the two .0001 condensers on the underside of the chassis, and the remaining resistance (1,000 ohms) is situated between the 25 mfd. electrolytic and the .01 mfd. fixed condensers, close to hole No. 10.

VOLUME CONTROL

"I should like to make up a set using for a volume control a variable anode resistance. Thus, the circuit would consist of a detector valve, R.C. coupled to the next valve, and the coupling condenser joined to the arm of the anode resistance which takes the form of a variable potentiometer. Do you approve of this, or is there any better method?"—A. H. (Boston).

The circuit arrangement is quite in order, and was, in fact, used in the Sixty-Shilling Three recently published. The only point to watch is the choice of the actual resistance. It will be appreciated that the anode current is passing through the resistance and, therefore, it must, in the first place, be capable of passing that current. Secondly, the movement of the arm must be so arranged that it passes gradually, without any sudden changes, from one portion of the winding to another. Some variable resistances of this type are arranged with a fairly large winding of fine wire and tapping points are made to heavier gauge wire or to separate contact points. Thus the arm progresses in a series of sudden jumps, and this results in a very noisy operation as the condenser charges and discharges with every change. You must, therefore, ensure that a smooth variation is made by the component. The alternative is to use a variable grid leak with the grid joined to the arm, and here no current-carrying capacity has to be taken into account. We prefer the former method.

Q.M.B. OR PUSH-PULL SWITCH?

"In the set I have got the switch has become faulty, and when I go to switch on sometimes it works and sometimes it does not. The knob sticks through a small opening and this has to be pushed down to switch on and up to switch off. Can you tell me what type of switch it is, and if an ordinary sixpenny on-and-off switch will do?"—O. T. (Whetstone).

As the switch operates by an up and down movement, it is almost certain that it is of the Q.M.B. type, and this is essential, of course, if the receiver is mains-operated—a point you do not mention. Without further notes concerning the type of receiver, we cannot say whether it is a single on-off switch or whether other components are disconnected by the same movement, but we would certainly not advise you to replace it with a cheap push-pull switch, unless you can be absolutely certain that there is no great current passed. It is a safe rule to use only the Q.M.B. type of switch for operating all-mains receivers, and even for switching on and off the ordinary battery valves it will be found extremely efficient.

DATA SHEET No. 64.

Cut this out each week and paste it in a notebook

TELEVISION DISC DATA FOR PRESENT TRANSMISSIONS.

Diameter of Disc, Inches.	Radius for First Hole Inches.	Size of Hole, Inches.	Picture Width, Inches.	Revolutions per Minute
26	12.0	.0358	1.0751	750
25	11.5	.0343	1.0303	750
23	11.0	.0328	.9855	750
23	10.5	.0313	.9407	750
21	10.0	.0299	.8959	750
20	9.5	.0284	.8511	750
19	9.0	.0269	.8063	750
18	8.5	.0254	.7615	750
17	8.0	.0239	.7167	750
16	7.5	.0224	.6719	750

The above details are for thirty-line scanning, and the dimensions for hole sizes are worked to the nearest decimal point. To obtain actual figures the measurement in the second column should be multiplied by .08959 and the result divided by thirty.

A.V.C. AND THE BATTERY SET

"I was very interested in the circuit of your recent A.C. Superhet, and would like very much to make up one on these lines, but using battery valves. Would it be sufficient to wire up the circuit with 4-pin holders and use the same types of battery valves, or would the circuit need re-designing?"—E. W. G. (Cardiff).

At the present moment valves of the same type as were used in the Luxus are not obtainable for battery operation, although they will not be long before they appear on the market. You could not, we are afraid, simply alter the circuit by changing valves, as several resistances used in that circuit were designed to operate only with the valves of certain characteristics, and those which apply to the battery valves in question are quite dissimilar. We are, however, experimenting with a receiver on these lines, and as soon as the design is completed it will be published in our pages.

TELEVISION AND SOUND

"I would like to raise a point which occurs to me in regard to modern television systems. At present the sound is transmitted from one station and the vision from another, which means that two receivers are necessary, tuned to each station. Is it not possible to transmit the sound and vision together from one station and receive them on one set, separating them out at the detector or output end of the receiver and thus give more economical results? I think the speech could be given on one side-band and the 'vision' on the other, and the circuits made sufficiently selective to tune each half separately. I may be wrong, of course."—Y. A. (Blackpool).

Many schemes have been tried for the adoption of an arrangement on the lines you suggest, but there are many difficulties in the way of its correct application. Whilst one side-band can be removed from a transmission, and replaced at the receiving end, the quality would not be of a sufficiently high standard to warrant the broadcasting of musical items. Speech is certainly intelligible by this means, but really only because it consists of words which are readily recognizable, no matter what distortion accompanies it. Alternatively, the picture which could be transmitted on one side-band would be very lacking in detail (with the present methods of transmission), and we are afraid, therefore, that your scheme is not technically sound. One American system has been tried with very great success (with silhouette pictures) where vision and sound was combined and transmitted from one aerial at different frequencies, but it has not yet become practicable beyond the laboratory stage.

TELEVISION DISC DATA

"After following many of your television notes I am seized with a desire to make up a receiver, but have not got a motor which will be powerful enough to drive a disc as large as you suggest. Is there any reason why I cannot use a disc of, say, 6 or 7in. in diameter, with corresponding alteration in the spacing of the holes? Any suggestions regarding the disc would be appreciated."—A. T. Y. (Hendon, N.W.).

The picture ratio must be maintained, no matter what size the disc. In England this is 8 to 7, and this ratio must be maintained by making the size of the holes such that the spiral occupies a width which will permit of thirty-line scanning with the holes accurately aligning. This means that for a disc having a diameter of 8in. and allowing a small margin from the edge of the disc for the first hole, the thirty holes would have to be cut in a total distance of less than three-quarters of an inch, and they would, therefore, have to be less than one-fortieth of an inch in diameter. The total light space will therefore be so small that the picture will be very poorly lighted, and we do not think you would gain anything from your proposed economy. The standard disc of 10in. permits of holes having a diameter of .02 of an inch and a picture width of .85in., thus providing not only more illumination, but a more reasonable size of picture. We would advise you, therefore, to obtain a better motor and use this size of disc.

FREE ADVICE BUREAU COUPON

This coupon is available until Dec. 16th, 1933, and must be attached to all letters, containing queries.

PRACTICAL WIRELESS, 9/12/33.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

PREMIER SUPPLY STORES Offer the following Set Manufacturerers' Surplus New Goods at a fraction of the Original Cost, all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers resistances and diagram, 120v. 20 m.a. 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T., L.T. 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps, with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working, 2 mf. 3/6, 4mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the following Lines 6d. each or 5/- per dozen; 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; .01, .05 and 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd.; 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes 20 hyns., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

HARLEY Pick-up, complete with arm and volume control; 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15, our price 18/6.

PREMIER British Made Meters, moving iron, flush mounting, accurate; 0-15, 0-50, 0-100, 0-250 milliamps., 0-1, 0-5 amps., all at 6/-.

ORMOND Condensers, 2-gang, semi-shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v., 60 m.a., rectified, with 4v. 1-2a and 4v. 3-5a., L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 1-2a and 4v. 3-5a, L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a, L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms 1/-. 250,000 ohms, 50,000 ohms and 500,000 ohms 2/6.

ROLA F7 MOVING COILS, 1000 Ohms. FIELD. 20/-; MAGNAVOX 142. 1,000 Ohms. FIELD 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

FOLLOWING VALVES USED FOR TEST ONLY. CALLERS ONLY. MS4B, MS4, DSB, DS, PT4, S4VB. ALL HALF PRICE.

DOUBLE Spring Motors, made by Garrard, play five sides of 10in. record, complete with turntable and all fittings; 17/6.

SPECIAL Offer.—Accumulator chargers, input 200-250 v. A.C., to charge 2- and 4-volt accumulators at ½ amp.; owing to the high efficiency of the silver oxide rectifier employed charger may be used during broadcast; 9/6 each.

RELIABLE Canned Coils with circuit; 3/- per coil accurately matched; dual range.

PREMIER L.T. Supply Units, consisting of Premier transformer and Westinghouse rectifier, inputs 200-250 A.C., output, 8v. ½ amp. 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1a, 37/6.

PREMIER Mains Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., c.t. L.T., 2/- extra; Westinghouse rectifiers for above, giving 180v. 30 m.a., 8/6.

Easy Terms

Strict Privacy Guaranteed —we deal with you direct

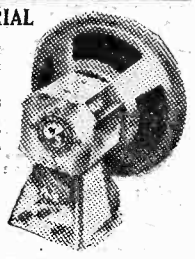
W.B.P.M. 4 MICROLODE MOVING-COIL SPEAKER

SEND FOR IT ON 7 DAYS' TRIAL

5/- DOWN

With Switch-controlled Multi-ratio input transformer. Send 5/- for 7 Days' Trial. If approved, balance in 8 monthly payments of 5/3. Cash or C.O.D. Carriage Paid. 42/-.

W.B.P.M. 6. Send only 2/6, balance in 8 monthly payments of 4/3. Cash or C.O.D. 32/6.



BLUE SPOT 29 P.M. MOVING-COIL SPEAKER

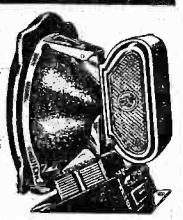
SEND FOR IT ON 7 DAYS' TRIAL

2/6 DOWN

A very popular P.M. Moving-coil Speaker for operation from Power or Pentode.

Send only 2/6 for 7 days' trial. If approved, balance in 6 monthly payments of 5/6.

Cash or C.O.D. Carriage Paid, £1/12/6.



TELSEN ELIMINATOR

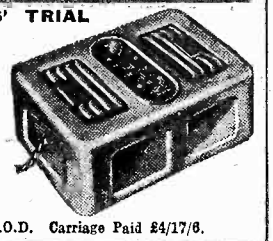
SENT ON 7 DAYS' TRIAL

2/6 DOWN

Model W.346. 150 volts at 28 m.a. S.G. and Detector tappings.

Send only 2/6 for 7 days' trial. If approved, send further 2/6. Balance in 17 monthly payments of 6/-.

Cash or C.O.D. Carriage Paid £4/17/6.

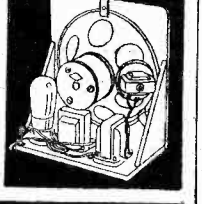


N.T.S. CLASS 'B' SPEAKER-AMPLIFIER

SEND FOR IT ON 7 DAYS' TRIAL

5/- DOWN

Gives seven times the volume. Ready assembled, with Class B Valve and N.T.S. Permanent Magnet Moving-Coil Speaker. Send only 5/- for 7 days' trial. If approved, balance in 11 monthly payments of 5/6. Cash or C.O.D. Carriage Paid. £2/19/6.

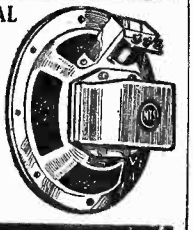


N.T.S. CLASS 'B' SPEAKER

SEND FOR IT ON 7 DAYS' TRIAL

2/6 DOWN

Gives perfect reproduction. With input transformer for power or pentode. Send 2/6 for 7 days' Trial. If approved, pay balance in 5 monthly payments of 4/6. Cash or C.O.D. Carriage Paid. 22/6. Also model for Power or Pentode. Same Price and Terms.



New Times Sales Co

56, LUDGATE HILL, LONDON, E.C.4.

Dear Sirs:

(a) Please send me.....

(b) I enclose Cash/Deposit.....

NAME.....

ADDRESS.....

..... Pr.W.9/12/33.

PREMIER Mains Transformers, output 250-0-250 volts 60 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350 volts, 90 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400 volts, 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary; 15/-.

PREMIER Auto Transformers, 100-110/200-250 volts or vice versa, 60-watt, 7/9; 100-watt, 10/-.

B.T.H. Induction Type (A.C. only) Truespeed Electric Gramophone Motors, 100-250 v.; 30/- complete.

SPECIAL Offer of Manufacturers' Type Transformers, input, 200-250v., output 250-0-250 volts, 60 m.a., 4v. 1a., 4v. 3a. (both c.t.), 8/6; H.T.8 transformer, with 4v. 3-4a. (c.t.), 8/6; with Westinghouse rectifier, 18/6.

WESTERN ELECTRIC Condensers, 250v. working 1 mfd., 6d., 2mfd. 1/-; 500v. working, 1 mfd., 1/-.

T.C.C. Condensers, 250v. working 4x4x1x1x. 5mfd., 3/6; 6x4x2x2x2 mfd., 375v. working, 6/11; H.M.V. 4x4x1x1x1x.5 6/-. 400v. working.

SPECIAL Offer of Wire Wound Resistances.—4 watts, any value up to 10,000 ohms., 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms. 2/6.

MAGNAVOX P.M. M.C. Speakers, 7-inch cone, 18/6. Please state whether Power or Pentode Transformer required.

SPECIAL OFFER. Valves by World-Famous Continental Manufacturers. Fully guaranteed. All Standard Mains Types; 4v. 1 amp filament. HL. L. SG. 350v. 120 mA Rectifier, 5/- each. SGVM Pentode Power 6/6 each.

A LARGE stock of all types of Radio Cabinets at very low prices for callers.

WESTINGHOUSE Rectifiers, 120v. 15mA., 6/6; 200v. 30 mA, 8/6; 200v. 60 mA, 10/-.

GRAMPIAN Moving Coil P.M. Speakers, 9in. Cone, Handles 4 watts, 18/6.

PLEASE mention PRACTICAL WIRELESS when ordering.

PREMIER SUPPLY STORES, 20, High Street, London, S.W.4. Macaulay 2188. Closed 1 o'clock Wednesdays, open to 9 o'clock Saturdays. Nearest Station Clapham North Underground.

SOUTHERN RADIO'S Wireless Bargains.—Set manufacturers' guaranteed surplus.

VARIABLE Condensers.—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; all ganged condensers are fully screened, with trimmers and boxed; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1, 1,000 volt test, 7/- each; 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd., Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor screen grid 3-valve kit, less valves, 26/-; with 3 Mullard valves (P.M.12a, P.M.2D.X., P.M.2a), 49/- (list £5/7/6).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6 each (list £4/17/6); Mullard Radio for Million 3-valve battery kits, complete with 3 Mullard valves, £3/3 (list £6/2/6), all kits brand new in original sealed cartons.

MARCONI 1934 Pick-up No. 19, 26/- (list 32/6); Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/9 each (list 35/-); H.M.V. volume controls 1/6 each (list 12/6). We have purchased the complete liquidated stock of large northern Manufacturer and Factor and can offer the following special bargains:—Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each. 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each, Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each, 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. assorted. Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

ALL Goods guaranteed New and Perfect and sent Carriage Paid.

PLEASE Note.—We have opened branches at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle Street, W.C.2, where callers are cordially invited to inspect our large stocks of wireless bargains. Please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

GRAMOPHONES. Radiograms, 64 page. How to Make 'm 3d. Motors, Arms, Pick-ups, Speakers, Horns, Springs, Repairs.—Regentprac, 120, Old Street, London, E.C.1.

CASH your old set or components with Wigfield. Best allowances made on your unwanted wireless goods in exchange for anything new or second-hand. Large stocks of secondhand goods, sets, valves, etc. State requirements. All makes of new sets, kits and parts supplied.—Wigfield.

Two-valve all-electric sets, detector pentode, own make, selective, powerful, beautiful consolette cabinet, oak, or walnut finish, illuminated dial, etc., twelve months guarantee, £4 10s. Prompt delivery, satisfaction guaranteed.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

BIRMINGHAM RADIOMART Radiophone, 27/6; straight 3-gangs, dust cover and trimmers, 12/6. RADIOMART.—Utility, 25/-; 2-gangs with concentric knob trimming wavelength disc dial, 7/6. RADIOMART TCC electrolytic bias condensers, boxed. 50 mfd. 12v. or 6mf. 50v., 7½d. RADIOMART milliammeters, all readings above 20 ma., 5/9. Super 3" model, 6/9. RADIOMART TCC. 4 x 4mf. 375v. wkg., 3/9; 2½ x 2½mf. 500v. working, 2/9. 4 x 4 x 1mf. 500v. test, 3/3. RADIOMART 440v. electrolytics TCC. 8mf. aqueous 3/11. Hellesen, do., 3/3. Hellesen 8 x 4 mf., dry, 3/3. RADIOMART Wearite transformers, 300/300, 250/250. HT8.HT9., all with 4 x 4A. C.T., 4v. 2½A. C.T., 10/6. Metwick, 250/250 4v2.4v5, 12/6; no stripped models. RADIOMART 1-watt resistances wire ends. Erie most values, 8d.—one dozen your selection, 6/9; HMV. Philips, etc., 6d.—one dozen your selection, 5/6; our selection all different, 3/-. Metvick, 25,000, 100,000, 2meg., three for 6d. Ohmite, ½meg. 6d. RADIOMART.—Lotus super chassismount screened coils, Aerial 2nd band pass, Tuned HF. with reaction, 2/- each, set of three 5/-. RADIOMART.—Lotus super Jackplugs, 9d.; 6ft. Lewcos twin-screened pickup cable, 9d.; ditto single, 6d.; 5way heavy cable, 6d., yard length. RADIOMART.—Noninductive tubulars, .1. TCC 375wkg. .2., or .01mf. 1,500wkg., test, 6d. each. RADIOMART Lotus pushpull, 3½–1, intervalve transformers. Manufacturing type, no bakelite case, 2/-. RADIOMART Postage on less than 6/- 6d. extra, otherwise free.

New and revised list now ready for stamp, 19, JOHN BRIGHT ST., BIRMINGHAM.

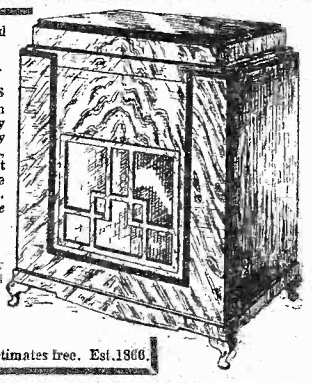
CHAL Electric offers Brand New Set Manufacturers' surplus Moving Coil Speakers, Magnavox Type D.C.144, 7-in. cones 100/100 D.C. (2500 ohms). (40/76 M.A.) and 100/280 D.C. (6500 ohms) (29/43 M.A.) at 19/- each. 152 Type, 9-in. cones same voltages at 26/- each. ROLAS F.6 (voltages as in Magnavox), 7½-in. cones at 18/-; F.7 9-in. cones same voltages at 25/-. Permanent Magnets; F.6 P.M., list 49/6, at 28/-; F.7 P.M., list £3, at 33/-. State if Power or Pentode Transformer. All fitted Humbuckers. Also number of Class "B". State requirements. All goods Carr. Paid. Cash with order or C.O.D. Chal Electric, No. 6, Conduit Street, London, W.1. Regent 6240.

CHARGING WITHOUT MAINS!—Thousands are charging their own accumulators, why don't you? "Tonic" trickle-charger kits keep 2-volt accumulators fully charged. Ideal for remote districts. From 7-/, postage 9d. Full particulars, stamp.—Williams, Netherend, Cradley, Nr. Birmingham.

RADIO SUPPLIES

Send your list of Radio needs for our quotation. Kits, Parts, Sets, etc. Everything in Radio stocked, prompt delivery. 7 days' approval. Catalogue free. Taylex & Standard Wet H.T. replacements stocked.
N. TAYLOR. 9. GROVE RD., BALHAM, S.W.12

Write for Illustrated Catalogue of **Radio-Gramophone Cabinets** of exclusive modern design, made by craftsmen in highly figured Oak, Walnut, or Mahogany, post free. Cabinets made to order a speciality. *Makers under licence of the* HOWE BOX BAFFLE. Recommended by the B.B.C. Full details on request.



GILBERT
Cabinet Maker,
SWINDON. Estimates free. Est. 1866.

FEL-ECTRIC ELIMINATORS
from **39/6** A.C. 120 v. 12 MA.
UNEQUALLED—PRICE—QUALITY—SATISFACTION
CLASS "B" AMPLIFIER UNIT, 28/-.
Ask your dealer or write for lists.
FEL-ECTRIC RADIO, GARDEN ST., SHEFFIELD.

THE following valves are guaranteed unused and perfect, and any valve differing from the makers' characteristics will be exchanged; and all latest types. A.C./Pens, P.T.4s. A.C.S.G/V.M.s, Pen. 4Vs, M.V.S.G.s, A.C.S.2/Pens, M.M.4V.s, P.T.625s, V.M.S.4s, D.C.2/Pens, D.P.T.s, P.M.24M.s, M.P.T.4s, V.M.4V.s, A.C.S.1/V.M.s, P.M.24B.s, D.C.2S.G./1V.M.s, 11/-; M.S.4s. M.S.4B.s, A.C.S.G.s, S.4V.A.s, S.4V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S./2s, D.C.2S.G.s, 9/6; U.14s, 10/-. "Class B": P.M.2B, P.D.220, 220.B, 8/6, M.L.4s, A.C./P.s, P.M.24s, 8/-; A.C./H.L.s, 164V.s, 354V.s, A.C.2/H.L.s, 41M.H.L.s, U.10s, U.U.60/250s, M.H.4s, M.H.L.4s, 7/6; V.S.2s, 2158.G.s, 220S.G.s P.M.12s, P.M.12A.s, 9/-; 442B.U.s, D.W.3s, 8/6; 215 P.s, 220P.s, L.P.2s, 4/9; P.2s, 6/6; P.T.2s, P.M.22A.s, 9/-; H.L.210s, H.210s, L.210s, L.2s, 3/9. All Types of Brand New American Valves in Stock, first-class makes: 247s, 235s, 224s, 236s, 237s, 233s, 238s, 239s, 245s, 244s, 12/-; 227s, 226s, 280s, 9/6; 242s, 232s, 11/-; U.X.250s, 16/-; 281s, 14/6. Carriage Paid. Cash with Order or c.o.d.—Ward, 12, Tredegar Road, Bow, E.3. Advance 3668.

EVERYTHING to make your own transformers (mains and push-pull), chokes and coils. Lists free.—Lumen Electric Coy., 9, Scarisbrick Ave., Litherland, Liverpool, 21.

ERICSSON 3/1 L.F. Transformers, List price, 17s. 6d. New and guaranteed. Our price, 2s. 3d. post free U.K.—Pioneer Radio, Coptic St., London, W.C.1.

LOUD-SPEAKERS, 4s. (Blue Spot a speciality, 5s.). All repairs remagnetised free. Moving-Coil and Eliminators quoted for. Discount for trade. Twenty-four hours service. Clerkenwell 9069.—E. C. Mason, 44, East Road, City Road, N.1.

"UNIVERSAL" Radio Bargains: Ready Radio 303 Kits, 17s. 6d., with Cabinet and Moving Coil Speaker, 35s.; S.T.500 Kits, 67s. 6d., in sealed cartons; D.X. Screened Coils, 2s. 11d.; Harlie Pick-ups with Arm and Volume Control, 11s. 3d.; Lotus Transformers, 2s. 11d.; H.M.V. Screened Chokes, 10d.; Amplion Speaker Units, 1s. 11d.; Record Valves from 3s. 3d.; Eliminators D.C., 15s. 6d.; A.C., 32s. 6d. Thousands of other Radio Bargains. Full range Telsen and Lissen Components and Kits at right prices. Stamp for our huge Bargain Lists and prints.—"Universal," 20, Victoria Rd., Peckham, S.E.15. New Cross 4933. Stockists Milnes H.T. and Spares.

REPAIRS TO ANY RADIO APPARATUS. Quick service guaranteed laboratory tested. Loud-speakers, transformers from 4/-. Blue Spots 5/-. New Cones fitted to moving-coil speakers. Eliminators Volt/Amp meters, Mains transformers, etc. quoted for. Repair Dept. C.—Weedon Power Link Radio Co., 185, Earlham Grove, London, E.7. Maryland 4344.

ADVERTISEMENT INDEX

YOU CAN TAKE IT FROM ME!

ELECTRADIX XMAS BARGAIN SALE LIST Will Save You Pounds

HOME RADIO MIKE. This No. 11 Home Mike at 5/6 is a new design. Solid bakelite case, back terminals. Fine, robust and excellent reproduction. Can be used with any radio set for home broadcasting. YOUR CHRISTMAS WOULD BE INCOMPLETE WITHOUT ONE. only **5/6**

THE DIX-MI-PANTA METER. THREE ranges of volts: 0-7.5, 0-150, 0-300. Used for MILLIAMPS reads 0-12 m/a., and 0-75 m/a. **The Dix-Mi-panta.** In black bakolite case. Measures only 2½ in. x 2½ in. A 2-guinea Tester. **Complete in case with pair of test leads and plugs** **19/6**
Leaflet gives full information.

ENGLISH HEADPHONES Lightweight. Highly sensitive, pair **2/9**

STAMPINGS from 3/6 per gross pairs. Super-Efficient **"LESDIX 27 AERIAL,"** for short-wave reception, 27 distinct copper strands, each separately insulated, 50 ft. for **1/8**; 75 ft., **2/1**; 100 ft., **2/8.**

PHOTO-CELLS. Last chance at sacrifice prices of a few £5 light-sensitive R.C.A. 367 for 25/-. Holders, 1/- and Brit. Talking Pics. at 15/-. 1/- Booklet now ready. Beck mounted prisms, 5/6; P.C. Lens, 3/6; R.C.A. Micro Adjusters, 1/-; Exciter Lamps, 3/6. **LESDIX SELENIUM CELLS** are Light-sensitive Resistances with gold grids, moisture-proof, 5/- Mounted in Bakelite Case, 7/6. Super Model in oxy-brass body, with window, 10/-.

PERMANENT MAGNETS. Tungsten Steel, Powerful horseshoe, 5 in. No. 1 is 1 lb., 2/6; 4 in., No. 2, ¾ lb., 2/-; No. 3, ½ lb., 1/6; No. 4, ¼ lb., 1/-.

MICROPHONE BUTTONS for all purposes, 1/-. Volume Controls, 6d.; Announcers' 11B Mikes, 7/6; Pedestal type, 12/6 and 18/6. Microphone Carbon Granules, in glass capsule, for four buttons. Grade No. 1, 8d.; No. 2, Medium, 1/-; No. 3, Fine, 1/6; Carbon, solid back, blocks, 3d. Mouthpieces, curved or straight, 10d. Carbon diaphragm, 55 m/m., 4d. Panel Brackets, pivoted, 5/-. Reed Receiver Unit for Amplifier making, 3/-. Headphones, 2/9 pair.

The BATTERY SUPERSEDER makes H.T. from your L.T. 2-volt battery, rectified and smoothed. Gives 3 tappings and lasts indefinitely. A boon to those who are not on the mains. **Reduced from £3/15/-. New L.T. and Guaranteed.**

PARCELS of experimental odd coils, magnets, wire chokes, condensers, switches, terminals, etc., post free: 10 lbs., 7/-; 7 lbs., 5/-. 1,000 other Bargains in New Sale List "N."

ELECTRADIX RADIOS,
218, UPPER THAMES ST., LONDON, E.C.4.

THE Exchange Specialists. Get your New Kits, Speakers, Radio Sets or Components from us. Your Old Set, Speaker or Components taken in part payment. Absolute satisfaction assured.—Rad-Auto-Gram Co., 39, Tulketh Street, Southport.

OUR ACCUMULATOR H.T. HIRE SERVICE is cheaper and better than dry batteries. Hundreds of testimonials.—Ancloy Radio, Hindmans Road, E. Dulwich, S.E.22. Oldham Service Station and charging contractors to Camberwell Council. 'Phone: New Cross 4074.

NEW AND USED RADIO COMPONENTS, Cheap for Cash.—Arlin, 44, Ranelagh Road, Westminster, S.W.1.

TELEVISION SET. Mains D.C. Motor, Baird parts, £4. Hurst, 26(b) Quarters, R.A.F., Cranwell, Lincs.

SUPER "DIRECTOTONE" KIT BARGAINS.—Remarkable offers to home constructors. All parts guaranteed. Every component carefully tested. Straight 2-valve kit, 14s. 6d. Straight 3, 17s. 6d. S.G.3, employing 2 H.F. stages, 24s. 6d. Also the new S.T.500, 66s. 6d. All carriage paid, cash or C.O.D. Large quantities of radio parts at revolutionary prices! 2d. stamp brings list of these with particulars of our Special December Snip!—The Direct Trading Company, 65–66, York Terrace, Baker Street, N.W.1.

A.C. Eliminator Kits with diagram—20 m.a. 28s. "Class B." 36s, 60 milliamps 38s. fully tapped.—Rickards, 97, Turberville, Maesteg.

A.C. Eliminators, Graham 105v-250v., outputs—60v. S.G. 150v. 20 m.a. Guaranteed 24s.—P. and D. Radio, 1, Goodinge Road, N.7

P. W. Gift Stamp No. 63

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

P. W. Gift Stamp "Popular Mechanics" No. 7

COIL-MAKING FOR BEGINNERS!

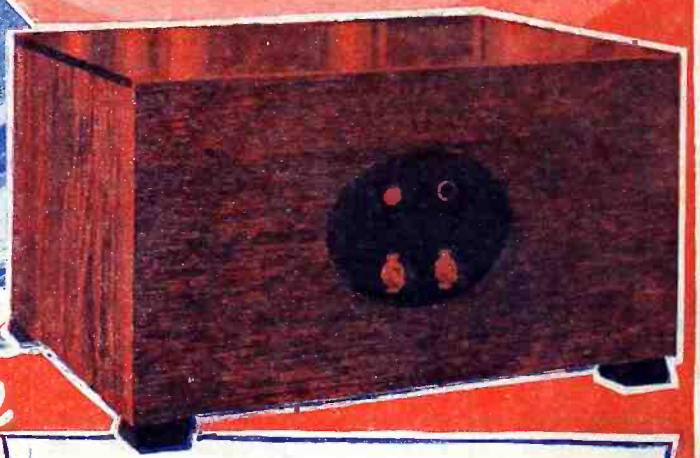
Practical Wireless

3D

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 3.——No. 65.
DECEMBER 16th, 1933.
Registered at the G.P.O. as a Newspaper.

EDITED BY F. J. CAMM.

Building a Class "B" Power Unit



Also Inside

HUM AND ECONOMY
WHERE THE CURRENTS FLOW
A.C. RECTIFIERS AND RECTIFICATION
SHORT-WAVE SECTION
CONVERTING YOUR SET TO ALL MAINS

The GREATEST THING YOU CAN POSSIBLY GIVE YOUR HOME THIS CHRISTMAS!

INTER-COMMUNICATION WITH ALL THE PEOPLES OF THE WORLD!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

Lissen have made this All-Wave All-World Radio available to Home Constructors because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created.

Build with your own hands a set which will receive ULTRA SHORT and SHORT waves as well as ordinary broadcast programmes

When you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it, and how to work it, and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!

KIT COMPLETE WITH VALVES £5·12·6

To LISSEN, LTD.,
Publicity Dept., ISLEWORTH.
Please send me FREE copy of All-Wave All-World "Skyscraper" Chart.

Name .....

Address .....

..... P.W. 2134

POST COUPON FOR CHART FREE

LISSEN ALL-WAVE ALL-WORLD

"SKYSCRAPER" 4

THE LEADING WEEKLY FOR CONSTRUCTORS!

Practical Wireless

EDITOR:
Vol. III. No. 65 || F. J. CAMM || Dec. 16th, 1933
Technical Staff:
W. J. Delaney,
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.,
Frank Preston, F.R.A., W. B. Richardson.

ROUND *the* WORLD *of* WIRELESS

Vol. II Index and Binding Case Now Ready!

HAVE your issues of PRACTICAL WIRELESS bound. Regular readers should have their copies bound in the special covers issued by the Publishers for that purpose. A 12-page index, complete with title page, and containing over 5,000 references, is issued with it and affords a means of rapidly turning up that piece of information which you know has appeared, but cannot easily locate. *This is not a loose binder*, but a correct cover in blue cloth on strong boards with silver letters. We will undertake to bind your 26 copies of Vol. II (issues dated March 25th, 1933, to September 16th, 1933) for a charge (inclusive of cover and index) of 5s. 6d. Return carriage is paid on all orders. Full particulars of this offer appeared on page 445 of our issue dated November 11th.

Young Accumulators

AS from the 16th of December, the whole of the sales of Young Accumulators in Scotland will be handled by Messrs. Day and Night Auto Serve, Ltd., 285-295, Clyde Street, Glasgow (Tel. No.: 578-9 Central Glasgow), and arrangements have been made for ample stocks of all types of batteries, including batteries for heavy commercial vehicles, and servicing facilities to be available at all times of the day and night.

"Practical Wireless" in Penang

ONE of our advertisers has just received the following letter (relating to an ad. in a recent issue) from a reader in Penang, Straits Settlements:—

"Dear Sirs,

"Referring to your 'Microlode' P.M. Moving Coil Loud-speakers, will you please let me know whether you can supply type PM4A fitted in a cabinet? Please send by return full particulars and lowest cash price." The sun never sets on *us!*

Short-Wave Wireless for Aircraft

A FURTHER example of the remarkable results obtainable with well-designed short-wave wireless equipment, both for ground-and-air communications over considerable distances, and as a simple and reliable means of contact between aircraft flying in formation was the performance of the Marconi Type A.D.24D equipment installed in an aeroplane which formed one of a flight of Argentine aeroplanes recently from Buenos Aires to Rio de Janeiro.

The flight covered a distance of 2,100 kilometres, and it is reported that telegraphic contact was maintained throughout with the terminal aerodromes, although the Argentine station had only a two-valve receiver. Positions were reported every ten minutes and telephonic contact maintained with the rest of the units of the flight. Signals were always clear and powerful, and no difficulty or delay of any kind was encountered.

France's One Million Listeners

ACCORDING to a report issued by the Department of Overseas Trade, the market for radio in France is far from saturated, while the demand is steadily increasing. On August 31st, 1933, the number of sets declared was 1,173,817, of which 296,579 had been declared in Paris and district.

Four different fees are levied on persons owning receivers. For purely crystal sets the licence costs approximately 2s. 6d. at par, while private people having other types of sets have to pay 8s. 4d. There is also a valve tax to be paid by retail purchasers, varying between 6d. and 10d. a valve according to its selling price.

Listen to Radio Budapest

THE new 120-kilowatt Lakihegy transmitter was formally opened on Saturday, December 2nd, and now regularly broadcasts the Hungarian wireless programmes on 550.5 metres. On January 15th, 1934, no great alteration will be needed as, according to the Lucerne Plan, the channel allotted is but 1 kilocycle higher, namely 546 kilocycles (549.5 m.). The 18-kilowatt station which has been used so far will broadcast an alternative programme every evening.

The Farmyard Awakens Listeners

AS a colourable imitation of the "cock crow" which the Prague station has adopted to tempt its listeners out of bed, the Riga station has devised for the same purpose a full collection of farmyard noises. If you care to tune your sets to Riga on 525.3 metres or, better still, to Madona (452.3 m.) at 5 a.m. G.M.T., you will hear the Latvian roosters calling their owners to physical exercises. This is followed by the cackling of hens, the grunting of pigs, the mooing of cows, all of which should awaken even the Seven Sleepers of Ephesus!

Brussels on Short Waves

IN order to permit its nationals in the Belgian Congo to listen to the Brussels broadcasts, the programmes will shortly be retransmitted through one of the Ruysselede stations (near Bruges) on 29.04 metres (10,331 kc/s). In view of the difference in time, the broadcasts will be made from G.M.T. 18.00—22.00.

Extended German Programmes

FOR a period under the new régime, German broadcasting stations had somewhat curtailed their evening transmissions. Now, however, in view of increased power of stations and the greater possibility of broadcasts being picked up by Germans resident in foreign countries, late programmes are regularly given by the Frankfurt, Cologne, and Stuttgart group of studios. This principle will later be adopted by Königs-Wusterhausen, Hamburg, Munich, and Breslau.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Plans for the Change-over.

TO permit stations to take up their exact locations in the wave-band on January 15th, 1934, all transmitters will close down on the eve of that day at G.M.T. 23.00, and engineers will make the necessary alteration in wavelength. According to instructions each station in turn will give out its full call for a period of two minutes, and will play a specified gramophone record. The actual measuring of frequencies will be carried out by Brussels, Berlin, Helsinki, Noghinsk (Moscow), Prague, Rome, Stockholm, London, Warsaw, and Berne. Results will be communicated to individual transmitters direct, or will be broadcast through a high-power station. During the night of January 16th-17th the official Brussels listening post will again check up the transmissions on their new channels.

B.B.C.'s Twenty-third Studio

ST. GEORGE'S HALL, the former home of the Maskelyne and Devant Mysteries, has now formally come into regular use as a B.B.C. broadcasting studio; it will accommodate an audience of 450 people, and will be mainly used for vaudeville, variety, and the lighter forms of entertainment.

"The Path of Glory"

L. DU GARDE PEACH'S amusing radio comedy, which was first produced in 1931 and revived one year later, will again be broadcast in the National programme on December 15th, and from the Regional stations on the following day. It is a story of the inner history of the recent incredible hostilities between the Republic of Thalia and the Kingdom of Sardonia. Without doubt it is one of the best microphone plays offered to listeners during recent years.

Radio-Toulouse Relays Paris

IF you listen to Radio-Toulouse on any Friday evening at G.M.T. 21.30 (9.30 p.m.), you will hear from this station a relay from the famous Medrano Circus at Paris. This is a regular feature of the weekly programmes. It is a curious fact that, although taking place in the French capital, these performances are not broadcast by any Paris station.

Pity the Poor Portuguese

ACCORDING to a Lisbon paper, the 20-kilowatt station of which the formal opening was previously announced for October, cannot yet operate, as the buildings are not yet finished. Although there exists as yet no broadcasting service in Portugal, the State has been collecting the licensing tax since September, a step which is arousing considerable criticism in that country's wireless circles.

Christmas Greetings

PRIOR to His Majesty the King's Christmas message from Sandringham, greetings will be exchanged between British citizens and friends of the Empire, and good wishes will be transmitted to and from London. They will include messages from the Irish Free State, Bermuda, Canada, Australia, New Zealand, India, and South Africa. The King's address will be broadcast at 3.0 p.m. G.M.T. In view of the difference in time, it will be received at Sydney (N.S.W.) at 1.0 a.m., and at Wellington (N.Z.) at 3.0 a.m. on the morning of December 26th; in Bermuda at 11.0 a.m., Ottawa 10.0 a.m., Cape Town 5.0 p.m., and Bombay 8.30 p.m. on Christmas Day.

INTERESTING and TOPICAL PARAGRAPHS

RAMSAY MAC. HEARS HIS MASTER'S VOICE

Mr. Ramsay MacDonald in a corner of the assembly factory during his recent visit to "His Master's Voice" factories.

The New Frankfurt-am-Main Group

IN anticipation of the re-grouping of the Frankfurt-am-Main, Stuttgart, and Cologne studios, the new Freiburg station has been added to the network already including Cassel and Treves (Trier), and now exclusively takes the Frankfurt wireless entertainments.

Broadcasts to the Fishing Fleet

ON the occasion of the recent appointment of the Governor of Flanders, as certain speeches delivered at the Ostend (Belgium) Town Hall were of vital interest to the masters and crew of the fishing fleet, the addresses were relayed to the Ostend Coastal wireless telephony station and re-broadcast on 180 metres. During the past two years most of the ships connected with the Belgium fishing industry have been equipped with wireless apparatus. This is the first occasion on which transmissions, other than weather reports, instructions, or private messages, have been broadcast through this coastal station.

Austria's Half-Million Listeners

SINCE the opening of the new Bisamberg high-power station the number of subscribers to the Austrian broadcasting service has rapidly increased. As a reward the authorities offered a gold watch to the holder of the 500,000th licence. The ceremony, including the presentation of the gift by the Minister of Commerce at Vienna, was registered on a gramophone record and later broadcast in the course of the evening programme throughout all stations in Austria.

Solving a Swiss Problem

IN view of the mountainous character of the country, Switzerland requires high-power stations, and listeners are of the opinion that neither Sottens nor Beromünster on the medium waveband at their present power can give adequate service. Although rumours have been current in respect to an imminent increase in the output of these transmitters, according to a Berne daily, the matter is only under consideration, and no definite decision has yet been taken by the authorities. Much will depend on the results achieved by the Lucerne Plan. If this does not give sufficient satisfaction to Switzerland, steps to strengthen the transmissions of both Beromünster and Sottens will be taken in March, 1934.

G.M.T. For Holland

THE Dutch Government is examining the possibility of adopting Greenwich Mean Time and British Summer Time in Holland. So far, Amsterdam Time is used; it is twenty minutes in advance of our clocks. Generally speaking, the population is in favour of the change.

Edison Cables, Ltd.: Change of Address

ON December 4th, 1933, the Head Office of Edison Swan Cables, Ltd., was transferred from Queen Victoria Street to 155, Charing Cross Road, W.C.2, where all communications should be addressed. Telephone: Gerrard 8660. Business at the trade counter, 228, Upper Thames Street, will be carried on as usual.

SOLVE THIS!

Problem No. 65.

Rodgers made up a three-valve battery set employing detector and two L.F. stages, but when tested it motor-boated badly. He decided to decouple the detector stage and, on looking through his box of spare parts, found that the only resistances he had were two of 250,000 ohms each. He had plenty of 2 mfd. condensers, so he joined the two resistances in series to reduce the value to approximately 100,000 ohms and connected a fixed condenser of 2 mfds. between the earth and the junction of the transformer and resistances. This stopped the motor-boating, but he found that signals were very weak and it was impossible to obtain any reaction effects. Why? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and post to reach here not later than December 18th. Mark your envelopes Problem No. 65.

SOLUTION TO PROBLEM No. 64

Owing to the fact that Smith made up the chassis from plywood, he should have covered this with metal foil, but by omitting this he failed to provide return connections for the electrolytic condensers, etc., and thus hum was caused owing to the absence of the condenser across the bias resistances. The smoothing condensers are also earthed via the chassis.

Only one reader gave a correct solution to Problem No. 63, and a book has accordingly been forwarded to him: A. Balfour, 3, Little Chapel Street, Aberdeen.

Hum and Economy

Economy in the Wrong Direction Leads to Hum Troubles. How to Effect the Best Smoothing at the Lowest Cost is Explained by W. J. DELANEY

THIS article, as its title implies, is intended for the designer or constructor of a mains-operated receiver, although if the construction is being carried out from instructions relating to a receiver designed in our laboratories, all the following points will have been carefully considered by the designer. It will be interesting for the reader, therefore, after a perusal of this article, to refer to various mains receivers which we have described, or shall describe in the future, and to see how the points embodied therein agree with the main considerations of economy and hum-free working. Alternating current, as has been explained before in these pages, consists of a supply which changes its direction at a regular frequency, usually between 25 and 100 times per second. In other words, the current from a zero line rises to a maximum in a positive direction, falls to zero and then on to a similar value in a negative direction, returning again to the zero line. The complete course just referred to is a cycle, and in the majority of A.C. mains in this country the periodicity (or frequency) is 50 cycles per second. Fig. 1 shows the sine curve which demonstrates the complete cycle, and you will find on your supply meter (if A.C.) the figure corresponding to the frequency, namely 25, 50, 100, etc., followed by a small reproduction of this curve, thus 50 ~.

The H.T. Supply

The high-tension supply of a receiver operated from the A.C. mains will be obtained by means of a rectifier which is fed by a transformer interposed between the mains and the said rectifier, the transformer stepping the voltage either up

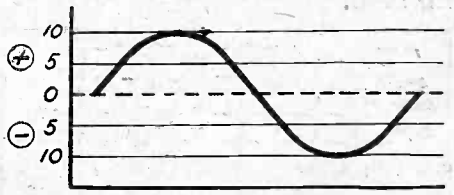


Fig. 1.—The sine curve, or symbol of alternating current. The passage of the oscillation from zero up to maximum, down to minimum and then back to zero, represents one cycle.

or down to supply the rectifier with the correct value. In the case of a half-wave rectifier (either valve or metal oxide) the secondary winding of the transformer will feed into the rectifier an A.C. supply which will be converted by the rectifier into a uni-directional, or direct current. With a full-wave rectifier each half-cycle is converted to account and passed on from the rectifying circuit. In both cases, however, although the current is uni-directional, it will bear the "pulsations" or regular rise and fall according to the frequency of the supply and the method of rectification. Thus if the supply is 50 cycles, a half-wave rectifer will pass on a direct current bearing a ripple of 50 cycles, whilst if a full-wave rectifier, the direct current will bear a ripple of 100 cycles. Our task on the H.T. side is, therefore, to retain the direct current but to suppress the ripple, and as a direct-current mains supply will also in most cases be supplied by means of a D.C. generator, there will also be the possibility of this bearing a ripple from the commutator, so that the following notes relate alike to A.C. or D.C. supplies, and Fig. 2 shows the point in the H.T. battery eliminator which is being dealt with now.

The Smoothing Circuit

It is customary to include across the points marked X what is known as a smoothing circuit, consisting of a pair of high-capacity condensers and a smoothing choke. This is shown in Fig. 3, and it will be seen that the choke is in the positive lead. A moment's consideration will show

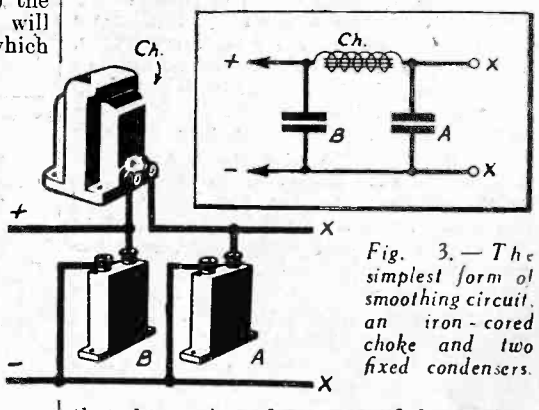


Fig. 3.—The simplest form of smoothing circuit, an iron-cored choke and two fixed condensers.

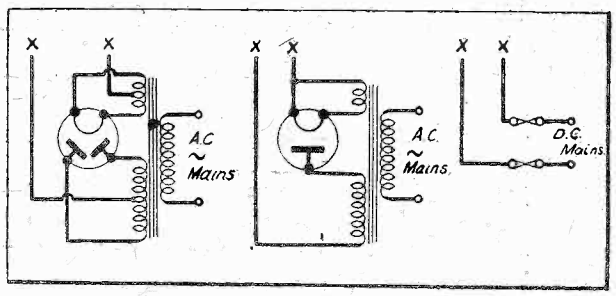
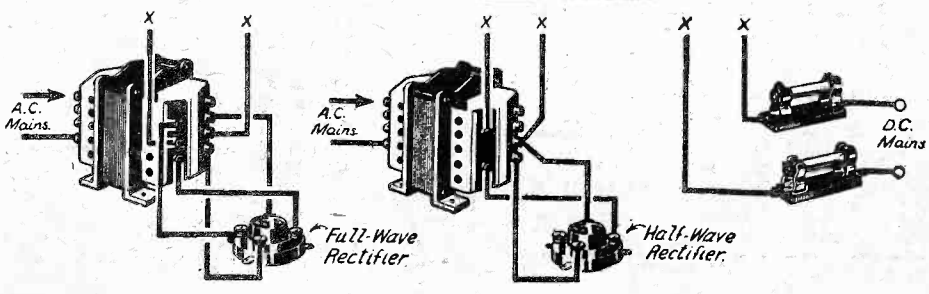


Fig. 2.—A half-wave rectifier, a full-wave rectifier, and the mains input of a D.C. supply shown diagrammatically. The points marked "X" represent positive and negative output leads which require smoothing in each case.



that the total anode current of the receiver passes through this choke, and in a mains receiver employing three valves this may easily total a minimum of 30 milliamps. The choke must, therefore, pass a current of this value and eradicate the ripple. The choke operates by virtue of its inductance, which means that the smaller the inductance the lower its smoothing properties and *vice versa*. In addition, it operates in conjunction with the condenser A, and this receives the impulses from the supply which are choked back by the choke, and any small ripple which is left is finally removed by the condenser B. On the face of it, therefore, to entirely remove hum all that would be required would be a large value condenser for A a very high inductance choke, and a further large-capacity condenser for B. Taking condenser A first of all, it is obvious that this is the load across the rectifying valve, and it is obviously impracticable to choose any value for this without first consulting the

(Continued overleaf)

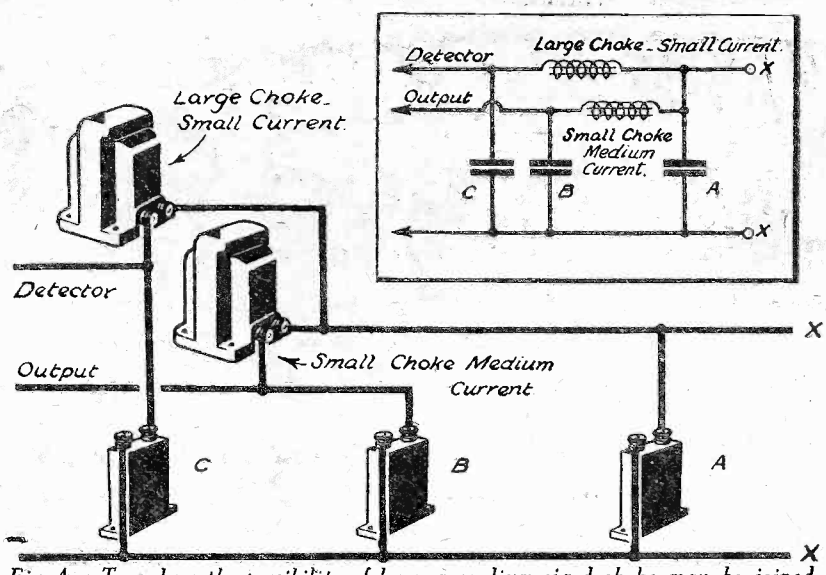


Fig. 4.—To reduce the possibility of hum, a medium-sized choke may be joined in the output or L.F. supply lead, and a further choke in the positive lead to the H.F. and detector stages.

(Continued from previous page)

valve, and a glance through any valve catalogue will quickly show that the valve makers generally recommend a value no greater than 4 mfds. for this.

The output from the rectifier is dependent upon this load, and a valve curve will show that the output increases as the value of the condenser is increased, so that we are more or less forced to adopt the valve-maker's recommendation and use a 4 mfd. condenser; or if we are certain that the valve will not be damaged, we may increase it to 6 mfds. By employing a Class B rectifier for a supply which could normally be obtained from a Class A rectifier we could adopt an 8 or 10 mfd. condenser, but this is certainly not economy. In economizing, therefore, we are bound to use a 4 mfd. condenser, and to obtain the maximum smoothing from this capacity it is obviously preferable to use one of the electrolytic condensers. This is our first point. With regard to the choke, it is essential to use a fair inductance, and as inductance depends upon turns, and the amount of wire is governed by the number of turns, it is obvious that the higher the inductance the higher the cost. Thus in economizing here we have to purchase the largest choke we can afford, although it is not essential to use a choke to smooth the entire supply, as I shall now show. I mentioned a little earlier that the total anode current passes through this choke, and that this may easily total 30 m/a or more. As inductance depends upon turns, and the greater the number of turns the higher the resistance, we are faced with the fact that there will be a drop in voltage across the choke, dependent upon its size and the current passing. If, therefore, we are using a receiver where the output valve requires 200 volts, and the rectifier only delivers a total of 200 volts, we cannot afford to waste any voltage across the choke and must reduce its size. Economy can definitely be effected here by adopting a "stage by stage" smoothing system.

The Detector

The last valve passes its signal direct to the loud-speaker, and therefore it is not so very important to ensure that every trace of ripple is removed from that valve, as there is no successive amplification. The detector, however, in addition to converting the high-frequency currents into an intelligible signal, also passes them on for further amplification, and we must endeavour to supply the detector anode with a perfectly smooth current in the interests of good rectification and to avoid any subsequent amplification of a small amount of ripple. The current in the anode circuit of a detector will not be greater than 10 m/a even with a power grid detector operating with its maximum H.T. In the majority of cases it will be of the order of 2 m/a only. Thus we can use a large resistance in its anode circuit without fear of voltage waste, and a large choke having an inductance of 300 henries, but wound to carry only a maximum current of 10 m/a will cost no more than a small, say 20 henry, choke wound to carry 50 m/a. This is the second point in our economy scheme, for we may adopt a really small choke, designed to carry only the current of the output valve, together with a large choke designed to carry the small current of the detector (and probably the H.F. valves) and join both of these to the H.T. supply direct. Fig. 4 illustrates this point. The addition of a further electrolytic condenser for C will ensure perfect smoothing. To substantiate the claim for economy I will quote from two well-known catalogues.

A 4 mfd. paper condenser costs 5/6
A 4 mfd. electrolytic condenser costs..4/6
A 300 henry, 10 m/a choke costs 12/6
A 40 henry, 10 m/a choke costs ..5/-
A 40 henry, 40 m/a choke costs 12/6

It will be seen that there is undoubtedly a saving in cost in adopting the separate smoothing system, in view of the more positive guaranteee of hum removal.

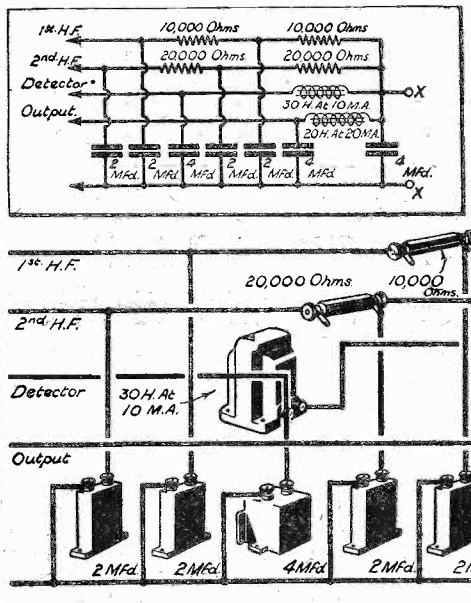


Fig. 5.—For the elimination of every trace of hum, a small choke may be joined in the output supply lead, a second choke in the detector supply lead, and resistance filters in the H.F. stages. This provides perfectly stable operation and removes all traces of hum at low cost.

Resistance or Choke

For the earlier stages in a multi-valve receiver it is quite sufficient to utilize resistances in place of chokes, and by adopting two resistances instead of one of double the value for decoupling purposes, and taking fixed condensers from the ends and the centre, a very effective hum-reducing circuit is obtained at a percentage of the cost of the orthodox smoothing choke system. This arrangement, incidentally, is utilized in the receivers manufactured by one of the largest firms in the country. Fig. 5 shows an arrangement which will be found extremely cheap to construct and which will supply a receiver employing two H.F. stages, an ordinary (not power-grid) detector and an output stage, and which, in addition to being absolutely hum-free, would be absolutely stable, owing to the separate anode supplies which are used.

Alternative Components

When we come to consider the use of alternative components in the interests of economy, we have, in addition to the resistance above mentioned, the employment of a loud-

(Continued on page 695)

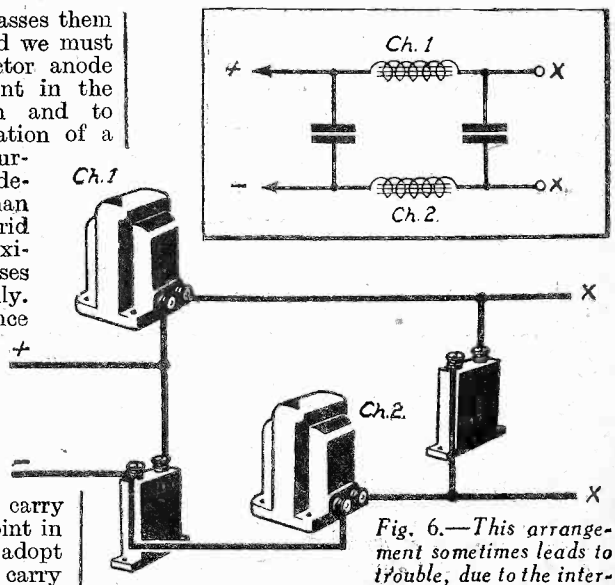
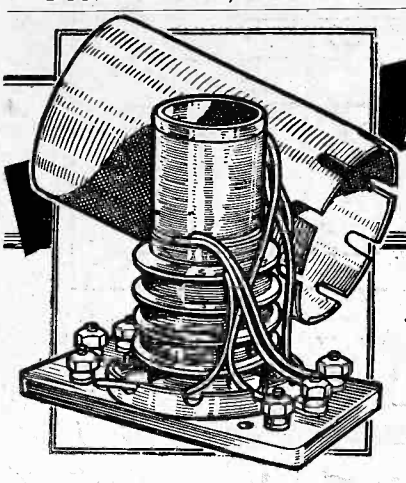


Fig. 6.—This arrangement sometimes leads to trouble, due to the interaction of the two chokes. In addition, the two inductances are in parallel.



MAKING YOUR OWN Screened Coils

In This Second Article the Author Describes the Construction of Some Other Types of Coils and Gives Various Circuits in Which They can Successfully be Employed

By FRANK PRESTON

IN the last article under this heading I gave full constructional details in regard to a type of screened coil which is extremely efficient and can be employed with complete success in a variety of alternative circuits. Only a single circuit was given, however, that being for the simplest type of detector-low-frequency receiver. The tuner can be put to excellent use in a circuit of the kind illustrated in Fig. 1, which is for a three-valve set having a variable-mu H.F. amplifier, followed by a leaky-grid detector and a pentode output valve. A circuit of this kind has of necessity two tuned circuits, and thus a pair of the coils described last week are required. Two three-point wave-change switches are also called for, and it is desirable that these should be mounted as near as possible to the coils upon which they are operative. The ideal method would be to make them integral with the coils themselves in the same way as many of the coil manufacturers do, but that is rather outside the scope of the amateur whose equipment is limited. Many constructors might wish to combine the two switches so that they can be operated by means of a single knob. There are various methods by which this can be done, one of which is to mount one switch on the chassis and the second one immediately behind it on a small angle bracket, linking the two spindles with a screwed piece of ebonite tubing. Most of the other methods involve the use of a switch of complicated design, and cannot be recommended.

The circuit shown at Fig. 1 is a particularly good one and, due to the fact that both tuners are tapped on each waveband, it has an extraordinarily useful degree of selectivity. A ganged condenser is shown for tuning both coils, but it is essential that this should be of the type fitted with trimmers, whilst it is better to use one which has one of its trimmers adjusted by an external knob. This is to ensure that the two circuits shall be exactly in tune at every condenser setting, but this result will not be achieved unless great care is taken to make the coils identical. It might be added that it is by no means essential that a gang condenser should be employed, and that equally good reception will be obtained by making use of separate components.

I am not giving a complete and dimensioned wiring plan for the circuit under review (nor for any other circuit dealt with in this series of articles), but the whole arrangement is so straightforward that no reader need find any difficulty in following it. The components are not critical, and provided that they are of the values stated, they may be of any make or variety that the constructor may have on hand. It is best, incidentally, to employ screened H.F. chokes or otherwise to use two components of different types and space them as far apart as possible, without making the connections to them unduly long.

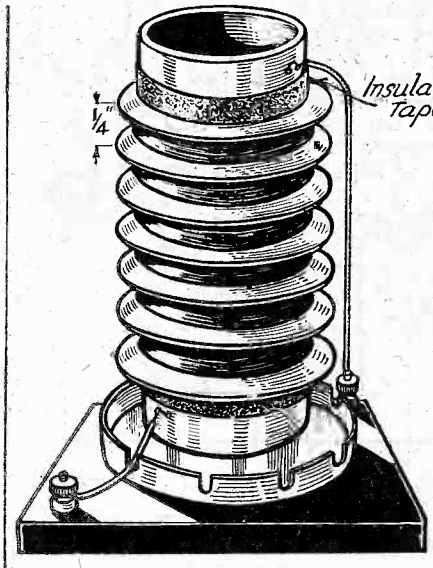


Fig. 2.—Constructional details of a very efficient H.F. choke made from the same materials as those employed for the coils.

Making the H.F. Chokes

If there are no suitable H.F. chokes to be found in the junk-box, it is a perfectly simple matter to make a couple by using the same materials as those employed for the coils. Simply fit seven of the paxolin spacer washers on the former to make six winding sections and put on a continuous winding of 900 turns of 34-gauge d.c.c. or enamelled wire, placing 150 turns in each slot. The beginning and end of the winding should be anchored by precisely the same method as that employed for the coils, and then connected to a pair of terminals fitted to the ebonite base. Fig. 2 shows the arrangement of the windings, spacers, etc., and gives an idea of the appearance of the finished component.

Modifying the V.M. Circuit

The circuit given in Fig. 1 can be modified in a variety of ways to meet with individual

(Continued overleaf)

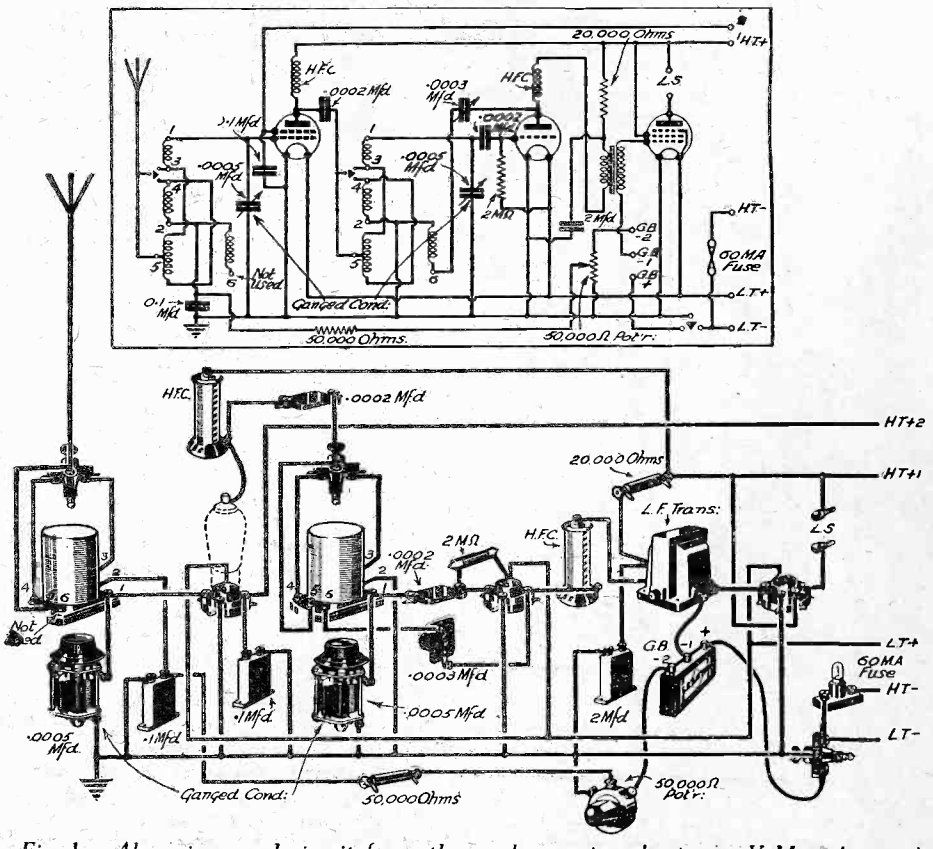


Fig. 1.—Above is a good circuit for a three-valve receiver having a V.M. value and using a pair of the tuners described in the accompanying text.

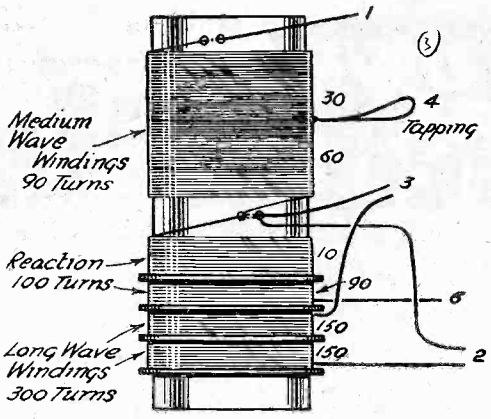


Fig. 3.—Main winding details for a coil suitable for use in a band-pass filter.

(*Continued from previous page*)

requirements and to enable one to make use of components which are readily available. For instance, the variable-mu valve could be replaced by an ordinary screened grid one simply by omitting the .1 mfd. condenser, 50,000 ohm fixed resistance, and 50,000 ohm potentiometer used for applying the variable grid bias. Terminal 2 on the first (aerial) coil would then be connected directly to earth.

The same circuit might easily be altered to include two S.G. or V.M. stages, since the tapped coils render the arrangement inherently stable on both medium and long waves.

Another Type of Tuner

Although ideal for many circuits, the coil described last week is not quite suitable for use in a band-pass circuit, but a coil for that purpose can easily be made by using the same materials. The main constructional details are given in Fig. 3, where it will be seen that the medium-wave winding is continuous (instead of being divided into two separate halves) and is normally wired in series with the long-wave winding. A tapping is taken from the thirtieth turn and is connected to terminal 4 on the ebonite base. The reaction turns are wound as before, but are differently connected, the "beginning" end being joined to the "finishing" end of the long-wave section. Of course, a pair of coils are required for the complete band-pass tuner, and these are wired up as shown in Fig. 4. The "reaction" winding on the first coil is not essential, but it can be used when desired to give a certain increase in selectivity, by transferring the connection from the .0002 mfd. pre-set aerial condenser on to terminal 6. When the tuner precedes an S.G. or V.M. stage terminal 6 on the second coil will also be left free, but in the case of a detector-L.F. circuit terminal 6 will be joined to the reaction condenser in the usual way. A two-gang condenser is shown for tuning both sections of the band-pass filter, but again there is no objection whatever to the use of separate condensers for the two circuits. A .01 mfd. coupling condenser is specified, and this gives just about the correct "band width" of 9 kilocycles. It is important that the condenser be of the non-inductive type; it may therefore be a mica dielectric one or one of the special non-inductive kinds which have been brought on to the market during the last couple of years or so. In order that any biassing arrangements shall not be upset by the band-pass filter, the coupling condenser is by-passed by means of a 2,000 ohms non-inductive resistance.

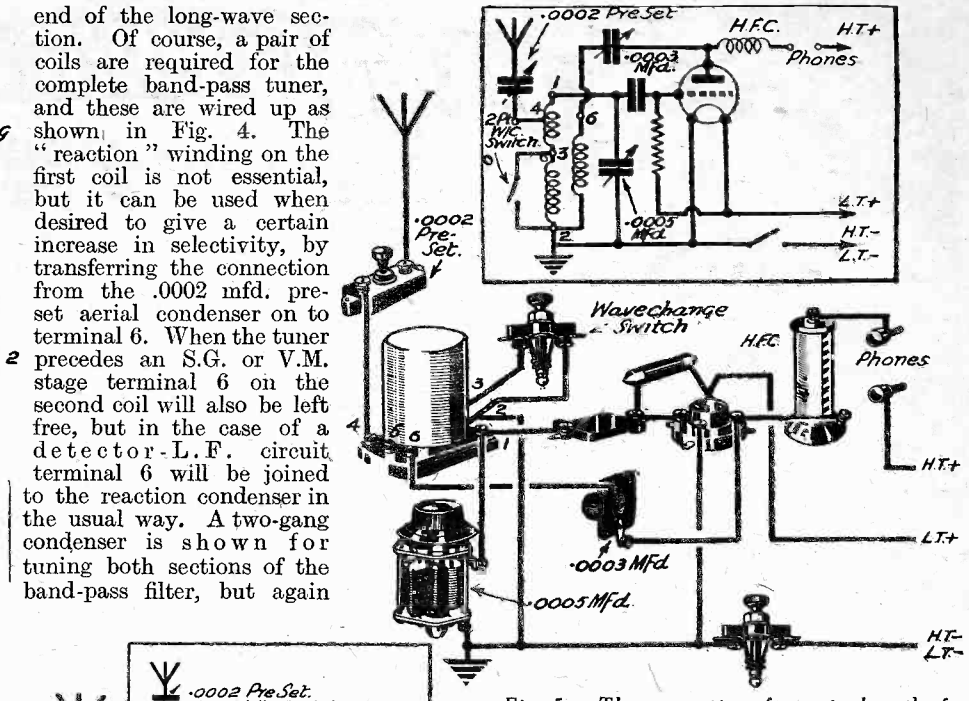


Fig. 5.—The connections for a single coil of the type described are shown above.

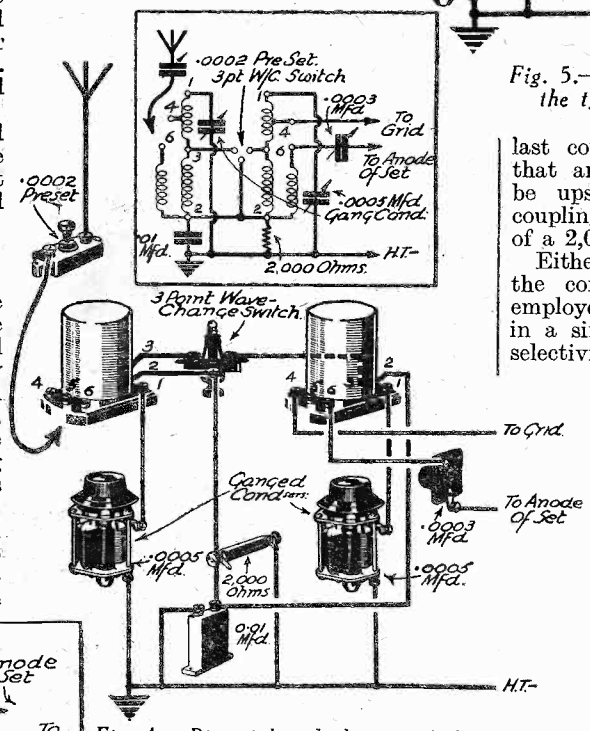


Fig. 4.—Pictorial and theoretical diagrams showing how a pair of home-made screened coils can be employed in an efficient band-pass filter circuit.

Either of the two coils which now form the complete band-pass circuit can be employed separately with every satisfaction in a simple receiver with which extreme selectivity is not wanted on the long-wave band. The connections are shown in Fig. 5, where a single-valve receiver is represented.

Preventing Medium-wave Break-through

With either of the coils described (as also with most commercial ones) there is always a possibility of medium-wave break-through being experienced when listening to long-wave signals. This condition can be corrected by making use of a special anti-break-through choke connected in series with the aerial lead-in, but that method is rather clumsy and it is much better to avoid break-through by designing a coil

(*Continued on page 707*)

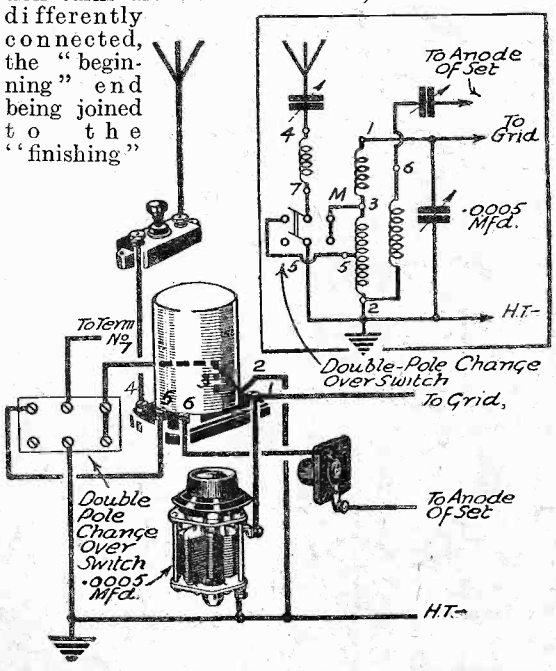


Fig. 6.—The circuit of a useful type of coil fitted with an anti-break-through winding.

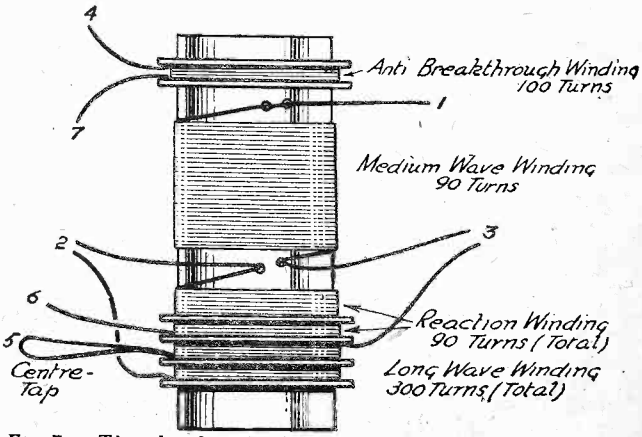


Fig. 7.—This sketch gives the necessary constructional details of a coil provided with an anti-break-through winding.

AT EARTH POTENTIAL

In This Article a Contributor Explains the Reasons for Earthing Various Parts of a Receiver

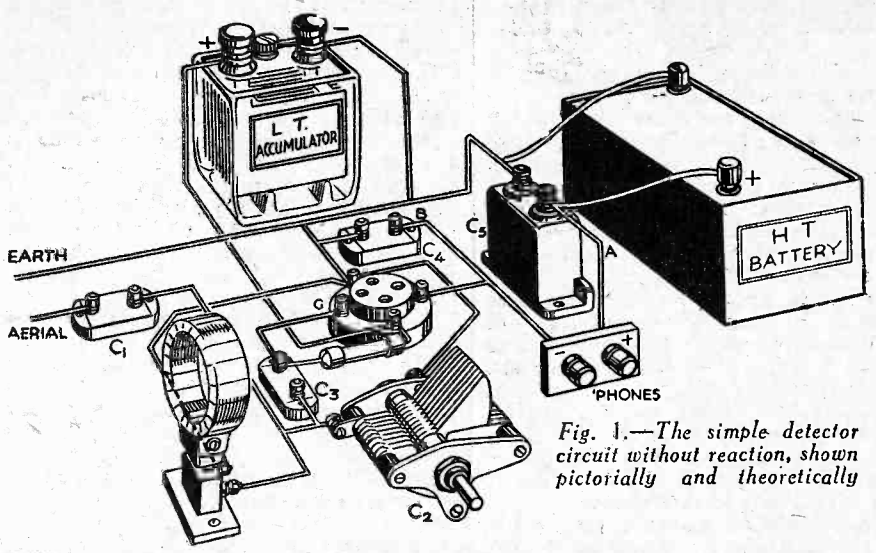
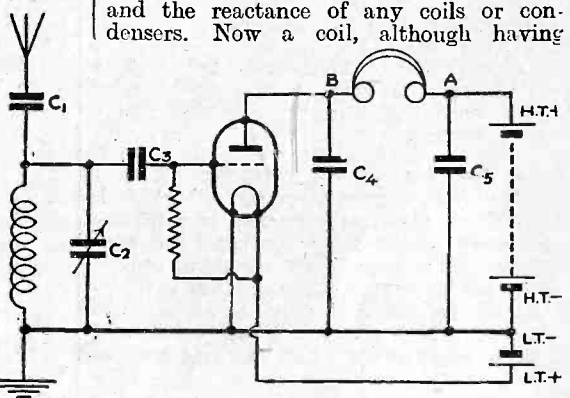


Fig. 1.—The simple detector circuit without reaction, shown pictorially and theoretically



THE phrase "at earth potential" or simply "earthed" is so very descriptive that the newest of newcomers to radio work can understand why it is used for, say, an L.T.— lead that is connected to a plate buried in the earth. It is not so obvious that the H.T.+ wire is also earthed, however; in fact, it appears to be a contradiction in terms to call a wire "earthed" when there is a battery representing a potential of 120 volts between it and earth. All the same, this wire is earthed *from the point of view of alternating currents* although at 120 volts above earth potential with respect to direct currents. To clarify this point let us consider the meaning of potential difference. The potential difference (P.D.) in volts between two points in a circuit is a measure of the electrical force which causes the current to flow round the circuit, and it can *only exist when a current is flowing.* How is it, then, that we can talk about the voltage of a battery whether it is delivering current or not? This is a different thing: the voltage of a battery measures the electro-motive-force (E.M.F.) which it is capable of exerting; when the battery is put into circuit its E.M.F. causes a current to flow which sets up a potential difference between any two points in the circuit. The relationship between E.M.F. and P.D. is that of cause and effect. The E.M.F. of a battery is constant, whatever the current drawn from it, but a P.D. depends on the strength of the current according to the familiar Ohm's Law equation:—

P.D. (volts) = current (amps.) × resistance (ohms).

This applies either to direct or alternating currents, except that in the latter case for resistance we read impedance, a quantity compounded of the resistance and the reactance of any coils or condensers. Now a coil, although having reactance to alternating currents, offers no opposition to direct current (if we neglect resistance for the purposes of argument), and therefore no D.C. potential can exist across it. Similarly, a condenser completely blocks a direct current, so again no D.C. potential can exist across it, although in both cases A.C. potential differences can be set up.

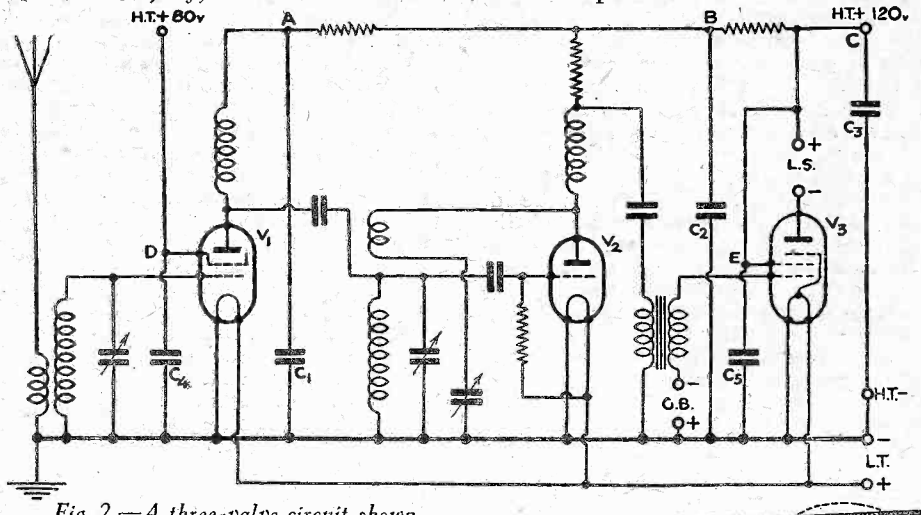
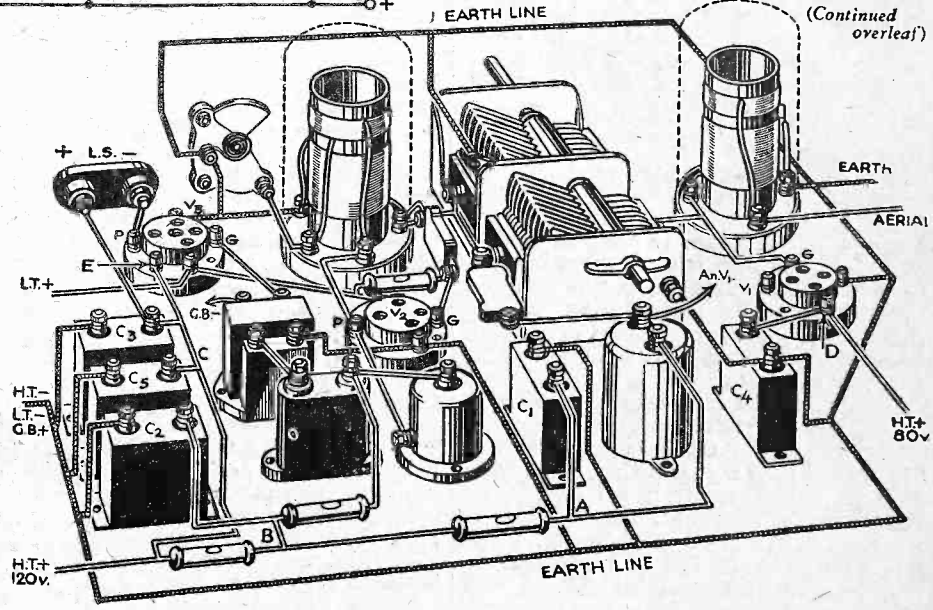


Fig. 2.—A three-valve circuit shown in theoretical and pictorial form

Simple Detector Circuit

Now let us consider the simple valve detector without reaction shown in Fig. 1. As is customary, the L.T.— wire goes to earth, and, therefore, everything connected to it is also earthed. Now what currents flow in the anode circuit? There are several; the direct current due to the H.T. battery; the low-frequency current, resulting from detection, which causes sounds to be heard in the phones; and a

(*Continued overleaf*)



AN EARTH POTENTIAL

(*Continued from previous page*)

high (radio) frequency current left behind by the detecting action. Of these, the D.C. is a necessary evil; it must flow through the battery, and will also flow through the headphones. The L.F. current is required to flow through the headphones and nowhere else; if it flows through the battery it will set up an L.F. alternating P.D. across it owing to the battery's impedance, and in a complicated receiver this would cause instability. At the same time, the L.F. currents must flow to earth somehow, and so an alternative path to that through the battery must be provided by the condenser C_5 which, if its capacity is right, will have a negligible impedance to the L.F. currents compared with the battery, but, at the same time, will draw no current from it. The effect of C_5 on L.F. currents, therefore, is the same as if the point A had been connected straight to earth; A, in short, is at earth potential with regard to L.F. currents, in spite of the H.T. battery.

H.F. Currents

The H.F. currents, on the other hand, are not wanted in the phones, and so they must be removed by another fixed condenser, C_4, which offers them a low impedance path to earth. The point B is therefore earthed for H.F. currents, although at 120 volts D.C. potential above earth, and also above earth for L.F. currents because of the L.F. P.D. across the phones. How is it that a condenser which at the point A shunted away the low-frequency currents does not do the same at B, but discriminates between H.F. and L.F.? The answer lies in the relative capacities of the condensers. The reactance of a condenser depends on its capacity and the frequency of the current; for any given capacity the reactance increases as the frequency gets smaller. For example, a .001 mfd. condenser has a reactance of only 159 ohms at 1,000 kc/s per second, corresponding to a 300-metre transmission, but the same condenser has a reactance of 15,900 ohms for currents of 10 kc/s (10,000 cycles), the highest audible frequency required for good reproduction. Clearly, then, since the P.D. is proportional to the impedance (or reactance), if C_4 is a .001 mfd. condenser there will only be a small H.F. potential difference between the earth and the point B, which is therefore effectively at earth potential, whereas the L.F. P.D. will be high and B above earth for L.F. currents. If the capacity of C_5 is 2 mfd. its reactance at 10 kc/s is 79.5 ohms, which is much less than that of the battery, so A is earthed.

Bypass Condensers

We can now attempt to choose the bypass condensers in the more elaborate set shown in Fig. 2. To prevent H.F. currents getting into the H.T. we have to earth the points A and B, and similarly we must earth C to keep L.F. currents out of the H.T. and the circuits of the preceding valves. To remove the H.F. currents C_1 and C_2 could be fairly small, but the usual value of 1 to 2 mfds. is chosen to ensure that no L.F. gets into the H.F. stages. Obviously, C_3 will have to be at least 2 mfd. Now the screen grid of V_1 must be earthed for H.F., although at high D.C. potential, so C_4 must have a low H.F. reactance; 1 mfd. is the value usually employed, but .1 mfd. is ample on short waves. C_5, however, which earths the screen grid of the pentode, must be at least 2 mfd. because it is dealing with L.F.; C_1 and C_5 earth the points D and E.

SPEAKER "RATTLE" AND ITS ORIGIN

MOST of those interested in radio reception have been worried at one time or another by "*rattle*" in the speaker. Rattle was at one time regarded as a trouble to which the moving-coil speaker was particularly prone. It was very natural that almost everybody jumped to the conclusion that the "rattle" had a mechanical origin; the writer himself, back in 1928, was for a long time deceived, and searched vainly for the cause of "rattle" as being the consequence of some obscure mechanical defect, such as incorrect centring or excessive movement. Since that date the same mistake has been made by others, times out of number. Without saying that there are not forms of "rattle" that have a mechanical origin, *the* rattle now under discussion is purely electrical and due to distortion.

In dealing with the question of distortion, it is common to refer to a certain percentage, say 5 per cent. of the octave harmonic, or some definite percentage of some other harmonic. If these harmonic contaminations were the only cause of trouble not one man in a hundred would notice it at all, because every musical note contains, as part of its structure, numerous harmonics, and the proportions in which these harmonics are present varies considerably. It is the harmonics which determine the distinctive quality of each orchestral instrument, or the tone of the human voice; for example, a characteristic of the "string quality" of the violin or 'cello is due to a preponderance of the odd-numbered harmonics over the even-numbered harmonics, and consequently a bad octave contamination will mar the beauty and perfection of the tone of these instruments. But this will only be noticed by trained musicians or others having an exceptionally keen ear. The ordinary listener is not disturbed by distortion of this character; the slight change of quality in a violin tone, suggestive of an oboe, is scarcely noticed even by a musician, actually one violin may differ appreciably from another in this respect. If there is so much octave contamination as to give a brassy character to the strings, the everyday listener may notice it, but in a mass of orchestration even that will pass unobserved.

The question then arises, what is the source of the "rattle," and what is the type of distortion to which it is due?

So long as the output from a power valve is of a single frequency, whether it be high or low, the distortion due to the curvature of the valve characteristic does, in fact, only consist of the addition of harmonics, that is to say, frequencies *related to the fundamental*, but which are alien to the broadcast. Let us, however, consider what happens when a tone of high frequency is accompanied by or superimposed on one of low frequency; then, referring to Fig. 1, for a given grid swing the superposition shows that the amplitude of the higher frequency (anode) wave varies according to whether the lower-frequency wave is in a trough or at a crest. When the low-frequency wave is at a trough as at *a*, the high-frequency anode swing is of less amplitude than when the low frequency wave is at a crest, as at *b*, owing to the curvature of the valve characteristic (this is shown clearly in the figure). When this happens we can see at once that the higher-frequency wave is being *modulated* by the lower frequency, and this modulation means that a high-frequency pure tone is accompanied by super-added side-bands. Suppose, for example, that the high-frequency tone has a periodicity of 3,200, and the low tone has a frequency of 100, then the side-bands will have frequencies of 3,100 and 3,300, which, accompanying the pure tone of 3,200, will result in a discord and beats of 100 frequency. If the conditions could be represented by just two tones, as above suggested, the result might not be serious, but in view of the fact that a full orchestra includes some seventy or more instrumentalists, and each instrument emits a whole range of harmonics, it may be readily appreciated that a low tone of considerable amplitude will give rise to such a mass of discordant side-band frequencies as to constitute the "rattle," which has been, and often is, a source of annoyance and complaint. Added to this is the fact that often there are several deep notes being sounded simultaneously, whose fundamental tones each give rise to a whole range of side-band frequencies.

The theory of "rattle" and noisy distortion given above accounts for the fact that "rattle" is nearly always worse with a power valve of low output capacity, and has little or nothing to do with the speaker. The only reason that it is more noticeable with a moving-coil speaker than one of the old balanced armature or inductor type is that the moving-coil speaker has a fuller frequency range. The writer has demonstrated over and over again that the "rattle" (on an ordinary single triode power valve) takes place when the flick of the milliammeter needle shows overload. Change the set to one having a push-pull output circuit, or a more powerful valve, and it is found that in abolishing the condition of overload the "rattle" is eliminated. Without a definite demonstration of this character it is difficult to convince those who suffer from "rattle" that it is not mechanical, and that it has nothing whatever to do with the speaker, except as evidence that the speaker has very full response curve extending over a very complete range of acoustical frequencies.

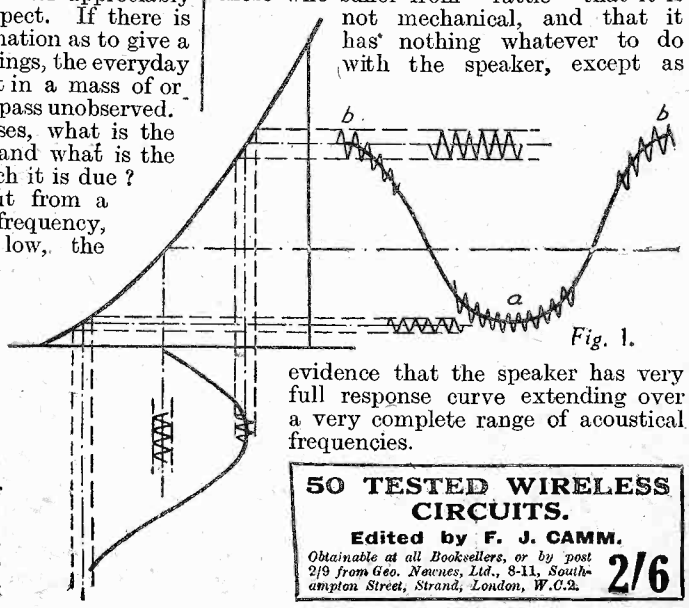
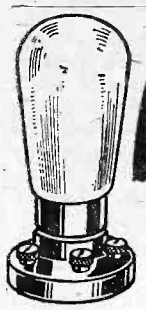
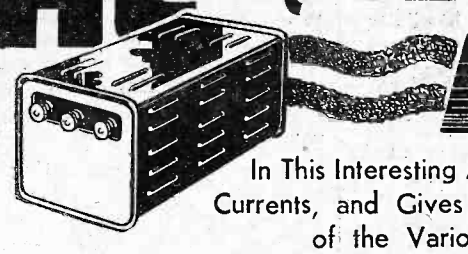


Fig. 1.



AC RECTIFIERS & RECTIFICATION



In This Interesting Article the Author Explains the Principle of Rectification of Alternating Currents, and Gives Much Practical Information in Regard to the Choice and Use of the Various Types of Rectifiers.

By BERNARD DUNN

IN order to use the alternating current (A.C.) mains as a source of high-tension supply for charging accumulators, or for energizing the magnets of certain types of moving-coil loud-speakers, it must first be changed into direct current or D.C. That fact is perhaps very well known, but the principle of rectification and the methods employed are by no means so familiar, although they are quite interesting and well worthy of consideration.

The first question that the beginner asks is "Why is rectification necessary?" The answer is simply this. With alternating current the voltage is constantly varying between zero and maximum, whilst the polarity of the two leads changes rapidly from positive to zero and from zero to negative. A graphical representation of the output voltage from an A.C. supply is given in Fig. 1, where it can be seen that the output is represented by a uniformly wavy line. If the supply is at 50 cycles (the most usual frequency) fifty "ripples" or "waves" will occur every second. Obviously, if such a supply were connected to the high-tension terminals of a wireless set nothing would be heard from the speaker except a (rather unmusical) note. This would be produced due to the fact that the set would operate when the polarity of the supply were correct, and gradually cease to function as the polarity became reversed.

Fig. 1.—A graphical representation of the output from an A.C. supply; the voltage and polarity are constantly changing.

Fig. 2.—This graph shows the result of half-wave rectification; one half of each wave is eliminated.

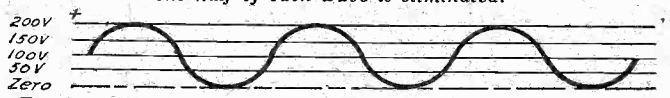
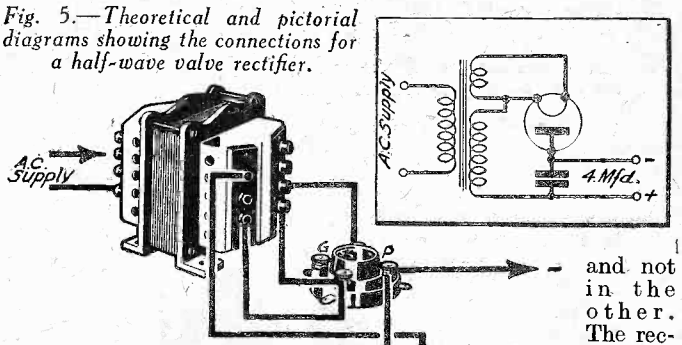


Fig. 3.—This shows the result of full-wave rectification. Both halves of the wave are made use of to produce a voltage of uniform polarity.

It can thus be seen that, for the supply to be of any use it must be of constant intensity and uniform polarity. To obtain such a supply from A.C. makes it necessary to employ some form of rectification, which in turn means using a rectifier, the object of which is to allow current to pass through it in one direction and not in the other. The rectifier may be of the half-wave or full-wave type, when it will produce the effect represented in Fig. 2 or Fig. 3 respectively. A half-wave rectifier simply "cuts off" one half of the wave, leaving the other; thus in one lead the potential is constantly positive or negative (according to the way the rectifier is connected) whilst the other takes the opposite polarity. In the case of full-wave rectification, however, both halves of the wave are made use of, one half becoming positive and the other negative.

Fig. 5.—Theoretical and pictorial diagrams showing the connections for a half-wave valve rectifier.



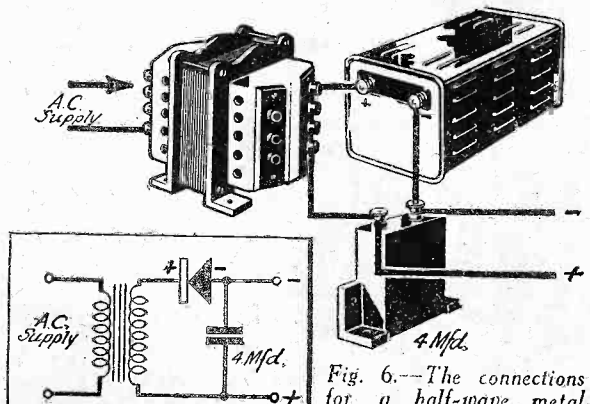


Fig. 6.—The connections for a half-wave metal rectifier are shown above.

Types of Rectifier

Rather than pursue the theoretical considerations farther it will be more interesting to get down to the practical points of rectification. You know, of course, that the process of rectification can be carried out by means of a rectifier valve, a copper-oxide (or metal) rectifier, a vibratory reed, a glow-discharge rectifier or a chemical rectifier of the nodon valve type. Perhaps, also, you have often wondered what are the relative advantages of the various systems. I do not wish to bring personal opinion to bear too much on the subject, and will, therefore, discuss briefly the pros and cons of the individual methods.

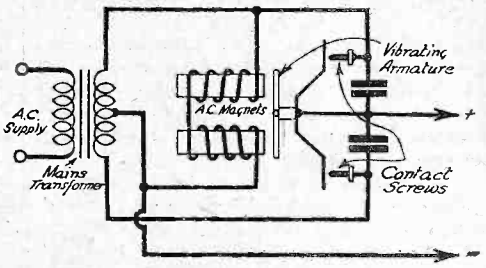


Fig. 4.—This diagram shows the chief features of a vibratory type of rectifier.

As valve and metal rectifiers are now employed almost universally for wireless purposes, we will leave them until last and make passing references to the other systems which have been fairly popular at different times, but for various reasons have fallen into comparative disuse. The vibratory-reed rectifier is fairly economical in use, and its function depends upon the correct "timing" of a vibratory contact-maker to the frequency of the supply. Once the period of vibration has been accurately adjusted the rectifier operates quite well, but the difficulty of arriving at such a state need not be dwelt upon to be well imagined. This type of rectifier is comparatively expensive in regard to prime cost, though fairly efficient in operation. It is, however, inclined to be noisy, due to the vibrating reed, whilst it is rather bulky. Fig. 4 shows the general arrangement of the vibratory rectifier, and the method of working will easily be followed by making reference to it.

The glow-discharge rectifier has never attained any measure of popularity in this country, but it has been fairly widely used in America. This rectifier is similar in appearance to a valve, but instead of having a filament the cathode is unheated, the current flowing between the electrodes by reason of the ionization of the gas in the bulb. It is an obvious advantage to have a rectifier which does not require any filament supply, but this type of component is only suitable for outputs up to

(Continued overleaf)

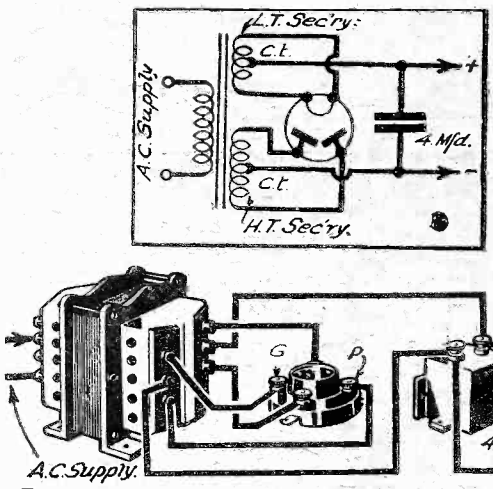


Fig. 7.—The circuit of a full-wave valve rectifier. A centre-tapped secondary is required on the transformer, and this must give the necessary rectifier voltage on each half of the centre-tapping.

(*Continued from preceding page*)

about 50 milliamps, and it is rather limited in regard to its working voltage.

Chemical rectifiers, or nodon valves, are cheap to make, and consist of a glass jar containing a solution of ammonium phosphate, in which an aluminium anode and a lead or iron cathode are placed. The nodon valve has a rather high resistance besides being "messy" to handle, and it is because of these two objections that it is scarcely ever used for any other purpose than occasionally charging small accumulators, or doing other "intermittent" work.

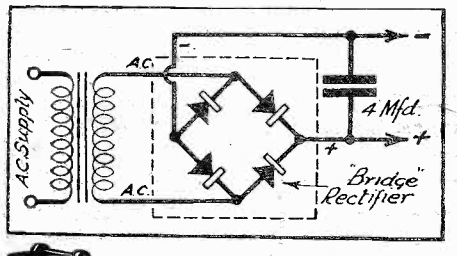
Now we come to the valve and metal rectifiers, and, since these are (justly) most popular and widely used, it will be well to consider them more fully than we have done the other types. The valve rectifier has a lower resistance than has the metal one, and is, therefore, somewhat more suitable for use in a powerful set, where the volume control is of such a type that its use results in a variation of the H.T. current. On the other hand, the metal rectifier is rather cheaper in running costs, since it does not require any filament supply and is very nearly everlasting. There is another point in favour of the valve rectifier (of the type having an indirectly-heated cathode), which is that it does not give its full output until the cathode attains its normal working temperature. And as this heats up at the same rate as do the cathodes of the receiving valves, it means that at no time is there a high-peak voltage which might have tendency to damage fixed condensers and other components. On this score the valve rectifier can be considered better for use in a powerful mains receiver where a comparatively high anode voltage is employed. Apart from the points just raised there is little to choose between the valve and metal rectifiers, and it is very largely a matter of individual taste as to which should be used. For that reason we can consider the two components jointly, especially since the circuit requirements of both are very similar.

Half- or Full-wave?

Whether a valve or metal rectifier is to be used the first question to be settled is that of "half- or full-wave?" Full-wave is more efficient and thus rather more economical, but the actual difference in this respect is too slight to be considered very seriously. What is more important is the fact that with full-wave the "hum frequency" (assuming that it is impossible to remove all traces of mains hum) is twice that of the supply, whilst with half-wave the hum frequency is exactly the same as that of the supply. Thus, if the speaker employed were so designed that it gave a peak response at round about 100 cycles, it would be unwise to employ full-wave rectification if the supply frequency were the usual one of 50 cycles. On the other hand, if the frequency happened to be 25 cycles, full-wave rectification might prove more satisfactory. In any case, it is scarcely possible to give a definite ruling on this question, but the experimenter will always find it interesting to observe the effect of changing over from half-wave to full-wave.

Half-wave Rectification

The connections for a half-wave valve rectifier are shown in Fig. 5, whilst those for a metal rectifier are given at Fig. 6. It will be seen that they are practically the same in both cases, a mains transformer being used to supply the requisite voltage to the rectifier. The chief difference is that the valve requires a second transformer winding to supply its filament or heater. It will be seen that, in both cases, a fixed condenser is shown as being connected in parallel with the output leads; this is important, and its capacity should not be less than 4 mfds. If the condenser were omitted, or if too low a capacity were employed, the output voltage would be less than the nominal figure quoted by the makers of the rectifier in use. Incidentally, it is sometimes possible to increase the maximum voltage slightly by using a condenser of higher capacity, or by wiring a second one in parallel with that originally fitted. Another point that should be observed is the inclusion of a fuse between the rectifier and the output leads. This acts as a safeguard in case of a short-circuit and is a real protection for the rectifier. Its current rating should be approximately twice the normal consumption of the receiver to suitably allow for the "surge" when first switching on.



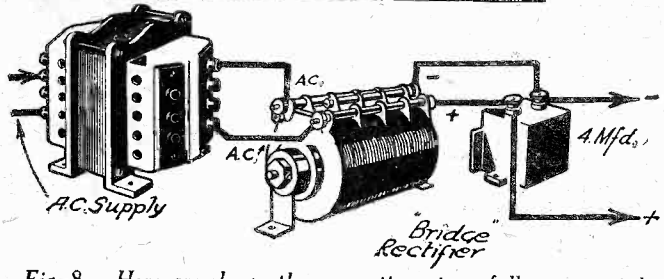


Fig. 8.—Here are shown the connections to a full-wave metal rectifier of the type using four cells to form a "bridge."

Full Wave

The method of connecting a full-wave valve rectifier is shown in Fig. 7, where it will be seen that the H.T. secondary winding requires to be a "double" one, giving the full rectifier voltage on each side of the centre tapping. On the other hand, some types of full-wave metal rectifiers require only a "single" secondary, as shown in Fig. 8. The rectifier illustrated in Fig. 8 is really a multiple one consisting of four cells connected together on the "bridge" principle, and it is not widely employed.

A far more usual system of full-wave rectification by means of a metal rectifier is that shown in Fig. 9, where the rectifier is connected on the "voltage doubler" principle. The working of this system depends upon the use of two large-capacity (generally 4 mfd.) fixed condensers wired in series across the positive and negative leads; one lead from the transformer is joined to the centre of the two condensers, and the other is connected to a centre-tapping on the rectifier. Theoretically, the voltage output from such an arrangement should be twice that of the input from the transformer secondary. In practice, however, such a state of perfection is not attained, the ratio between the output and input voltages being about 3 : 2. In choosing a mains transformer for use in a voltage-doubler circuit there is a rather important point which must be remembered; its secondary winding should be capable of delivering three times as much current as is required from the rectifier.

In all the circuits given so far it will have been noticed that a transformer has been included between the mains supply and the rectifier. This is generally essential for the purpose of obtaining the correct rectifier input voltage, but it sometimes happens

(*Continued on page 699*)

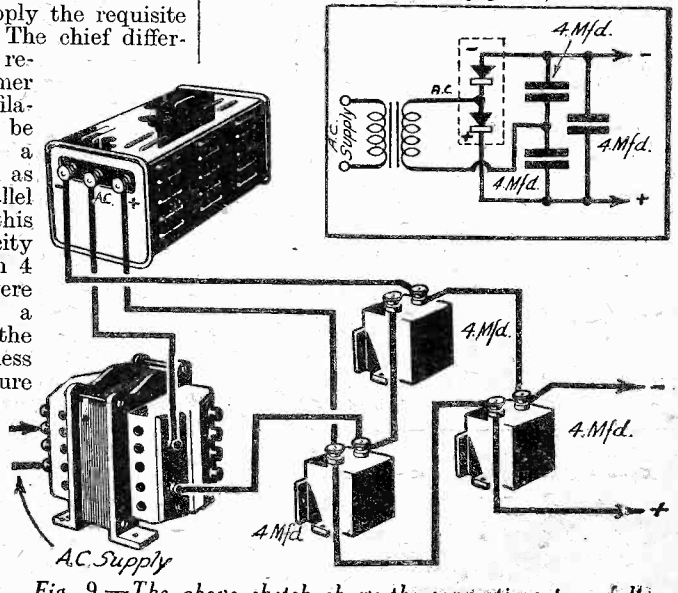
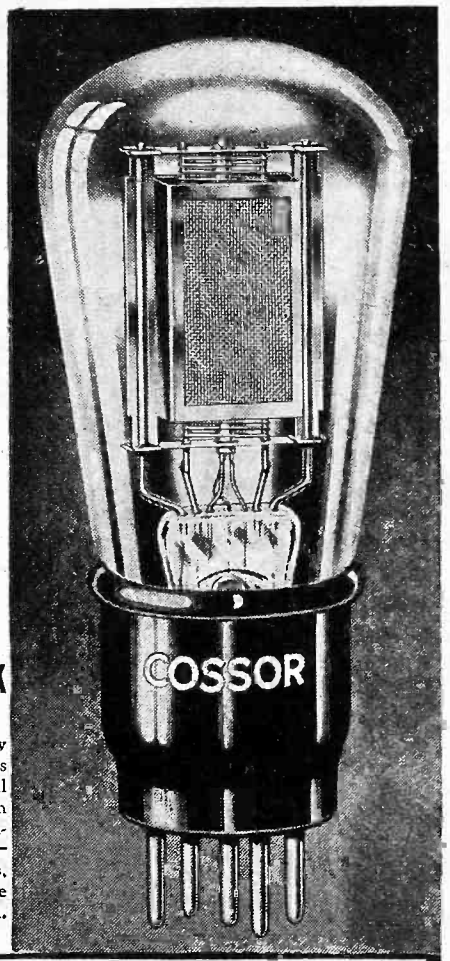


Fig. 9.—The above sketch shows the connections to a full-wave metal rectifier wired on the "voltage-doubler" principle.

EFFICIENCY
UNIFORMITY
LONG LIFE

KINGS OF THE AIR

You can appreciably improve the performance of your All-Electric Receiver, especially if it is two or three years old, by fitting the correct types of Cossor Mains Valves. Due to their advanced design and their famous Mica Bridge Construction, Cossor Mains Valves possess remarkable efficiency, uniformity and long life. Your dealer will tell you the types you need to make your Set like new again.



FREE !

72 PAGE WIRELESS BOOK

From cover to cover this new Cossor 72-page Wireless Book is packed full of useful and interesting information—latest circuits—explanations of technical terms—list of broadcasting stations, etc. Send at once for free copy. Please use the coupon.

To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5

Please send me free of charge, a copy of the Cossor 72-page Wireless Book.

Name .....

Address .....

B.V.33 PRAC. 16/12/33.

COSSOR
A.C. and D.C. MAINS VALVES

COSSOR A.C. MAINS VALVES *(4 Volt Indirectly Heated Cathodes)*

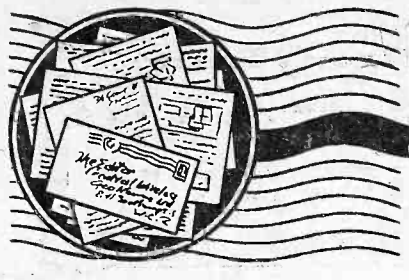
Type	Purpose	Imped-ance	Amp. Factor	Mut. Con. m.a./v.	Price
*†M.S.G.-H.A.	Super H.F. Amp'n	500,000	1,000	2.0	17/6
*41 M.S.G.	Super H.F. Amp'n	400,000	1,000	2.5	17/6
*†M.S.G.-L.A.	Super H.F. Amp'n	200,000	750	3.75	17/6
†*M.V.S.G.	Variable Mu S.G.	200,000	—	2.5	17/6
**M.S./PEN.-A	H.F. Pentode	—	—	4.0	17/6
†*M.S./PEN.	H.F. Pentode	—	—	2.8	17/6
†*M.V.S./PEN.	Variable Mu H.F. Pentode	—	—	2.2	17/6
*41 M.D.G.	Bigrid	40,000	10	.25	19/-
**D.D./PEN.	A.V.C. (Detector and L.F. Amp.)	—	—	2.7	20/-
**D.D.T.	A.V.C. (do.)	17,000	41	2.4	15/6
41 M.R.C.	R.C.C. or Det.	19,500	50	2.6	14/-
*41 M.H.	Detector	18,000	72	4.0	13/6
41 M.H.F.	H.F. or Det.	14,500	41	2.8	14/-
*41 M.H.L.	Det. or H.F.	11,500	52	4.5	13/6
41 M.L.F.	Low Frequency	7,900	15	1.9	14/-
41 M.P.	Normal Power	2,500	18.7	7.5	14/-
41 M.X.P.	Extra Power	1,500	11.2	7.5	16/6
M.P./PEN.	Pen. Power Output	—	—	3.5	18/6
‡P.T. 41B	Pen. Power Output	—	—	2.25	22/6
‡P.T. 41	Pen. Power Output	—	—	3.0	18/6

COSSOR D.C. MAINS VALVES *(16 Volt 0.25 amp. Indirectly Heated Cathode)*

Type	Purpose	Imped-ance	Amp. Factor	Mut. Con. m.a./v.	Price
†*D.V.S.G.	Variable Mu S.G.	—	—	2.5	17/6
*D.H.L.	Detector	13,000	58	4.5	13/6
D.P.	Power Output	2,800	17	6.0	15/-
D.P./PEN.	Power Pentode	—	—	3.5	18/6
*D.S./PEN.	H.F. Pentode	—	—	3.0	17/6
*D.V.S./PEN.	Variable-Mu H.F. Pentode	—	—	3.0	17/6
**D.D.T.16	Double Diode Triode (A.V.C.)	16,000	40	2.5	15/6

*Supplied with Plain or Metallised Bulbs. **Stocked with Metallised Bulb only
† Characteristics measured at-1.5 Grid Volts. ‡ Directly heated filaments.
Prices in this List do not apply in I.F.S.

♡ 4136

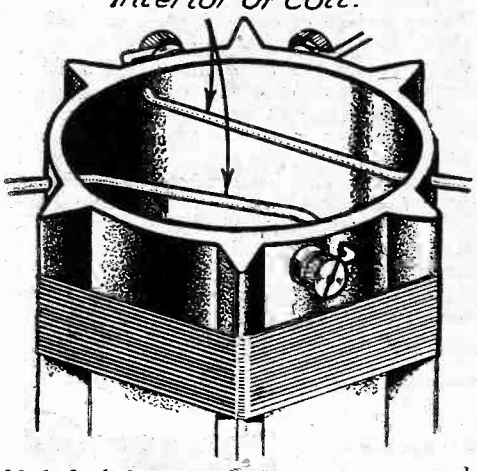


READERS' WRINKLES

THE HALF-GUINEA PAGE

Shortening Leads to Tuning Coils

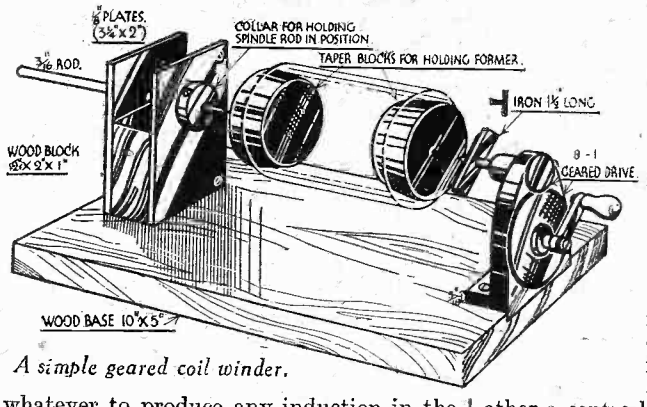
UPON many occasions I have wished to shorten leads to my tuning coils, and eliminate those deviating routes necessitated by the positioning of the coil terminations. Finally, I decided to drill the coil former in several places at the upper and lower edges; this procedure enabled me to pass any connections to the more remote coil terminals through the interior of the coil, and considerably shorten the long leads. There is absolutely no tendency whatever to produce any induction in the coil, and yet I achieved the desired results. The sketch will give the reader an idea of the advantage to be gained and the positioning of the required drillings.—WM. A. HARRISON (Aintree).



Method of shortening leads to a tuning coil.

THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.



A simple geared coil winder.

A Coil Winder With Geared Drive

THE coil winding machine shown in the sketch can be easily and cheaply made from the following materials:—

A geared drive; about 1½in. of ⅞in. T-angle iron; two pieces of ¼in. brass 3¼in. by 2in.; a 6in. length of 3-16in. steel rod; a small collar to slip on the rod with a grub screw for locking; and two pieces of wood, one for the base 10in. by 5in. by ¾in. thick, the other piece 2in. by 2in. by 1in., for holding in position the two ⅛in. metal bearers to the base.

The geared drive is part of a high-speed emery wheel (ratio about 8-1), and it can be bought separately for 6d.

Having obtained the drive, take off the washer and screw out the thumb screw in the base as this is not wanted. Take the baseboard, and recess the fixing lug of the drive to a depth of 3-16in., and fix it in place with a ¾in. wood screw. With a file, sharpen the end of the threaded spindle to a point, taking care to leave enough thread to screw on the piece of T-angle iron, which is drilled and tapped in the centre with a corresponding thread.

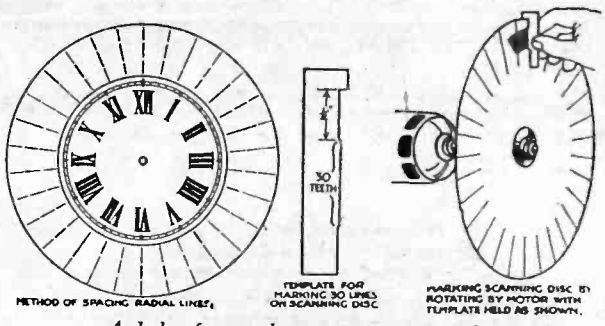
The bearers for the centralizing spindle rod are drilled and fixed with wood screws on either side of the wood block, after which the two 3-16in. clearance holes can be drilled in correct alignment with the driver spindle. The 3-16in. steel rod should be pointed the same as the driver spindle, put through the two bearer holes and the collar slipped on.

If a hollow former is to be wound, two small wood blocks will have to be cut to fit tightly into each end, one having a slot and the other a centre hole.

The sketch gives a good general idea of the construction.—E. SYRED (Brixton).

Marking out a Scanning Disc

HERE is a method I have used for making a scanning disc with great accuracy. The radial lines were obtained by placing over my disc a clock dial, and marking off, with dots, two minute intervals. These dots were connected by a line drawn through the centre. The spacing was obtained by making a template, as shown, with teeth like a saw, and holding it against the disc while revolving on its own shaft. The holes were made with a large darning needle ground square and fitted into a wooden handle.—C. MORTON (Leicester).



A dodge for marking out a scanning disc.

A Useful Wave-change Scheme

MOST wave-changing is done nowadays by means of switches, but it is possible to adapt most circuits by means of plugs alone. This was brought to my notice when I had most of the components for a set, and had omitted to purchase any switches.

The first attempt was with the simple circuit of the Reinartz type (Fig. 1). The circuit has a common aerial reaction winding. It has a 6 to 10 turn coil closely coupled to a grid coil of 50 turns. The long waves require a coil of 250 turns, and a 60 reaction.

The complete short-wave coils connected in series complete the 60 turns required for the reaction coil, and the scheme works out as shown. 1 is short-wave aerial coil; 2 the short-wave grid coil; 3 the long-wave grid coil. Two sockets and plugs will be sufficient. When both plugs are in place No. 3 coil is shorted, and the circuit is right for the short waves, because No. 3 is the 250 coil. When plug A is in C, and D is left out, the set is right for long waves. 1 and 2 act as long-wave

(Continued on page 692)

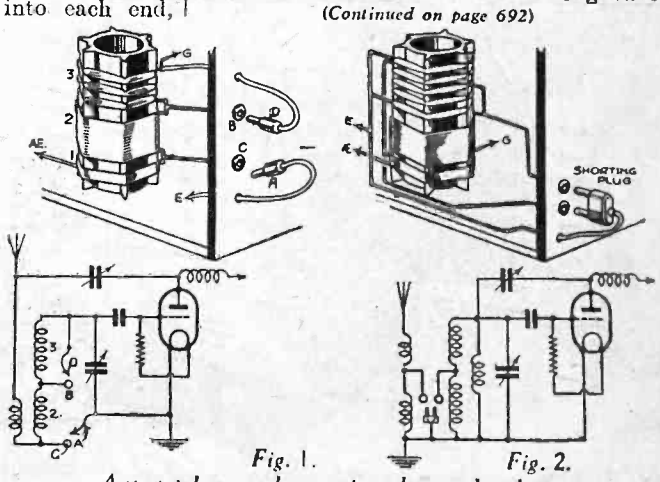


Fig. 1. Fig. 2.

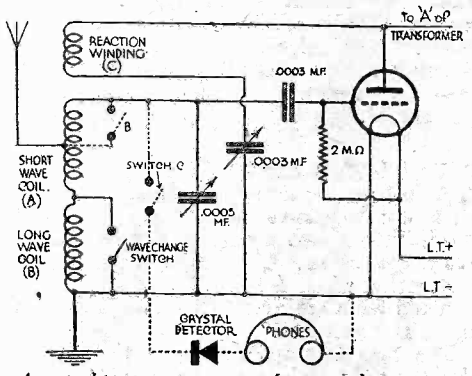
A wave-change scheme using plugs and sockets.

READERS' WRINKLES

(*Continued from previous page*)

aerial coil, and 3 is long-wave grid coil. On the short waves No. 1 is the aerial coil and No. 2 is the grid coil.

Fig. 2 illustrates the substitution of a 2-pin plug for a three-way switch when a dual-range coil is used. In such a case the plug is simply left out for the long waves, and placed in position for the short waves. Using a plug, the connection is positive, and should the leads get damaged they are easily repaired, whereas a switch will often give trouble.—W. H. GRAYLING (Cambridge).



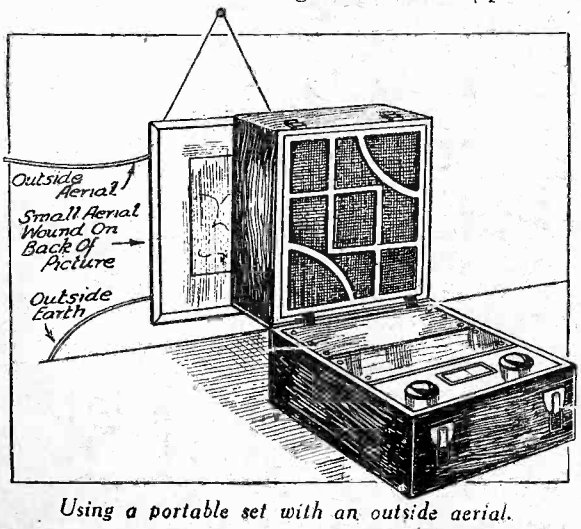
A switching arrangement for switching over to valve or crystal.

Valve or Crystal

THE arrangement shown in the accompanying diagram enables the crystal to be used instead of the valve, with a saving in battery costs. By mounting the crystal detector and switches on the panel of the valve set it is possible to change over quickly when other members of the household do not wish to hear a particular item. It will be seen that the short (medium) wave coil is tapped for the aerial connection to provide selectivity, and the lower portion of this serves as the crystal set tuning coil. When the receiver is on for medium waves, and the crystal is required to be brought into operation, the switch B is closed, and this short-circuits part of the grid tuning coil, but leaves the lower portion available for the crystal set. It can be seen from this that any set may easily be converted so long as the aerial coil is tapped for selectivity. The extra connections are shown by the dotted lines. —P. RUDD (Pinner).

Using a Portable with an Outside Aerial

THE following idea may be of some use to those who own a suitcase set and wish to obtain the benefit of greater volume afforded by an outside aerial. Some sets are provided with terminals or sockets for aerial and earth, but mine has no such provision. I therefore made a small frame by winding a dozen turns of wire around the back of a picture frame, the picture being then hung so that it was directly behind the place occupied by the radio set; the two ends of the small frame were connected to the outside aerial and earth respectively. When the set was placed in front of the picture the two aerials were coupled inductively and the signal energy transferred to the frame aerial of set.—C. E. ROSSITER (Taunton).



Using a portable set with an outside aerial.

A Simple Aerial-Earthing Switch

HERE is a simple but effective aerial-earthing device which entirely isolates the receiver when placed in the "earth" position. A piece of $\frac{3}{16}$in. ebonite about 3in. by $2\frac{1}{2}$in. is drilled to take four large telephone type terminals, which are arranged as shown in Fig. 1. In each of the left-hand pair of terminals an additional hole is drilled at right angles to the existing one, as indicated in Fig. 2. Two pieces of $\frac{1}{8}$in. brass rod, $2\frac{1}{2}$in. long, are fitted with a small ebonite knob on the end of each. Two holes are drilled near one edge of the ebonite for taking screws for fixing the switch to the edge of the window frame. The leads from the aerial, earth, and receiver can be clamped under the back nuts of their respective terminals. When the receiver is to be used, the brass switch rods are both pushed horizontally through the terminals as in Fig. 1, and the terminal screws tightened up. For earthing the aerial, the bottom switch rod is simply pulled out to the right, clear of the left-hand terminal, and the top rod withdrawn, and passed vertically through both left-hand terminals, as in Fig. 3, thus completely isolating the receiver.—W. DAVEY (Wembley).

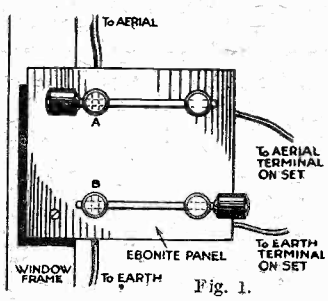


Fig. 1.

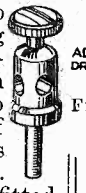


Fig. 2.

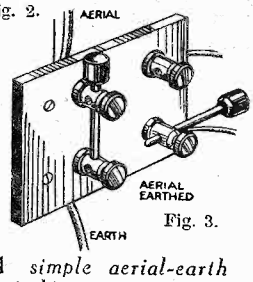
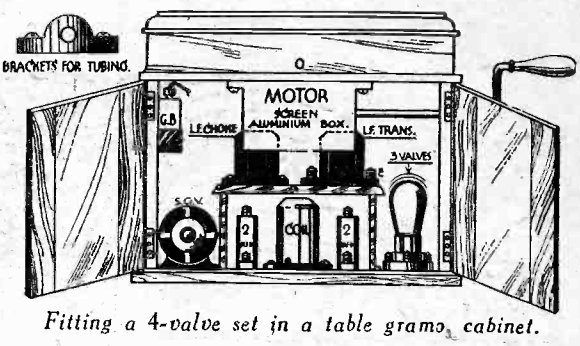


Fig. 3.

A simple aerial-earth switching arrangement.

SEND FOR YOUR TOOL KIT WITHOUT DELAY!



Fitting a 4-valve set in a table gramo. cabinet.

A 4-valve Set in a Table Gramo. Cabinet

THE accompanying illustration shows how I built a 4-valve set in a table gramophone cabinet. In the sketch the panel is removed to show how the valves and other components are arranged. The S.G.V. is on the left, and three L.F. valves on right. Owing to lack of space, I made a table of aluminium, with legs also of aluminium, which earths the transformer and chokes, mounted thereon, to the aluminium base which arrangement gave me ample room for the other components on the base without overcrowding. The motor is screened in an aluminium box, which serves a twofold purpose of screening the motor and catching the oil therefrom. When I tried the set out it began to howl (low frequency). I went over it all very carefully and finally cured the trouble in the following manner. All the wires on the cored circuit are run through glass tubing of about $\frac{1}{8}$in. bore, which was bent to the shapes required by heating in the fire. The tubing is supported in small ebonite brackets. —W. WILSON (Greasbrough).

Slow-motion Disc Drive

THE accompanying sketches show a simple method of converting a tuning condenser to a slow-motion drive. The condenser is mounted on two brackets, the condenser dial being reversed and attached to a tin lid on the inside, as shown in Fig. 1. A cardboard disc, with the necessary gradations marked on, is glued to the tin, and a suitable aperture cut in the panel, as in Fig. 2. The spindle of the slow-motion knob, the end of which is supported in a brass angle-bracket, is provided with a piece of rubber sleeving, as shown in Fig. 3, which forms an efficient friction drive with the flange of the tin lid.—A. J. SMITH (Kenton).

NEW ELTHAM AND DISTRICT WIRELESS ASSOCIATION

An interesting lecture will be delivered to the above association on the 14th inst. by Mr. C. A. Quarrington, of the Technical Service Dept., Messrs. A. C. Cossor, Ltd. The main topic of interest and demonstration is an elaborate cathode ray display, and valves will also be dealt with.

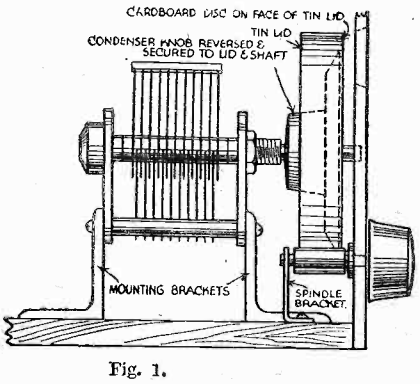


Fig. 1.

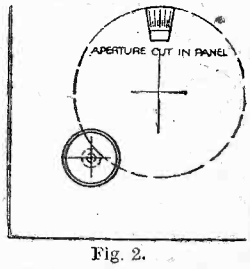


Fig. 2.

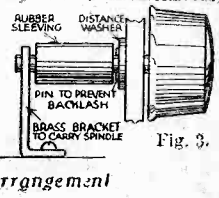
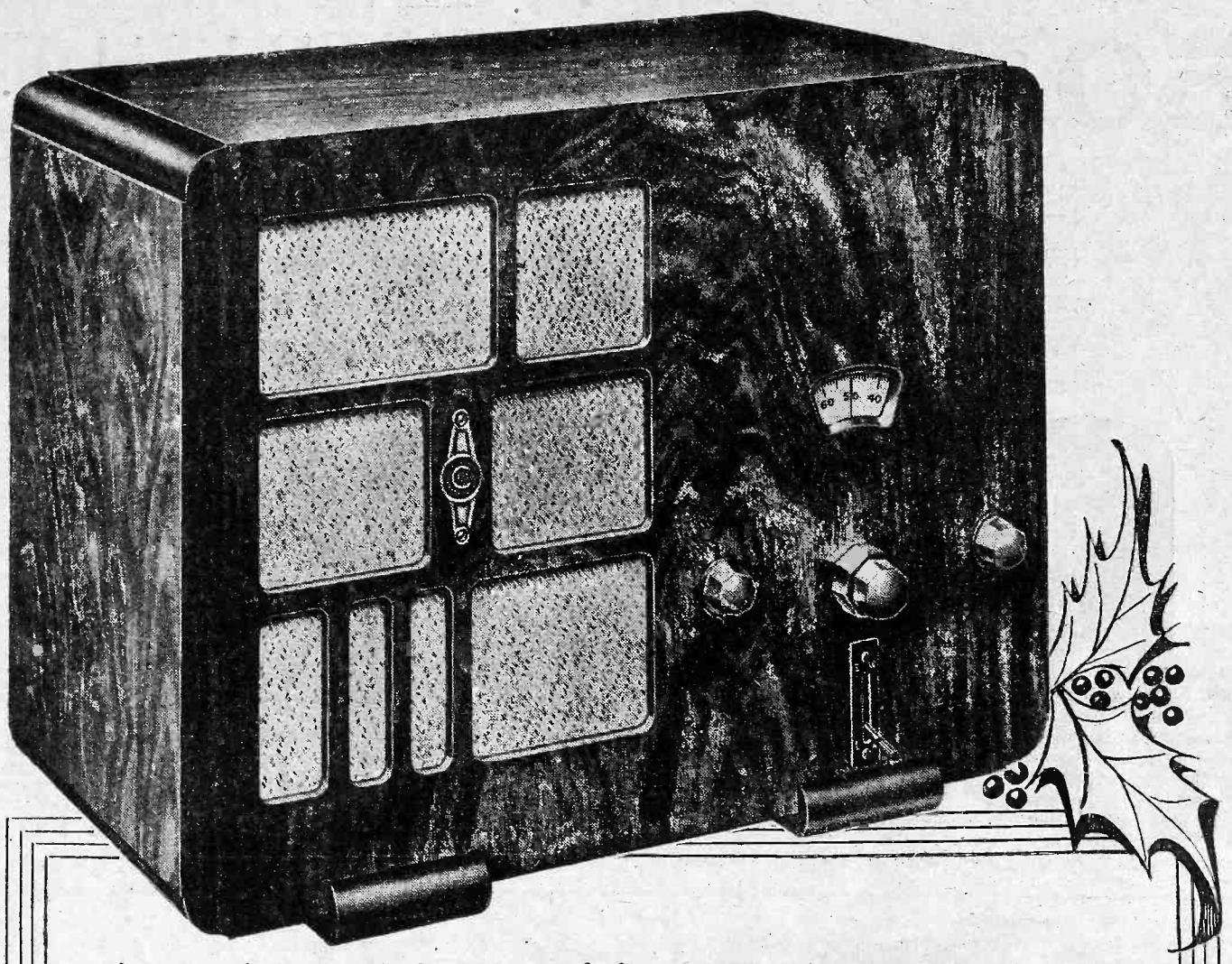


Fig. 3.

A neat slow-motion disc-drive arrangement



An old, old, Problem SOLVED!

THIS YEAR *Give a*

COSSOR
MELODY MAKER

Here's the solution to the "what-to-give?" problem—a Cossor Melody Maker. This remarkable Receiver will bring endless entertainment to the lucky recipient. Capable of bringing in the best European programmes at generous volume with a rich true-to-life tone, it is one of the most efficient 3-valve Screened Grid Sets you can buy. Incorporating every worth-while radio development, it is made in four models for battery and all-electric operation. Send at once for full particulars, please use the coupon.

BATTERY MODEL KIT **341**
PENTODE OUTPUT
Balanced Armature Loud Speaker

Complete Kit of Parts including Cossor Variable-Mu Screened Grid, Detector, and Pentode Valves. Fully screened coils, Double-Gang Condenser, all-metal chassis, and all the parts. Handsome cabinet 18½" x 13½" x 10", space for batteries and accumulator. Balanced Armature Speaker; provision for Gramophone Pick-Up Plug and Jack, Wave-length range 200/530 and 900/2,000 metres. **Price £6.7.6**

Hire Purchase Terms 16/- deposit and 10 monthly payments of 12/6, or alternatively 20/- deposit and 6 monthly payments of 20/-.

BATTERY MODEL KIT **342**
MOVING COIL LOUD SPEAKER

Complete Kit of Parts similar to Model 341 described above, except that it is supplied with a Permanent Magnet Moving Coil Loud Speaker. **Price £7.2.6**

Hire Purchase Terms 17/6 deposit and 9 monthly Payments of 15/6.

BATTERY MODEL KIT **344**
CLASS "B" OUTPUT

Complete Kit of Parts as Model 341, described above, but with four Cossor Valves, Class "B" Output Stage and Permanent Magnet Moving Coil Speaker. **Price £8.2.6**

Hire Purchase Terms 20/- deposit and 10 monthly payments of 16/-.

Prices do not include batteries or accumulator.

ALL-ELECTRIC MODEL KIT 347

Complete Kit of Parts similar to Model 341, described above, but with four Cossor A.C. Mains Valves (incl. Rectifier) Power Unit and Mains Energised Moving Coil Loud Speaker. For A.C. Mains only 200/250 volts (adjustable) 40/100 cycles. **Price £8.19.0**

Hire Purchase Terms 20/- deposit and 9 monthly payments of 20/-.

Prices do not apply in I.F.S.

To A. C. Cossor Ltd., Melody Dept., Highbury Grove, London, N.5.

Please send me a Constructional Chart which tells me how to build a Cossor Melody Maker.

Model.....

State Model No. required.

Name .....

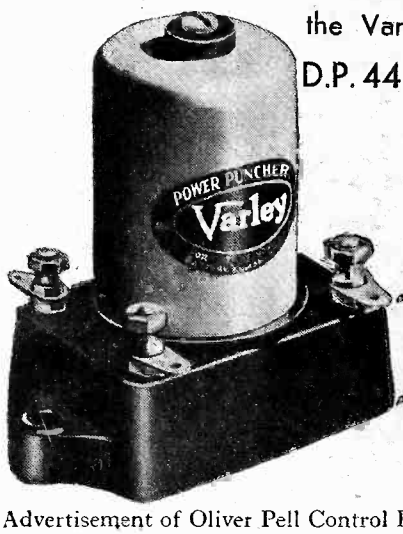
Address .....

PRAC. 16/12/33.

50% REDUCTION IN H.T.
and prolonged battery life

For example, in an average 3-valve set (1 S.G. Det. and Small Pen.) you save half of the H.T. consumption. In other words you save at least one H.T. battery renewal per year and in some cases two. In addition to that saving you have **increased volume.** Why not fit the Varley "Power Puncher" to your set—easily incorporated, only two connections necessary. Write for the Varley Catalogue—it is FREE.

D.P. 44 15/6



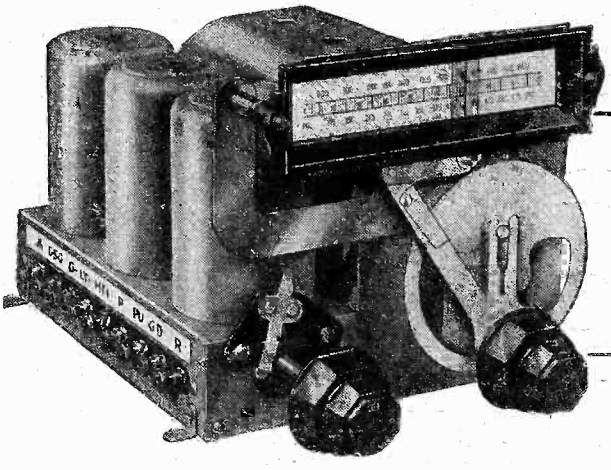
FOREMOST AS PIONEERS

Varley

Proprietors: OLIVER PELL CONTROL LTD.

POWER PUNCHER

Advertisement of Oliver Pell Control Ltd., Kingsway House, 103 Kingsway, London, W.C.2. Telephone: Holborn 5303.



Free Blueprint!

THE REMARKABLE LINACORE

3-valve circuit equal to a "Superhet"

By sending this coupon NOW you will receive free a blueprint of an Ideal battery model "LINACORE" circuit which from 3-valves will give you results equal to a "Superhet." Enclose 2d. only for postage.

For battery receivers type BPB, (as illustrated) **69/6**

REG TRADE MARK

COUPON To: JACKSON BROS. (London) LTD., 72, St. Thomas Street, London, S.E.1.
Please send free blue print. I enclose 2d. in stamps for postage.
Name.....
Address.....
Pr.W.

Converting Your Set to All-Mains

With Particular Reference to the Types of Valves to be Used

By C. H. KEELING

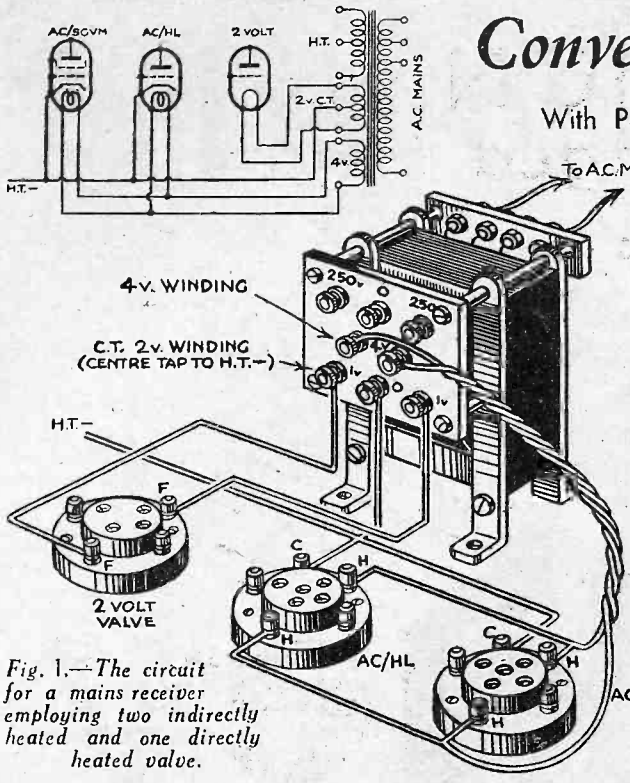


Fig. 1.—The circuit for a mains receiver employing two indirectly heated and one directly heated valve.

WHERE an H.T. eliminator is used in conjunction with a receiver of the battery type, one is often asked: "Can I, with slight modification, change my set for use with all-mains valves?" Providing that the eliminator has a sufficiency of milliampere output, the change can be effected with little outlay and the minimum of trouble.

Assuming the mains are A.C., and that the set is home constructed with its parts fairly accessible, we can proceed to get together the necessary components.

We probably have to deal with a popular three-valver, comprising one stage of H.F., detector, and L.F. amplifier. It will be essential carefully to select A.C. equivalents, bearing in mind that the amplification with mains valves is considerably more than that obtainable with the battery types.

As we already have the unit for the H.T., we have only to procure a transformer for supplying the "raw" A.C. at 4 volts to the heaters of the valves. Of course, 5-pin valve-holders will have to be substituted, but this may not be necessary in the output stage if we intend to use our existing output valve with "raw" A.C. on its filament. If the latter is a 4-volt valve the matter is simplified; if either 2-volt or 6-volt a special transformer will be required, and details for winding one will be given in a later article.

The diagram, Fig. 1, shows the wiring to the 5-pin valve-holders, and assumes that the old type 2-volt valve is going to be used in the output stage.

Fig. 2 indicates the connections when using a battery type 4-volt valve as L.F. amplifier; in this instance an ordinary commercial type transformer can be utilized, such as the Heayberd No. 723, price 12s. 6d.

One has to bear in mind the fact that when using an eliminator H.T. volts are very precious, the usual unit only supplies something like 120/50 volts. This has a bearing on the type of bias we should employ. If we attempt to apply automatic bias we shall lose our valuable volts; for example, if an A.C. valve requires 10 volts for cathode bias, our H.T. will be reduced accordingly. It is therefore recommended that when making the suggested conversion, battery bias should be retained. In this case the cathodes will be joined together and connected to earth or H.T. negative.

If our conversion calls for a vari-mu S.G. valve in the H.F. and the eliminator can supply only 20 milliamps, we may use an A.C./S.G.V.M. in the first position, an A.C.2/HL as detector, and a PM4 as output valve.

The centre tap on the mains transformer should be taken to earth, or a suitable variable resistance can be connected across the winding with the earth connection brought to the slider of the resistance.

As a result of the extra punch the set will now give us, it may be necessary to introduce more effective screening into the H.F. section between the S.G. valve and the detector stage; if our coils are already screened this will probably not be required.

Although straight wiring is shown in our diagrams for the sake of simplicity, it is best if the heater wires are twisted together in order to minimize hum.

The various types of transformers required to meet the different types of output valves will be dealt with in another article, when constructional details will be given.

If the eliminator is one of those rarities which supply milliamps in abundance, an indirectly heated A.C. mains type output valve may be used; it then becomes essential to use a mains heater transformer giving sufficient L.T. amps. The wiring diagram is shown in Fig. 3.

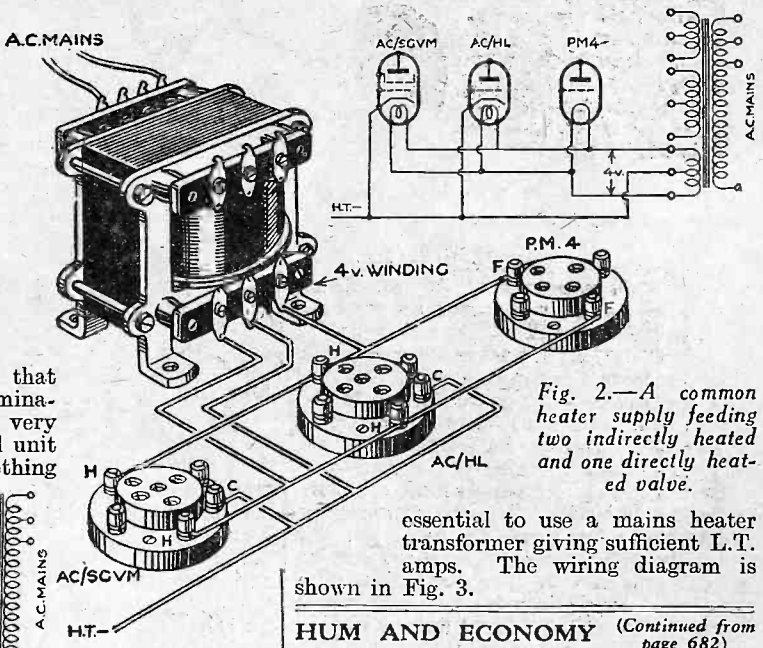


Fig. 2.—A common heater supply feeding two indirectly heated and one directly heated valve.

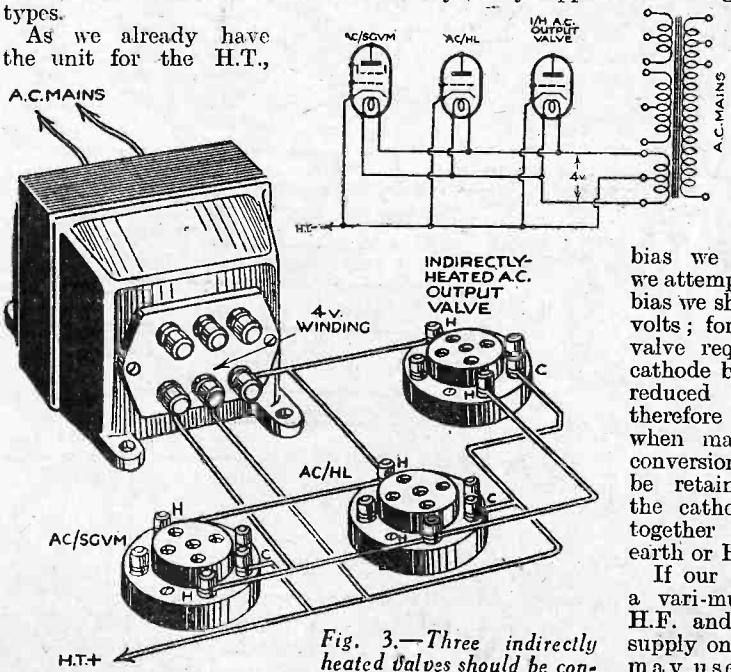
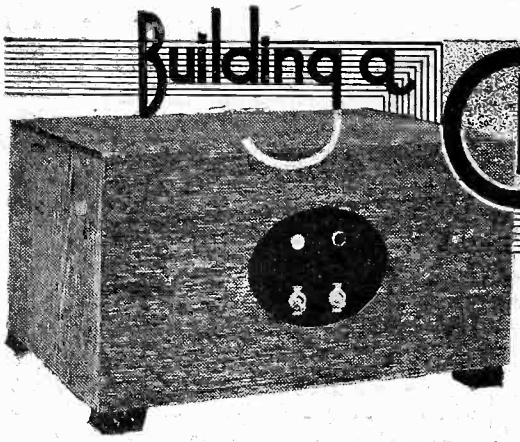


Fig. 3.—Three indirectly heated valves should be connected as shown in this illustration.

HUM AND ECONOMY

(Continued from page 682)

speaker field as a smoothing choke. This can be employed in place of the choke in the positive lead, and although an inductance of the order of 60 henries is generally obtained, there is a corresponding large voltage drop, resulting in approximately 100 volts or so being lost in this part of the circuit, although the wattage must be obtained from some source to energize the speaker. It is not wasted, therefore. Alternatively, the speaker field may be used as a biasing resistance for the L.F. valves, although with this method particularly, there is possibility of hum due to interaction. It is in every case advisable to use a speaker which has what is known as a "hum-bucking" coil fitted, to ensure that the ripple is not picked up by the speech coil and thus added to the music or speech. As a final warning in the matter of economy, do not attempt to use two cheap, medium-inductance chokes, inserted in both positive and negative leads from the rectifier.



Building a Class "B" Power Unit

A Practical Article Describing the Construction and Operation of a High-class Combined H.T. Eliminator and Accumulator Charger

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

WITHIN the last few months the Class "B" method of low-frequency amplification has been introduced to give battery users an economical method of achieving the equivalent of a mains-driven set volume. It has already been pointed out to readers that with a Class "B" output stage the current drawn from the H.T. supply varies, within very wide limits, according to the type of signal being received. The peak values of the anode current may be as much as ten times the "standing" current, and in consequence such a radio receiver, if fed from an ordinary H.T. eliminator, could not be expected to be stable.

It is necessary therefore to adopt a special design for an eliminator unit of this character, and the criterion is one which has what is called technically a "close regulation." This is the same as saying that even if the current demanded varies between wide limits, the voltage variation confines itself to narrow limits—something of the order of 10 volts or so between the usual maximum and minimum values of the Class "B" output valve anode current. There is more than one way of carrying this to a successful conclusion, and in the unit I am about to describe a metal rectifier is used of the half-wave type with very generous smoothing arrangements.

To make the power supply more complete in itself it is obvious that the accumulator which normally must be employed for delivering the total valve filament current merits consideration. If on the high-tension side we are replacing dry batteries which inevitably must run down at some time, and so reduce the power and possibly cause distortion, why not maintain the accumulator in a fully-charged and first-class condition at the same time. The dual scheme has been incorporated in the unit which is seen in the accompanying illustrations.

Theoretical Considerations

A reference to Fig. 1, will enable the reader to see just how this is done. First of all we have a mains transformer T_1 having an output of 150 volts feeding into a H.T. 13 metal rectifier H.R. Two H.T. tappings are provided with a separate smoothing choke (LF_1 and LF_2) and a separate smoothing condenser (C_2 and C_3) in each lead. One of these must feed the Class "B" output valve alone, while the remaining one serves all the other anode supplies in the radio receiver with which it is used in conjunction. This is an important point, and since no decoupling arrangement is included in the eliminator every user of this unit must make sure that the decoupling is taken care of in the set.

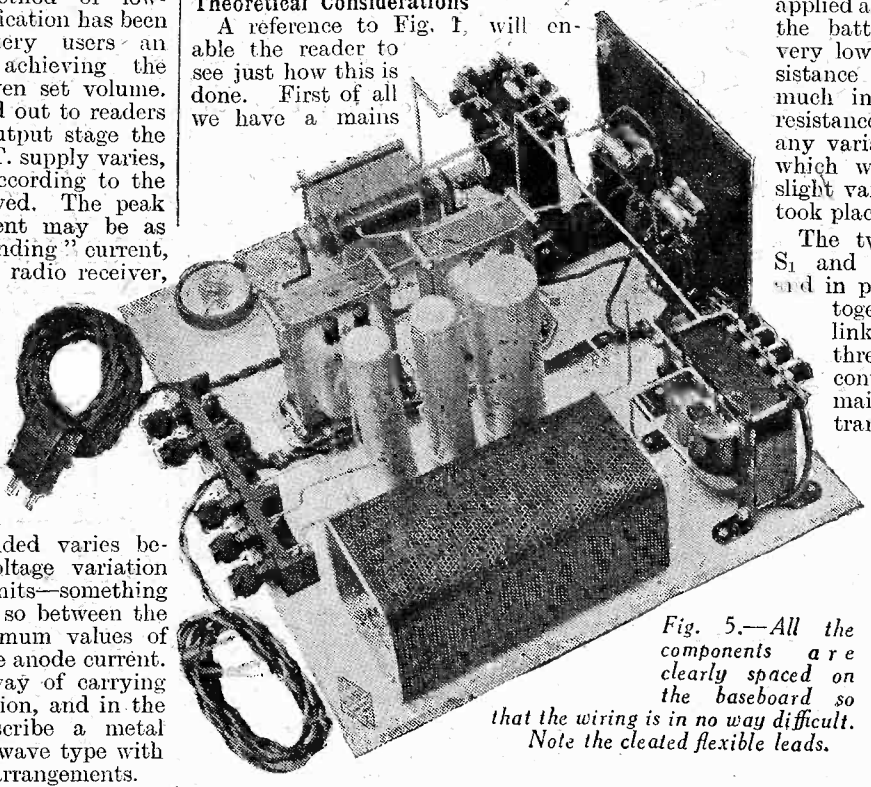


Fig. 5.—All the components are clearly spaced on the baseboard so that the wiring is in no way difficult. Note the cleated flexible leads.

Visible Indication

The second mains transformer T_2 with the tapped secondary connects to low-tension dry rectifier L.R. The resistance R in the D.C. output side of the rectifier is essential for it enables a control of the charging current to be made. When charging a battery, the current flowing depends upon the battery resistance and the difference between the applied and battery voltages. Since the battery resistance is always very low, the addition of the resistance R, which has a value much in excess of the battery resistance, will almost eliminate any variations in charging current which would otherwise arise if slight variations in applied voltage took place.

The two change-over switches, S_1 and S_2, are shown together, and in practice they are operated together. With the circuit linked up as shown, and the three switch arms making contact on the left, the A.C. mains are switched to the transformer T_2 and the accumulator is placed on charge. The small lamp across the rectifier output will glow, and gives a visible red indication that charging is taking place.

With the three switch contacts over to the right, the transformer T_1 is brought into circuit and T_2 cut out. The high-tension supply is therefore made available while the accumulator is switched over to the L.T. terminals which are joined to the set, and so feeds the valve filaments. There is another lamp across this pair of terminals which gives a white glow to show that the unit is alive.

(Continued on next page)

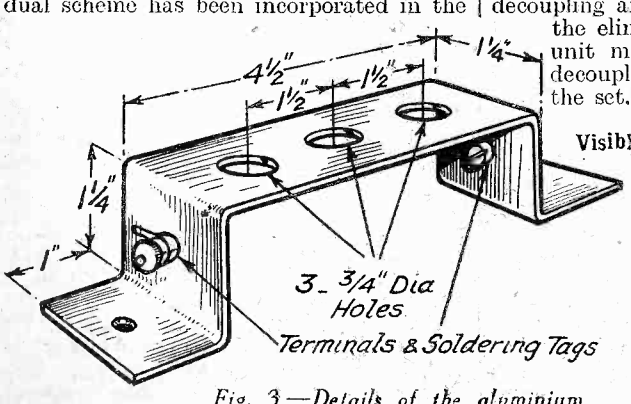


Fig. 3.—Details of the aluminium support for the three electrolytic condensers.

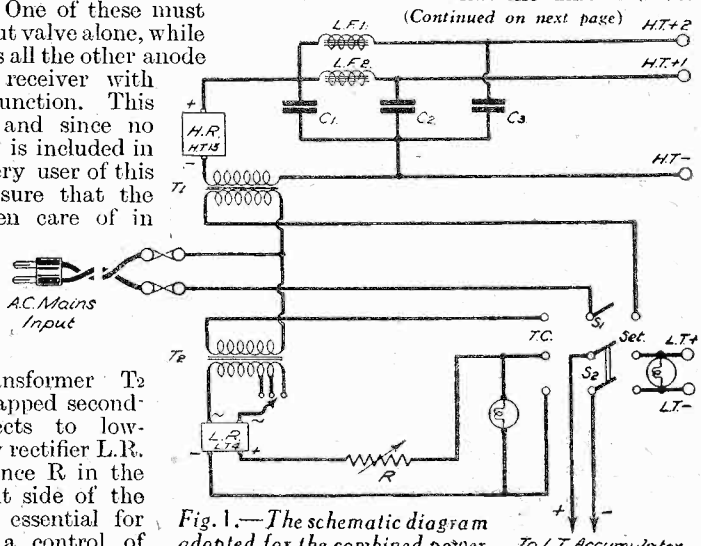


Fig. 1.—The schematic diagram adopted for the combined power unit and trickle charger.

BUILDING A CLASS "B" POWER UNIT

(Continued from previous page)

Construction

A complete list of solus specified components is given below, and as they are all standard products are readily obtainable. First of all, cut a recess 6in. long and 3 16in. deep in the centre of one of the long edges of the baseboard. This is to accommodate the panel so that its front face is flush with the baseboard edge, and in this way will fit better into the cabinet.

Now drill the panel according to the dimensions given in Fig. 2, and attach the two switches and two signal lamp fittings as shown. Be sure to intimate to the makers that one of these fittings must have a white lens (this is the one on the left facing the panel front) and in addition both switches must be supplied with panel indicating plates marked TC/Set (see illustration on page 696). When this is completed and the brackets added, lay the panel on one side for a time and make up an aluminium bracket to act as a fixture for the three dry electrolytic condensers.

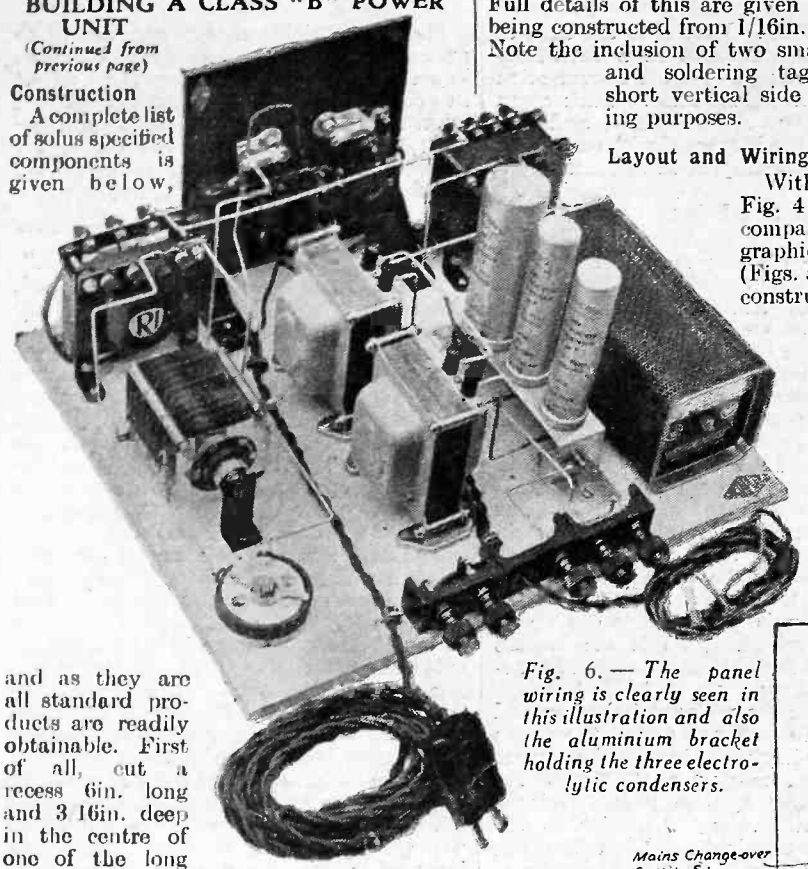


Fig. 6. — The panel wiring is clearly seen in this illustration and also the aluminium bracket holding the three electrolytic condensers.

Full details of this are given in Fig. 3, it being constructed from 1/16in. thick metal. Note the inclusion of two small terminals and soldering tags on each short vertical side for connecting purposes.

Layout and Wiring

With the aid of Fig. 4 and the accompanying photographic illustrations (Figs. 5 and 6), the constructor can now assemble all his components in their correct positions on the baseboard. This is quite a simple matter as there are not many components. See that the electrolytic condensers are rigidly screwed to the aluminium mount and each component firmly screwed to the Metaplex baseboard.

Now proceed to carry out as much of the baseboard wiring as is possible, using Glazite connecting wire and making neat right-angled bends with sound electrical joints. Figs. 4, 5 and 6 will help you here, and each wire should be checked carefully. Be sure and connect the L.T.4 rectifier round the right way, the four terminal tags being stamped with their indicating mark.

Attention can now be given to the switch and lamp connections on the panel before it is attached to the baseboard. These leads are shown very clearly in the wiring diagram of Fig. 4. By using the "Pull back" wire the linking up of the switches and lamp-holders becomes a very simple process. Remember that with both the switches up the unit is in the trickle charge (TC) condition, and with both switches down (Set) power is given to the set.

The pair of red and black flexible leads passing to spade tags for joining to the accumulator should be connected while the

(Continued on next page)

Components Required for the Class "B" Power Unit.

- 3 *High voltage dry electrolytic condensers: 2—4 mfd. (C2 and C3), and 1—8 mfd. (C1). (Dubilier.)*
- 2 *Mains transformers for L.T.4 and H.T.13 rectifiers (T1 and T2). (Radio Instruments.)*
- 2 *Metal Rectifiers—H.T.13 (H.R.) and L.T.4 (L.R.). (Westinghouse.)*
- 2 *Constant inductance chokes, type H.T.12 (L.F.1 and L.F.2). (Wearite.)*
- 2 *Change-over toggle switches—single-pole type S81 (S1) and double-pole type S89 (S2). (Bulgin.)*
- 5 *Type B terminals: H.T.+2, H.T.+1, H.T.—, L.T.+ and L.T.—. (Belling and Lee.)*
- 3 *Terminal blocks. (Belling and Lee).*
- 2 *Spade tags L.T.+ and L.T.—. (Belling and Lee.)*
- 2 *Miniature signal lamp fittings, type D.19, with two-volt low-consumption bulbs. (Bulgin.)*
- 1 *0/6 ohm baseboard variable resistance (R). (Igranic.)*
- 1 *Fuseplug, type P.25. (Bulgin.)*
- 1 *Metaplex baseboard 14" × 12" × 3/16". (Peto-Scott.)*
- 1 *Ebonite panel 6" × 7" × 3/16". (Peto-Scott.)*
- 1 *Oak table cabinet with oval vignetted front. (Peto-Scott.)*
- 1 *pair panel brackets. (Peto-Scott.)*

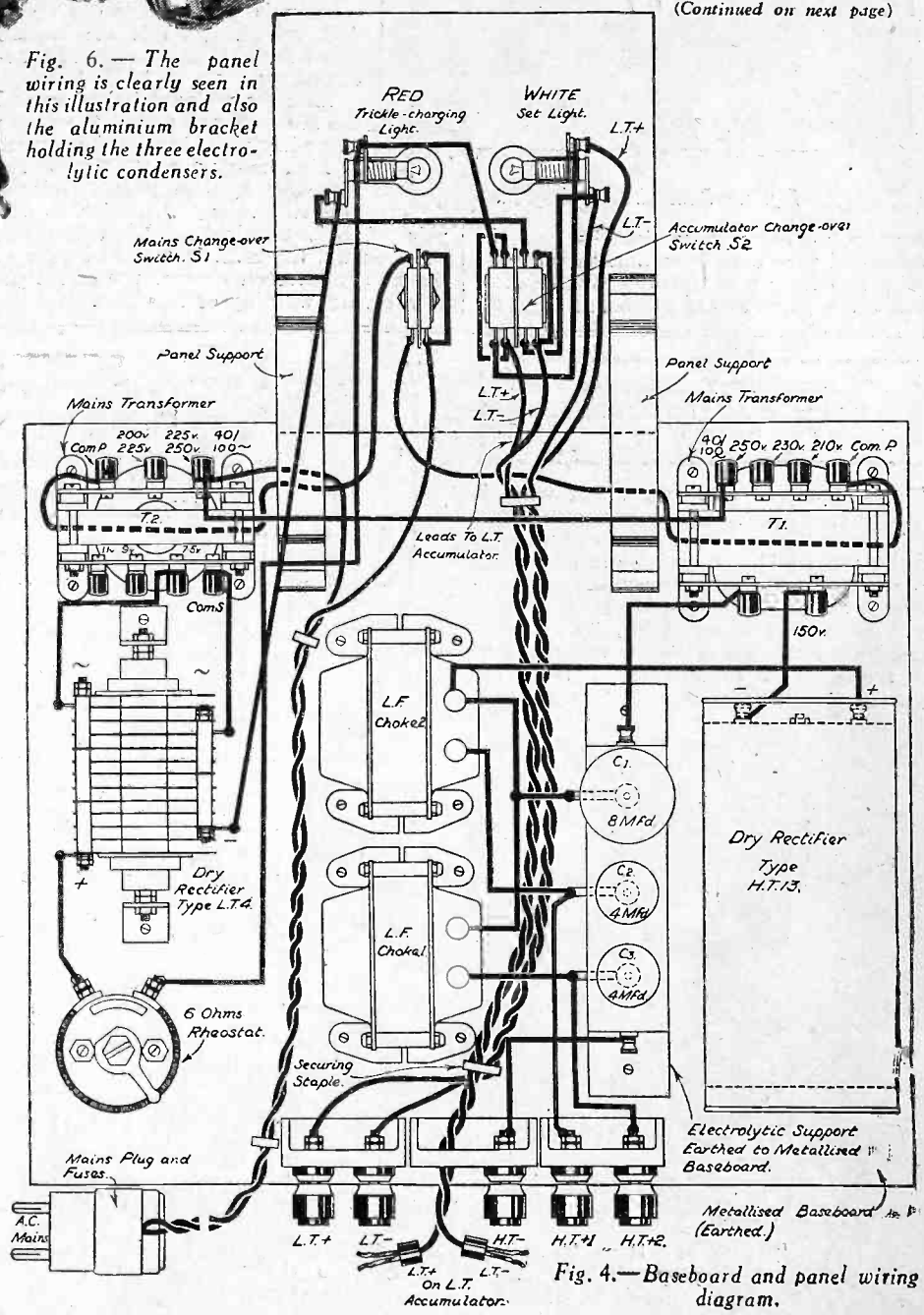


Fig. 4.—Baseboard and panel wiring diagram.

BUILDING A CLASS "B" POWER UNIT

(Continued from previous page)

panel is "free," and also the flex leads to the L.T.+ and L.T.— terminals, together with the mains lead and links between the switch S_1 and the pair of mains transformers. These wire lengths can be measured very readily so that they can be joined to their respective terminals. Now screw the panel to the baseboard edge, fix the brackets and complete the small amount of wiring. Note that the ends of the mains lead terminate in a twin fuse-plug, this affording a measure of protection should a short circuit arise. Tuck away neatly any spare flexible leads, and also cleat them to the baseboard with one or two insulated staples, as indicated.

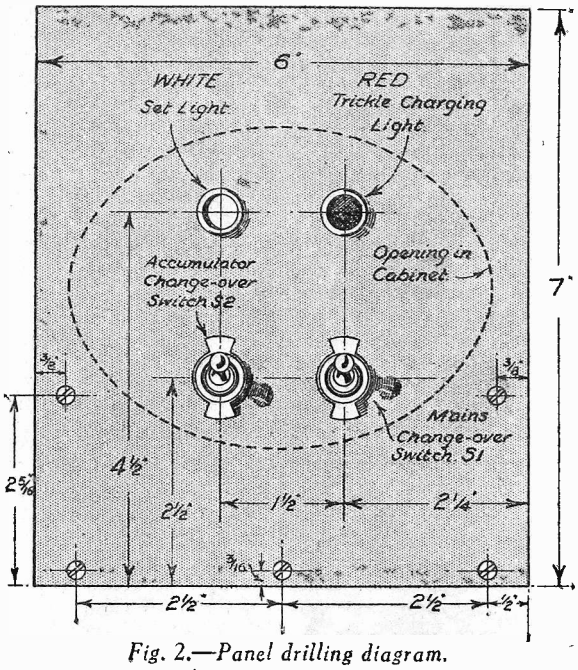


Fig. 2.—Panel drilling diagram.

Testing and Using

The unit is now ready for testing before housing it in its cabinet. Join the mains plug to a convenient electric socket, and the pair of spade tags to the two-volt accumulator. Before switching on the mains, adjust the baseboard resistance R so that the total resistance is 1.75 ohms. This is very easily done by estimating the position of the movable arm, bearing in mind that the total resistance is 6 ohms. Just under a third of the total resistance strip gives the value required, and in addition make quite sure that the mains transformer feeding the L.T.4 rectifier is joined to the 7.5 volt A.C. output. This is the correct value for charging a two-volt accumulator.

With the mains switched on and the *two* switches down, the white lens will glow to indicate that there is high tension available at the three appropriate unit terminals, and two volts low tension at the pair of L.T. terminals. With the two switches up, the H.T. is switched off and the accumulator on charge, the red light now giving warning of this fact.

Rated Output

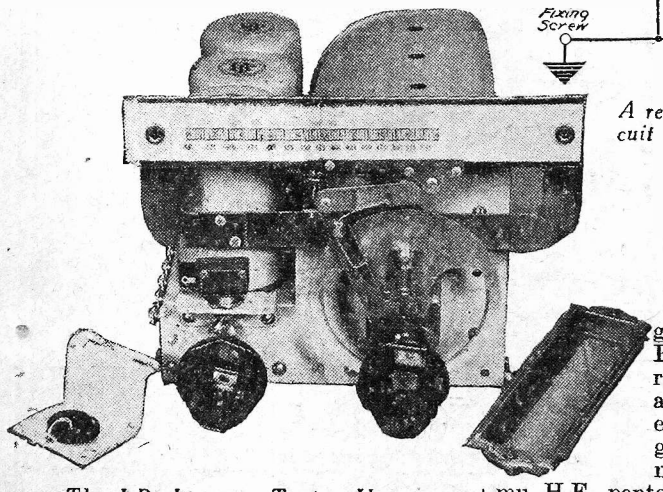
Since the trickle charge current is one ampere it is a very easy matter to calculate how long the accumulator must be charged in order to replace the energy extracted when the set is in use. For example, if the total filament current of the set is 0.8 ampere (this can be readily totalled from the data on the individual valve cartons) then the time of charging is just $\frac{0.8}{1.0}$, that is, four-fifths of the set's "working time."

As far as the high tension is concerned, the rated output *after* smoothing is 25 milliamps at 150 volts, while the maximum current is 40 milliamps. This is ample for any normal Class "B" receiver, a fact which I have proved very conclusively under rigid test conditions. Furthermore, there is not the slightest trace of mains hum, this being due to the very generous design of the smoothing equipment, while the presence of the 8 mfd. condenser C_1 materially improves the voltage regulation.

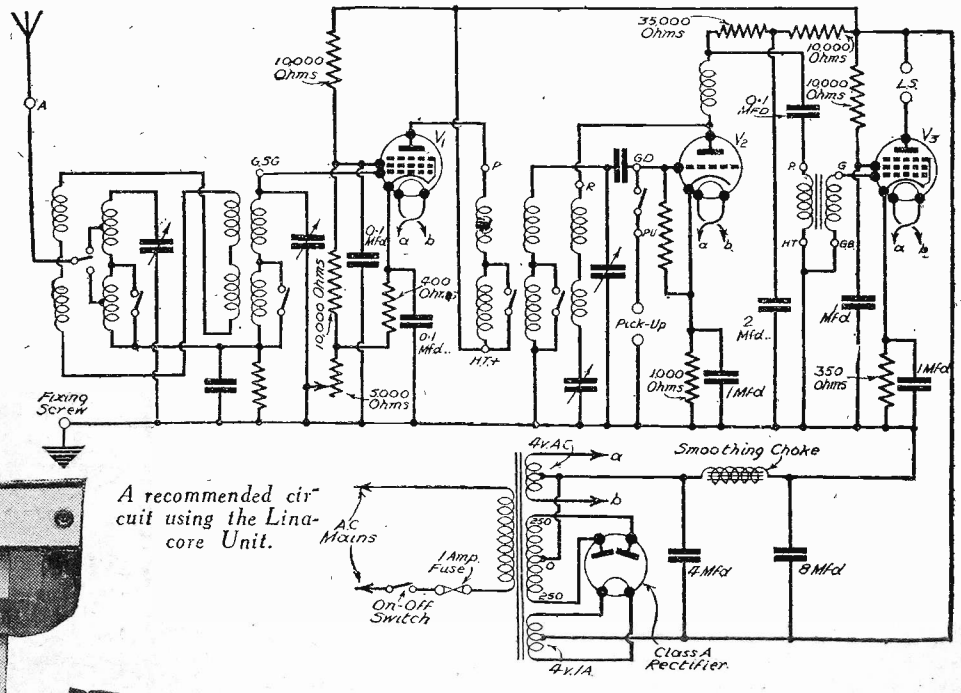
The unit can now be housed in its own cabinet, which has a particularly neat and unobtrusive appearance, as will be seen on page 696. In use, just connect the H.T. and L.T. leads from the radio set to the unit and switch on as previously instructed. The warning lights will remind you that the unit has to be switched off from the mains when not in use for power or charging, and, in addition, disconnect one of the spade tags from the accumulator when no charging is being done and the mains are switched off, otherwise one or other of the lights will glow. This is because I have not included a switch in the pair of L.T. accumulator leads, an unnecessary complication.

AN EFFICIENT THREE-VALVE VARIABLE-MU BAND-PASS RECEIVER

THE use of complete tuning units is becoming increasingly popular with amateurs, due to the fact that such units can be bought which are accurately ganged over the complete range of wavelengths. An excellent example of the type of unit referred to is the J.B. "Linacore," a brief description of which was given in a recent issue of PRACTICAL WIRELESS on the "Facts and Figures" page.



The J.B. Linacore Tuning Unit.



A recommended circuit using the Linacore Unit.

The J.B. "Linacore" is made in two patterns, for battery-operated or mains receivers, and both provide the same general circuit arrangement. For the benefit of numerous readers who have asked for a circuit to incorporate this excellent unit, a particularly good three-valve arrangement, comprising a variable-mu H.F. pentode amplifier, detector, and power pentode is illustrated on this page. All the necessary components which are external to the unit are marked with appropriate values, but those parts which are included in the unit itself are unmarked, so that they may easily be recognized. Additionally, the terminals on the "Linacore" are shown as circles and are marked with the same letters as those used by the makers. The component values are approximate ones suitable for use with most makes of valves of the types shown, but they might need to be modified slightly in some cases to comply with the figures recommended by the makers of the particular valves employed.

THE EFFECT OF THE POWER GRID SCHEME

By J. BURNS

A PROBLEM that every amateur will come up against when house-lighting mains become available to him, is how to avail himself of the great benefit they bestow on him. Probably he has a battery-driven set that is giving every satisfaction and perhaps, after debating the problem, he may come to the conclusion that, after all, the cheapest and easiest thing for him to do would be to invest in one of the well-known makes of H.T. eliminator and battery charger that are on the market.

Bearing in mind that he has had no previous opportunity of experimenting with that frightful bogey, "mains," this view is usually taken, because of the great uncertainty of not knowing what will happen, or what to expect. But let me warn the more experienced wireless amateur that this outfit will only suit him for a limited time; soon he will see what a marvellous difference in reception and quality of reproduction he has attained, so that the small output of the eliminator he has purchased will have to be augmented,

Working on D.C. Mains

For the man who suddenly finds D.C. mains available to him, nothing would seem easier than to merely smooth the voltage with an L.F. choke and a condenser of a few mfds., and drop the excess voltage across a resistance. This would serve the double purpose of decoupling the plate circuits; the filaments in this case are the biggest problem. Of course, it is possible to still run the existing valves from the accumulator, and charge about once a week through a resistance lamp, but this is not economical, and we still have the old trouble of attending to the accumulators; so probably under these circumstances the most practical way out of the difficulty would be to invest in a complete set of indirectly heated D.C. valves, and wire the valve-holders in series.

Adapting a Receiver to A.C. Mains

The position of A.C. mains is altogether different, and most of our supply mains are now A.C. Those that are D.C. are being changed to A.C. as soon as the various companies find it convenient to do so. At first the amateur is inclined to bemoan his fate if his mains are A.C., as he realizes that for H.T. he will have to have the same smoothing equipment as his D.C. friends, with the addition of a mains transformer and an H.T. rectifier, which is the most expensive part of the H.T. eliminator. Added to this trouble it appears to him that his filaments are going to be a big problem, and the cost of the two alternative ways of dealing with this are to be carefully considered. Either he will have to charge the present accumulator through a trickle charger, over the period the set is not working, or, alternatively, scrap the accumulator and battery valves, and replace with A.C. valves. The first alternative is the way intended to be adopted by the manufacturers of the combined H.T. and trickle charge L.T. eliminators, and at first sight this seems to be the cheapest and easiest

(*Continued in third column*)

(*Continued from first column*)

way of dealing with the matter, as, added to the cost of the H.T. portion of the outfit, it is only necessary to provide an additional winding on the transformer, a low-voltage metal rectifier, and a cheap resistance of some sort. Then it is possible to retain the complete set in its present form. However, this has its drawbacks, as it seems a half-hearted attempt at a complete mains set, and when the accumulator packs up, as it certainly will, its life being perhaps three to five years at the most, we need to buy another one, and, therefore, we are still not clear of the accumulator trouble. The second alternative certainly means buying new A.C. mains valves (at least, all except the last, or power, valve), and in the case of a superhet. this is no small matter.

If the set is to be worked near a high-power broadcasting station, a detector and output valves will be the only two valves necessary to give very good results from this station, and if the detector battery valve is replaced for one of the A.C mains detector valves, both the receiving valves can then be run from 4 volts A.C. obtained from a separate winding on the mains transformer that is being used for the H.T. supply. If the power valve happens to be a two-volt valve, either a resistance could be used to break down the four volts to two, or the centre tap on the four volts winding and one of the other two outer terminals could be used.

The last valve is the only valve in the set that will work equally well from either a D.C. supply from an accumulator or A.C. stepped down from the mains in this way.

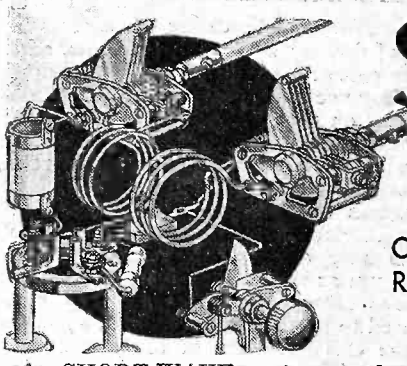
Grid Bias Supply

Having decided which method we shall use for H.T. and L.T. working, the grid bias is the only other supply to be considered, and this is most easily arranged by the aid of a resistance in the H.T. negative lead between the set and eliminator. The eliminator end of this resistance then becomes grid bias negative, and the receiving set end grid bias positive. The value of this resistance depends on the power valve used, and is usually in the neighbourhood of between 600 and 1,100 ohms; the exact figure is arrived at by dividing the voltage required for bias by the number of milliamps passing through the power valve. Expressed as a fraction of an amp. (i.e., 1 milliamp = $\frac{1}{1,000}$ amp.) the resulting figure is the number of ohms resistance required.

A.C. RECTIFIERS & RECTIFICATION

(*Continued from page 688*)

(for example, when using an H.T.9 metal rectifier) that the mains voltage is exactly the same as that required. In such a case the transformer might appear superfluous, but it should still be employed as a safety measure; if it were omitted there would be far more danger of receiving a nasty shock when handling the receiver, due to certain parts being "alive." In any high-tension eliminator operating from A.C. mains it is most desirable that a suitable transformer should be inserted between the mains supply and the rectifier. This is not by any means so necessary, though, in the case of a battery charger or in a unit employed for energizing a moving-coil speaker, and may be dispensed with provided that the apparatus is thoroughly insulated from "earth."



Short Wave Section

Choosing Condensers for the Short-Wave Receiver.

By MANDER BARNETT

A SHORT-WAVE receiver can be made or marred by the condensers used, and from the home-constructor's or experimenter's point of view, the amount of consideration given to the choice of the correct types will be well repaid.

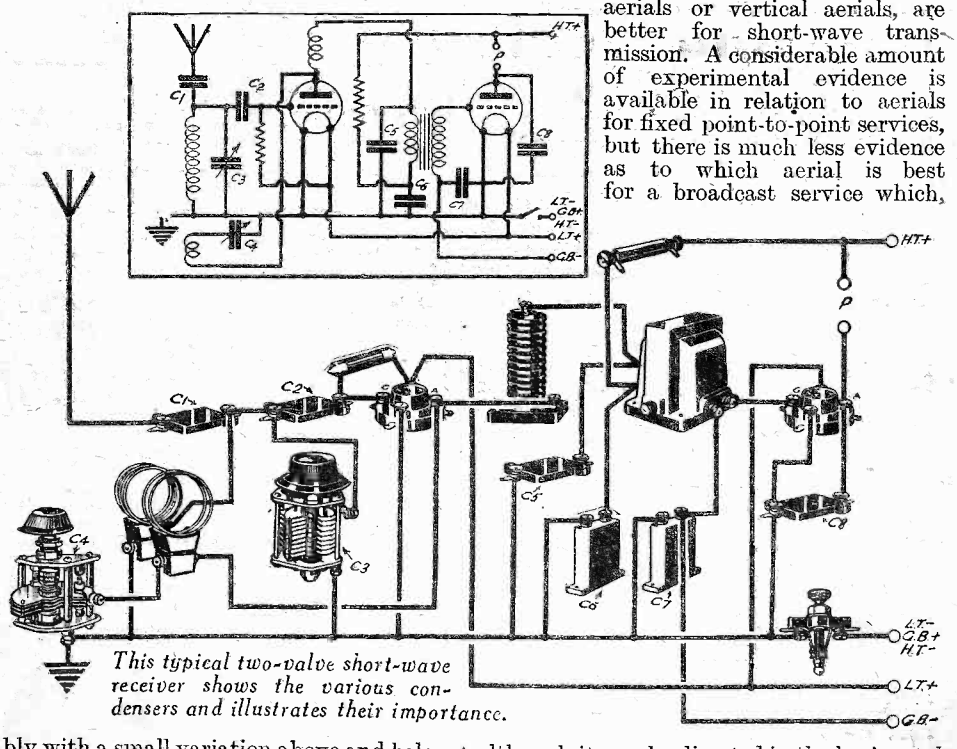
The only condensers in a short-wave receiver which require to be actually different structurally from those in a medium-wave receiver are, of course, the tuning condensers and, in some cases, the aerial coupling condenser. Short-wave tuning condensers have caused any amount of trouble in the past—some low-capacity tuning condensers are quite suitable for short-wave tuning and others, although their capacity may be correct, are definitely *not* suitable. It is impossible to lay down any hard and fast rule as to what constitutes the best type of short-wave tuning condenser, but the reader may rest assured that the present-day manufacturer who turns out a small-capacity condenser, and designates it as a short-wave model, is producing a satisfactory article. The usual capacity in use to-day is .00025 mfds. for normal short-wave work, although smaller capacities are sometimes used, down to .00005 mfds. for ultra-short-wave work, and even less. The error which must not be made, however, is in assuming that any variable condenser of a rated capacity of .00025 mfds. is suitable for short-wave tuning purposes, because some condensers, whilst they are perfectly satisfactory for service as reaction condensers, etc., in medium-wave receivers, will not work satisfactorily in a short-wave receiver, this being immediately obvious with some types by the production of loud scratching sounds as the spindle is turned. For actual tuning purposes below 50 metres, therefore, it is essential to use a condenser designed especially for this particular job. Some condensers of this type use a pigtail connection for making a satisfactory connection to the moving spindle, whilst others do not. Suffice it to say that, for really satisfactory operation, if a pigtail is used, it must consist of *insulated* wire, otherwise noise is liable to be set up on the shortest wavelengths, due to two or more turns of the pigtail coming into contact with each other.

The normal capacity of .00025 mfds. is usually prescribed for use with the present-day dual-range type of short-wave coils, and this capacity is usually necessary to cover the full range without any gaps, whereas if we use plug-in coil units, we may use a smaller condenser with a capacity of about .0001 mfds. resulting in a greater efficiency and also greater ease of tuning, although on the debit side we have to use more coils to cover the same bands, and this means just so much more hard labour.

Reaction Condenser Requirements

The reaction condenser requirements do not, of course, require to be so exacting, and almost any normal type of reaction condenser with a capacity somewhere between .00015 and .0003 mfds., either of the air or solid dielectric type, will be found satisfactory, although it is undoubtedly an advantage to have some type of vernier control, as the reaction control in most types of short-wave receivers has a considerable effect on the actual tuning. This, however, can be regarded as a luxury and the average short-wave receiver does not usually incorporate a vernier reaction control.

The accompanying diagram is of an average two-valve short-wave receiver, and illustrates the points where attention has to be given to the various types of condensers used therein. Condensers for the positions occupied by C_3 and C_4 have already been dicussed. For C_1, a capacity of about .00005 mfds. is required, preferably with a small variation above and below this capacity. Condensers C_5, C_7, and C_8 are merely for high-frequency by-passing purposes, and need not exceed a capacity of about .0005 mfds. C_5 and C_8 in particular help to stabilize the receiver and should be regarded as necessities, although they are, no doubt, often omitted. The detector grid condenser, C_2 in this case, may consist of the normal capacity of .0003 mfds., although a lower capacity is sometimes prescribed for short-wave work. However, in actual practice, .0003 mfds. is a good average size, and will provide really satisfactory operation of the detector circuit. High-frequency by-passing condensers of .0005 mfds. capacity can very well be placed at the position shown in the succeeding stage or stages on the low-frequency side in larger receivers.



This typical two-valve short-wave receiver shows the various condensers and illustrates their importance.

Tuning the H.F. Stage

In receivers employing tuned H.F. stages, we are faced with the problem of another tuning control, but there is really no reason why the condensers should not be ganged in the same manner as in the medium-wave receiver. The tuning of the high-frequency stage will, in most cases, be comparatively flat on the short waves, compared with the detector stage, and thus we can allow a certain amount of tolerance with little or no loss in signal strength. Inter-stage screening will have to be very complete, but a trimming condenser will probably be found unnecessary. It will, however, be found advantageous here to use dual-range coils for each stage, rather than plug-in coils, as, if the latter were used, *two* coils would have to be changed for each wave-range.

Short-Wave Transmissions from Daventry

It is mentioned in the B.B.C. Year Book, 1934, that a good deal of useful knowledge is still to be gained in the field of short-wave transmission and reception, and that one aspect of this is already being explored. A series of experimental short-wave transmitting aerials has been erected at Daventry, and these are used for regular and experimental transmissions. There has long been a controversy as to whether high aerials or low aerials, horizontal aerials or vertical aerials, are better for short-wave transmission. A considerable amount of experimental evidence is available in relation to aerials for fixed point-to-point services, but there is much less evidence as to which aerial is best for a broadcast service which, although it can be directed in the horizontal plane, still has to be receivable over large areas of country which lie at widely different distances from the transmitter. As to receiving aerials, it is well-known that considerable advantage can be obtained by the use of directional arrays, but these are costly. Work has, however, been undertaken on the design of small aerials which the ordinary listener could erect, and preliminary experiments suggest that they could be used with advantage.

By
PERCY RAY

CLASS "B" & the STRAIGHT THREE

A Practical Article Dealing With Essential Points, with Special Reference to the Pentode

ALL the general aspects of Class B Amplification have been fully dealt with by PRACTICAL WIRELESS, but there are a number of points that arise when the fitting of Class B to a Det. and 2L.F. set is contemplated, and before going into the question farther a proper understanding of the driver is essential.

The function of the driver valve is to supply the necessary voltage input required by the Class B valve, and in addition, it must be capable of delivering up a certain amount of A.C. current without distress. When the Class B valve is required to deliver 2 watts the driver valve will be called upon to deliver 65 to 75 milliwatts, and when the Class B valve is only required to deliver 1 watt the driver valve will only require to give an output of about 35 to 40 milliwatts. It is therefore evident that any valve capable of delivering these small outputs may be used as a driver valve provided that a suitable ratio of output transformer is available.

The reason for this will readily be understood when it is realized that a certain voltage must be developed across the secondary to drive the Class B valve, and with an unsuitable transformer the voltage available might be too small even though the output in milliwatts is adequate.

The grid-filament path of the output valve is in shunt with the secondary, therefore the total impedance of the secondary circuit must always be less than the grid-filament impedance, and this figure is often too low to act as the load for the driver valve.

It will be necessary to diverge from the subject slightly in order to draw attention to the fact that any resistance connected across one side of a transformer will be virtually across the other winding in proportion to the ratio. To take a concrete example: suppose that the grid-filament impedance of the Class B valve at working peak is 5,000 ohms, this 5,000 ohms will be in parallel with the secondary, and if the ratio of the transformer is 1:1, the anode load will be practically the same as the impedance of the secondary.

Transformer Ratios

When a valve such as the 210 L.F. is used an anode load of 5,000 ohms would be inadequate, although the output from this valve would be ample to act as a driver for a Class B output valve adjusted for a maximum of 1 watt. This valve has an impedance of 10,000 ohms, and an anode load of about 20,000 ohms would be suitable; thus it will be necessary to use a transformer having a step-down ratio of 2:1, or of 4:1 overall. This should not be confused with an ordinary 2:1 transformer, which has a step-up ratio, *i.e.*, voltage across the secondary is greater than the voltage across the primary.

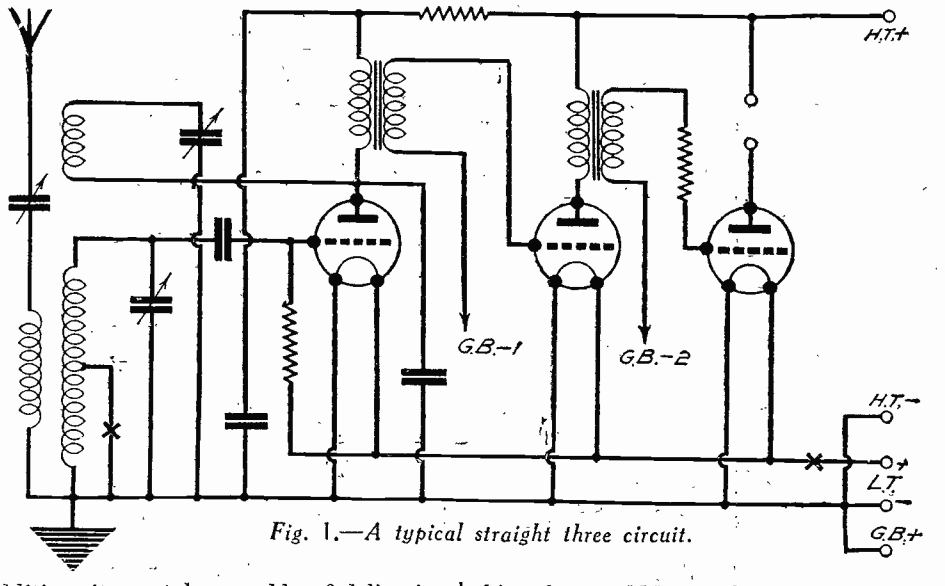


Fig. 1.—A typical straight three circuit.

The above remarks show that any valve capable of an output of 70 milliwatts (if two watts are required) or 35 milliwatts (if one watt is required), could be used, providing that a *suitable* transformer is available. This raises the possibility of using a pentode valve as a driver, which, in turn, makes possible the use of a Class B output of a receiver of the popular detector and 2L.F. type.

Fig. 1 shows a circuit diagram of a typical detector and 2L.F., which, like all other receivers of its class, will have a very small output, and for this reason will not lend itself for use as a radiogram. Conversion of this receiver to Class B would raise the output available 10 to 15 times, providing that the Class B output valve could be given sufficient signal voltage to drive it.

The apparent method of converting this receiver would be to keep the detector as it is, use the middle valve as the driver, and replace the output valve by a 240 B. This is one of the biggest pitfalls into which the constructor can fall, as the result would be most disappointing unless used as a local receiver only relatively near to a station.

Driver and Class B Valve as a Single Stage

The driver valve and the Class B valve must be considered as one stage, because the driver valve will give little or no gain as the grid current drawn by the Class B valve is wasted energy, with the result that the stage gain of the driver and Class B valve will only exceed that of an ordinary output valve by sufficient amplification to provide the increase in volume that the output valve is capable of.

Referring again to Fig. 1, it will be seen that if we make the L.F. valve do the duty

(*Continued on page 709*)

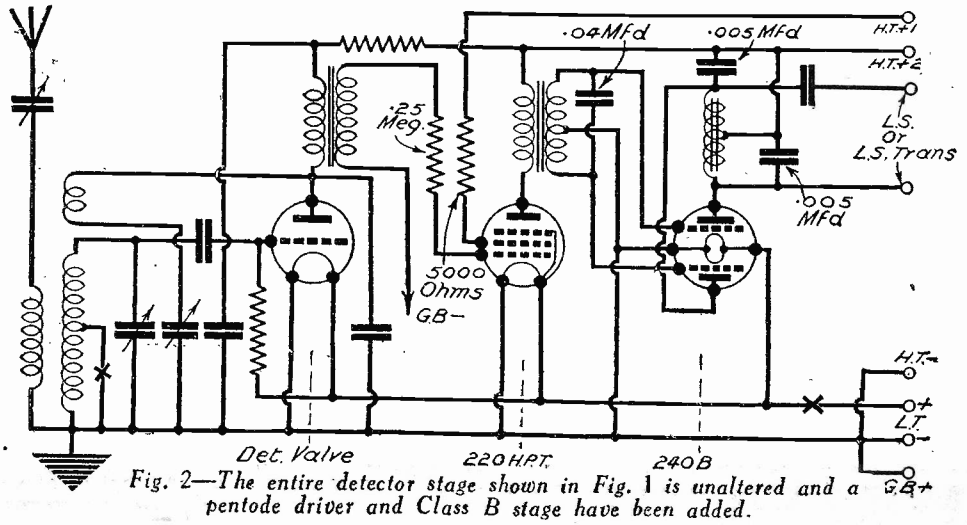


Fig. 2—The entire detector stage shown in Fig. 1 is unaltered and a pentode driver and Class B stage have been added.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

An Instructive Article in Which the Author Gives a Lucid Explanation of the Word "Potential" as Applied to Radio, and also Demonstrates the Use of Potentiometers and Potential Dividers in Wireless Circuits

"POTENTIAL" is a word which crops up very frequently in connection with radio. We talk of "potential difference," high potential, low potential, etc.

Although we use these terms quite freely there is no doubt that in the minds of many readers their meaning is not at all clear. This is probably due in a large measure to the somewhat abstract nature of the word *potential* itself. The dictionary tells us it means "Existing in possibility, not in act, latent. Expressing power, possibility or obligation; anything that may be possible," etc. Incidentally, it is used both as an adjective and as a noun.

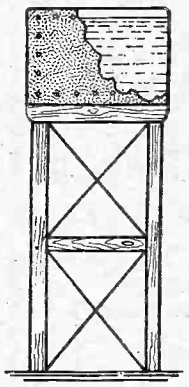


Fig. 1.—Difference of potential illustrated by the height of a tank of water.

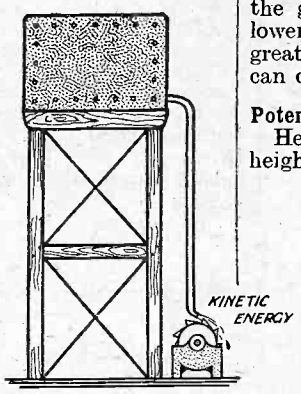


Fig. 2.—How work may be done by virtue of the difference of potential.

Perhaps an example of the use of the word outside the realm of radio will help to make its meaning clear. Suppose, for instance, there is a tank of water suspended at a height above the ground as in Fig. 1. The water is not moving and does no work. However, owing to the force of gravity it only needs a pipe from the tank down to the ground level to enable it to perform useful work, such as driving a pump or water wheel. The energy is there, although it is not actually being used. It is called *latent* or *potential* energy. Of course, as soon as the water is allowed to flow down a pipe, as in Fig. 2, the stored-up energy is released—it does work—it is no longer potential but *kinetic*.

This is an example of the use of the word in its adjectival sense. Using it as a noun we say that the water in the tank is at a certain potential above that of the ground. The potential at the ground level is zero, but the potential of the water is high; the actual value being represented by the number of feet it is above ground level. If the height be increased the potential will become still higher, for, naturally, the farther the water has to fall the greater will be the pressure at the lower end of the pipe, and, therefore, the greater will be the amount of work it can do.

Potential Difference

Here we see potential is represented by height or level. Of course, potential is purely relative. For instance, there may be a tank or reservoir of water situated, say, 100 ft. above ground level, which empties into another tank 40ft. above the ground. The energy being expended here is not proportional to the height the first tank is above the ground but to the height of the first tank above the second tank, that is, by the difference between the heights of the two tanks.

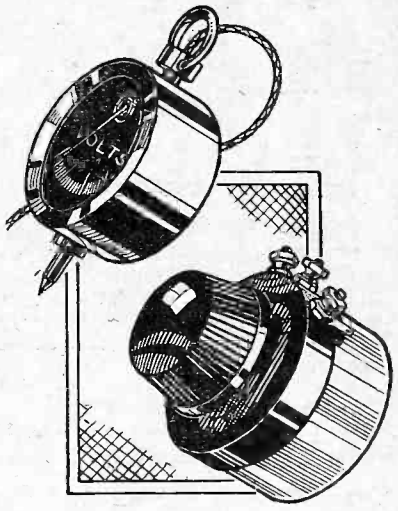


Fig. 3.—A voltmeter is a true potentiometer. The volume control on the right is, strictly speaking, a "potential divider."

It is the *difference of height or potential* which is the important thing.

The same thing applies to other forms of potential, such as heat potential and electrical potential. Heat potential is represented by *temperature*. A high temperature in itself does not necessarily signify a large amount of available energy. If everything is at the same temperature, whether it be high or low, no energy will be available. For example, a hot-air balloon will not rise if the outside air is equally as hot as that within it. It is when there is a *difference* in temperature between the air inside and that outside that it rises. Similarly with electricity. Electrical potential is measured in volts, but it is the *difference of potential* or voltage between two points in a conductor which causes a current to flow and energy to be expended. For instance, a battery or dynamo produces a current when its two terminals are joined with a wire, because these two terminals are at a different electrical potential. The current flows from one to the other like water flowing down a hill. On the other hand, without a difference of potential no current can flow. Potential alone is not sufficient, for two bodies may each be heavily charged with electricity to a very high potential, but if the potential is the *same* in each case then no current will flow between them on joining them with a wire. Just in the same way that no water would flow between two lakes high in the mountains and connected by a pipe, if each lake were the same height above sea level.

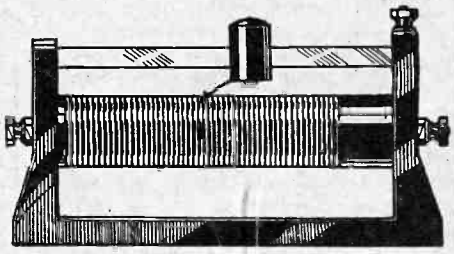


Fig. 4.—A variable potentiometer of the slider type.

Electricity is only useful when it moves. When it is static, as in a charged condenser, no work is done. The potential difference existing between the plates may be very high, yet until they are joined by a wire or other conductor no current can flow. Of course, if the P.D. is excessive then the insulation between the plates will break down and a spark will jump between them. The energy stored in the plates will be then manifested by the heat, noise, and light of the spark.

Potentiometers and Potential Dividers

Difference of potential is measured by means of a voltmeter or *potentiometer*.

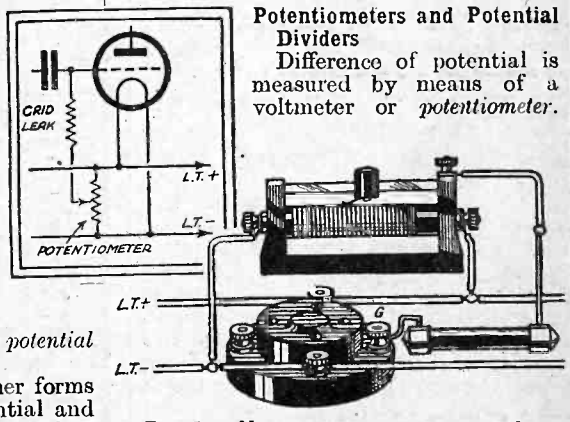


Fig. 5.—How a potentiometer may be connected to the detector valve to overcome "ploppy" reaction.

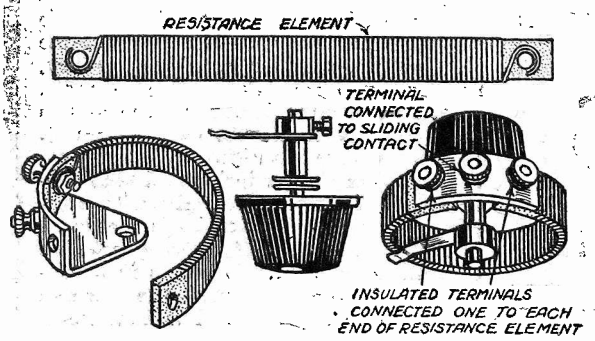


Fig. 6.—Details of the construction of a simple potentiometer of the circular type.

Every radio fan knows what a voltmeter is, but the term "potentiometer" has been so abused that its real meaning has been lost sight of. A potentiometer is obviously a *measurer of potential*. The ordinary tapped resistances and volume controls, etc., are not potentiometers but *potential dividers*. They are not instruments for measuring, but simply devices for providing intermediate potentials between two points.

A true potentiometer may take the form of a voltmeter, or a Wheatstone bridge, or similar apparatus. Only the voltmeter will concern the average constructor. However, the so-called potentiometers, that is, the potential dividers just mentioned, figure largely in the make-up of modern receivers. Let us have a look at a few. Fig. 4 shows a simple form of variable potentiometer. It consists of a tube of some insulating material wound with bare resistance wire spaced between each turn, to each end of the resistance wire is connected a terminal, while a third terminal makes contact with a slider which moves up and

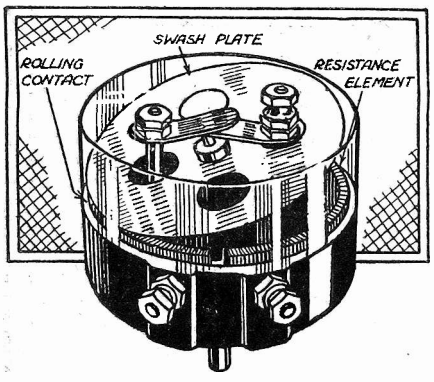


Fig. 7.—The ingenious swash plate device of the Lewcos potentiometer provides a rolling instead of a sliding contact.

down the whole length of the coil. The instrument is used by connecting the two end terminals to the two points in the circuit between which it is desired to obtain an intermediate potential. The part of the circuit or the component which is to be connected to this intermediate point is then joined to the slider terminal. By moving the slider from end to end of the resistance element any voltage between that of the two extreme ends can be obtained. Let us take an elementary example of the use of such a potentiometer.

Adjustment of Grid Bias with a Potentiometer

In a battery set with leaky-grid detection the "lower" end of the grid leak is usually connected to L.T.+, that is to say, it is connected to a point which is 2 volts positive in respect to "earth" (assuming the negative side of the usual 2-volt L.T. battery is earthed). Now, it is often found that this connection, although it gives the most sensitive working of the detector valve, yet is inclined to give fierce or "ploppy" reaction. On the other hand, connecting the grid leak to L.T.—, that is to say, to zero potential, will give smooth reaction, but at the same time will reduce the sensitivity of the valve considerably. Clearly the ideal potential for the grid is some point between zero and 2 volts positive (usually at about 1 volt positive). To obtain this intermediate position a potentiometer is connected across the low-tension leads to the valves, and the grid leak is connected to the slider of the potentiometer, as in Fig. 5.

By connecting the potentiometer across the L.T. leads in this way there is a difference of potential of 2 volts between the two end terminals, in other words, one end of the potentiometer must be at the same potential as L.T.+ while the other end is at the same potential as L.T.—. The potential of the resistance wire must therefore drop from 2 volts positive to zero throughout its length. The slider traversing this wire is able to select any intermediate potential between these two points so that by connecting the grid leak return to the slider we can give the grid any bias between 0 and 2 volts positive by adjusting the position of the slider.

Incidentally, a potentiometer connected in this way must be of fairly high resistance, since it is connected directly across the L.T. terminals and therefore takes current from the accumulator. The higher its resistance the less will be the current consumed.

Different Types of Potentiometers

A more familiar form for the variable potentiometer is the circular type. Details of the construction of a simple instrument of this form are given in Fig. 6. The resistance wire in this case is wound round a flat fibre strip. This strip is bent into circular form and fitted with terminals connected to each end of the wire. It is held in position by a skeleton metal framework on which is mounted a revolving arm or spring contact. The arm bears on the edge of the resistance element and can be rotated by means of a knob so as to make contact with the wire the whole way round. Modern circular potentiometers, however, are usually of more sturdy construction than that shown in Fig. 6, the body of these instruments being of moulded bakelite. Various devices are used to ensure smooth and even contact. One particularly ingenious method consists of a swash plate of thin springy steel which rocks in a circular manner as the knob is rotated, thus the edge of the plate makes a rolling contact with the edge of the resistance element. There is no rubbing as with the ordinary type of arm, and therefore very little wear at the point of contact. This naturally makes for good electrical contact throughout the whole movement as there is no production of metal dust due to any scraping action. A potentiometer of the swash plate type is illustrated in Fig. 7.

Another type of potentiometer, this time of the semi-variable kind, is shown in Fig. 8. This particular model is

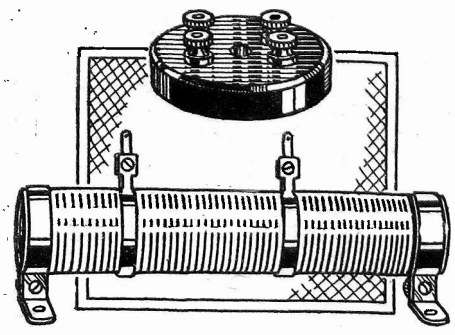


Fig. 8.—Examples of a fixed and a semi-fixed potentiometer.

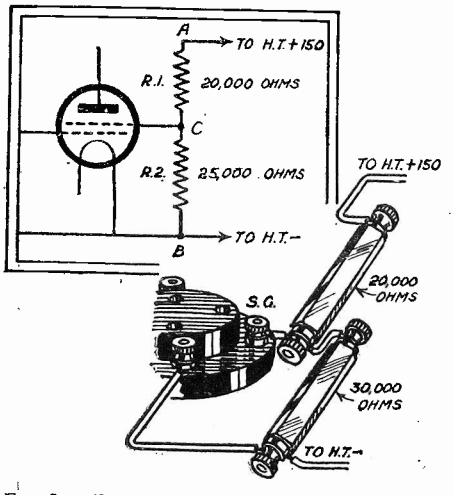


Fig. 9.—Potentiometer method of obtaining screening grid volts.

TOPICAL TECHNICALITIES

Time and Frequency.

Frequency may be defined as the "regularity or rate of recurrence of phenomena which occur in cycles." That is to say, any event which takes place over and over again at regular intervals may be said to have a frequency, and each occurrence may be said to be a cycle. As with all measurements, a standard is used as a basis upon which to calculate the recurrence, or frequency, and this is based upon the rotation of the earth. The earth takes one sidereal day to make one complete revolution, and this is the fundamental "time interval." The rate of rotation, namely one cycle per sidereal day, is the standard fundamental frequency standard. Thus from this data it is possible to calculate any other frequency. By means of recording timepieces (or astronomical clocks) the time period of one (solar) day may be accurately recorded at any given moment, and by comparing the movement of any other cyclical phenomena with this passage of time, its frequency may be determined. Thus, if we set a pendulum oscillating, and by recording its movement ascertain that during a period of one day it gains (or shows an advancement of) "x" times, we can calculate its frequency by adding this number to the number of seconds in a day (86,400) and dividing the sum by the latter figure, thus $\frac{86,400+x}{86,400}$ *= y cycles per second.*

(Continued on facing page)

(*Continued from page 704*)

designed for mains use, and is wound on a porcelain former. As with other types, a terminal is fitted to each extremity of the wire element.

Apart from the variable and semi-variable types of potentiometers there are also one or two fixed types such as that also shown in Fig. 8. This has a composition resistance element and is provided with two fixed tappings. Its use is for providing suitable grid bias for the detector valve as already described.

Screen-grid Volts by Potentiometer Method

Of course, the usual way of providing a fixed potentiometer is to use two or more ordinary fixed resistances in series, and to take the tapping or tappings from the connecting point between the resistances. This method is extensively used for obtaining the necessary voltage for the screen of a screen-grid valve. Suppose, for instance, the maximum H.T. voltage available in a receiver is 150 volts, and the screening grid of the S.G. valve requires only 70 volts. The usual way to lower the voltage to this figure is to use the potentiometer method shown in Fig. 9. Two resistances, R.1 and R.2, are connected across the H.T. supply as shown. Naturally, the potential difference or voltage drop between the two extreme ends is 150 volts, since the "top" end A of R.1 is at 150 volts positive, and the "bottom end B of R.2 is at zero volts (earth potential). Now if we take a tapping anywhere between A and B, the potential or voltage available will be something between 0 volts and 150 volts, therefore, by seeing to it that the two resistances are of suitable values, the connecting point C can be arranged to be at the desired potential of 70 volts. I will explain how the values of 20,000 ohms and 25,000 ohms for R.1 and R.2 respectively are arrived at in this particular case. First of all, the current passing through the potentiometer from A to B must be large compared with that taken by the screen of the valve. This is in order that fluctuations in the screen current shall not appreciably affect the voltage on the screen. Assuming the screen takes no more than 1 milliamp, then a current of 3 milliamps through the potentiometer would be suitable. Now let us see what are the necessary individual values for R.1 and R.2. First of all take the case of R.2. The voltage drop across this is the voltage required by the screen, namely, 70 volts. To take 3 m.a. at 70 volts, it must have a resistance of 70 divided by $\frac{3}{1,000}$ = 23,333 ohms (by Ohm's law $\frac{E}{C}$=R, where R is the required resistance, E the E.M.F. or voltage, and C the current in amperes). The nearest standard value to 23,333 ohms is 25,000 ohms, so we must be content with this value.

Now consider the case of R.1. Firstly, the current through R.2 will be 70 divided by 25,000=2.8 milliamps. Now, not only will this current of 2.8 milliamps pass through R.1, but the current taken by the screen as well, namely 1 m.a., giving a total of 3.8 m.a. Well, since R.1 has to drop 80 volts (150—70=80), then its resistance must be 80 divided by $\frac{3.8}{1,000}$ =21,053 (approx.). The nearest standard resistance, namely, 20,000 ohms, would be suitable.

OUR VIEWS ON RECEIVERS

Peto-Scott Screen-Grid Battery Three

A CHEAP battery receiver, housed in an attractive cabinet, and containing a moving-coil loud-speaker. These, in brief, are the salient points of the new Peto-Scott Receiver. The cabinet is well known, having been used in more than one of our own receivers, and the attractive lines and fret details of this need no emphasising. The general appearance of this receiver is enhanced by the new straight-line full vision scale which is fitted, and probably to many the fact that there are only three knobs (in addition to the wave-change switch) will also prove a most valuable feature. When the back of the receiver is removed, all that can be seen of the actual receiver is a neat all-metal chassis with a completely enclosed ganged condenser, and three valves. By the side of this is the moving-coil speaker, and ample room is left behind this for the batteries. An interesting point when first examining one of these receivers is the manner in which the battery leads are fixed to the bottom of the cabinet and retained in position by an instruction sheet, so that the receiver cannot be placed into commission in an incorrect manner owing to the user's attention being so clearly drawn to the correct manner of connecting up.

Specification

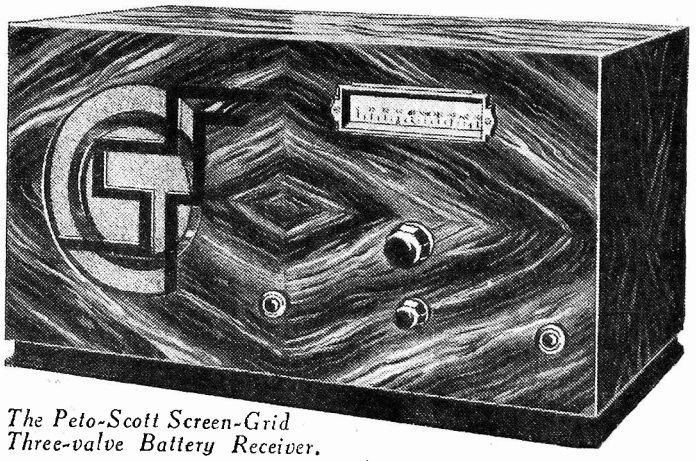
The receiver embodies the well-tried arrangement of screen-grid H.F. stage, detector, and L.F. valve. As is already proved, this arrangement, when properly designed, provides the best all-round performance, delivering power with good distance-getting properties. In this particular receiver the aerial coil and the H.F. coupling coil are of the totally screened type, and are situated beneath the chassis, thus ensuring short wiring with a minimized risk of direct pick-up on the wiring should the receiver be used in a situation close to a main or high-powered station. Transformer coupling is provided between detector and output valves, and the wiring and layout of all the components has obviously been the result of some thought with regard to general efficiency and stability. In place of terminals, socket strips are provided for aerial, earth, loud-speaker and pick-up connections, and a neat self-contained aerial device has been included. This consists of a length of flex pinned to the top of the cabinet and to one side of it also, and is fitted with a plug which may be inserted into the aerial terminal. One other point is worth mentioning, as it is often overlooked by many manufacturers, and that is the fact that the chassis is stamped, in large letters, with the valve identification for each socket. There is thus no likelihood of the wrong valves being inserted.

Controls

The three control knobs are arranged as follows: the centre knob controls the gang condenser and tunes both aerial and H.F. coupling coil. The right-hand control operates a solid dielectric reaction condenser, and the left-hand knob controls a combined on/off switch and volume control. This operates on the H.F. valve, which is, accordingly, of the variable-mu type. A small central knob is fitted for wave-change purposes.

Results

The receiver was connected exactly as recommended, and was tested in a locality which is known to be good for general reception. The general first impression is one of extreme liveliness, and a run round the dial, with reaction advanced to a position about one-third, produced a fair number of stations. The receiver was then handled with more care, and judicious use was made of the reaction and volume controls, with the result that the receiver seemed to produce a station at every degree on the dial. The outside aerial was then removed and the small internal aerial plugged in, with, of course, a substantial reduction in power. Although small, however, this aerial seemed to be very effective, and enabled Hilversum on the medium waves, and Radio-Paris on the long waves to be received at quite comfortable volume with only the slightest trace of reaction. It was possible to increase this strength and obtain sufficient volume for normal listening purposes without any difficulty, although under this condition the general background noise was rather too prominent for comfortable listening. Tested in an area where results are usually very bad, the receiver seemed to be above



The Peto-Scott Screen-Grid Three-valve Battery Receiver.

(*Continued on page 707*)

(*Continued from page 706*)

the average in general performance. Stations which, generally speaking, are difficult to tune seemed to be obtained easily on this receiver, and this is apparently due to the method of coupling the aerial circuit to the first valve. Quality on all stations was of a high standard, due to the moving-coil loud-speaker. The general brilliancy of reproduction was one of its most favourable features, resulting in very distinctive speech and fine brilliancy on music. Such instruments as the violin, cymbals, piano, and similar types, which rely for the characteristics on the higher notes in the scale, were splendidly reproduced, whilst there was no absence of bass. In place of the customary bass thump there was a clearly defined low-note response which, whilst not so full as is obtainable with larger output valves and adequate H.T., was yet sufficiently powerful to enable a dance band to be reproduced at full room strength with the drums and other bass instruments well in evidence.

This is a splendid general purpose receiver which may be relied upon to provide good quality reception from a number of stations under practically any conditions, and which is also most economical in upkeep costs. The price of this receiver is Eight Guineas.

MAKING YOUR OWN SCREENED COILS

(*Continued from page 684*)

to overcome it. It should be emphasized that this break-through is not troublesome in all localities, but generally only in those fairly near to a medium-wave transmitter. Consequently, if break-through is not experienced either of the coils already described will prove perfectly satisfactory. Where break-through is experienced, a coil giving the circuit arrangement shown in Fig. 6 is very suitable. It will be seen that a loose-coupled aerial winding is employed in addition to the two tuned windings and the reaction one. The extra winding is so connected that it is in series between the aerial lead-in and the centre-tapping on the long-wave winding when the wave-change switch is in the long-wave position. But when the switch is changed over for medium-wave reception the winding is connected between the aerial and earth so that the coupling between it and the tuned winding is purely an inductive one. To permit of the necessary changes of circuit a two-pole double-throw switch is required for wave-changing, and this tends to complicate the arrangement to a certain extent. Nevertheless, the arrangement is a good one and well worth trying. The object of the extra winding is to act as a rejector wave-trap on long waves and as an ordinary loose-coupled aerial coil on medium waves, and thus it serves, not only to prevent break-through, but also to improve selectivity on the lower waveband.

The method of construction in respect to this coil is very similar to that employed for previous ones, but it will be seen from Fig. 7 that an extra winding section is needed on the former. This is provided by arranging two of the paxolin spacers about ¼in. apart at the top of the tube and ¼in. away from the medium-wave windings. The anti-break-through winding consists of 100 turns of 34-gauge wire (again either d.c.c. or enamelled is suitable) wound in the newly formed slot at the top of the former. For this particular coil seven terminals are required.

WHAT IS ITS RESISTANCE?

A Simple Method of Calculating the Resistance of Milliammeters.

THIS is one of the most perplexing questions that experimenters and amateurs are confronted with, when they find that they want to extend the range of their milliammeters and are at a loss to know what is the resistance of their instrument.

Let us take a milliammeter reading from 0 to 5 milliamps., and assume we are desirous of finding its resistance so that its range can be extended.

Now consider the accompanying circuit diagram. In it we have a 2-volt accumulator, a variable resistance of approximately 1,000 ohms, capable of carrying the current of 5 milliamps., and a milliammeter reading from 0 to 5, and, although not shown in the diagram, a 30-ohm variable resistance.

Connect up the apparatus as in the diagram, and we are then in the position to start our calibration.

In the diagram there are two points marked x and y, and these should be connected together for the time being with a piece of thick copper wire, then with the variable resistance—marked Vr—in the 'all in' position, switch on the accumulator.

We shall now get a reading on the milliammeter, the value of which will depend on the voltage of the battery, and the amount of resistance in circuit. Adjust the variable resistance until the milliammeter indicates that the maximum current it will carry is flowing, namely, 5 milliamps.

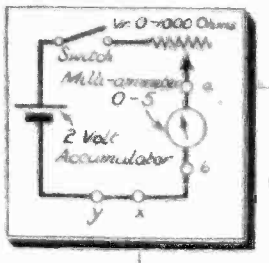
Our next step is to connect the 30-ohm variable resistance—leaving the arm in the central position—across the terminals of the milliammeter, keeping the connecting wires as short as possible. This will be across the points marked a b.

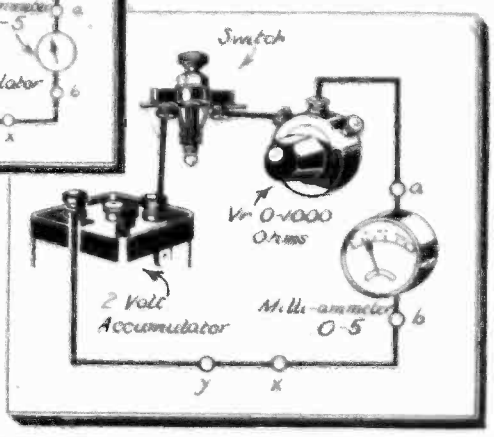
You will now find that the milliammeter will have a different reading, depending upon the value of this resistance, and the greater the ohmic value of this resistance, the nearer to 5 milliamps. will the instrument read, and vice-versa.

Keeping the variable resistance Vr in the same position—and do not alter it during the remainder of the calibration—vary the 30-ohm resistance until we get the milliammeter reading half its maximum value, namely, 2.5 milliamps. As we have now halved the current through the milliammeter, it follows from Ohm's Law that the values of both paths of this divided circuit are equal, and that therefore the resistance of the milliammeter must be equal to the value of the resistance shunted across its terminals. Our next step is to determine the value of this resistance.

We know that the current flowing in the circuit was .005 amp.—5 milliamps.—and that by Ohm's Law the total resistance of the circuit will be given us by R = E/C and that is 2/.005 = 400 ohms. This 400 ohms includes the value of the variable resistance, the resistance of the milliammeter, and the internal resistance of the accumulator. These individual values do not matter to us, as we only want to know the total resistance of the circuit.

Keeping the variable resistance Vr in the same position, and breaking the circuit at x and y, we insert the adjusted 30-ohm variable resistance. On completing the circuit by the switch we find that we shall get a new reading on the milliammeter. In the case under discussion this was 4.78 milliamps. We now find that the total resistance of the circuit is 2/.00478, which gives a total resistance of 418 ohms, and, as the total resistance has increased from 400 ohms to 418 ohms, it follows that the added resistance is 18 ohms, and this is also the resistance of our milliammeter. This result was checked by another method and the results agreed very closely.





Including Some Practical Points About Needles.

By ALFRED J. POTTS

IN response to many requests I propose in this article to enlarge upon that recently published in PRACTICAL WIRELESS, and to add several new points and hints.

In the previous article I dealt with the various types of motors, including the synchronous type, which during the description of this type, I stated to be only suitable for use with A.C. mains. This, of course, was quite true, and still remains so, but it should be added that since the article was written at least one of the manufacturers of this type of motor has put a converter on the market to enable these motors to work from D.C. mains. This is, of course, carried out by converting the D.C. to A.C. and working the motor from the latter. Unlike most converters sold for similar purposes, this one is quite cheap, in fact, the motor and converter can be purchased together and yet still be cheaper than any of the universal motors. In addition, one has the satisfaction of knowing that even if the mains should be changed from D.C. to A.C., the motor is still perfectly satisfactory, all that has to be done is to disconnect the converter and carry on with the motor in the ordinary way. Fuller details can be obtained if required from the makers of "Simpsons" Electric Turntable, which is a very compact type of this motor.

Spring Motors

Dealing with spring motors, I mentioned that spring "barrels" should be kept filled with a thick grease, and I have been asked what grease should be used for this. There are many suitable greases available, but probably the best for the purpose is "graphite grease." This consists of a fairly thick grease in which *very* fine powdered graphite is mixed. This graphite helps to reduce friction to the very minimum, and helps to prevent the grease from changes in consistency which often takes place in the ordinary greases. It should be added here that the mixing of the graphite in with the grease is a very difficult job, so do not attempt to do it yourself. In any case, it is not expensive to purchase, and a double spring motor can be re-greased for about a shilling, whereas if you try mixing it yourself you might soon be needing a new motor! By the way, it is best to put the new grease into the barrels after the old has been cleaned right out; do not put in just enough new grease with the old to make up the required amount.

As mentioned before, particular care should be taken when removing the spring from the case. I have known one to spring out and inflict severe cuts on the hands, and the damage which might be done to the face can easily be imagined. If you *must* take the spring out, tie it before removal with strong wire twisted tightly round it with pliers, before attempting its removal, in a similar way to which new springs are tied when purchased separately.

Lubricating Oil

The motor must be kept well oiled, but do not drown it as when working all the excess oil will be thrown about owing to centrifugal force. For the same reason the oil used, while it must be fairly thin, should not be *too* thin. Remember, it is far better to oil a little at frequent intervals rather than apply a lot of oil at long periods. With regard to rattles and humming sounds which are caused by bad design of the motor, most motors are supplied with some form of anti-vibration washers, very often of fairly soft rubber. These are put one each side of the motor board and the fixing screws passed through them to the motor. If these washers are to act satisfactorily they must not be screwed up so hard that they are squashed flat. They should only be screwed up sufficiently hard to firmly fix the motor so that when the turntable is placed on its spindle it does not "wobble." If the edge of the turntable is pressed down hard with the hand a slight give should be felt. This will indicate about the best adjustment for use.

Correct Mounting

Another point often overlooked when a gramophone motor is being mounted is the necessity of having it mounted perfectly level. It is very important, both from the point of view of wear and quality of reproduction, that this should be done. If it is not level, the needle will press far more on one side of the groove than the other, thus causing very uneven wear, and consequent ruination of both record and quality. A good test as to whether the turntable really is level is to place a record on it and start the motor; then bring the pickup over the edge and carefully lay it on the *blank* part of the record at the outside edge. This is usually about ¼in. to ⅜in. wide, and if the needle is placed in the centre of this it should stay there all the time when it is released. If it tends to slide towards the centre, or into the grooves, it is not level, while if it slides off the edge of the record, the same remarks apply.

Of course, the record used must be a fairly new one and must not be buckled. In any case, it will not damage the record, as the proper way to place the needle on the record is to place it on the edge and to slide it gently into the grooves. Most of the scratches and damage that takes place in the first few grooves of records are caused through carelessly placing the needle on the record.

About Needles

While on the subject of needles, it will not be out of place to mention that most people choose a "loud" or "extra loud" needle and let it go at that. Others choose the semi-permanent type of needle, while others choose the so-called "permanent" type, which are claimed to play 150 times. I will deal briefly with each type in turn.

First, then, the ordinary steel needle. In almost every case where a pick-up is used with "extra loud" and "loud" needles a volume control has to be used rather drastically. There are many good reasons for using the softer needles. They bed down deeper in the grooves and do not cause so much wear on the sides of the grooves.

Next there is the semi-permanent type of needle. The makers of these state each can be used ten times, which means ten *sides*, or five records. They are usually of medium tone, and with most pick-ups give very good quality.

Then there are the so-called "permanent" type, some of which are claimed to give 150 playings. These needles are made of fairly soft metal, with a very fine, short wire of an extremely hard material inserted for the point. This gives a much longer playing time to the needle, but once inserted they must not be taken out until worn out, as they cannot be replaced without causing damage to the records.

There is one other type of needle and that is the fibre kind. These needles certainly do minimize wear, but they have to be often resharpened for good results.

CLASS "B" AND THE STRAIGHT THREE

(*Continued from page 702*)

of driving, we shall have turned our 3-valve set into a 2-valve set from the point of view of sensitivity, which would seriously diminish volume on the local stations unless they are close, and remove altogether the foreigners.

To preserve the necessary three stages it will be necessary to add the 240 B as an extra valve, which would make stability difficult to obtain when decoupling is so limited by the high-tension battery voltage.

The solution for those who wish to use a straight three is to use the first L.F. valve as a driver, but to employ a suitable pentode which will more than make up for the loss of one stage.

Using a Pentode as Driver

Fig. 2 shows the diagram of a three-valve set with a pentode as driver. The pentode valve used should be one of the economy type, and will therefore require a very high anode load. This load is not critical, but an ordinary 1:1 transformer would be useless, and recourse must be made to a Class B transformer having a step-down ratio as high as 3:1 each half.

The bias on the pentode valve may be somewhat critical, but as there is only one grid-bias plug the best value will be easily found, remembering to use the highest possible bias without impairing quality of reception, as this procedure will effect an economy in H.T. current consumption.

It will be seen in Fig. 2 that a condenser has been placed across each half of the primary and the driver secondary, which is a precaution that is strongly recommended, as it prevents any possibility of parasitic oscillation, which would cause the anode current to rise so high that the H.T. battery life would be greatly reduced.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

SLADE RADIO

A lecture, entitled "Modern Radio Practice," was given by Mr. P. W. S. Valentine, A.M.I.E.E., of Messrs. Mullard Wireless Service Co., Ltd., at the meeting held last week. After stating that the improvements in the last year or two had been far-reaching, and that he was dealing with the subject from the aspect of valves, he mentioned early circuits and triodes and the development of the screen-grid valve. He then passed on to the variable or multi-mu valves, screened pentodes and multi-mu screened pentodes. A number of excellent slides were shown, including eight which showed the stages of manufacture of the screened pentodes. A.V.C. and modulation came next, after which followed Class A and Class B amplification.

A lantern lecture entitled "Sea routes to the East, Gibraltar to Malta" was also given by Lieut.-Commander Brewster recently. Commencing with the Straits of Gibraltar there followed a most interesting description of the Rock, general conditions and a short history. Passing on to Malta here again a very complete description of the town and the inhabitants was given. A large number of excellent slides were shown, some of them proving of considerable interest. The lecture was thoroughly enjoyed by all present especially as the lecturer was able to recount a number of personal experiences. The Society, which offers exceptional facilities to anyone interested in wireless, still has room for new members. Details and advance programme can be obtained from the Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE CROYDON RADIO SOCIETY

The Croydon Radio Society discussed Electronic Music for its meeting on Tuesday, November 14th, at St. Peter's Hall, South Croydon. The lecturers were Mr. Harwood and Mr. Budd, who brought an electronde to demonstrate electronic music. The instrument was described as one in which the player produces electrical vibrations which by a loud-speaker are changed to sound vibrations. Mechanical and electrical means were used to produce the electrical vibrations. The electronde was an example of the latter method, having two oscillating valves and tuned circuits, one at a fixed frequency and the other's frequency was varied by the player's hand moving to and fro. This instrument was connected to the aerial input of any wireless receiver, and Mr. Harwood showed what it could do. In performance a wide frequency range was obtained, nine and a half octaves being possible.

Mr. W. J. Bird, a member, gave his maiden lecture on Tuesday, November 21st, at St. Peter's Hall, South Croydon. The topic was "Electrical Measuring Instruments, and their Application to Wireless Receivers." He was soon relating in a brisk manner the design of various types, such as the moving-iron, moving-coil, hot-wire, electrostatic and other types used for particular purposes. Mr. Bird explained very clearly just why one type of meter had an advantage over another, and the percentage accuracy of each. It was pointed out that 100lbs. per square inch might be the pressure on an instrument's pivot, and its shape was discussed in detail. For the point, jewels were used, sapphire being most popular. Finally, Mr. Bird demonstrated various meters, some unique types being on exhibition.

Another short-wave night was held on Tuesday, November 28th, at St. Peter's Hall, S. Croydon. Mr. P. Deacon, head of the short-wave section, described improvements he had effected in his receiver. For instance, a screen-grid detector now gave increased amplification, and what was more, resulted in the almost entire elimination of hand-capacity effects. Mr. Deacon described other experiments such as on the new tuning inductance with special wire, and his home-made choke. In the demonstration which followed, two Empire stations, two Moscow transmitters and a German, as well as many others unidentified were all well received. A discussion on harmonic interference, heterodyne whistles, dead spots and anode feed resistances, concluded a most instructive meeting. The next short-wave night is on Tuesday, December 19th, the last meeting of 1933. The New Year's fixture cards are nearly ready, and PRACTICAL WIRELESS readers are invited to write for one.—Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

THE SOUTHALL RADIO SOCIETY

A lecture entitled "Modern Radio Practice" was given by Mr. Carter of Mullard's Wireless Service Co. at the meeting held last week.

After dealing briefly with the developments in H.F. and L.F. amplification, he proceeded to describe the H.F. screened pentode, double-diode-triode and Class "B" Valves. Particular mention was made of the necessity for coils of high dynamic resistances for the full benefits of the H.F. pentode to be realized.—Hon. Sec., Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

BEC RADIO SOCIETY

A series of interesting and instructive lantern slides, explaining step by step how the Catkin valve is manufactured, were displayed to members of the Bec Radio Society during a lecture on the "Catkin Valve" which was given by Mr. W. G. J. Nixon, of the General Electric Co., Ltd., at the Society's headquarters on Thursday, November 23rd.

The method of assembling the electrodes in the Catkin valve was of particular interest. Whereas in the ordinary valve the makers are obliged to introduce curves in the wires and supports of the electrodes, this disadvantage has been overcome, and now a straight assembly of the electrodes gives almost complete uniformity. The introduction of the rubber mounting, and the special mica separators for the electrodes, were other points demonstrated on the screen.

Mr. Nixon gave some useful information regarding the double-diode-triode, the indirectly-heated cathode rectifier and the D.A.100, and concluded his lecture by demonstrating a G.E.C. super-heterodyne receiver employing the new valves. Prospective members desirous of enrolling for the new session should communicate with Mr. A. L. Odell, Hon. Sec., 9, Westway, Grand Drive, Raynes Park, S.W.20.

INTERNATIONAL SHORT-WAVE CLUB, LONDON

The subject at the London Chapter meeting held on Friday, December 1st, at the R.A.C.S. Hall, Wandsworth Road, S.W.8, was "Short-Wave Reception and Superhets." A very interested assembly listened to Mr. J. L. Hills, who lectured on superhets. He afterwards demonstrated a Faraday S620L, A.C. All-wave Receiver. Members were particularly interested in the application of A.V.C. on stations which showed deep fading. Among the features arranged for future meetings are morse instruction at each meeting from 7.45 to 8.15 p.m., lectures, demonstrations, and set construction, etc. All PRACTICAL WIRELESS readers are welcome.—A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

THORNTON HEATH RADIO SOCIETY

A meeting of this Society was held at St. Paul's Hall, Norfolk Road, on Tuesday, November 21st. Mr. S. J. Meares presided. By the courtesy of Messrs. Igranic Electric Co., Ltd., a lecture was given on short-wave reception illustrated with lantern slides. The lecture was delivered by Mr. Dabbs. After dealing with the general phenomena accompanying the propagation of short waves, the principle of short-wave reception was dealt with, and also the circuits most suitable for the reception of short-wave signals, namely, the "straight," the super-regenerative, and the super-heterodyne. The various circuits were shown on the screen and their outstanding points described. Particulars of future lectures and demonstrations can be obtained from the Hon. Sec., Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

PROPOSED RADIO CLUB FOR WOOLWICH AND DISTRICT

Readers interested in the proposed formation of a Radio Club for Woolwich, Plumstead and district, are invited to write for further particulars to Mr. D. J. Fryer, 151, Griffin Road, Plumstead, S.E.18.

GOLDERS GREEN AND HENDON RADIO SOCIETY

The greatest interest was shown in a recent meeting organized by the above Society. Over 250 members were present, including representatives from the Radio Society of Great Britain, Northwood Radio Society, and a number of other clubs. Mr. F. Harwood, describing the various types of electronic musical instruments, pointed out that these instruments could be broadly divided into two classes: those in which the electrical vibrations were produced by mechanical means and those where the vibrations were produced by purely electrical means. Examples of the numerous effects produced by the various types of electronic instruments were given by means of gramophone records. The mechanical class was first shown. Amongst the electrical class which utilize in some form a thermionic valve or a Neon discharge tube to generate purely electrical vibration, may be mentioned the Trautonian, which is fitted with a number of tone-control knobs. The two records heard showed eight different timbre effects. The electronde is designed to be attached to a wireless receiver. Pitch is controlled by movement of the hand towards a metal rod. Interruption of sound is effected by a switch in the other hand and volume is controlled by a simple foot pedal. Various pieces of music of a classical nature were played on the apparatus, and were greatly appreciated by those present. K. Ashley Scarlett, Vice President, 60, Pattison Road, London, N.W.

HACKNEY RADIO AND PHYSICAL SOCIETY

Recently Mr. Ashby, B.Sc., gave a very interesting lecture on Metal Rectifiers. After prefacing his remarks with a description of the components making up a metal rectifier and the method of manufacture, the lecturer compared the metal rectifier with its counterpart—the valve—and spoke on the advantages and disadvantages of both types of rectifiers. The various methods of utilizing metal rectifiers were then dealt with at length, various ways of using the Westector being of exceptional interest. In a very novel way the function of an input transformer and metal rectifier was demonstrated with a cinema film. Lantern slides depicting voltage regulation curves, etc., were also shown. Details of further meetings will gladly be sent to any local reader of PRACTICAL WIRELESS on request to the Secretary, A. F. Rogerson, 19, Sewdley Street, Clapton, E.5.

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

WATBRO D.C. ELIMINATOR

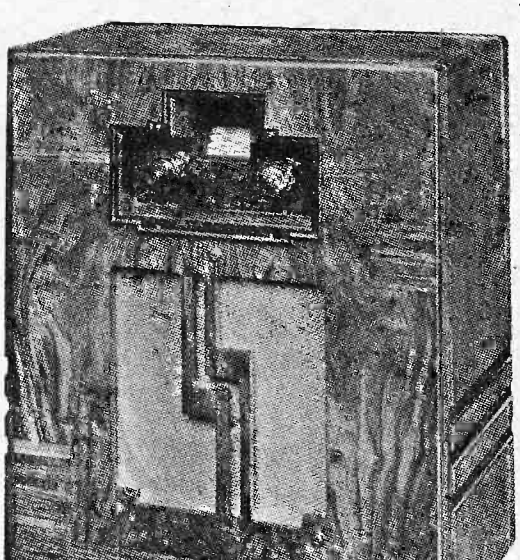
A VERY good example of a D.C. eliminator has been received from Messrs. Watkins Bros. & Co., and has been thoroughly tested in our laboratories. The eliminator is finished in the usual metal case with a black "crackle" coating, and the front portion is sloped and provided with four sockets and a control knob for a variable tapping. The sockets are marked "—," "S.G.," "90," and "150." A really substantial length of connecting flex furnished with a mains plug is attached for connection to the nearest lighting main socket. On the underside a small terminal is fitted and a label fastened to this emphasizes the necessity for removing the earth lead from the receiver and connecting this instead to the terminal on the eliminator. This is, of course, necessary in order to avoid the possibility of short-circuiting the mains should the positive main lead be earthed. The unit was connected and loaded to provide various voltage readings and these were checked off against the makers' figures. The total output is rated at 30 m.a., and this figure was given with a voltage of 155 against the makers' 150. At this load the detector tapping of 90 volts was slightly below that figure, with the S.G. tapping at its minimum figure. It was found possible to obtain an output of 150 volts at 25 m.a., with 90 volts at 5 m.a., and then to permit of an adjustment on the S.G., potentiometer of 0 to 40 volts. These figures show that the eliminator is highly suitable for the operation of the standard type of receiver; and the tapping points in the unit are adequately decoupled, thus preventing the possibility of instability due to back-coupling. The price of the unit is 22s. 6d.

BENJAMIN CLASS B OUTPUT CHOKE

THE latest type of Benjamin Class B choke is provided with four tapping points, permitting of matching with practically any type of Class B valve, whilst also enabling the choke to be employed, if desired, with pentode valves in Quiescent Push-pull. The primary winding is rated at 400 ohms, and on test was found to be actually this value. The tapping points provide ratios of 1.2 to 1, 1.6 to 1, 1 to 1, 1 to 1.6 and 1 to 1.9, and these various ratios are obtained by joining the loud-speaker and the anodes to the terminals in various combinations. Thus, the anodes joined to the two ends of the winding and the speaker joined to terminals 1 and 4 gives a ratio of 1.2 to 1, whilst by joining the anodes to terminals 2 and 3, and connecting the speaker to the two ends of the winding enables the ratio to be altered to 1 to 1.9. The choke is thus truly universal, and will enable many variations to be carried out in the output stage so that the optimum setting can be found under any conditions. The price of this handy choke is 11s., and the makers are Benjamin Electric Ltd.

VARLEY POWER PUNCHER

THE title of this component may seem rather out of the ordinary for wireless components, and, indeed, its use may not seem actually to be supported by its title. It does not punch power out of a receiver, nor does it actually add more punch to a weak receiver. What it does is to economize in H.T. current and thus permit the use of a small output valve and H.T. battery whilst enabling loud signals to be obtained without distortion. The effect is very similar to that obtained with a Class B valve, namely the anode current varies with the signal strength. The device consists of resistances, condensers, and a metal rectifier, and it is included in the anode circuit of the output valve somewhat after the manner of a filter-fed loud-speaker. As the anode current passes through the device and is rectified by the metal rectifier the bias applied to the output valve is varied, and this enables a preliminary excessive bias to be applied with a consequent economy in H.T. current. As the signal increases in strength the bias is automatically reduced, thus permitting a larger anode current to flow. In this way a smaller H.T. battery may be used, and will last for a considerable period, owing to the fact that the excess bias keeps down the anode current consumption, and provided the receiver is not adjusted so that very great volume is obtained for the whole of the listening period, there will be a consequent economy. The price of the Power Puncher is 15s. 6d.



The new H.M.V. Portable Grand which was referred to on page 547 of the Nov. 25th. issue.

NEW FERRANTI RECEIVER

NEWS is to hand of a new Ferranti receiver, namely the Arcadia Console. This is of the pedestal type, just under three feet in height, and has the novel feature of a pair of openings through which the tuning scale is viewed, and these are fitted with lenses giving great magnification. The actual setting of the tuning condenser is therefore obtained with ease. The price is 23 guineas.

W. B. EQUILODE.

A NEW speaker announced by the Whiteley Electrical Radio Co., Ltd., is intended to fulfil as an extension speaker the same function as that performed by the "Microlode" as the set's principal reproducer. In the same way that the "Microlode" is arranged to match any output stage, so the new "Equilode" can be used as an extension from the "extra speaker" terminals of any set on the market. The necessity for a speaker of this type is due to the lack of any standard practice among set manufacturers in their method of arranging extra output terminals. Some allow for the ues of a speaker fitted with an output transformer having a similar primary impedance to the one already fitted in the set and connected in parallel with it. Others take leads from the existing speech-coil connections, and stipulate the use of an extra speaker having a speech coil of similar impedance and connected direct without transformer. Even in this latter case different speakers are normally necessary for different sets, for some use a speech coil of 3 ohms impedance, some of 5 ohms, and three well-known makes require a 9 ohms speaker. In the "Equilode" an adaptation of the "Microlode" method is used to match the speaker accurately to the set and existing speaker. It is emphatically claimed by the makers that in each case volume on the "Equilode" is exactly equal to that of the set's principal speaker, and they have so far found no case where the use of the two speakers instead of one entails appreciable loss of volume. Full instructions are, of course, issued with each instrument. The price is 33s. 6d. in chassis form and 48s. 6d. in a walnut finished cabinet with the characteristic "W. B." fret.

NEW TRIOTRON UNIVERSAL VALVES

A NEW range of Universal A.C./D.C. valves is announced by the Triotron Radio Co., Ltd. These have a 20 volt filament taking .18 amps. The Variable-mu H.F. pentode is designed for a maximum anode voltage of 200 and a screening-grid voltage of 100 volts. The price is 12s. 6d. The H.F. pentode having similar characteristics with the exception of the variable grid bias control is priced also at 12s. 6d. A special detector, having an amplification factor of 100 and a slope of 4 m.a./v costs 8s. 6d., whilst an output pentode, delivering an undistorted output of 1,350 milliwatts, costs 12s. 6d.

NEW COLLARO AUTOMATIC RECORD PLAYER

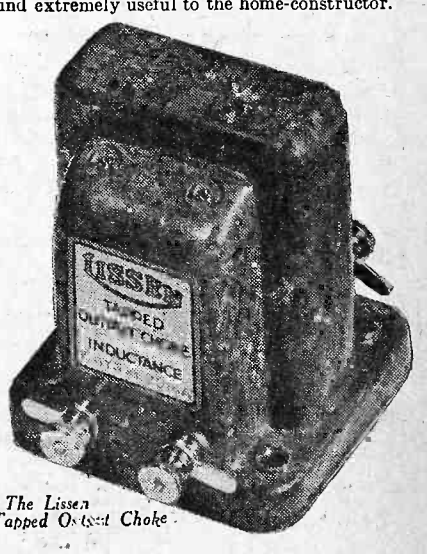
FROM Messrs. Collaro, Ltd., we have received details of their new automatic device which enables one to instantly convert a radio receiver into an automatic radio-gram, and has the added advantage that no lid has to be opened for the purpose of placing the record on the turntable or changing the needle. It will play any size of record without any adjustment. There are no controls and the record is automatically returned when it has been played through. A slot is provided near the top of the instrument and the record is inserted into this slot in the course of which it switches the current on. If desired the record may be rejected before the playing is concluded. As the record passes out through the slot the current is automatically cut off so that no waste can occur. At the present moment the instrument can only be obtained for operation from A.C. mains, but it is stated that a D.C. model will shortly be obtainable. The ingenious "Empire" self-starting induction motor is fitted, together with the well-known Collaro "No. 20" Pick-up. As a table model the cost is £8 17s. 6d., and as a low-boy model the price is 10 guineas. In addition, a special chassis type is available at £6 18s. 6d.

G.E.C. BATTERY H.F. PENTODE

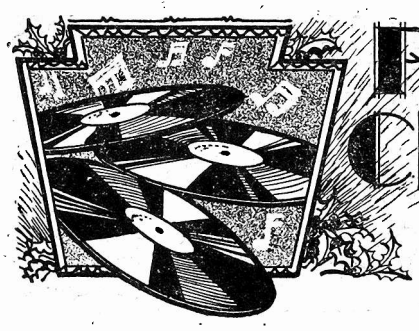
THE new battery pentode, type VP.21, has now been received and tested. The valve is obtainable only with a metallized surface, and, unlike the ordinary metallized valve, this coating is joined to one of the pins on the valve base, which in this case is fitted with the new seven-pin arrangement. A further novelty lies in the fact that the suppressor grid is also brought out to a separate terminal. Thus, the pins on the base of this valve are joined to filaments, control grid, suppressor grid, metal coating and screening grid; one pin being left unconnected. The anode is joined to the terminal on top of the valve in the usual S.G. arrangement. The valve was first tried in a normal H.F., Det., and L.F. receiver, with marked superiority in the results. The actual applied potentials were not by any means correct, but the change revealed a splendid improvement. The various voltages were then adjusted to operate the valve at its best point, and the metal coating was joined to earth. The actual H.F. gain was very noticeable, many stations previously only just audible being brought up to comfortable strength, and no sign of instability being discernible. The valve will prove extremely valuable to the battery user and enable him to gain many of the advantages of the mains receiver with no additional cost. The price is 15s. 6d.

LISSEN TAPPED OUTPUT CHOKE

THIS choke is intended for use in any circuit where its characteristics render it applicable, and these are quite a number. For instance, it may be employed as a smoothing choke in a mains unit; as an output choke following a power valve; as a low-frequency coupling choke, or as a push-pull output choke. It is thus of the universal type, and although fitted with four terminals it is actually only a centre-tapped choke. One end of the choke is taken to one terminal marked "P," whilst the centre-tap is marked L.S.—. The other end of the choke is joined to two terminals, marked H.T. and L.S. positive. In an output position the choke may be included in the anode lead between H.T. positive and the anode of the valve, and a loud-speaker may be filtered from the centre-tap or from the anode, thus permitting two different ratios. In a push-pull circuit the two ends are connected to the two anodes with the centre-tap to H.T. positive, and the speaker fed from the two anodes, either direct or through 2 mfd. fixed condensers. The inductance at 7 m.a. is 18 henries, and at 40 m.a. this drops to 12 henries only. The D.C. resistance is 400 ohms, and the maximum permissible current is 50 m.a. At 7s. 6d. this represents very good value and will be found extremely useful to the home-constructor.



The Lissen Tapped Output Choke



RECORDS for CHRISTMAS

A Selection of Some Bright Numbers for the Festive Season

FROM Caruso's re-created voice singing in English to a complete recording of a Gracie Fields music hall act is the scope of the December issue of new "His Master's Voice" records. This is probably the finest collection of records that has ever been issued at one time. Every record is made by a celebrity.

During the past year "His Master's Voice" have made great strides in perfecting their process of voice re-creation, and the two new Caruso records—*For you alone* and *A Dream*, *H.M.V. DA*1349, and *The Lost Chord* and *Ombra mai fu*, *DB*2073—are the outcome of the new improved process. These records headed the list of Caruso's best sellers during his lifetime, and he learnt English to make the records specially for "His Master's Voice" in English. The first two titles were made in the big studio at St. John's Wood with a special orchestra conducted by Lawrence Collingwood. Wearing headphones, he alone of the musicians was able to hear the voice of the dead singer. The other titles were made with organ accompaniment at the Kingsway Hall. Herbert Dawson, the organist at St. Margaret's, Westminster, who is responsible for the new accompaniment of these records, said, after the session, that it had been one of the eeriest of his life to accompany a singer he had never heard in person.

These latest Caruso records will be an excellent medium for introducing a new generation to the greatest tenor of all time.

Elgar Conducts Own Compositions

First thoughts of English music bring to mind Sir Edward Elgar and his many compositions depicting English life. This month "His Master's Voice" release a new recording of the *Cockaigne Concert Overture* on *DB*1935–6, in which Sir Edward conducts the B.B.C. Symphony Orchestra. These records were made just prior to his illness. They are wonderful recordings and every tone of the great orchestra has been faithfully captured on wax. The work depicts in music a stroll round London at the beginning of the present century. There is no doubt about the brilliance of the sun in the opening bars—we can see the Houses of Parliament, the river and the bridge over it, the horse buses and Whitehall looking fresh and clean in the warm sun. We watch a pair of lovers strolling intimately through a shady side way (what tender, loving music Elgar writes for them) until a group of Cockney urchins catches our attention. Now a military band comes within earshot with its grand brassiness and swagger of the dawn of the century. The urchins follow them and are soon lost to sight, but we can still see the lovers, although we forget them when a Salvation Army band, playing rather out of tune, demands our attention. Now the lovers turn into a quiet church, and we hear the deep notes of the organ as we watch their mutual absorption. Back we go to the street, and Elgar leaves our love of London, our pride, our humour and our inborn gusto for life.

On the last side, *DB*1936, Sir Edward conducts the B.B.C. Symphony Orchestra in giving a grand representation of his own *Pomp and Circumstance March No.* 4, which is considered by many to be finer than the one *Land of Hope and Glory* was derived from.

The other records of serious music in the first consignment of *H.M.V.* December discs is a new recording of the most popular concerto in Britain—Greig's *Concerto in A Minor*, *H.M.V. DB*2074–6.

Stroh Violins in Orchestra

In 1909 Wilhelm Backhaus created another milestone in musical history by making the first gramophone records of a concerto—Greig's in A Minor. He tells us that it is practically impossible to realise now the difficulties under which these records were made. The sounds of the orchestra and soloist were captured on to wax by a crude mechanism of two horns and a thin glass diaphragm actuating a sapphire point. "A full-size orchestra was out of the question," said Mr. Backhaus. "We had to use Stroh violins with horns in place of the ordinary instruments, and I remember that all players discarded first their coats, waistcoats, shirts and eventually finished the recording session wearing only their trousers, as the heat in the small recording room, with no ventilation, was so great."

This new recording of Greig's Concerto in A Minor by Wilhelm Backhaus and full Symphony Orchestra was made under vastly different conditions in one of the new H.M.V. studios at St. John's Wood.

Gracie Fields' Act Recorded Complete

The most unusual records to be issued since the first of the re-created Caruso records twelve months ago are H.M.V. C2625–7, on which is recorded a complete performance of a Gracie Fields act at the Holborn Empire. The applause of the audience and the whole atmosphere of the English variety stage is captured on these records. Gracie sings nine of her songs and the wildly enthusiastic welcome she is given, can be clearly heard.

These records are quite unique. They were made under conditions of the utmost secrecy by means of a number of microphones secreted in the foot-lights and in the wings of the theatre; special wiring connected these microphones with the "His Master's Voice" Mobile Recording Laboratory which was parked at the side entrance of the theatre. In order not to arouse suspicion the Laboratory was disguised as a furniture pantechnicon, special canvas covers bearing the name of a well-known Furniture Store being mounted on the Laboratory for the evening.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

The "Orbit" Again

SIR,—I would indeed be an ingrate if I failed to express to you my *complete* satisfaction and appreciation of your "Orbit." It leaves nothing to be desired, as far as my opinion is concerned. Undoubtedly, it is the ideal family set. If you could see my "junk-box" you would realize how many circuits I have constructed and then discarded as not being up to my hyper-critical standard. I could always find something lacking with them. Anyhow, I shall not have any inclination to pull the "innards" out of my "Orbit," of that I am certain. I had to wait three weeks before my dealer obtained the coils and an additional week before he got the A.V.C. unit. When I switched on, I heard the locals all over the dial on both wavelengths. After a few hours the volume fell to nothing. It took hours of patient searching before I found out that both coils No. 1 terminals were making poor contact with the soldering tags and eyelets. Pulling the connecting wire did not disclose the trouble. A spot of solder on each soon put them right, and in a very short time I realized what you meant when you described the set as being like a superhet.

Wishing you every success and thanking you for a very fine circuit.—C. T. HOWARD (London, N.15).

From a Chinese Reader

SIR,—I am glad to tell you that I have received my Encyclopædia. I have read every page of it, and can definitely say that it is "the book" for the wireless enthusiast.—CHAN WAH LEE (Singapore).

An All-Pentode Three Wanted

SIR,—I think it is time that you included in your excellent paper an All-Pentode Three. What I require is an A.C. set, consisting of perhaps Colvern Ferrocart coils, F1, F2, and F3. A Mullard V.P.4, Mullard S.P.4, and a Mazda A.C.-Pen, a reliable 3-gang condenser, a good transformer, and a good speaker would complete it. I think we might get some good stuff from this.—M. A. FLOOK (Gloucester).

The "Orbit" Still Going Strong

SIR,—I thought it would interest you to know we have two "Orbits" in the family now, and I'm shortly going to construct a third, so that we shall all have the latest type of receiver. Please don't tempt us by bringing out yet another battery set; let's wear this one out first. I started wireless in the good old days of the crystal, and amplifiers and long, long handles, and, of course, the units, and then—well, progress beat my pocket, so for some years I dropped it. Strange as it may seem, I happened to go on a long train journey and bought a copy of PRACTICAL WIRELESS No. 1 by mere accident, for I certainly had not heard of its publication. Since that time I have built many sets. I now have all the issues of PRACTICAL WIRELESS up to date, and what an asset they have been. Going back to my second "Orbit," with the two separate tuning condensers (I do not like ganged ones, because I do not think one has so much control), at 3.55 a.m. on a Monday morning recently, I again heard Schenectady, U.S.A., and on the L.S. this time, but using a separate amplifier. The "Nicore" does definitely remove fading, especially on Athlone, Poste Parisien, and Fécamp.—A. J. PEDLAR (Holloway).

"Action and Reaction"

SIR,—Although I always read with deep interest the articles by "Photon," I feel called upon to hurl my gauntlet into the lists in a friendly spirit when he attempts to answer that "ridiculous" question: "What happens when an irresistible force is brought to bear on an immovable object?" by the statement that "the abutment gives way." Now honestly, sir, this is a most unfortunate example to choose as, logically, one cannot have an "irresistible force" if one allows an "immovable object."—J. E. BISHOP (King's Cross).

[Our contributor was merely being humorous.—Ed.]

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT the short-base variable-mu valve offers the same degree of control with its short grid-bias adjustment as the ordinary type with a much greater variation.

—THAT in view of the above, the battery short-base valve requires only a 9-volt bias battery instead of a 15- or 16-volt battery.

—THAT when placing a variable resistance across the secondary winding of a transformer care should be exercised that the quality is not impaired, as the characteristics of the transformer are considerably altered by this method of control.

—THAT when tightening nuts on components in a receiver it is sufficient only to lock the nut to finger tightness—there is no need to use grips or pliers.

—THAT several faults in receivers sent to us for test have been found to be due to the excessive tightening of a nut resulting in the rear portion coming away, or wires being sheared off.

—THAT soldered connections should also be carefully made in order not to loosen the internal connection in components such as transformers, fixed condensers, chokes, etc.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

"ORMOND" PRODUCTS

IN addition to a fine range of loud-speakers and condensers, a new Logging Drum Dial is shown in the latest booklet issued by Ormond Engineering Coy., Ltd. This dial is a distinct advance in design as, in addition to its attractive appearance, provision is made for logging stations on either side of the graduated scale round the drum, the dial surface of which can be illuminated. A well-finished bakelite escutcheon plate, with control knob to match, is provided, and the slow-motion device incorporated is of strong construction, the action being remarkably smooth. Condensers can be connected on either side, the whole assembly being extremely simple. In the loud-speaker section there are models designed for use with Class B and Q.P.P. output, and mains energized instruments for use on D.C. supplies. Another new Ormond component is a three-gang condenser which has been developed after careful research work, and incorporates the latest principles in modern practice. Maximum rigidity is assured by the all-steel frame, and each section is provided with an individual trimmer. The capacity of the trimmers is 70 mfd. Also included in the booklet are slow motion midget and differential condensers, and small solid dielectric condensers. Copies of this useful booklet can be obtained from Ormond House, Rosebery Avenue, London, E.C.1.

HIVAC VALVES

HIVAC valves are the result of several years of intensive research work, and no pains have been spared to produce a high-class valve at a reasonable price. They embody the latest and most advanced methods of construction, and great care has been taken to ensure that individual valves are up to characteristics. In a neat folder, just issued, comparative tables are given of equivalent valves, from which can be seen at a glance the characteristics and prices of Hivac valves in comparison with similar valves of other makes. Full particulars with characteristic curves of the full range of Hivac valves is given in a booklet of data strips, copies of which can be obtained on application to The High Vacuum Valve Coy., Ltd., 113–117, Farringdon Road, London, E.C.1.

THE WESTINGHOUSE BATTERY SUPERHET

WE have received from the Westinghouse Brake and Saxby Signal Co., Ltd., a copy of their envelope containing constructional details and operating instructions for their new battery superheterodyne receiver. This receiver has been designed particularly for the use of constructors who wish to make the best use of Westectors, of which two are used in the circuit. A number of recent developments are embodied in the receiver, which employs five valves and provides first-class reception of a large number of alternative programmes. Single dial tuning is provided, with a scale calibrated in actual wavelengths. The design has been simplified as much as possible in order to utilize only those materials which are readily available, and in many cases components requiring soldered connections have been chosen with a view to reducing cost. The layout of the receiver is particularly neat and businesslike, the speaker being arranged at the side of the chassis. Amongst the refinements included in the circuit are A.V.C., pentode output, battery economizer circuit, tone correction, and provision for pick-up. Westectors are used as a second detector and in the battery economizer circuit. It may be mentioned here that it is not the intention of the Westinghouse Coy. to construct and market these receivers, nor will it be possible for them to undertake construction, test, or servicing for the constructor. The envelopes, which contain, in addition to the book of instructions, full size prints of the wiring diagrams, chassis, and panel layouts, are priced at 1s., and can be obtained from The Westinghouse Brake and Saxby Signal Coy., Ltd., 82, York Road, London, N.1.

RAWSWOOD TRANSFORMERS

MODERN machinery and the finest quality raw materials combine to make Rawswood mains transformers high-class and dependable components. They undergo stringent stage by stage tests, leaving an ample margin of safety against overload and breakdown. Windings carrying normal loads are wound with enamelled copper wire, the windings of high potential are of enamelled S.S.C. copper wire, whilst the low-tension windings conveying heating current to wireless valves are of D.C.C. wire. A full range of these transformers is given in an attractive folder, in which filter chokes, power packs, H.T. eliminators, and trickle chargers are also listed. Interested readers are advised to write for a copy of this folder to The Rawswood Electrical Coy., Preston New Road, Blackpool.

"THE WIRELESS AND GRAMOPHONE TRADER YEAR BOOK AND DIARY"

THE 1934 edition of "The Wireless and Gramophone Trader Year Book and Diary," just published, contains many new features of great assistance to retail traders. This is the tenth successive year of its publication, and the size of the book has been doubled, which makes it much more convenient for reference purposes. There are several new features, including a section giving complete technical data regarding all makes and types of valves on the market, accompanied by an article explaining the functions of all the new multiple valves. Complete details of two entirely new manufacturing licences (the "Pool" A.4, and the Phillips-Mullard), are included with lists of important patents. "Practical Methods of Fault Finding" deals generally with repair work. Full instructions are given for the building of a "Universal Valve-testing Panel" to test every type of valve and an A.C. Public Address Amplifier capable of giving up to 15 watts undistorted output. All the regular features which have proved valuable in the past are retained, including the list of mains voltages throughout the country. The Directory Sections have been re-arranged to provide more rapid reference. These include a Classified Buyers' Guide; the Directory of Trade addresses, giving manufacturers, agents, and allied firms addresses, branches, telegraphic addresses, and 'phone numbers; "Directory of Wholesalers" arranged alphabetically and territorially.

In addition, there is an excellent diary (two pages to one week), ruled with cash columns. Altogether this is a book no trader can afford to be without.

The price of the book remains the same, *viz.*, 5s. 6d. post free, with a special rate of 3s. 6d. post free to subscribers to "Trader" Journals. It is published by The Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

WESTINGHOUSE METAL RECTIFIERS

THE construction of H.T. battery eliminators and battery chargers, embodying Westinghouse Metal Rectifiers, is fully dealt with in a useful handbook entitled "The All-Metal Way, 1934." The book, which is primarily of interest to home constructors who prefer to build their own apparatus, covers the subjects of rectification, battery elimination problems, mains conversion, and battery charging. New units are introduced for use with receivers employing Q.P.P. or "Class B" amplification. There is also a section devoted to Westectors and their uses in various circuits. The book is well illustrated with diagrams which should be very useful to the home constructor. Copies of the handbook can be obtained for 3d. each, post free, from The Westinghouse Brake and Saxby Signal Company, 82, York Road, King's Cross, N.1.

REPLIES TO BROADCAST QUERIES.

SEARCHER (Westbury): Madrid (EAJ7); gramophone records and election speeches. R. H. M. (Bromsgrove): Amateur transmitters: G6OI, Major J. Timbrell, King Edward VI School, Stourbridge, Worcestershire; G2NV, H. Littley, "Radiohm," Bridgnorth Road, Stourton, Stourbridge, Worcestershire. It is impossible to trace telephony transmissions without some idea of wavelength. RECEIVEM (Nottingham): We can trace the following call signs: G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon, Surrey; G5RD, A. R. Gardner, "Ashleigh," Abbots Langley, Watford, Herts.; G5SR, S. Riesen, 35, Wood End Road, Sudbury Hill, Harrow, Middlesex; G6KO, J. B. Sturrock, Kirkbuddo, Forfar, Angus, Scotland; F8VM, Michel, 53, Avenue de Lyon, Clermont-Ferrand (Pûy-de-Dome), France; F8WZ, Antonin Michel, Argeres-en-Beauce, France; F8JJ, Etabl. Bélin, 296, Avenue de Paris, Rueil-Malmaison (Seine-et-Oise), France; F8JD, Bastide, 26, rue Taupin, Toulouse (Haute-Garonne), France; F8LO, Jourdan, 15, rue Hoche, Cannes (Alpes-Maritimes), France; F8TR, Thibault, 7, rue des Ecoles, Villeneuve-St. Georges (Seine-et-Oise), France; F8QI, Nicaud, 104, rue Victor-Hugo, Tours (Indre-et-Loire), France; ON4AJ, A. Redemans, 150, Chaussée de Charleroi, Brussels, Belgium. KEITH WRIGHT (Lancs.): Very much regret, but we are unable to trace the amateur call signs you give as they are not published in the latest lists. BALCH (Derby): (1) WIOD, Miam Beach (Fla.), 230.6 m.; (2) Either WTAM, Cleveland (Ohio), 280.2 m., or WTIC, Hartford (Conn.), 282.8 m.; (3) WCAU, Philadelphia (Pa.), 256.3 m. QRA'S PLEASE (W.1.): We can trace the following call signs: (1) EAR185, Edmundo Mairlot, El Calevo, Asturias, Spain; (2) G6TA, C. D. Abbott, 120, Cavendish Road, Balham, S.W.12; (3) G5VB, A. F. Elton Bott, "Francisca," Barlow Road, Hampton, Middlesex; (4) G5YH, C. H. Chorley, 78, Nightingale Lane, Balham, S.W.12; (5) W6DRE, H. F. Rawls, 80, West Lewis Avenue, Phœnix (Ariz.); (6) W1EW, Albert L. Roberts, Chatham (Mass.); (7) EAR182, Rafael Fernando, Avenida Alfonso XIII, 323, Barcelona, Spain; (8) CT1BG, José Pinheiro, 1, Sargento da G.N.R., Vizen, Portugal; (9) G2YC, H. J. Stannard, 18, Wimpole Mews, Cavendish Square, W.1.; (10) EAR73, Martin Colon and J. Mangrave, Mallorca 152, Barcelona, Spain; (11) OK2RP, amateur transmitter, Czecho-Slovakia; (12) CT1JC, Claudino Diniz, Penafiel, Portugal; (13) G6QK, R. F. Hilton, 14, Overton Drive, Wanstead, E.11; (16) VQ3BAL, amateur transmitter, Tanganyika; (17) G6CJ, F. Charman, "The Cottage," Parkway, Long Lane, Hillingdon, Middlesex; (18) G2ZQ, J. Hunter, 63, Hervey Road, Blackheath, S.E.3; K. YARNOLD (Gloucester): W2ZG, Fred J. Becker, 905, South Alden Street, Philadelphia (Pa.); K4SA, Richard Bartholomew, Barrio de Sabana Hoyos Garrochales, Porto Rico. TIGER ISLAND (Ingatestone): W3BMS, G. F. Hall, 535, West Horter Street, Philadelphia (Pa.); W2KI, R. P. Liptrott, 1,432, Beverly Road, Brooklyn, New York, U.S.A.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers,

(2) Suggest alterations or modifications of receivers described in our contemporaries.

(3) Suggest alterations or modifications to commercial receivers.

(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

VOLUME CONTROL

"I wish to fit a volume control to my set, the circuit of which is enclosed herewith. What do you think would be the best form of control to fit? I have not yet bought anything for the control, so that I am perfectly free to buy just what you recommend."—J. L. (Hampstead).

The circuit which J.L. encloses is of the standard H.F., detector and L.F. type, and is battery-operated. In view of your situation there is a possibility that the input from the London stations may be sufficiently powerful to overload the detector valve so that this indicates that a pre-H.F. volume control should be fitted. This may consist of a differential reaction condenser wired in the aerial circuit, with the aerial joined to the moving plates, and one set of fixed plates connected to the normal aerial terminal, and the other set connected to earth. On the other hand, there is the possibility that you need a control which also will be operative when using the receiver for gramophone reproduction, in which case we would recommend the inclusion of a variable resistance across the primary of the L.F. transformer. The value will, of course, have to be chosen with care in order not to spoil the quality of reproduction, and you should consult the transformer manufacturer's data sheet regarding the actual value.

FOUR-VALVE SUPERHET

"I have four good mains valves by me, namely, H.F. pentode, S.G., det. and pentode, and I should like to make up a really powerful set with these. I am not certain of the best circuit to include these in, and wondered whether the A.C. Fury Four would be worth making, using these valves instead of those you suggested. I do not mind how much I spend on the set, but I should very much like to use the valves, as they were a present, and I would like to do them justice. Is it possible to use the superhet arrangement with these particular valves?"—T. C. A. (Leicester).

Quite a good modern circuit may be made up with the particular valves which you have, T. C. A. You would require a pair of band-pass coils and an oscillator coil, together with two I.F. transformers. The band-pass circuit would be used to couple the aerial to the pentode, which would perform the dual function of first detector and oscillator, and the oscillator coil would be fed by the cathode injection method. The variable-mu S.G. valve would serve as I.F. valve, and the ordinary valve would be used as second detector. The pentode would be coupled by a transformer or resistance-capacity coupling in the usual manner. Either a metal-oxide or valve rectifier should be employed in the mains portion of the apparatus, and this would give you a very good receiver.

TONE CONTROLS AND QUALITY

"I notice that in most of your circuits using a pentode valve, and in some others as well, you include a tone-control. I have been thinking round these devices, and it appears to me that they must spoil the quality as must also the whistle filters, which I have seen you recommend before. Surely, if a device is used to cut out the top notes the quality of a band, for instance, will be impaired. I should like to have your remarks on this question."—T. Y. (Blackheath).

A tone control device employed with a pentode valve is included solely for the purpose of removing the *excessive* high-note response. This valve has the peculiarity that certain high frequencies are amplified to a greater extent than some of the low frequencies, and this results, if not corrected, in an unbalanced reproduction rather on the shrill or squeaky side. The high-note filter, or tone control, serves to remove some of this, but it must not be adjusted to remove all of it, as the fault will then be present in another form. The whistle filter, on the other hand, is designed to cut off all frequencies above a certain value in order to avoid reproduction being spoilt by the presence of a high-pitched whistle which is received with the carrier wave, and although it is obvious that top notes of certain values will also be eliminated, it is a question of the lesser of two evils. If the music cannot be tolerated with the higher notes removed, then it surely cannot be tolerated with a whistle accompanying it. Actually, however, the frequency is so high that no cut-off will be noticeable unless the apparatus, including the loud-speaker, is so good that these frequencies are reproduced with the full volume, and all that will be appreciated when the device is included is a slight change in tone, with the whistle completely eliminated.

DATA SHEET No. 65.

Cut this out each week and paste in a notebook.

BRITISH ASSOCIATION (B.A.) SCREW THREADS

B.A. No.	Effective Diameter m.m.	Diameter m.m.	Pitch m.m.	Depth of Thread m.m.
0	5.4	6.0	1.0	.6
2	4.215	4.7	.81	.485
3	3.66	4.1	.73	.44
4	3.205	3.6	.66	.395
5	2.845	3.2	.59	.355
6	2.48	2.8	.53	.32
7	2.21	2.5	.48	.29
8	1.94	2.2	.43	.26
9	1.665	1.9	.39	.235
10	1.40	1.7	.35	.21
12	1.135	1.3	.28	.17

D.C. CHARGING

"My house has now been fitted with D.C. mains, and I am wondering whether it is worth while fitting a D.C. charger for my accumulator. I have bought an H.T. unit, but I read that the charger will have to dispose of 190 odd volts, and as this must be wasted, I am wondering whether the waste will be more than the cost of charging. What do you advise?"—G. J. (Muswell Hill).

The accumulator requires to be charged, say, as half an amp, and if you are on 200-volt mains, this means that you will need a 100-watt lamp in series with the accumulator in order to give the correct charging rate. If you use a lamp of this order in the living-room, there is no reason why you should not fit up a small charging board and only charge the accumulator when you are using the lamp. It should not be difficult to find one or two evenings when there is nothing in the programme to interest you and thus enable the accumulator to be charged, or alternatively, you can buy a second accumulator. Naturally, if you are going to put such a lamp in circuit during the daytime there will be no save to you, but by adopting the above arrangement you should certainly be able to keep the battery in good condition.

THE WAVE-LENGTH SHUFFLE

"I read in the papers that most sets will become obsolete when the new wavelengths come into operation next year. Surely this cannot be so, as I cannot imagine the B.B.C. allowing anything to happen which will render the majority of sets obsolete. I should like your re-assurance on this point."—T. B. S. (Margate).

You need have no worry at all regarding the forthcoming change-over. All that will happen is that certain stations will change their position on your tuning dial, and if your particular dial happens to have the station names *only* on it, then it will be a little more difficult for you to find the new positions, but beyond that there will be no other ill-effect. On the contrary, there will be some improvement as Radio-Paris, for instance, will be found much lower down the dial, thus permitting of its easier separation from Daventry on the simpler types of receiver, whilst Königswusterhausen will also be found in a more easily-tuned spot on the dial.

SPARKS AND FLASHES

"I have a mains set which I bought from a cheap wireless store near me, and I am rather afraid to use it. We are on D.C., and when I switch on, although I can hear music, the set gives off flashes now and then, and sometimes you get a shock when you turn the switch. The shopkeeper said it is all right, but we are afraid to use it. Can you suggest what is wrong?"—S. T. (Holloway).

We do not know whether S.T. is pulling our leg, but certainly if the set gives off flashes it is dangerous to use it. However, we rather think that this query is meant to be a joke, in which case, of course, we can only treat it as such and offer no solution. If, however, the case is genuine, we shall be glad to offer some suggestions on receipt of more detailed information.

TESTING AN H.F. CHOKE

"I have got one or two old components by me and am rather doubtful as to their efficiency, etc. I have tested the fixed condensers by means of charging up, as you have mentioned before, and the resistances have been measured and found in order. I have, however, got an old un-named H.F. choke and I should like to get some idea of its values. Can you help me to do this?"—D. B. (Croydon).

The resistance of the choke may, of course, be measured by means of a meter and battery. By connecting a milliammeter in series with the choke and battery the current flowing will enable you, from Ohm's law, to ascertain the resistance. The voltage is divided by the current expressed in amps, giving you the resistance in ohms. It will help you if you remember that the resistance is most likely of the order of 400 ohms or so. The inductance and self-capacity need not be measured so long as you can ascertain that the choke acts as it is intended, and this can be checked by joining it across the tuning condenser in a standard receiver.

FRAME AERIAL CONSTRUCTION

"I wish to build a set with self-contained frame aerial and should like to know whether I would gain anything if I made this absolutely efficient in every direction. That is to say, if I used Litz wire, made a framework which had only the very minimum of solid material in it, and used ebonite combs for holding the wires, would I get louder signals? Perhaps you could give me some hints?"—Y. A. F. (Pontnewydd).

The frame aerial should, of course, be made fairly efficient, although there would be very little gain from going to all the trouble you mention. The difference in signal strength obtained with a thick wire frame as compared with a Litz wire frame would not be noticeable and would certainly not justify the expense of the latter wire if you intend to construct a small frame for a small self-contained receiver. On the other hand, self capacity should be kept down, and by using spacing strips at the corners, and removing some of the wooden framework you would certainly add slightly to the efficiency. Space the medium-wave winding with about one-tenth of an inch between turns, and keep the long-wave winding about half an inch from the medium-wave winding.

FREE ADVICE BUREAU

COUPON

This coupon is available until Dec. 23rd, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 16/12/33.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

PREMIER SUPPLY STORES Offer the following Set Manufacturers' Surplus New Goods at a fraction of the Original Cost, all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers, resistances and diagram, 120v. 20 m.a. 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T., L.T. 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps, with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working 2 mf. 3/6, 4 mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2 mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the following Lines 6d. each or 5/- per dozen: 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; .01, .05 and 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd., 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes, 20 hys., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

HARLEY Pick-up, complete with arm and volume control; 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15, our price 18/6.

PREMIER British Made Meters, moving iron, flush mounting, accurate; 0-15, 0-50, 0-100, 0-250 milliamps., 0-1, 0-5 amps., all at 6/-.

ORMOND Condensers, 2-gang, semi-shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 100-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v., 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a., L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a. L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms, 1/-. 250,000 ohms, 50,000 ohms and 500,000 ohms, 2/6.

ROLA F7 MOVING COILS, 1,000 Ohms. FIELD, 20/-; MAGNAVOX 142, 1,000 Ohms. FIELD, 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

FOLLOWING VALVES USED FOR TEST ONLY. CALLERS ONLY. MS4B, MS4, DSB, DS, PT4, S4VB, ALL HALF PRICE.

DOUBLE Spring Motors, made by Garrard, play five sides of 10in. record, complete with turntable and all fittings; 17/6.

SPECIAL Offer.—Accumulator chargers, input 200-250 v. A.C., to charge 2- and 4-volt accumulators at ½ amp.; owing to the high efficiency of the silver oxide rectifier employed charger may be used during broadcast; 9/6 each.

RELIABLE Canned Coils with circuit; 3/- per coil accurately matched; dual range.

PREMIER L.T. Supply Units, consisting of Premier transformer and Westinghouse rectifier, inputs 200-250 A.C., output, 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1a., 37/6.

PREMIER Mains Transformer, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., c.t. L.T., 2/- extra; Westinghouse rectifier for above, giving 180v. 30 m.a., 8/6.

24 PAGES full of simple, pictorial diagrams which anyone can follow, showing easy alterations to make your wireless set right up to date at minimum cost. Illustrates numerous "gadgets" of use to every set owner and constructor.

Write Dept. "N."

A. F. BULGIN & CO. LTD., Abbey Road, Barking, Essex.

SURPLUS RADIO BARGAINS

LOOK AT THE PRICES.

Double smoothing chokes mounted, sound robust job, 120 m.a., 14/28 Henrys each; usual price, 35/-; our price, 6/6d. each, 9d. postage; single ditto, 4/6d. each.

Resistances, wire-wound, finest quality, 5 Watt, 8,000 Ohms and 65,000 Ohms, worth 3/6d. each; 6d. each, postage 3d.

Potential dividers, wound 2 sections, 5 Watt; 40,000 and 23,000 Ohms; 40,000 and 80,000 Ohms; 40,000 and 100,000 Ohms; 30,000 and 50,000 Ohms; at 1/- each, postage 3d.

Chokes, small iron-cored, 2,000 Ohms for output or choke coupling; 1/6d. each, 3d. postage.

A.C. H.T. Eliminators, 220 V to 240 V with 4 tappings. Total output 150 V at 25 m.a. For use with PV 495. Price with valve, 35/-, less valve 27/-.

Wearite Mains Transformers. Rectified Output, 300 Volts at 60 M/A. Heaters, 2-0-2 up to 4 Amps. Rectified Filament, 2-0-2 up to 4 Amps, input 200, 220, 240 V. For use with D.W.3 Rectifier, 12/6d. each, postage 6d.

Mains transformers for eliminators. Output 250-0-250 at 60 M/A. 4 V at 1 Amp. State input when ordering. Price 6/6d., postage 9d.

14 mfd. Block Condensers, 750 V DC Test 6-4-2-1-1 or 9-3-2, 10 mfd. Block Condensers, 750 V DC Test 4-4-1-1-350 V Peak; at 4/- each, postage 6d.

W.re-wound potential dividers, 60 Watt wound three sections, 4,500 Ohms, 3,000 Ohms, 2,000 Ohms, 1/6d. each, postage 3d.; 5 Watt ditto, 20,000 Ohms, 20,000 Ohms, 20,000 Ohms, 1/- each, postage 3d.

Power pack Chassis: wired with Wearite Transformers as above and T.C.C. 4 mfd. Electrolytic Condenser, etc., 200, 220, 240 V input, 20/- each, packing 9d.

Resistances. 2 Separate Resistances on 1 Tube, 60 Watt, 2,500 Ohms and 500 Ohms, 1/6d. each, postage 4d. 3 Separate Resistances on 1 Tube, 2,500 Ohms, 1,000 Ohms, 80 Ohms; 1/- each, postage 3d. 100,000, 200,000 and 300,000 Ohms, 1 Watt Type Resistances at 4/6d. per dozen, postage 3d.

Leaks. 2 Meg, .1 Meg, .5 Meg Leaks; .001, .0001, .015 mfd.

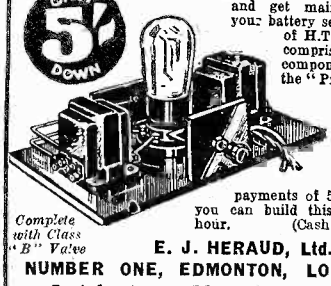
Fixed Condensers, all 3/- per dozen, post 3d.

Condensers. 1 mfd. Condensers 250 Volt working. 8d. each, postage 2d. 4 mfd. Condensers, 250 Volt working; 1/6d. each, postage 4d.

If you cannot call to inspect these and other wonderful bargains, write for Free List "N." Goods despatched Cash or C.O.D.

SURPLUS RADIO, 94, HIGH HOLBORN, LONDON, W.C.1.

"PRACTICAL WIRELESS" CLASS 'B' CONVERSION KIT



Complete with Class "B" Valve

BUILD YOUR OWN CLASS "B" UNIT and get mains volume from your battery set at very low use of H.T. We offer a Kit comprising all the exact components specified for the "Practical Wireless" Class "B" Unit, together with Class "B" valve and full-size Blue Print. SEND ONLY 5/-, balance by 7 monthly payments of 5/-. Send at once, you can build this Unit in half-an-hour. (Cash in 7 days, 35/-.)

E. J. HERAUD, Ltd., Dept: P.37, NUMBER ONE, EDMONTON, LONDON, N.18

Satisfaction or Money Back Guaranteed

RADIO SUPPLIES

Send your list of Radio needs for our quotation. Kits, Parts, Sets, etc. Everything in Radio stocked, prompt delivery. 7 days' approval. Catalogue free. Taylex & Standard Wet H.T. replacements stocked. **N. TAYLOR, 9, GROVE RD., BALHAM, S.W.12**

PREMIER Mains Transformers, output 250-0-250 volts 60 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350 volts, 90 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400 volts, 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-110/200-250 volts, or vice versa, 60-watt, 7/9; 100-watt, 10/-.

B.T.H. Induction Type (A.C. only) Truespeed Electric Gramophone Motors, 100-250 v.; 30/- complete.

SPECIAL Offer of Manufacturers' Type Transformers, input 200-250v., output 250-0-250 volts, 60 m.a., 4v. 1a., 4v. 3a. (both c.t.), 8/6; H.T.8 transformer, with 4v. 3-4a. (c.t.), 8/6; with Westinghouse rectifier, 18/6.

WESTERN ELECTRIC Condensers, 250v. working 1 mfd., 6d., 2 mfd., 1/-; 500v. working, 1 mfd., 1/-.

T.C.C. Condensers, 250v. working 4x4x1x1x.5 mfd., 3/6; 6x4x2x2x2 mfd., 375v. working, 6/11; H.M.V. 4x4x1x1x1x.5 6/-. 400v. working.

SPECIAL Offer of Wire Wound Resistances.—4 watts, any value up to 10,000 ohms., 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

MAGNAVOX P.M. M.C. Speakers, 7-inch cone, 18/6; Please state whether Power or Pentode Transformer required.

SPECIAL OFFER. Valves by World-Famous Continental Manufacturers. Fully guaranteed. All Standard Mains Types; 4v. 1 amp filament. H.L. L. SG. 350v. 120 mA Rectifier, 5/- each. SGVM Pentode Power, 6/6 each.

A LARGE stock of all types of Radio Cabinets at very low prices for callers.

WESTINGHOUSE Rectifiers, 120v. 15mA, 6/6; 200v. 30 mA, 8/6; 200v. 60 mA, 10/-.

GRAMPIAN Moving Coil P.M. Speakers, 9in. Cone. Handles 4 watts, 18/6.

BULGIN 3 amp. Mains Switch, 1/-; T.C.C. 6 mfd. Electrolytic Condensers, 50v. working, 1/-.

PLEASE mention PRACTICAL WIRELESS when ordering.

PREMIER SUPPLY STORES, 20, High Street, London, S.W.4. Macaulay 2188. Closed 1 o'clock Wednesdays, open to 9 o'clock Saturdays. Nearest Station, Clapham North Underground.

SOUTHERN RADIO'S Wireless Bargains.—Set manufacturers' guaranteed surplus.

VARIABLE Condensers:—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; all ganged condensers are fully screened, with trimmers and boxed; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1, 1,000 volt test, 7/- each; 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd.. Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor screen-grid 3-valve kit, less valves, 26/-; with 3 Mullard valves (P.M.12a, P.M.2D.X., P.M.2a), 49/- (list £5/7/6).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2.D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6, each (list £4/17/6); Mullard Radio for Million 3-valve battery kits, complete with 3 Mullard valves, £3/3 (list £6/2/6), all kits brand new in original sealed cartons.

MARCONI 1934 Pick-up No. 19, 26/- (list 32/6); Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/9 each (list 35/-); H.M.V. volume controls, 1/6 each (list 12/6). We have purchased the complete liquidated stock of large northern Manufacturer and Factor and can offer the following special bargains:—Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each. Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each. 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. assorted. Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

ALL Goods guaranteed New and Perfect and sent Carriage Paid.

PLEASE Note.—We have opened branches at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle Street, W.C.2, where callers are cordially invited to inspect our large stocks of wireless bargains. Please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

BIRMINGHAM RADIOMART.—Radiophone 27/6, straight 3-gang dust cover and trimmers, 12/6.
RADIOMART.—Utility 25/-, 2-gangs with concentric knob trimming wavelength disc dial, 7/6.
RADIOMART.—T.C.C. electrolytic bias condensers, boxed, 50 mfd. 12 v. or 6 mfd. 50v., 7½d.
RADIOMART.—Milliammeters, all readings above 20 m.a., 5/9, super 35 model, 6/9.
RADIOMART.—T.C.C. 4 x 4 x 1 mfd., 500 test, 3/3, 2½ x 2½ mfd., 1,000 test, 2/9, Dubilier, 4 x 2 mfd., 500 test, 2/9.
RADIOMART.—440 v. Electrolytics T.C.C. 8 mfd., aqueous, 3/11. Hellesen do. 3/3. Hellesen 8 x 4 mfd., dry, 3/3.
RADIOMART.—Wearite transformers. 200/300 250/250, HT8, HT9, all with 4 x 4 Act. 4 v 2½ Act., 10/6. Metvick 250/250 4v2, 4v5, 12/6. 110v. 25 cycle ditto, same price. All perfect, not stripped, types.
RADIOMART.—1-watt resistances, wire ends; Erie, most values, 8d. each, one dozen your selection, 7/3. H.M.V., Philips, etc., 6d., one dozen, your selection, 5/6, our selection, all different, 3/-. Metvick 25,000, 100,000 2 meg., three for 6d. Ohmite, ½ meg., 6d.
RADIOMART.—Lotus super chassis-mount screened coils, aerial, 2nd, band pass, tuned H.F., with reaction, 2/- each, set of three, 5/-.
RADIOMART.—Lotus super jack plugs, 9d. Lewcos twin screened pick-up cable, 9d.; ditto single, 6d.; 5-way heavy cable, 6d. yard length.
RADIOMART.—Non inductive tubulars .1 T.C.C., 375 wkg. .2, or .01 mfd. 1,500 v. test, 6d. each.
RADIOMART.—Lotus push-pull 3½-1, intervalve transformer, manufacturing type. No bakelite case 2/-.
RADIOMART.—Latest Rola Moving Coil transformers for push-pull or power and Pentode; suit Magnavox, etc., 3/6.
RADIOMART.—B.T.H. Moving Coil R.K. transformers, 20-1, 40-1, 18 and 21-1, 23 and 25-1, each type, boxed, 3/6.
RADIOMART.—Postage on less than 6/-, 6d. extra; otherwise free. New and revised list now ready for stamp.—19, John Bright St., Birmingham.

WANTED good Modern Wireless Parts, Sets, Eliminators, Meters, Valves, Speakers, etc. Spot Cash Waiting. Send or bring. We pay more than any other Dealer. Open 9-8.—University Radio, 142, Drummond St., Hampstead Rd., N.W.1.

NEW model Famous Lincoln Stewart Permanent Magnet Moving Coil Speakers, with universal transformer matching all types output valves, including Class B. Over 2,000 already sold to PRACTICAL WIRELESS readers. List price, 47/6. Special Price, 16/11.
REVEAL A.C. Eliminators, 200-250 volt, input 25 m.a., output 3 positive and 1 negative tappings. List price, £2/19/6. Bargain, 29/6.
THE well-known Lincoln Stewart dual range shielded coils, 200-550 metres, and 800-2,100 metres. List price, 6/6. Our price 3/3.
THE Sovereign Permeability Tuner, complete with blue print for constructing 3-valve Permeability Tuned Receiver, complete with dial escutcheon. List price, 15/-. To clear, 7/11.
TRIOTRON MAGNA 4-pole balanced armature units, Type P, beautiful tone, well made. Listed at 27/6. Special offer, 9/6.
REGENTONE Pentode 2-valve A.C. All-Electric Receiver, complete with valves. Original price, £6/15/0. Our price, £2/19/6.
LOTUS 3-1 and 5-1 L.F. Transformers, moulded bakelite case. To clear, 3/11.
CAMCO 75/- Radiogram Cabinet, 24/11. (This item is carriage forward.)
All goods sent carriage paid, cash or C.O.D.
PEARL & PEARL, 190, Bishopsgate, E.C.2.

"MELFORAD" SPECIAL XMAS OFFERS.—Author's Kits: ST500, 78/-; 60-3, 33/-; 5gn. 3, 29/6; Double X3, 56/-. Television Kits, 50/-. Class B Chokes, drivers, 5/-. ST500 Coils, 5/6. Lists Free.—5, Queen's Place, Hove.

TELEVISION Constructor's Guide, 1/3d. Illustrated catalogue free. Notes 1d.—Goodman Television, 16, Highbury Terrace, N.5 (Nr. Highbury Stn.).

GRAMOPHONES. Radiograms, 64 page. How to Make in 8d. Motors, Arms, Pick-ups, Speakers, Horns, Springs, Repairs.—Regentprac, 120, Old Street, London, E.C.1

THE following valves are guaranteed unused and perfect, and any valve differing from the makers' characteristics will be exchanged; and all latest types. A.C./Pens, P.T.4s, A.C.S.G/V.M.s, Pen. 4Vs, M.V.S.G.s, A.C.S.2/Pens. M.M.4V.s, P.T.625s, V.M.S.4s, D.C.2/Pens. D.P.T.s, P.M.24M.s, M.P.T.4s. V.M.4V.s, V.C.S.1/V.M.s, P.M.24B.s, D.C.2S.G./V.M.s, 11/-; M.S.4s. M.S.4B.s, A.C.S.G.s, S.4V.A.s, S.4V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S./2s. D.C.2S.G.s, 9/6; U.14s, 10/-. "Class B": P.M.2B, P.D.220, 220.B, 8/6, M.L.4s, A.C./P.s, P.M.24s, 8/-; A.C./H.L.s, 164V.s, 354V.s, A.C.2/H.L.s, 41M.H.L.s, U.10s, U.U.60/250s, M.H.4s, M.H.L.4s, 7/6; V.S.2s, 215S.G.s, 220S.G.s P.M.12s, P.M.12A.s, 9/-; 442B.U.s, D.W.3s, 8/6; 215 P.s, 220P.s, L.P.2s, 4/9; P.2s, 6/6; P.T.2s, P.M.22A.s, 9/-; H.L.210s, H.210s, L.210s, L.2s, 3/9. All Types of Brand New American Valves in Stock, first-class makes: 247s, 235s, 224s, 236s, 237s, 233s, 238s, 239s, 245s, 244s, 12/-; 227s, 226s, 280s, 9/6; 242s, 232s, 11/-; U.X.250s, 16/-; 281s, 14/6. Carriage Paid. Cash with Order or c.o.d.—Ward, 45, Farringdon St., E.C.4

ADVERTISEMENT INDEX

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

MAKING L.F. AND SMOOTHING CHOKES

Practical Wireless

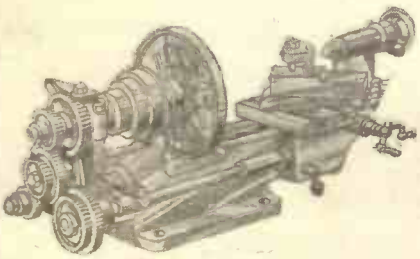
3D

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 3.——No. 66.
DECEMBER 23rd, 1933.
Registered at the G.P.O. as a Newspaper.

EDITED BY F. J. CAMM.

MICROPHONES - Types & Uses!

fascinatingly illustrated from cover to cover



THIS new monthly magazine caters for those who wish to make things for themselves, and fosters the interest of those whose hobbies deal with matters practical. The range of subjects dealt with is bounded only by the limits of science itself.

NEWNES PRACTICAL MECHANICS is the only magazine dealing with modern subjects in everyday language. It is THE magazine for those who wish to keep themselves up-to-date with modern technical and mechanical tendencies.

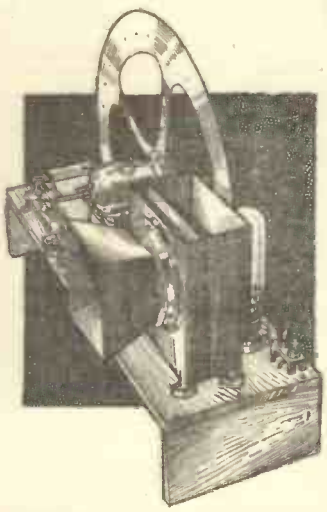
Every article in NEWNES PRACTICAL MECHANICS is the work of an acknowledged expert in the various fields and is fascinatingly presented to the non-technical reader. A well-equipped Science laboratory and workshop staffed by enthusiastic experts, is responsible for testing the latest devices and designing the various pieces of apparatus described in NEWNES PRACTICAL MECHANICS.

This magazine affords an intriguing, valuable and cheap means of keeping yourself up-to-date with modern technical and practical tendencies.

NEWNES PRACTICAL MECHANICS tells you how to make and do things for yourself. It places the world's heritage of technical and scientific knowledge before you in an easily assimilable form. The timely publication of NEWNES PRACTICAL MECHANICS coinciding as it does with the arrival of the new scientific era in which we live, provides everyone with the means of understanding the technical achievements nowadays of almost daily occurrence.

Some of the Subjects regularly dealt with.

LATHE WORK — MODEL AIRCRAFT — TELEVISION —WIRELESS CONSTRUCTION—MONEY - MAKING IDEAS — ELECTRICAL EXPERIMENTS—CHEMISTRY—MODEL RAILWAYS AND MODEL BOATS—PATENTS AND INVENTIONS—NEW TOOLS AND ACCESSORIES — THE LATEST NOVELTIES—PHOTOGRAPHY—MICROSCOPY — CINEMATOGRAPHY —ASTRONOMY, ETC., ETC.



PRACTICAL MECHANICS

The January issue contains an entertaining blending of the most interesting subjects of modern appeal to every man.

There are articles on lathe building and lathe work, astronomy, microscopy, all types of mains transformers, model boats, railways and aeroplanes, television, wireless, the latest novelties, tools, gadgets, accessories, cinematography, photography, patent advice, electrical experiments, chemistry, etc., etc.

If your hobby or your work is in a practical direction you cannot afford to miss a single issue of this live, up-to-date, and interesting magazine, which will keep you abreast of the times and acquainted with modern technical and scientific developments.

6D.

NOW ON SALE

At all Newsagents and Bookstalls, or post free 7½d. from George Newnes, Ltd., 8-11, Southampton Street, London, W.C.2.

Geo Newnes, Ltd.

THE LEADING HOME CONSTRUCTORS' WEEKLY

Practical Wireless

EDITOR: F. J. CAMM

Technical Staff: W. J. DELANEY, H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E., FRANK PRESTON, W. B. RICHARDSON

Vol. III, No. 66 Dec. 23rd, 1933

ROUND *the* WORLD *of* WIRELESS

Listen in to H.M. The King!

HIS MAJESTY THE KING will broadcast a message to his subjects in all parts of the world on Christmas Day at 3 p.m. G.M.T. Every reader should keep this appointment with his radio set. And, again, a pleasant and enjoyable Christmas to every reader.

A Remarkable Radio Year

THE year 1933, now drawing to a close, has been the most remarkable one for radio developments since the industry first started. Next year may witness even more astonishing developments, for radio still awaits its missing link—television. Radio cannot be considered as perfect until a satisfactory combined speech and vision programme is an actuality. Much is being done to accelerate that desirable end, especially with high definition television, and it seems to us that the solution will *not* be a mechanical one. We should not be satisfied with silent films today, and once we have synchronized vision and speech we shall marvel that we were able to suffer for so long from radio "blindness." Whenever television arrives, it will be suddenly—overnight, so to speak, as radio did over twelve years ago.

Our Prompt Query Service

ALTHOUGH our Readers' Query Service is free, and hundreds of technical queries are received each week; and notwithstanding that the number of queries is on the increase, yet we are able in most cases to send a reply within forty-eight hours. We have considerably augmented the staff attending to readers' letters, and we hope that *every* reader in doubt or difficulty will not hesitate to seek our advice. It will be speedily, cheerfully, and helpfully forthcoming.

Motala's Increased Output

FOLLOWING the lead given by other European nations in the increased power of their National transmitters, Sweden in the early part of 1934 will broadcast its main programmes through Motala on 150 kilowatts. So far the transmissions of this station have not exceeded 30 kilowatts (Copenhagen rating).

B.B.C. Regional Stations' Increased Power

WITH the reorganization of the B.B.C. system which is taking place next year, the power of the London, North, West, and Scottish Regional stations will be raised to 70 kilowatts as against 50 kilowatts at present used. The super high-power transmitter now under construction at Droitwich, and which is to replace Daventry National, will work on 150 kilowatts. It is expected to start testing towards March, and will then be formally opened for the summer months. Three National stations, namely, London, North and West, will then close down.

Original Musical Comedy Broadcast

MEET THE PRINCE, adapted from *The Prince and Betty* by P. G. Wodehouse, has been made the subject of a new musical comedy to be included in the Regional and National programmes on January 1st and 2nd.

Radio Lisboa

ALTHOUGH the buildings of the new high-power Portuguese station are not completely finished, the engineers have been trying out the transmitter. Listeners in the British Isles report hearing tests on 476.9 metres in the early hours of the morning.

American Stations Install Own News Service

AS a result of the restrictions made by the American newspaper organizations, the Columbia Broadcasting System has set up its own press bureau and broadcasts news collected by its representatives throughout the entire network. The C.B.S. news agencies have been established in the leading cities, and for the purposes of distribution the chain of stations is linked up by teletype, in order to rush the items through for dissemination through the microphone. It is stated that in this manner they are able to give their listeners details of topical events many hours before the newspapers are on sale in the streets. There is little doubt that the step taken will precipitate a fight between the broadcasting stations and the local press associations.

Belgium's Third Station

TO counteract Nazi propaganda broadcasts destined for the inhabitants of the Eupen and Malmedy (Belgium) districts, the authorities are considering the erection of a 7 kilowatt station on the eastern frontier for the transmission of programmes in the German language.

Interesting Statistics of Radio City

THE Headquarters of the N.B.C. at New York furnish some interesting figures regarding the installation on which six hundred engineers have been working for some months. The building is equipped with three hundred and twenty-five electric clocks which are all synchronized, and two hundred and fifty microphones have been scattered throughout the studios. In all, 1,250 miles of wire have been used, and it is estimated that this has entailed twenty million connections, one cable alone carrying 140 lines.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

K-B Win-a-Daimler Competition

MESSRS. KOLSTER-BRANDES, the well-known radio manufacturers, have instituted a remarkable competition, which will be open to all purchasers of any one of their sets until the end of the year, when the competition will close. The prize is a £450 15h.p. Daimler Saloon car, fully taxed and insured for twelve months. Messrs. Kolster-Brandes are searching for: 1. A good name or title for their K-B 666 de luxe Receiver. 2. A slogan. The prize will be awarded for the best title and slogan. Full particulars, entry forms, and leaflets can be obtained from all K-B dealers. The model for which the title is being sought was created by the well-known designer, Betty Joel, seen in the illustration on this page, and is constructed of Queensland walnut, bound with chromium-plated steel. The set is designed for the anti-interference device known as the "Rejectostat," a self-contained unit applicable to any radio set. Provided the aerial is placed outside the field of interference, it will successfully eliminate electrical interference appliances of all kinds.

Fighting the Radio Pirates

IN Germany stringent measures are taken against owners of unlicensed radio apparatus. Between July and September, two hundred and forty-five persons were convicted in the courts; of these two hundred and thirty-seven were heavily fined, and eight were condemned to prison, the sentences ranging from three days to three months!

Further Relays for Austrian Network

TWO new relay stations are to be installed at Leoben and Villach, and will be constructed as soon as the Bregenz-Vorarlberg transmitter has been completed. Following the German plan, Austria contemplates a regrouping of her stations. Graz, Salzburg, and Villach will then work on one common wavelength and Linz, Klagenfurt, and Bregenz on another. On January 15th the following alterations in channels will take place: Vienna (Bisamberg) 506.8 m., Graz, 338.6 m., Salzburg, 226 m., and Innsbrueck, 578 m. With the exception of Vienna, most of the other stations will see an increase in power during 1934.

European Broadcast of Lehar's new Opera

THE first performance of Franz Lehar's new opera *Giuditta* is expected to take place at Vienna in January next. It will be relayed later to most of the main European broadcasting stations, as Austria's contribution to the International transmissions. Richard Tauber will sing the principal part.

A Greatly Sought Honour

OVER six hundred applications from wireless operators were received by the Organisers of the Byrd Antarctic Polar Expedition, of which four only were chosen. Many of them were well-known experimental amateurs.

INTERESTING and TOPICAL PARAGRAPHS

Punctuality!

IN American broadcasts you will frequently notice that transmissions are faded out if they exceed by only a minute or so their allotted time limit. Punctuality in the working of the advertised programmes is strongly insisted upon, and the drastic measure adopted of cutting out the microphone in the case of offenders permits the studio's strict adherence to the time schedule. There are no waits between items.

A WOMAN RADIO DESIGNER

Betty Joel with the famous K-B 666 she designed, in connection with which there is now running a £450 "Win-a-Car" competition.

SOLVE THIS!

Problem No. 66

Whilst listening to a broadcast programme Brown's receiver suddenly gave a slight click and thereafter produced only badly distorted signals. He switched off and substituted all the valves with spares which he had and found that still only badly distorted signals could be heard. He inserted a milliammeter in each anode circuit in turn, and although the H.F. and detector valves gave correct readings, the current of the putput valve was much greater than it should have been. He altered the grid biasing plug, but this made no difference to the anode current of this valve. What had happened? Three books will be awarded to the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 66, and should be posted to reach here not later than Dec. 28th, 1933.

SOLUTION TO PROBLEM No. 65

Rodgers had forgotten that resistances in series produce a total resistance equal to the sum of the resistances, and thus he used a far too high value to enable the valve to receive sufficient H.T. Had he paralleled the two 250,000 ohm resistances he would have obtained better results.

The following three readers gave correct solutions of Problem No. 64, and books have accordingly been forwarded to them:

Mr. T. G. Childs, Torwood, Gubbins Lane, Harold Wood, Romford. Mr. G. T. Jervis, 343, Birchfields Rd., Webheath, Redditch. Mr. R. Taylor, Hazeldene, Churt.

Germany's Four Programmes

WITH the exception of the *Deutschlandsender* (Königs Wusterhausen), from January 15th, Germany will only broadcast three distinct programmes daily, as the stations are now being amalgamated into a Northern, Western, and South-Western network. The first will include Berlin, Stettin, Magdeburg, Hamburg, Hanover, Bremen, Flensburg, Kiel, Danzig, Königsberg, and Heilsberg; the second, Frankfurt, Cassel, Trier, Langenberg, Stuttgart, and Freiburg; the third, Munich, Nürnberg, Augsburg, Kaiserslautern, Leipzig, Dresden, Breslau, and Gleiwitz.

Monument plus Church Equals Station

THE new Turin local transmitter, which relays the Rome programmes, has been installed in the Teatro Torino, taken over by the Broadcasting Company. The aerial is connected to the top of the Mole Antonelliana, the tower of which is 550 feet high, the highest point of the City. The station works on 220 metres (1,364 kc/s), and has replaced the old Eremo transmitter, which was rendered useless through snow storms.

The First Time Signal

IN these days of progress it is easy to lose sight of events which in previous years aroused considerable interest. November 21st, 1933, was the twenty-third anniversary of the first time signal wirelessed by the Eiffel Tower from the Paris Observatory to ships at sea, an innovation which benefited the world at large.

Broadcast of Christmas Greetings

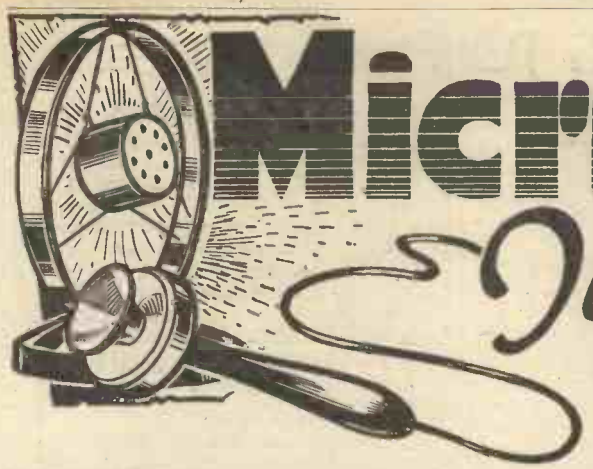
SIMILAR to the principle adopted last year the Danish authorities will again permit their licence-holders to broadcast private Christmas messages to relatives in Greenland and the Polar Circle. Seven studios will be placed at their disposal for this purpose for three nights before Christmas Eve between 11.0 p.m. and 1.0 a.m. G.M.T. The messages, which must be of a purely private character, are transmitted verbally through the high-power Kalundborg station.

How Many Broadcasters?

IF the latest returns are to be taken as accurate, there are, at present, 1,426 broadcasting transmitters in the world giving a daily service of wireless programmes. Of these, 585 are situated in the United States of America.

The Bells of Bethlehem

IT is now possible to announce that the programme specially composed for Christmas Eve by the B.B.C., in co-operation with the N.B.C. of America, will include items relayed from Bethlehem, Winchester, London, and New York. Thanks to the active co-operation of the Colonial Office and the High Commissioner for Palestine, arrangements have been concluded which will permit of a relay from the Holy Land at 8 p.m. G.M.T., on December 24th.



Microphones Types & Uses

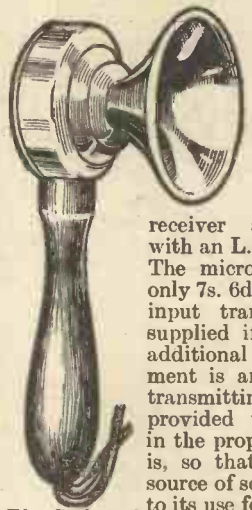
There are Now a Number of Small Microphones on the Market, and the Reader is Often in Doubt as to Which He Should Buy. This Survey of a Few of the Best-known Will Prove Helpful.

MICROPHONES are being used more and more by owners of wireless sets, and there is no doubt that they add much to the interest and entertainment of parties which are so frequently held at this time of the year. Until quite recently there were very few simple, inexpensive microphones available to the amateur, and to buy one of these instruments involved an expenditure of a fairly considerable amount of money. This state of affairs has now been modified entirely by the introduction of a number of really efficient, compact microphones, designed especially for use in conjunction with an ordinary wireless receiver of practically any type. Methods of connecting a microphone to the set were dealt with rather fully in articles which appeared in our Christmas Number, and we have since received numerous inquiries from readers in regard to the most suitable microphone for their individual requirements. For this reason a general review of some of the better-known components on the market, and at popular prices, will be helpful.

We might first of all refer to the General Electric Company's well-known "Home Broadcaster," which consists of a microphone flexibly suspended within a metal ring which is mounted on a hollow metal base. Inside the base are fitted a volume-control potentiometer (with calibrated scale) and also a small dry battery which supplies the energizing power. Additionally, there is a convenient switch connected in the battery-microphone circuit. Altogether this is an extremely convenient instrument which only requires to be connected up to the pick-up terminals of any receiver to enable excellent results to be obtained. The makers have even made arrangements for the latter connection by providing a good long, screened lead. Due to the screening, it is possible to use the microphone at almost any distance from the set without running the risk of instability or L.F. oscillation. The G.E.C. "Home Broadcaster" is unusually sensitive, and responds quite well to sounds originating several feet from it; in fact, we have found it possible to reproduce good quality speech by speaking at a distance of four feet from the instrument. At an inclusive price of 18s. 6d. this instrument represents wonderful value.

The Epoch Microphone.

A somewhat different type of microphone is that made by Messrs. R. C. and Wilson Electric, Ltd. This is of the "hand" pattern with "trumpet" mouthpiece, and is also supplied with a length of connecting lead. It is not fitted with a transformer, battery, or volume control, however, but is intended rather for use with a receiver already provided with an L.F. volume control. The microphone itself costs only 7s. 6d., whilst a suitable input transformer can be supplied if required for an additional 6s. This instrument is amply sensitive for transmitting speech or music, provided that it is turned in the proper direction, that is, so that it "faces" the source of sound. In addition to its use for home entertainment purposes, it will also find a wide application with those amateurs who hold transmitting licences.



The R.C. and Wilson Microphone.

Several useful and interesting microphones are made by the Scientific Supply Stores (Wireless), Ltd., and these range from a small microphone button (No. 1) at 3s. 6d., to a complete assembly (called the "De-Luxe" at 17s. 6d. There is also a second microphone button (No. 2) at 4s. 9d., or 5s. if fitted with a diaphragm. This firm supplies an extremely wide range of microphone components from which the constructor can build his own instrument in the simplest possible way and at a minimum of expense. The completely assembled microphone ("Junior" type), which costs 12s. 6d., is illustrated on the right, and can be seen to consist of a unit flexibly mounted in a metal ring and fitted with a circular base. An interesting point about both this and the "De-Luxe" model is that the flexible connecting lead supplied with it is provided with a neat valve-holder adaptor, consisting of a paxolin disc with holes corresponding to the pins on the valve base. A metal eyelet is fitted to the hole corresponding to the anode pin, and this is connected to one microphone lead; the other lead is fitted with an eyelet connector which is taken to an earth terminal. This method of connecting a microphone is rather unusual, but is found to work extremely well and has the advantage that it is applicable to any receiver whether it is provided with pick-up terminals or not. Additionally, it removes the need for an energizing battery, whilst the normal L.F. volume control in the set is operative upon the microphone input.

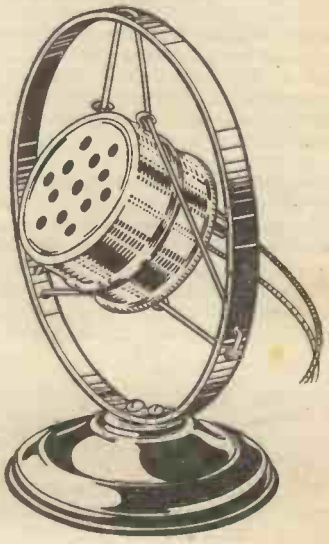
The Scientific Supply Stores Junior Type Microphone.

It will also interest readers to know that the Scientific Supply Stores publish an interesting little book entitled "Wonders of the Microphone," and costing 6d. Besides giving much useful information and many diagrams, showing how different microphones can be connected and employed for a variety of purposes, this booklet contains a price list of the many microphone accessories which the firm supply.

A Non-Directional Microphone

Another microphone which has many points of interest is that made by Capt. A. J. Roberts. This instrument can be used in the hand or it may be stood up on the table.

(*Continued on page 742*)



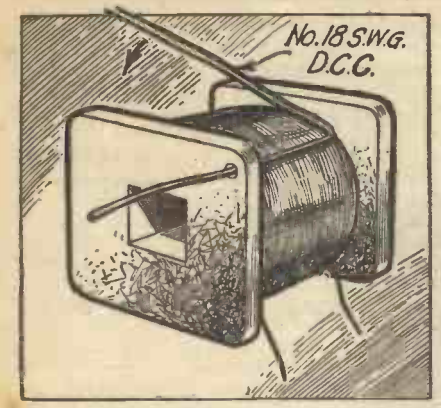


Fig. 1.—Cover the primary with a layer of cambric before starting the secondary winding.

CONVERTING TO ALL-MAINS

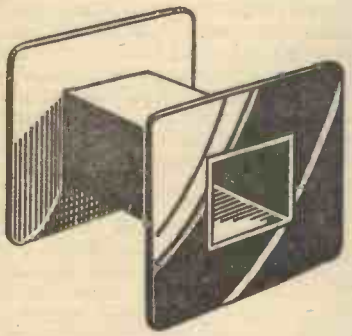
(PART II).

Details are Here Given for Building a Heater Transformer.

By C. H. KEELING, A.M.I.R.E.

IN the previous article we indicated the various alternatives, so far as the output valve is concerned. Readers may have in their possession a 2-volt, 4-volt, or 6-volt valve, therefore details will be given for the different windings required when building a heater transformer.

The number of turns of wire should be 9 per volt—that is to say, assuming A.C. mains of 230 volts, our primary will have to be wound with 2,070 turns of .0092 (34 gauge) enamelled wire, and the secondary supplying the heaters of the 4-volt valves should be wound with 36 turns of .048 (18 gauge) double cotton-covered wire. If we are using a 2-volt or 6-volt valve in the output stage, the filament of which is to have "raw" A.C. applied as shown previously, it becomes necessary to wind two separate heater secondaries, one for the 4-volt valves, and another for the 2- or 6-volt valve. If 2-volt, the separate winding will have to have 18 turns, and for a 6-volt filament we must employ 54 turns.



Centre-tapped Transformer

It is essential that the secondaries shall be centre-tapped, and this is easy to accomplish if we proceed to wind the transformer methodically. The primary wire can be wound first, care being taken to leave a good length of wire at both ends for making our external connections. Double cotton-covered wire could be employed for the primary, and no doubt would be less likely to be damaged in the hands of the beginner; incidentally, it is cheaper, but it is considerably more bulky, and would probably necessitate a larger bobbin. For this reason enamelled wire is recommended, it being stressed that great care must be taken to avoid "criss-cross" windings, which impose an enormous strain on the turns when the coil is fully wound. This very often is the cause of short-circuited turns owing to the enamel cracking. Periodical "interleaving" with cambric or impregnated paper will make for efficiency.

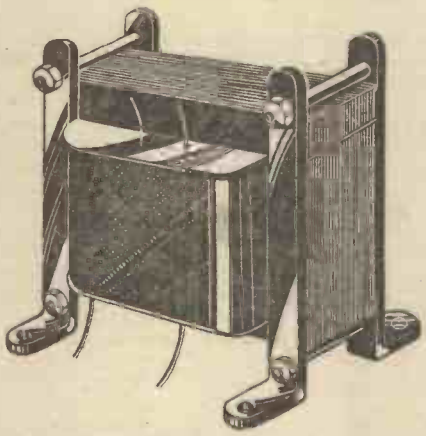


Fig. 3.—The finished transformer.

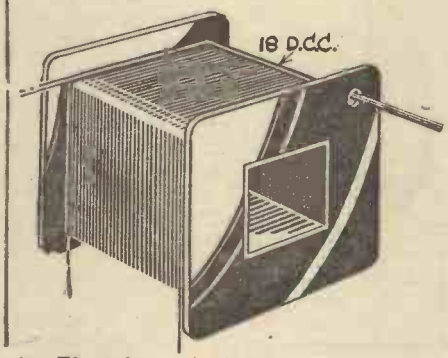
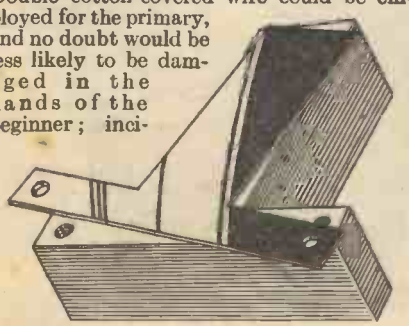


Fig. 4.—The bobbin, finished primary winding, and partly wound secondary winding.



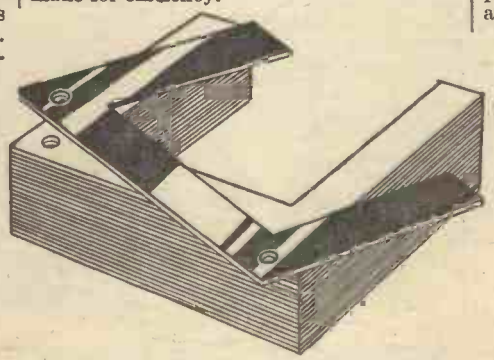


Fig. 5.—The stampings and clamping brackets.

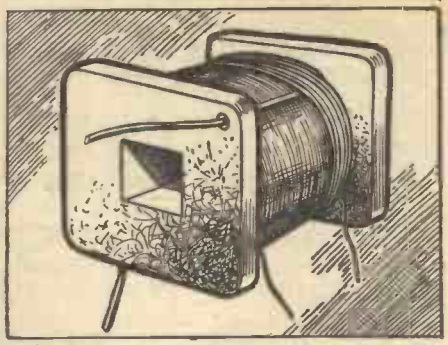
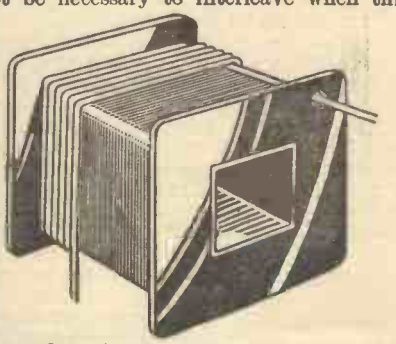


Fig. 2.—The commencement of the secondary winding.

The Secondary Winding

Having finished the primary, we can start on the secondary winding. First cover the primary with a layer of cambric, then drill a hole in the cheek of the bobbin just clear of the cambric; make a right-angle bend in the thick wire and place the end through the hole, allowing the angle in the wire to rest against the inside of the opposite bobbin cheek (see Fig. 1). We can now wind this thick wire over the bent section, thus ensuring that it will not slip. To obtain the centre tap, wind half of the total number of turns to be wound, bring out the end a few inches, bend a loop, and proceed to wind the rest of the turns. As we will have to bare the insulation at the loop, it may be advisable to cut the wire at this point, and twist the two bared ends together preparatory to soldering them later. In order to fix the turns in position when making the centre tap, or for any other reason, use a little Chatterton's Compound.

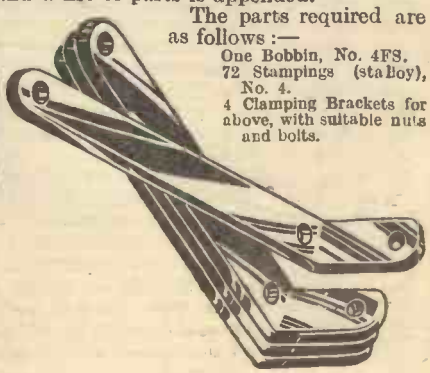
If d.c.c. wire is used instead of enamelled for the primary, first coat it with shellac and allow to dry before winding. It will not be necessary to interleave when this type of insulated conductor is in use, but a good layer of varnished cambric should be placed between the primary and secondary windings.



The illustrations Figs. 4 and 5 show the parts required to make a workmanlike job, and a list of parts is appended.

The parts required are as follows:—

One Bobbin, No. 4FS.
72 Stampings (stalloy), No. 4.
4 Clamping Brackets for above, with suitable nuts and bolts.



Interesting uses for H.F. METAL RECTIFIERS

The "Westector" has Many Interesting Applications to Modern Receivers, and a Number of These are Explained Below. By BERNARD DUNN

THE dry high-frequency metal rectifier, better known as the "Westector," was introduced to the public rather less than a year ago but, although it has been widely adopted by manufacturers of both complete receivers and components, the constructor seems to have been somewhat slow to recognize the undoubted advantages which it offers. As a matter of fact, this type of rectifier is of particular value in modern circuits, where it can be used for a variety of purposes. Moreover, it is inexpensive in prime cost and, since it requires neither high nor low tension current, it costs absolutely nothing in the way of running expenses.

As a Normal Detector

First of all let us consider just what this H.F. metal rectifier is capable of. It is similar in construction and principle to the larger metal rectifiers used in mains receivers and eliminators, but its self-capacity is so low that it can be used in radio frequency circuits. It is not particularly sensitive, and because of that it is not suitable for use in a "crystal" set in place of the crystal detector. But, on the other hand, it can handle a considerable amount of signal current, and is therefore eminently suitable for use as a detector following two or more stages of high-frequency amplification. A portion of the complete circuit of a two-V.M. receiver in which a "Westector" of the half-wave type is used as detector is shown in Fig. 1. It can be seen from this that the metal rectifier acts in almost the same way as does a diode valve, but it does not require any filament current. As the rectifier is connected it will be seen that the end which is remote from the tuned-grid coil becomes negative in respect to the other end (which is connected to earth), and from this it will be evident that the voltage-drop across the rectifier can be used for providing A.V.C. acting upon the V.M. valves. All the necessary components and connections required in order to obtain A.V.C. are shown in broken lines. The method of functioning of the automatic volume control device is perfectly simple and can readily be understood when it is realized that the voltage-drop, or potential difference, across the terminals of the rectifier depends upon the strength of the signals applied to it. The bias voltage fed back to the V.M. valves is, therefore, proportional to the voltage (H.F.) of the signal applied to the rectifier.

The method of rectification and A.V.C. just described is applicable to any receiver in which tuned-grid or tuned-transformer coupling is used between the second H.F. amplifier and the detector, but cannot be employed in conjunction with tuned-anode coupling because in that case there is no direct connection between the positive side of the rectifier and earth. Since the rectifier is so comparatively insensitive it is also absolutely essential for good results that the H.F. stages are really efficient. It can be stated as a fairly general rule that unless the degree of H.F. amplification is so high as to make it possible to overload an ordinary leaky-grid valve detector, the metal rectifier will not be very suitable.

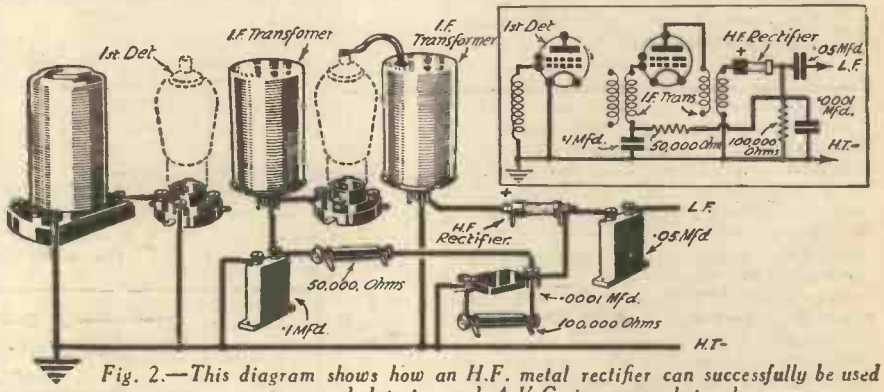


Fig. 2.—This diagram shows how an H.F. metal rectifier can successfully be used as second detector and A.V.C. in a superheterodyne.

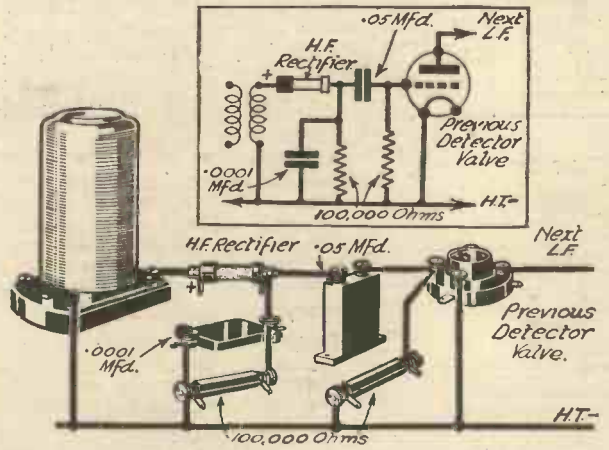


Fig. 3.—This circuit shows how a half-wave rectifier can be inserted between the last tuned circuit and the valve which previously acted as detector. The latter valve now acts as a resistance-coupled L.F. amplifier.

Better for Superhets

"Westectors" operate more efficiently at the lower radio frequencies, and for that reason they are particularly suitable for use as second detectors in superheterodynes, in which capacity they are nearly as sensitive as a valve, besides having the advantage that they can be used to provide an effective measure of automatic volume control. A skeleton circuit showing the first detector and a single I.F. stage of a superhet followed by a half-wave metal rectifier providing A.V.C., is given at Fig. 2.

In many cases where a metal rectifier is used to replace a valve as detector it is

(Continued overleaf)

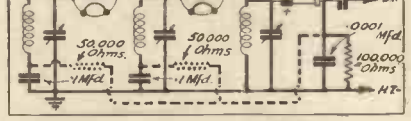


Fig. 1.—The skeleton circuit of a two-V.M. amplifier followed by a half-wave H.F. metal rectifier. The connections for A.V.C. are shown in broken lines.

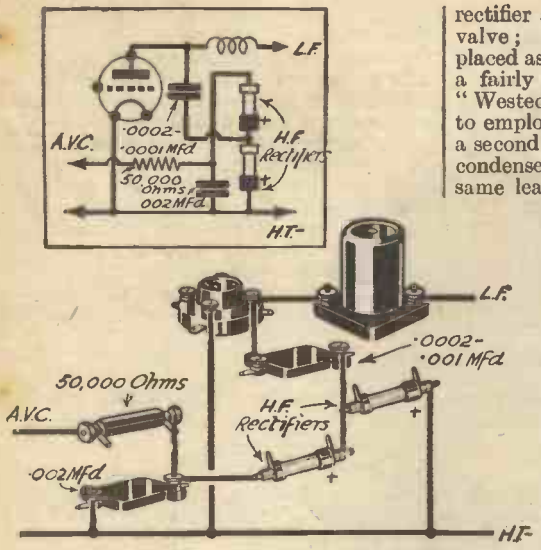


Fig. 5.—An arrangement which is somewhat better than shown in Fig. 4. The A.V.C. bias is supplied by a "voltage-doubler" circuit comprising two half-wave rectifiers.

(Continued from previous page)

preferable to add a second L.F. stage in order to maintain signal strength at the same level as before the alteration. This can be done most easily as shown in Fig. 3 by retaining the detector valve as a resistance-coupled amplifier and inserting the rectifier between it and the tuned circuit. The few new components required in addition to the "Westector" are:—One .0001 mfd. fixed condenser, two 100,000 ohm resistances, and one .05 mfd. condenser. If desired, the second 100,000 ohm fixed resistance used as a grid leak can be replaced by a potentiometer of similar value, which will serve as an effective L.F. volume control. Additionally, of course, provision can be made for connecting a pick-up in the grid circuit of the valve in the usual way.

Simplified A.V.C.

The methods of using the "Westector" as detector and A.V.C. so far dealt with have necessitated some departure from the conventional circuit arrangement, but it is quite possible to use the new rectifier for A.V.C. without modifying the standard circuit to any appreciable extent. The simplest way of doing this is shown in Fig. 4. It can be seen that the rectifier is connected in series with a fixed condenser (about .0002 mfd. is best with "straight" sets, and .001 mfd. with superheterodynes) between the anode of the detector valve and H.T. negative, whilst a lead is taken from the "top" of the rectifier (negative) to the grid circuit of preceding V.M. stages. When a signal is applied to the detector a portion of the signal voltage appearing in the anode circuit is diverted through the rectifier, across the ends of which a D.C. potential is developed. This potential is used to apply a variable bias to the preceding valves, and since the bias is proportional to the strength of the signal in the detector circuit, a true A.V.C. effect is produced. It will be seen from Fig. 4 that a decoupling resistance is included between the negative side of the rectifier and the grid coil of the preceding valve; this is essential and should be placed as near as possible to the coil. When a fairly long lead is necessary from the "Westector" to the grid coil it is better to employ "double" decoupling by fitting a second 50,000 ohm resistance and .1 mfd. condenser (non-inductive, of course) in the same lead but close to the rectifier. The second set of decoupling components are not indicated on the accompanying sketch.

Detector Damping

On first trying out the circuit shown in Fig. 4, it might be found that the detector does not oscillate in a normal fashion due to the damping imposed by the A.V.C. device. Should that prove to be the case, it will indicate either that the series condenser from the anode to the rectifier is of too high a capacity or that the leads in the anode circuit are too long.

It has been mentioned before that the H.F. metal rectifier is more efficient at the lower frequencies (higher wavelengths), so it will be obvious that the arrangement shown in Fig. 4 will be more effective on long waves in a "straight" set, although it will be equally effective over both wavebands in the case of a superhet. Where a greater degree of A.V.C. is required in a "straight" set, and especially when only a single V.M. valve precedes the detector, it is better to employ a pair of half-wave rectifiers connected in series as shown in Fig. 5. For simplicity, only the connections in the detector anode circuit are given, but the remainder of the circuit will be precisely the same as that shown in Fig. 4. The circuit given at Fig. 5 is a "voltage-doubler" arrangement, and thus the theoretical bias voltage applied back to the V.M. amplifier will be twice that of the previous arrangement; in practice the voltage is not quite doubled, but it is certainly greater and is sufficient to produce a really useful A.V.C. effect in even the simplest type of receiver.

H.T. Current Economy

There is yet another interesting use to which the "Westector" can be put, and this was described in a previous article in PRACTICAL WIRELESS. I refer to the use of the rectifier as an H.T. battery current economizer in conjunction with a super-power or pentode output valve. All the connections are given in Fig. 6, and from this circuit it will be seen that the rectifier is connected in series with a large capacity (1 to 4 mfd.) fixed condenser between the anode of the output valve and H.T. negative. A potentiometer arrangement is wired in parallel with the rectifier and a lead is taken from the tapping on this to the positive terminal of a grid-bias battery. The function of the circuit is briefly as follows: When a signal is being handled by the output valve a certain amount of the L.F. current appearing in the anode circuit is fed to the rectifier, and so produces a D.C. voltage across it. This voltage is in "opposition" to the normal grid-bias voltage, with a result that the G.B. actually applied to the grid of the valve is less than that of the battery. The voltage developed across the rectifier will clearly be proportional to the strength of the signal being handled by the valve, and consequently the bias voltage applied will vary in *inverse* proportion to the signal strength.

An Economy Device.

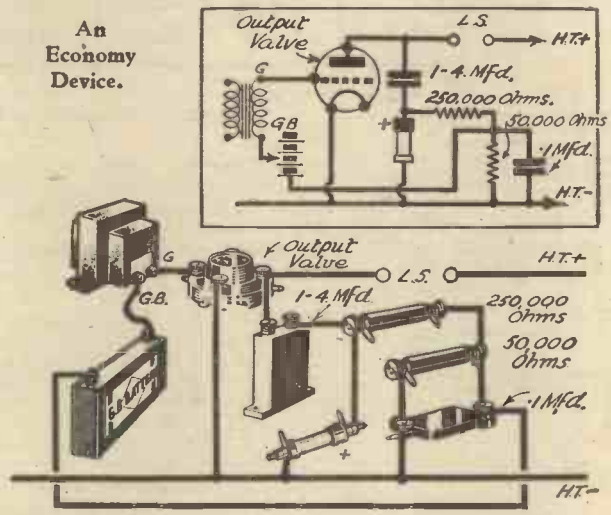
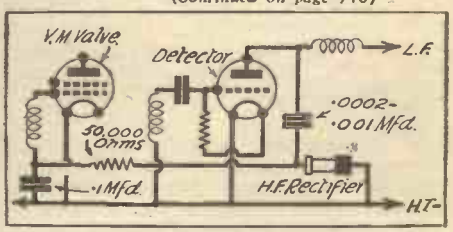


Fig. 6.—This circuit shows how an H.F. metal rectifier can be employed to reduce the H.F. current consumption of a power or pentode output valve.

Resistances Adjustments

Due to the effect mentioned above, it is possible to adjust the voltage of the G.B. battery so that the output valve is

(Continued on page 746)



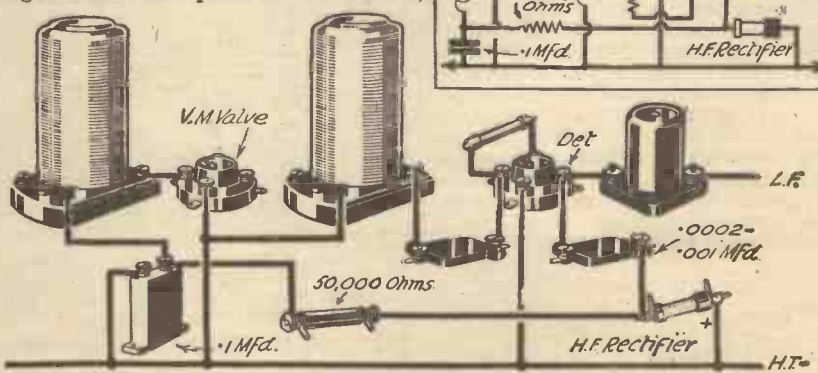
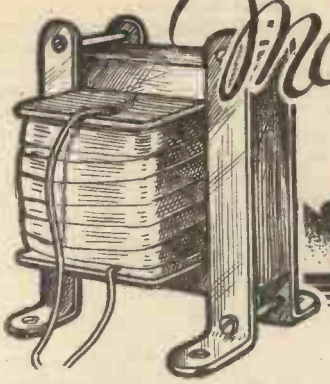


Fig. 4.—This is a very simple way of adding A.V.C. to any ordinary V.M. receiver. A half-wave H.F. metal rectifier provides the necessary A.V.C. bias voltage.



Making L.F. and Smoothing Chokes

Simple Instructions are Here Given Which Will Enable any Reader to Construct his own Chokes Without Difficulty.

By FRANK PRESTON, F.R.A.

THE tremendous amount of interest which is shown by readers of PRACTICAL WIRELESS in the home-construction of their own components is clearly indicated by the enormous number of letters we receive in regard to this matter. And, despite the fact that it is not usually any cheaper to make components than it is to buy them, the constructional work certainly forms a most interesting and fascinating pastime, besides giving a wonderful insight into the functioning of the parts.

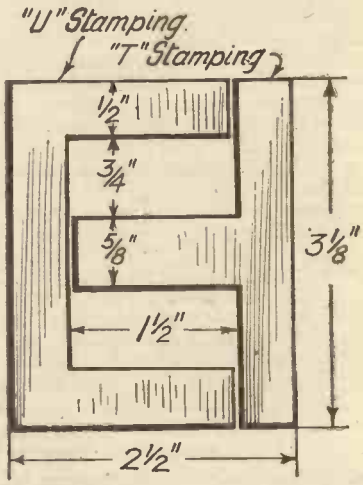


Fig. 1.—A sketch giving the dimensions of the No. 5 stalloy stampings required for the first choke described.

In a series of articles which is now appearing I describe the easy construction of various types of screened tuning coils, and here it is proposed to deal with the making of two or three kinds of iron-core chokes. Actually, chokes are very simple components consisting essentially of nothing else than a length (it is a very long length) of wire wound on a former built up from a number of laminations of iron. But to make a really efficient choke, of inductance, resistance, and current-carrying capacity, suitable for a particular purpose entails a certain amount of initial design, and it is the points which require special consideration that will be dealt with in this article.

A Low-frequency Choke

The simplest type of iron-core choke is one intended for coupling together two valves on the choke-capacity principle, or for connecting a loud-speaker to the output valve. The essentials of such a component are: An inductance of not less than 50 henries at the normal working current, a resistance to D.C. current of 2,000 ohms or less, and a safe current-carrying capacity of not less than 20 m.a. It is also an advantage, if the choke is provided with a tapping point, to enable alternative ratios to be obtained when it is employed to feed a loud-speaker.

In order to cover all the above requirements with an ample "reserve," the first choke I shall describe has an inductance of about 50 henries when carrying 25 milliamps. and a D.C. resistance of only 1,700 ohms. The winding is centre-tapped, and consequently the component can successfully be employed for a wide variety of purposes.

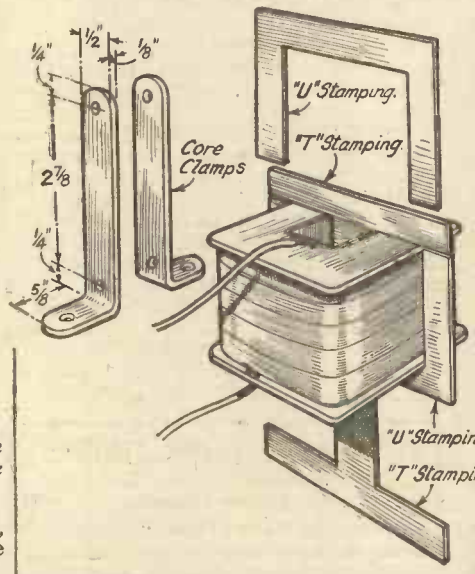


Fig. 3.—This sketch shows how the core stampings are fitted and gives details of the core clamps.

The core consists of about 3½ dozen pairs of No. 5 Stalloy stampings of "T" and "U" shape, whilst rather less than ¾ lb. of 38-gauge enamelled wire is used for the winding. Stampings of the size mentioned can be obtained from certain firms who specialize in the supply of such parts, but, incidentally, this size was employed for many of the better-quality L.F. transformers that were made a few years ago. The dimensions of the stampings are shown in Fig. 1, and by referring to these it will be an easy matter to tell if the core of an old burnt-out transformer which happens to be on hand can be made use of.

The Winding Spool

The first thing is to make a winding spool, which may have either a square or circular section "tunnel." If it is square it should be of the dimensions shown in Fig. 2, and can be made up by bending a strip of stout card in the manner indicated. When the card has been bent to shape it should be fitted with two end cheeks 2in. square. The latter can be fixed in position with "tacky" glue, after which the complete spool should be given a coat of thin shellac varnish to make it rigid. Before winding is commenced it is a good plan to wrap a layer of insulating tape round the spool to cover the otherwise sharp corners which might tend to cut the fine wire. A circular spool is somewhat easier to make, but is not quite so efficient. It is built up on a cardboard tube ¾in. inside diameter, and fitted with a pair of 2in. diameter end cheeks, after which shellac is applied as before.

Winding the Spool

After the winding spool has been made, two small holes should be made near the inside of one end cheek and a short length of rubber-covered flex threaded through these, leaving about 4in. projecting outside and 6in. projecting inside the spool. Next carefully solder the bared end of the 38-gauge enamelled wire to the end of the flex which is on the inside of the spool. It then only remains to wind on the wire. As there are a total of approximately 12,000 turns of this fine wire to be put on, however, it is best to give some thought to the most convenient way of winding. The complete job can be done entirely by hand, provided that a reasonable amount of patience is exercised, by making a wooden handle which will fit tightly into the spool. Should a lathe be available, this work may considerably be simplified and speeded up by gripping the handle between the jaws of a chuck. Yet another way is to make a short piece of wood to fit into the spool, and to fit this with a stout nail or bolt which can be held in the chuck of a hand-drill mounted in a vice. In any case, the bobbin of wire should be fitted into a small stand or on to a spindle, so that it can rotate freely whilst the wire is being drawn off. Also, when winding in the lathe, it is essential that a speed not greater than 50 or 60 revolutions per minute should be employed.

After winding on one-quarter of the wire the turns should be covered with a layer of insulation such as waxed paper, oiled silk, or empire tape, and this should be so put on that it will be impossible for later turns to slip past it. The winding should then be continued to 4,000 turns (it is not necessary to count, and an approximation based on the total quantity of wire will suffice) at which a tapping point should be made. To make this, scrape the in-

sulation away from the wire for a short distance, make a loop and then solder on a short length of flex, covering the joint with a blob of sealing wax, or with insulation tape. Fit another layer of insulation, continue to the 8,000th turn, again insulate, and then complete the winding. Solder a third length of flex to the last turn, pass this once round the spool, and then anchor it in a pair of holes made in a convenient position in the end cheek. It is a good plan to finish off the wound spool by applying a liberal coat of thin shellac varnish; this will keep out all traces of dampness. The winding should finally be covered with a protecting layer of empire tape.

Once the coil has been wound the stampings can be fitted into the spool. The method of fitting is perfectly simple if it is remembered that "T" and "U" shaped pieces are alternated throughout. Another point to remember is that each stamping is insulated on one side, and, to ensure that this shall be effective, the insulated (white or grey) side of every stamping should face in the same direction. To make the idea quite clear, the method of assembly is shown in Fig. 3. The core should be a really tight fit in the spool to prevent the possibility of vibration, and because of this it is best lightly to tap the last few stampings into position. The component is finally finished off by fitting a pair of core clamps made according to the dimensions given in Fig. 3. These are made from ¾in. wide by ⅛in. thick brass strip, and are held in place by means of 2 B.A. bolts, 1¼in. long.

It has been stated that the choke described above can be used for various L.F. coupling purposes, but it should be added that it is also entirely suitable for H.T. smoothing in mains equipment, where the total current does not exceed about 50 milliamps. When passing the maximum current, the choke will have an inductance of rather more than 30 henries and will produce a voltage-drop of eighty-five. The choke is really most suitable for use in an eliminator supplying about 30 milliamps., and under such conditions its inductance is sufficiently high to give adequate smoothing, whilst the voltage-drop produced will be fifty-one (a reasonably low figure).

A Gapped-core Choke

When dealing with currents in excess of some 50 milliamps., it is advisable to employ

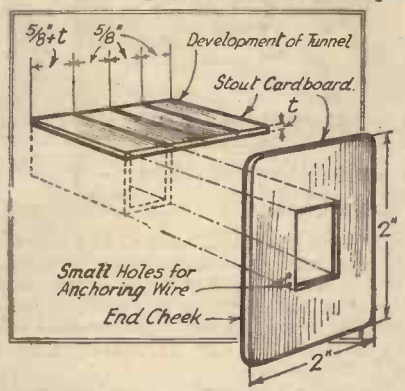


Fig. 2.—Constructional details of the winding spool for the choke.

a smoothing choke of greater dimensions and having a lower resistance to D.C. It is also an advantage to make the component of the so-called constant-inductance type, so that its inductance varies by only the very slightest amount when the current passing through the winding is varied. In order that a choke should show such characteristics, there must be an air-gap in the core; that is the "T" and "U" shaped stampings should not touch each other, but should be arranged with a small gap between them. Particulars will be given of a component of this type which has an inductance of 50 henries, a D.C. resistance of about 1,300 ohms, and a maximum current-carrying capacity of nearly 100 milliamps.

Six dozen pairs of No. 4 Stalloy stampings are required for the core, and the winding should consist of approximately 12,000 turns, or 1½lbs. of 36-gauge enamelled wire. The winding arm of the core will measure 15/16in. by 1 1/16in. by 2 5/16in. long, so a spool of these dimensions and fitted with end cheeks measuring 2⅝in. by 2⅝in. should first be made. This will be wound in exactly the same manner as was described for the smaller component, taking tappings if desired.

The only real difference occurs when the core stampings are to be fitted, since arrangements have to be made to provide the necessary air gap. This is easily done by fitting all the "T" stampings into the spool from one end, and then arranging all the "U" stampings opposite to them. The necessary gap is fixed by slipping strips of card 1/10in. thick between the ends of the "U" stampings and the sides of the "T's." Additionally, to prevent the gap being short-circuited, slips of paper must be placed between the core clamps and the core itself. When the clamps have been tightened up the cardboard slips may be removed if preferred, but there is no reason why they should not be left in place, because they have precisely the same magnetic properties as air.

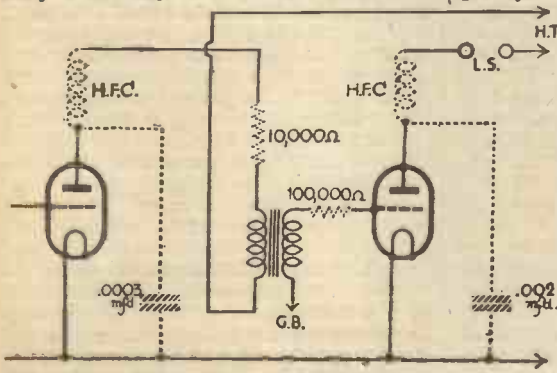
The gapped-core choke can be used for any purpose which demands a choke, but it is especially suitable for use in powerful mains receivers for smoothing, or feeding the loud-speaker. It can also be used very successfully as a loud-speaker field replacement choke. Very often, it is desired to make use of a permanent magnet speaker which might be more convenient, and in that case a choke having characteristics similar to those of the speaker field is called for. Most speakers of the type under consideration have a D.C. resistance of approximately 2,500 ohms; thus, to make our choke suitable it must be wired in series with a 3-watt (minimum), 1,000-ohm resistance. As an alternative, and where the maximum current does not exceed some 50 milliamps., the choke may be wound to almost exactly the correct resistance (2,500 ohms) by using approximately 1lb. 2ozs. of 38-gauge enamelled wire. This amount will run to just about 13,500 turns.

ELIMINATE THOSE HOWLS

Simple Precautions to be Taken for Curing the Trouble.

By "ELECTRON"

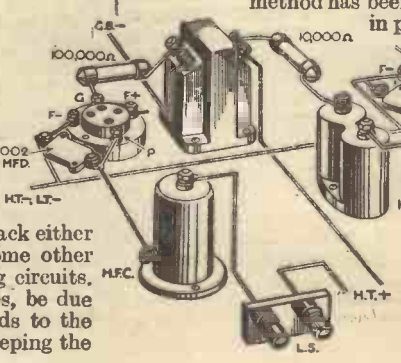
ONE of the greatest bugbears to the radio amateur is what is known as "threshold howl," which is an extremely aggravating type of reaction in the form of a low-frequency oscillation. It generally reveals itself as a low squeak or howl just as the set is brought to the "threshold" of oscillation by means of the reaction control, hence the name "threshold howl." When it occurs in a receiver relying upon the extensive use of the reaction control for the reception of the more distant stations, it can be very disturbing, as its effect is to limit the use of the reaction control to a point considerably lower than that at which the maximum sensitivity of the set is developed. To cross the threshold where the howling begins is to blot out signals completely. Consequently, some of the stations that could normally be received by the use of reaction are quite impossible to get.



Theoretical circuit of the principal modifications referred to in this article.

Simple Remedies

However, the fault is not usually a difficult one to overcome, being generally caused by high-frequency currents reaching the low-frequency stages, and feeding back either into the aerial or some other portion of the tuning circuits. It may, in some cases, be due to long extension leads to the loud-speaker. By keeping the loud-speaker leads away from the aerial, and not allowing them to double back across the receiver, a cure is often effected. A further precaution may be taken by inserting a high-frequency choke in the negative lead (the one nearest the plate of the output valve) to the loud-speaker, and connecting a by-pass condenser of about .002 mfd. between the plate side of the choke and negative filament. Frequently, however, volts are too precious to permit of any drop, no matter how small, in the anode potential of the output valve, so that it is wiser to bear in mind that "prevention is better than cure," and to take steps to eliminate the fault where the low-frequency stages begin, namely, the detector valves. The method has been fully described in previous articles.



Pictorial representation of the circuit shown opposite.

By PERCY RAY

CLASS B & the STRAIGHT THREE

A Practical Article Dealing With Essential Points, with Special Reference to the Pentode

PART 2

Last Week the Theoretical Side of Class B Amplification was Fully Dealt With, and in This Article the Practical Constructional Side is Considered

THE theoretical circuit, including the driver valve, is shown in Fig. 1. As touched upon in the previous article, the driver valve must be an L.F. or small power type, as it functions in the nature of a preliminary output valve rather than as a voltage amplifier, as it would do if used as a normal L.F. stage; this driver valve feeds the two grids of the 240B valve.

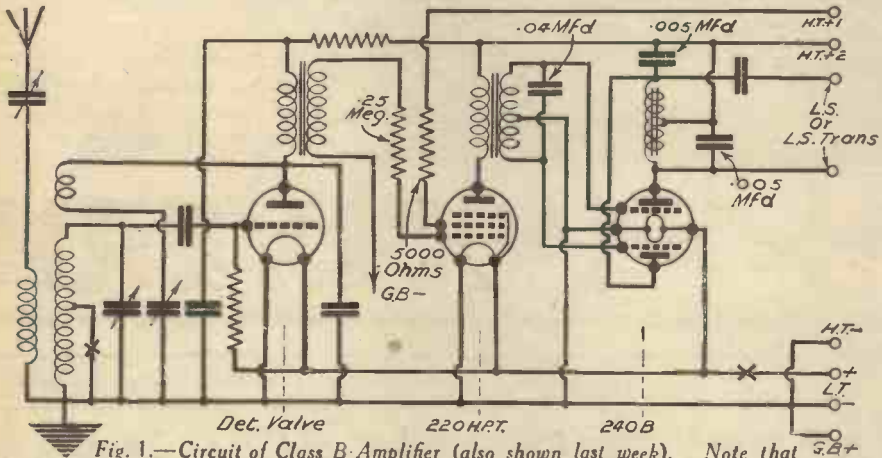


Fig. 1.—Circuit of Class B Amplifier (also shown last week). Note that the secondary of the input transformer and primary of output transformer must have very low resistance.

Reference to Fig. 2 will show that when the valve is delivering its maximum output, grid current up to 10 milliamps will be flowing. When current flows through a resistance there is always a voltage drop across it, and if the secondary winding of the input transformer has a high resistance, the passage of the grid current will result in bias being placed on the grids, which will result in horrible distortion if the resistance is high enough to raise the bias to an appreciable value.

Obviously, this secondary winding should have the lowest possible resistance, but in practice a value not exceeding 300 ohms will be found suitable It should be noted that the grid current will only flow through half the transformer at any given instant, so that the effective resistance will only be half of 300, namely, 150 ohms.

When only a small, undistorted output is required it would, at first sight, seem practicable to drive the valve direct from a power grid detector, leaving out the driver stage altogether. Such a procedure would work satisfactorily in the middle of the Sahara Desert, but would be quite useless in Europe, as the anode circuit of the detector valve would be so heavily damped that the tuned circuit in front of the detector would be very unselective indeed. To make matters worse, the selectivity would be dependent on the power of the incoming signal, so that irritating snatches of other programmes would be super imposed on the music from time totime.

Output Arrangements

The output arrangements call for some special care, and may either take the form of an output transformer, as shown in Fig. 1, or preferably an output choke, as shown in Fig. 3; the latter has the advantage that when suitably tapped it can be used with a moving-coil loudspeaker that would otherwise be quite unsuitable.

The primary of the transformer, shown in Fig. 1, or the choke shown in Fig. 3, must have a resistance not exceeding 400 ohms, as high resistance at this point would result in considerable loss of output; for example, 1,000 ohms would lower the output by a figure approaching one half, and would, in addition, tend to vary the "light and shade" of the music. Where choke or transformer is used, the ratio must be such that the speech coil of the lower speaker is raised to the optimum load of the valve, which should be 8,000 ohms for 120 volts, or 10,000 ohms when 90 volts is used. The output for the former set of conditions will be a little over two watts, and for the latter just over one watt. Reference to the accompanying table will show at a glance the load, the

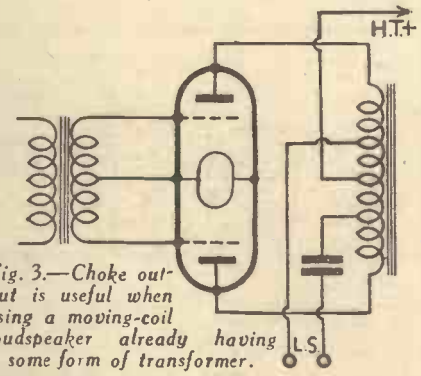


Fig. 3.—Choke output is useful when using a moving-coil loudspeaker already having some form of transformer.

(Continued on page 728)

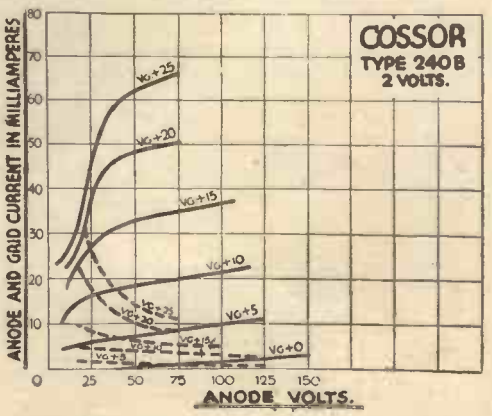


Fig. 2.—Anode/volt anode/current curve.

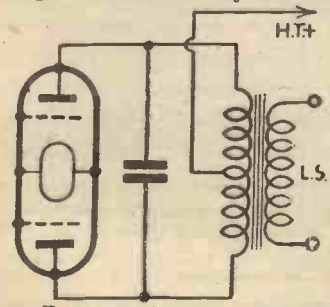


Fig. 4.—Tone control necessary with moving-iron speakers.

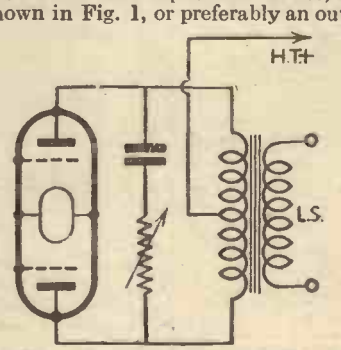


Fig. 5.—A modification of Fig. 5 to permit variation of tone.

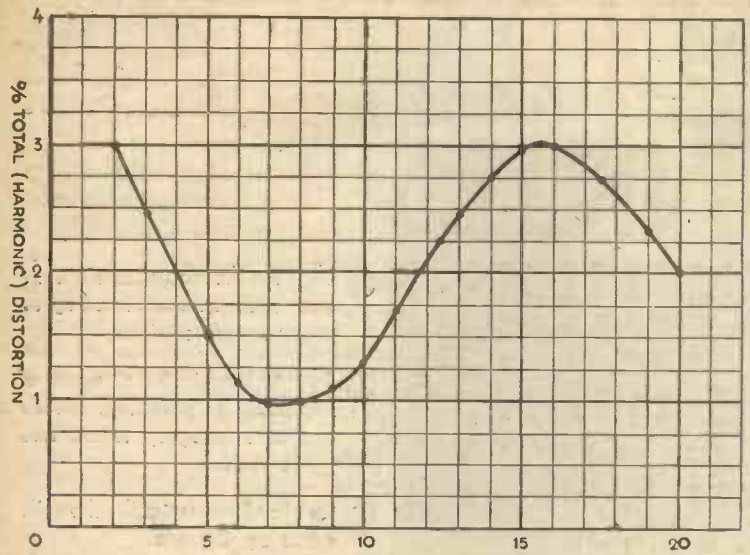


Fig. 6.—It will be seen from this curve that distortion does not exceed 3%.

(Continued from page 726)

undistorted output, average anode current, and other relative data.

Owing to the fact that only one valve is working at a time, the ratio of the transformer will be proportional to secondary turns and half of the primary turns. Thus, if the primary of the transformer has twice the number of turns as there are on the secondary, the transformer may be regarded as having a ratio of 1 : 1 for whichever valve is in operation.

Before leaving the subject of the output transformer, it will be as well to stress the fact that although the average anode current is only 11 milliamps, it will rise to 45 or more milliamps when the valve is called upon to deliver its maximum output; the secondary must, therefore, be capable of standing at least 50 milliamps. It should also be noted that, unlike the ordinary middle point push-pull output stage, the anode current is only flowing through one half of the transformer, and the iron core will become magnetized, as there is no current in the opposite direction.

The purpose of drawing attention to the magnetization of the core and the high momentary current is to illustrate to the reader, beyond any shadow of doubt, that the ordinary push-pull transformer is absolutely unsuitable. Only transformers or chokes expressly designed for use with Class B valves are suitable, and then only when made by a firm of repute.

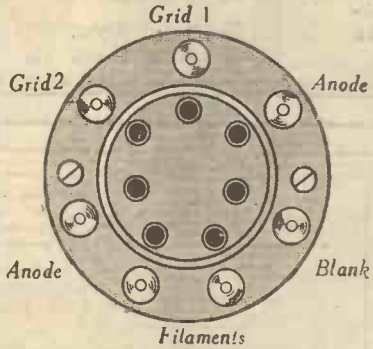


Fig. 8.—Drawing of valve holder showing pins

Tone Control and Moving-Iron Speakers

When using an ordinary balanced armature loud-speaker, there will be a slight tendency towards shrillness, and tone correction should be introduced similarly to the tone correction employed when an ordinary pentode valve is used. It should be clearly understood that this is not required with a moving-coil loud-speaker, unless of very indifferent design. Fig. 4 indicates the method of connecting the condenser between the two anodes of the 240 B valve. With the average loud-speaker, this may be any value between .005 and .02 mfd. Owing to the variations in transmissions and for other reasons, it is often desirable to make the tone correction variable, which is easily accomplished, as shown in Fig. 5, by inserting a 50,000 ohm variable resistance in series with the condenser.

These last remarks give rise to consideration of quality of reproduction, and it may be pointed out that the tone correction is not a reflection upon the valve in any way but is a reflection upon balanced armature speakers in general, as they have the inherent disadvantage that their impedance varies within wide limits at various frequencies; for example, a loud speaker that is good to listen to may have an impedance of 100 ohms at 250 cycles and 1,000,000 at 5,000 cycles.

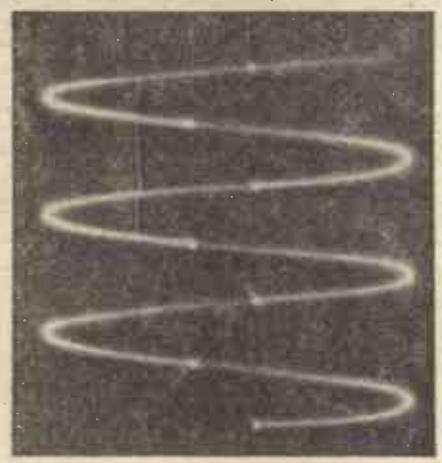


Fig. 7.—An interesting study of the output of a Class B valve taken with a cathode ray oscillograph.

Anode Volts	Static Anode Current		Average Anode Current		Optimum Load (ohms)	A.C. Output
	240 B only	with driver	240 B only	with driver	Plate to Plate	
						Watts
90	2·8	4·3	5·5	7·0	10,000	1
120	4	6·5	8·5	11	8,000	2

Harmonic Distortion

Figure 6 shows a distortion curve from which it can be seen that third harmonic distortion does not rise beyond three per cent., whereas a single pentode valve working in a normal manner usually gives as much as five per cent. third harmonic distortion when fully loaded. It will, therefore, be apparent that the 240B valve gives appreciably better quality than a pentode output stage. Fig. 7 shows an output study taken with the cathode ray oscillograph, and most careful analysis fails to show signs of appreciable distortion.

Fig. 8 shows the valve-holder, clearly indicating the connections to the new standard 7-pin base and valve-holder. It will be observed that one pin is left blank, presumably for some other form of valve, possibly an indirectly heated Class B valve.

Do not forget that the resistance of the grid and anode circuits must be kept low; those pitfalls such as the use of a grid stopper or anode resistance for lowering the H.T. voltage must be avoided with due care.

An eliminator invariably possesses resistance in its maximum tapping either deliberate, accidental or unavoidable, so that, quite obviously, a Class B valve or incidentally a pair of Q.P.P. valves, should not be used with an eliminator, unless special precautions are taken.

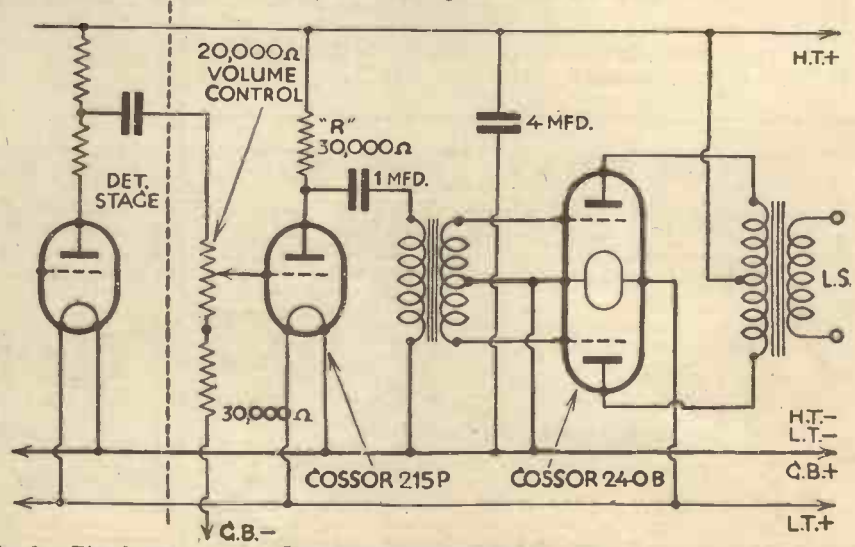


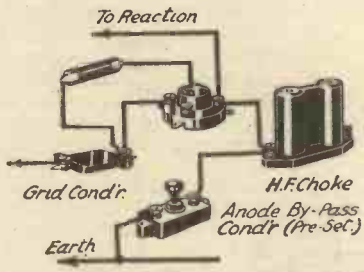
Fig. 9.—This drawing shows a Class B output stage with such refinements as the author considers to be reasonably necessary.

READERS' WRINKLES

THE HALF-GUINEA PAGE

Using a Pre-set Condenser for Anode By-pass

SOME time ago when I was making up a two valver, I used an old pre-set condenser (.0003 max.) for anode by-pass. This seemed to give better results than the fixed condenser generally used for this purpose. By unscrewing the knob one



A wiring diagram showing a pre-set condenser used for anode by-pass.

can obtain more reaction at will. This is, of course, the same action as obtained when using differential reaction. Recently I incorporated a differential reaction condenser in my set and so, when I was making up a one-valve short-wave adaptor, I used the old pre-set for by-pass—and with even better results. My adaptor had a tendency to threshold-howl over the lower portion of the wave-band and by adjusting the condenser it could be effectively cut out. —W. L. HUDSON (Kentish Town).

A Useful Compass Device

MANY other fellow-constructors may find the compass device, shown in the sketch, useful for marking out discs and centring cones. The following pieces of wood are required:—two pieces 8in. by ¾in. by ¼in., and two pieces 2½in. long. Cut the head off a 1in. wood screw, file to a point and screw it into the end of one of the short pieces of wood. The other short piece of wood is drilled to a depth of ½in. with a ¼in. drill to hold a short piece of pencil. The joints are made with 2B.A. screws and terminal nuts.—W. SHEPPARD (Birmingham).

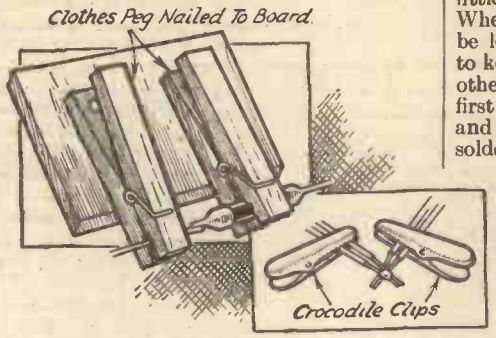
A Use for Spring Clips

IT is often found difficult to solder connections to the small tubular type of fixed resistances and condensers which have become so popular of late. A quick and easy way of doing this is to fix two clothes pins to a small piece of wood. These are secured by a couple of fine nails

THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

or screws a few inches apart and parallel to one another. The condenser or resistance is placed in one, and the wire to be soldered is placed in position and held there by the other, thus leaving both hands free for soldering. Another difficult soldering job is joining two wires together or making a number of contacts at one point, since the making of the second or subsequent joints is likely to melt the solder on the first

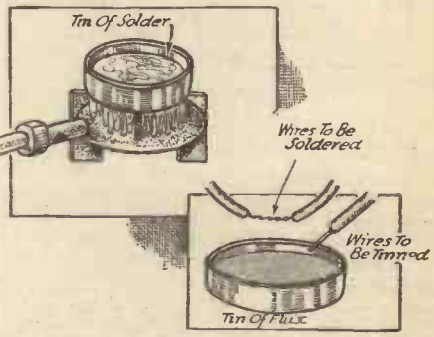


Spring clips used to facilitate the soldering of joints.

one. A few crocodile clips will be found ideal for holding wires both before and after they are soldered, and will enable any number of connections to be made at one point. They are quickly fixed and removed, and are so small that they do not get in the way. By use of the latter, and the board mentioned above, flex leads can be joined together or to spade terminals, and wires to soldering tags and other small objects connected; jobs which would otherwise be almost impossible to do single handed being quickly and easily completed.—Mr. M. MAHAFFEY (Belfast).

Mass Production Soldering

THE operation of soldering many wires together becomes somewhat tedious after a time, especially so if one's iron is only small, and needs constantly re-heating. A good idea, under these circumstances, is to get a shallow tin—the lid of a boot-polish tin will be very suitable—put a

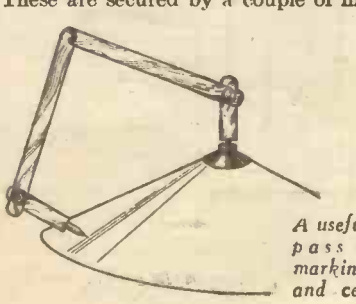


A quick method of soldering wires together.

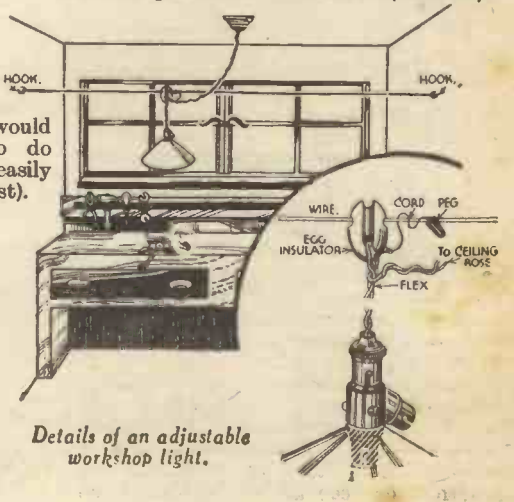
little solder in and heat on a gas ring. When the solder has melted the gas should be lowered, quite a low flame is sufficient to keep it molten. A tin of flux is the only other necessity, the wires to be soldered are first twisted together, dipped in the flux, and then into the molten solder. A good soldered joint is the result; this method is also very handy for tinning wires.—E. L. PARKER (London, S.E.15).

An Adjustable Workshop Light

WHEN working at my bench these dark evenings, I have found the necessity of having the light directly over the work in hand (inside the set cabinet, etc.), so I have devised the scheme shown in the sketch, which I think is more or less self-explanatory. I found that the weight of the lamp and adaptor caused the wire to sag, so a peg was fitted which, when plugged tightly into the insulator through which the running wire passes, effectively locks it in any desired position.—L. BOWMAN (Bicester).



A useful compass device for marking out discs and centring cones.



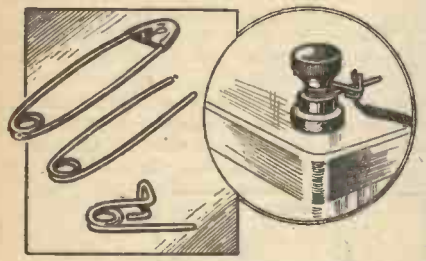
Details of an adjustable workshop light.

READERS' WRINKLES

(Continued from previous page)

Spring Clip Terminals

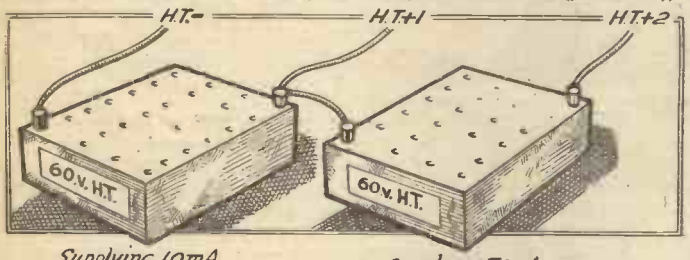
EXCELLENT wiring clips can be very easily made from safety pins, as shown in the accompanying illustration. The fastening end is first cut off, and the pin then bent as shown, so making a spring grip. By reason of the safety pins being tinned, excellent contact is made by the use of these clips.—A. G. ACKROYD (Forest Gate).



Handy spring clip terminals.

H.T. Battery Connections

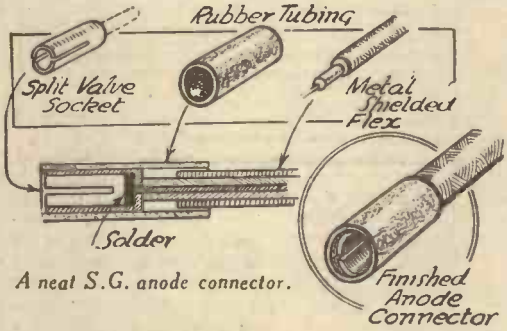
THE compactness and availability of 120-volt high-tension batteries has led the majority of battery users to use these instead of the 60-volt units. Most battery sets require a total current of about 3 m.a. at 60 volts (screened grid and detector) and 7m.a. at 120 volts (S.G. plate and output), thus the first half of the battery is supplying 10 m.a., and the second half only 7m.a. The second half will, therefore, last longer than the remainder of the battery, and the usual method is to buy another battery of the same voltage and join part of it in series until the old battery has run down, then the whole of the new battery is brought into use. This method is rather unsatisfactory, as part of the battery is always more run down than the other, and one is liable to get somewhat confused when it comes to remembering which is the best section. If two 60-volt batteries are used, the first one can be replaced when run down, the second one being replaced at a later date, its life being longer through less H.T. consumption. The result is that the H.T. supply is always reasonably constant and, instead of several sections of various batteries connected in series, two batteries only are used.—R. WATERS (Putney).



Connecting H.T. batteries.

Soldering Enamelled Wires

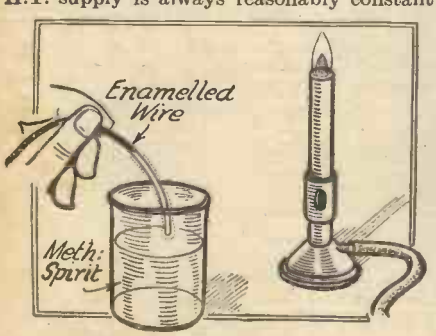
SOME difficulty is often experienced when soldering thin wires which have enamel insulation. If the wires are thick they can easily be cleaned by ordinary methods, such as rubbing with sand-paper, etc. To overcome the badly-cleaned wire problem, place it in a clean bunsen flame, and when red hot, plunge into a container of methylated spirit. When the wire is withdrawn it will be found to be perfectly clean. It will be appreciated that the above method of cleaning cannot be employed with success where the wire is oxidized.—W. G. HILL (Jnr.) (Dagenham).



A neat S.G. anode connector.

S.G. Anode Connector

THE illustration shows a method of making a safety S.G. connector from a few simple parts which the average constructor will no doubt have amongst his spares. The requirements are: one valve socket, ¼in. of rubber tubing (acetylene tubing will do), and a piece of flex, preferably metal shielded. The drawing is self explanatory, the thread is cut off the socket, and a hole is drilled in the bottom. If not already so, the socket should be split, to make it springy. The wire is dipped in flux, and the end pushed into the hole. the end being splayed by means of a match pushed into the socket. If a small blob of solder is dropped into the socket it will be found that the application of a hot iron to the base of the socket will soon melt the solder, and a solid join should result. The rubber tubing is then slipped over so that it projects about 1·32in., this prevents the socket from touching any projecting metal parts, thereby shorting the H.T. battery.—E. L. PARKER (London, S.E.15).



Soldering enamelled wires.

Neat Flex Ends

WHEN braided flex is used for connections to terminals it is often found that however much care is taken, the braiding eventually comes undone and looks untidy and ragged. An easy method of preventing this is to get a blob of molten sealing-wax and press it around the prepared wire. The wax can be neatly shaped before it sets, and different colours can be used for different leads, such as red for the aerial lead, and black for earth.—E. L. PARKER (London, S.E.).

Neat flex ends.

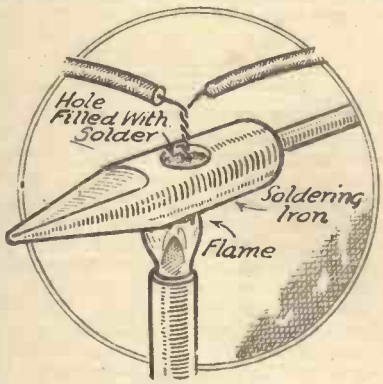
Soldering Twisted Wires

WHEN soldering two twisted wires it is often difficult to know if the iron is hot enough to permit of the solder to run well in and bring about amalgamation.

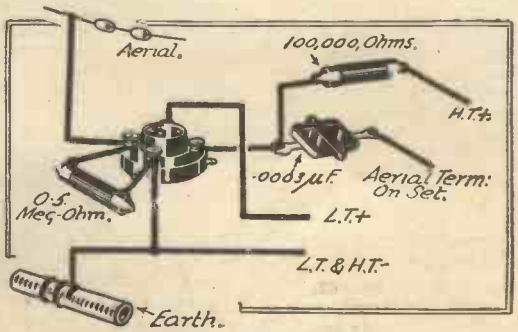
By this it is meant that the solder may combine only on the surface of the twist, but to all intents and purposes appears a good joint which only time disproves. A good plan is to drill a hole, say, ⅛in. in diameter, in the soldering iron, fill it with solder and place over a gas flame. When the solder has reached a temperature sufficient to permit a good joint being made plunge the fluxed joint into the hole and a perfectly good joint will result. —S. JACKSON (Bushey).

An Emergency Amplifier

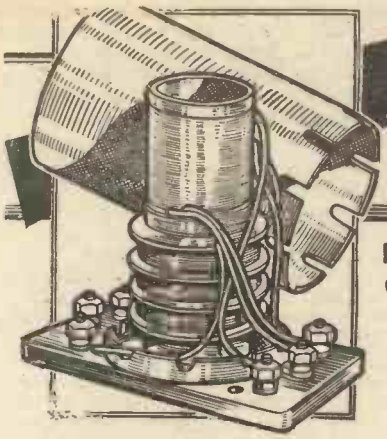
AN aerial breakdown recently was hurriedly repaired in time to listen to the evening's broadcast, but the inefficiency of the temporary aerial made it necessary to construct an amplifier quickly so that the programme could be heard at sufficient strength through the loud-speaker. A resistance-coupled H.F. stage was successfully made as shown in the sketch below.—M. L. HASELGROVE (Dorchester).



A soldering dodge.



An emergency amplifier arrangement.



MAKING YOUR OWN Screened Coils

In This, the Third Article of a Series, the Author Describes in Detail the Construction of an Efficient Dual-range Short-wave Screened Coil, and Gives a Circuit in which it can be Successfully Employed.

IT is frequently considered that short-wave coils cannot properly be screened unless one is prepared to tolerate inefficiency, but this idea is entirely disproved by the component to be described, as well as by a number of the high-class short-wave tuners which are now on the market. As a matter of fact, I am of the opinion that screening is even more important in a short-wave set than in one designed for use on the higher wavebands, and provided that it is properly and carefully arranged, screening is an undoubted advantage in so far as it eliminates unwanted hand-capacities. By so doing, it considerably simplifies the operation of the receiver and enables it to be used in its most sensitive condition, almost on the verge of oscillation.

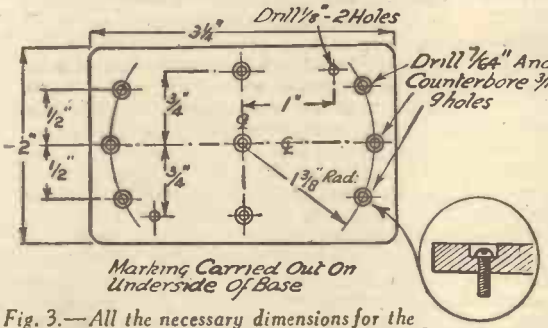


Fig. 3.—All the necessary dimensions for the ebonite base-plate are given in this drawing.

Two Tuning Ranges

The tuner to be described is really two tuners in one, since it has been carefully designed to operate satisfactorily on two wavebands. Actually, the approximate wavelength ranges covered, when a .0003 mfd. tuning condenser is employed, are from 14 to 30 metres and from 25 to 55 metres, and the positions and sizes of the windings have been so arranged that maximum efficiency is obtained over the whole of both bands. It might also be mentioned at this point that, if desired, a smaller tuning condenser (.0002 or .00025 mfd.) can be used to cover a slightly narrower band of wavelengths, and to permit of rather easier tuning below 20 metres or so. Even when using the smallest condenser mentioned, there is a very slight "overlap" between the two ranges, so that there is no "break" between the ultra-short and normal short wave bands.

By making reference to Fig. 1, it will be noticed that there are actually six windings on the paxolin former, two each of which are for the aerial coil, grid coil, and reaction respectively. This arrangement has been found best in preventing "dead spots" and similar troubles, and makes the dual-range tuner quite as efficient as two separate coils of the more usual type. The two aerial windings are in series, and although they both remain in circuit on both wavebands, one of them is ineffective on the lower range due to the fact that it is well away from the smaller grid winding. The same idea applies to the reaction winding, whilst a switch is connected across a portion of the grid coil so that it can be short-circuited when desired.

Parts Required

For the benefit of those readers who missed the first two articles on making screened coils, it should be stated that the paxolin former, screen, and mounting bracket are to be obtained as a complete set from Messrs. Peto-Scott. The other materials required are: one piece of ebonite, measuring 3in. by 2in., six 6B.A. terminals (also obtainable from Messrs. Peto-Scott, or any good radio stores), a few feet of 28 gauge d.c.c. wire, a length of systoflex sleeving, and a short length of insulated connecting wire, such as that made by Messrs. British Radiophone. It will be seen from this list that the total cost of the tuner works out at less than half a crown.

Fig. 2.—This photograph shows the appearance of the finished short-wave tuner.

Winding The Tuner

Having obtained the required parts, the first thing is to make a couple of small holes near one end of the paxolin former, anchor one end of the 28-gauge wire in these, leaving a length of about 4in. projecting, and then wind on three turns. A single hole is then made near the end of the third turn and about 18in. of wire passed through this. Another hole is then made lower down the former in the position clearly shown in Fig. 1, and the wire passed back through this and taken another four times round the former. Two holes are made near the end of the fourth turn and the end of the wire anchored in these. It is important to make sure that the turns in both halves of the winding go in the same direction, since if they do not the halves will be in "opposition."

So much for the aerial winding. The grid winding comes next, and is again in two halves, one of four and the other of five turns. The thicker connecting wire is used for this winding, and the end should be bared for a length of 4in. or so. Two small holes are made in the position indicated in Fig. 1, and the bared

(Continued overleaf)

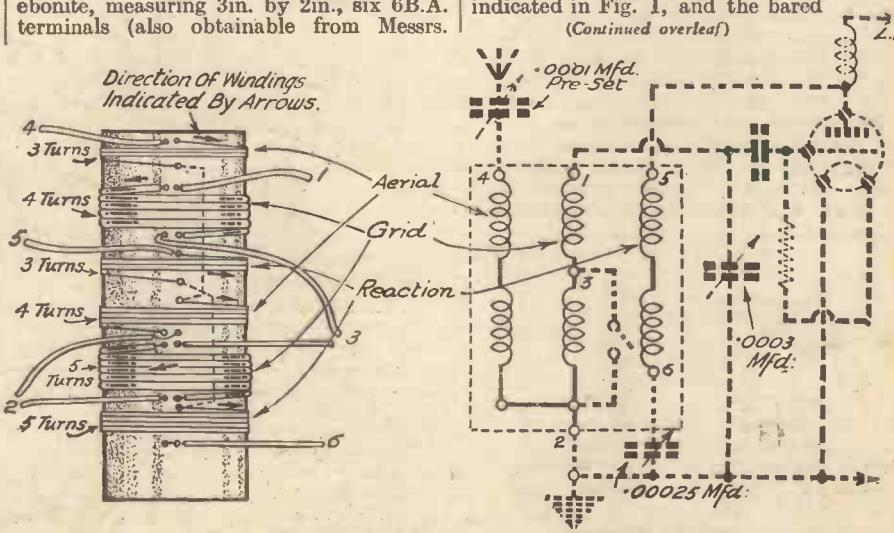


Fig. 1—Details of the windings and connections for the dual-range short-wave tuner are clearly shown in this diagram.

(Continued from previous page)

end of the wire is anchored by passing it through them. Put on the necessary four turns, placing them side by side. Instead of passing a length of wire through a hole to the second portion of the winding, it is better (due to the thick-

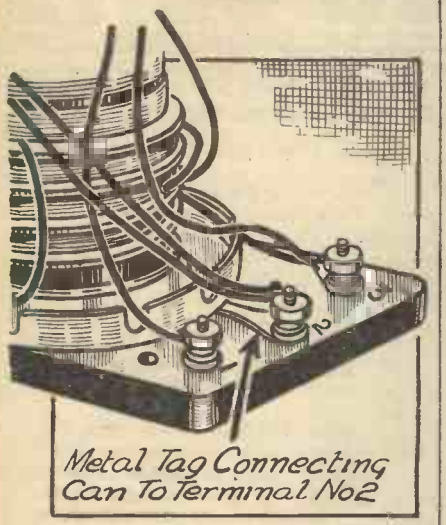


Fig. 4.—This sketch shows how the screen is earthed by means of a soldering tag fitted under the clamping nut of terminal number 2.

ness of the insulated connecting wire) to terminate the first section by baring the end and anchoring it in a couple of holes. At this juncture it should be explained that, although the turns are close together, there is actually a space between the wire forming one turn and that forming the next, which is produced by the insulating material. In the case of the particular wire specified above, and which is of 22 gauge, the thickness of the insulation gives a space between the actual turns which is equivalent to three times the diameter of the wire. Thus, the self-capacity is reasonably low and, since the insulating material has very low losses, the efficiency of the finished coil is quite as high as would be the case if the much more difficult method of using bare wire and spacing the turns were employed. The second portion of the grid winding should next be wound on in the correct position, and it should carefully be noted that the turns forming the grid coil are put on in the *opposite direction* to any of the others. This is important, for if the turns were wound in the opposite direction correct coupling between the various windings would not be obtained.

After completing the grid coil the reaction winding can be dealt with, and the positions for the two halves of this can again be obtained from Fig. 1. This winding consists of eight turns in all, of which three constitute the upper and five the lower sections. Both windings are continuous, the wire being passed through holes in the former from the end of one to the beginning of the other. In Fig. 1 all the holes for anchoring the ends of the various windings are shown as being one above the other; this is only for clarity in the drawing, and it is much better in practice to arrange them at different points on the circumference, so that the connections can more easily be recognized and connected to their appropriate terminals. This particular point will perhaps be more readily understood by making reference to the photograph of the actual coil described, which is shown at Fig. 2.

Mounting the Coil

On completion of the windings, the ebonite base and screen must be prepared. Drawings which give the necessary details of this part of the construction were published with the article under this heading given a fortnight ago, but that showing the layout of the baseplate is reproduced at Fig. 3. It will be seen that there are six holes for terminals and three for mounting screws, and that each of these is first drilled 7/64in. diameter and then counterbored ⅜in. diameter so that the heads of the terminals are slightly recessed and cannot short-circuit on to a metallized chassis.

A soldering tag is fitted under the clamping screw of each terminal for taking the coil connections, whilst a second tag is fitted to terminal 2 to make contact with the "lid" of the screening can in order to earth it. (See Fig. 4.) All the leads are cut off to such lengths that they will just reach the terminal soldering tags and are then passed through suitable lengths of systoflex sleeving. In judging the lengths of the leads it is well to rotate the former until all leads are as near to their respective terminals as possible, and at the same time care must be taken that the leads are long enough to loop sufficiently to allow the screening cover to be fitted without pressing against them. The correct terminal connections are shown in Fig. 1, and it is best to make soldered joints although, if this presents any very great difficulty, the bared ends of the leads can be gripped tightly underneath the tags.

Connecting the Tuner in Circuit

The more experienced readers will find all the information they require for connecting up the tuner in the theoretical circuit at Fig. 1, but for the benefit of others who are not so accustomed to circuits, the pictorial wiring plan given at Fig. 5 will be more useful. This circuit is for a two-valve Det.-L.F. short-waver of fairly standard type and high efficiency. The circuit shows a .0001 mfd. pre-set condenser in series with the aerial lead, and this is to enable the optimum aerial coupling to be obtained at all frequencies. It should be adjusted until smooth and steady reaction can be obtained over the whole of both wavebands. In some cases, however, it might be found that such a setting is impossible, and then it will be necessary to make a slight adjustment to the condenser at different parts of the tuning scale.

A .0003 mfd. variable condenser is shown for tuning purposes but, as was explained above, a somewhat lower capacity can be employed if desired. The essentials of the condenser are that it should be of the distinctly low-loss type and must be fitted with a good slow-motion drive. For reaction purposes a .00025 mfd. variable condenser is indicated, for although this capacity is rather higher than that generally employed it is found to be most suitable. This is partly because the number of turns on the reaction winding has been purposely made less than that on the tuned winding. The reason for this is that when more turns (and consequently a lower condenser capacity) are used for reaction there is often some difficulty in entirely preventing "dead spots" and parasitic oscillation. Personally, I have always found it better to use a large capacity and a (comparatively) small number of turns, but this idea is not shared by all experimenters. If you happen to be one of those who are in favour of the opposite system, there is no harm in trying the effect of increasing the reaction turns to 5 and 8 respectively on the two portions of the winding, and using a .0001 mfd. or a .00015 mfd. reaction condenser.

The H.F. choke shown in Fig. 5 may be any good one of the short-wave type, or may be made by winding a hundred turns of 32 gauge d.c.c. wire on a former exactly like that employed for the tuner; the screen and base will, of course, be used exactly as for the coil excepting that only two terminals will be required on the latter. When using a receiver designed around the circuit given at Fig. 5 it might sometimes be found that better results can be obtained by transferring the connection to the pre-set aerial condenser from terminal 4 to terminal 1 on the tuner; this will cut out the loose coupled aerial winding and might in some cases result in greater signal strength. If the aerial is too long, however, the change-over might make it impossible to obtain sufficient oscillation at certain points on the tuning scale.

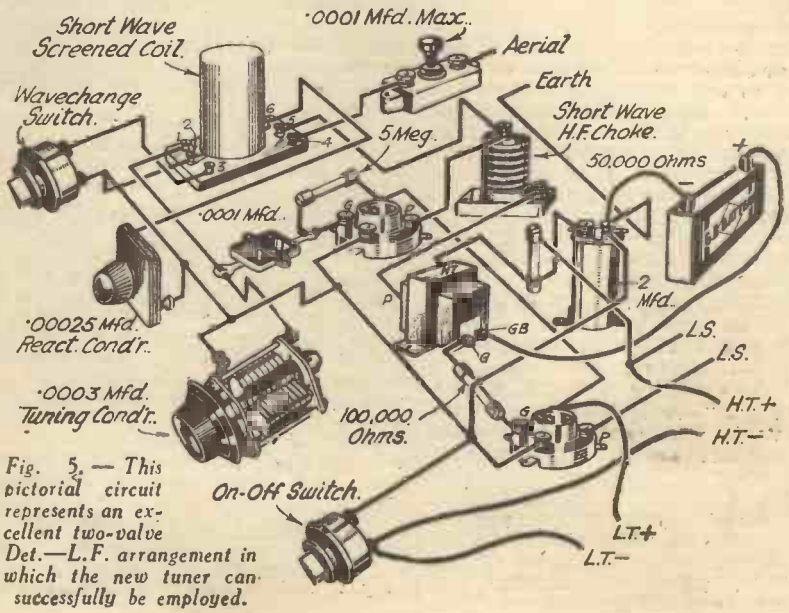


Fig. 5. — This pictorial circuit represents an excellent two-valve Det.—L.F. arrangement in which the new tuner can successfully be employed.

Where the CURRENTS FLOW

In this Article the Author Describes the Various Types of Current Flowing in Radio Circuits and How these Currents are Distributed in a Modern Radio Receiver.

By H. J. BARTON CHAPPLE,
Wh.Sch., B.Sc.

WHEN we connect a piece of apparatus such as a small lamp bulb to an electric battery we know that a steady, direct current will flow, and will have a value depending upon the voltage of the battery and the resistance of the circuit. Similarly, when we switch on a lamp connected to the alternating current electric mains we realize that an alternating current of a certain strength will pass along the wires.

Familiarity with these simple circuits is apt to make one forget that in most sections of a radio receiver the currents flowing are of a much more complex nature. As a matter of fact, there are very few portions of a radio circuit which carry only a simple current; most of the network carries at least two, and in many cases three or more different currents are flowing in one wire at the same time.

This subject is really an important one and merits investigation, for it throws some light on the actual operating principles of radio reception.

Types of Current Found

First of all, however, it is advisable to consider what types of current are likely to be found in a radio receiver. The simplest of all electric currents, of course, is the ordinary direct current—a more or less steady current flowing always in the same direction. A familiar example of a direct current is the current passing along the low tension (filament) circuit of a battery-operated receiver.

Then, if your set be of the A.C. all mains type, we shall encounter the commercial alternating current—a current which flows first in one direction, and then in the reverse direction, the changes in direction being made at a definite frequency—usually fifty complete alternations per second. Such currents will flow in the primary and secondary windings of the power transformer and in the low-tension heating circuits of the set.

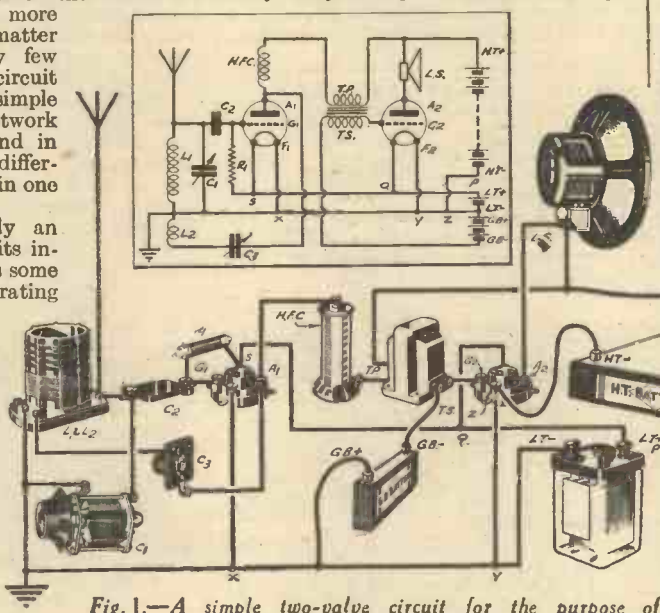


Fig. 1.—A simple two-valve circuit for the purpose of explaining current flow.

Next we must consider the radio-frequency or high-frequency currents. A radio-frequency current is, in point of fact, an alternating current, but one in which the number of complete alternations per second is very much higher than for a commercial alternating current power supply, and ranging, in the case of broadcasting transmissions, between about 100,000 and a couple of million vibrations per second. They correspond to the frequencies of the waves broadcast from the various transmitting stations.

Complexity

Finally, some of the currents with which we shall have to deal will be "audio-frequency" currents—again alternating currents, but this time covering a range of frequencies quite different from those of the radio-frequency currents—frequencies corresponding to those of the air vibrations which we call "sound." These frequencies range from a few dozen up to several thousands of vibrations per second.

Here it must be explained that when speech or music is being reproduced the audio frequencies are constantly changing and combining in accordance with the "pitch" of the sounds, treble notes being represented by higher frequencies than bass notes. It will thus be seen that the audio-frequency currents in a radio receiver are very complex in nature.

It should also be mentioned that in some sets, those known as superhets, a fourth kind of alternating current occurs, this being called "supersonic" or "intermediate frequency." The frequency in this case is greater than those in the normal audio-frequency range, but less than the radio frequencies.

Having described the various types of currents flowing in radio circuits we can now proceed to examine typical receiver circuits, and to see how these different currents are combined and distributed in the network of apparatus.

On the Aerial Side

Fig. 1 shows the circuit diagram of a conventional two-valve receiver of the battery-operated type, employing an ordinary leaky grid detector and a three electrode output valve. Various letters and figures are marked on the diagram to facilitate reference to the different parts of the circuit. Possibly the simplest way of tackling the problem will be to build up this circuit gradually, seeing what currents flow in each part.

For example, Fig. 2 indicates the aerial and earth, and the tuning coil, L_1 only. If the coil were simply connected in this way between aerial and earth, and we

(Continued overleaf)

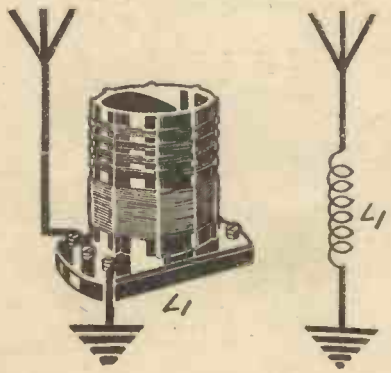


Fig. 2.—In the plain untuned aerial coil various high-frequency currents flow.

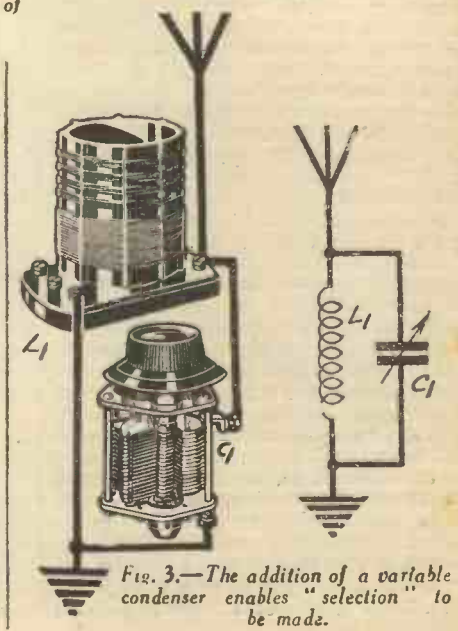


Fig. 3.—The addition of a variable condenser enables "selection" to be made.

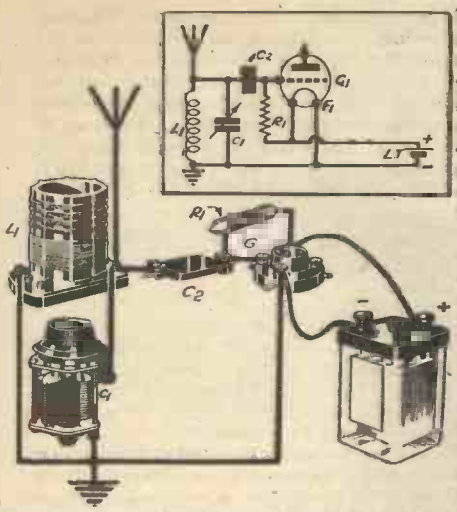


Fig. 4.—The circuit is here taken a stage farther by adding the rectifying valve.

(Continued from previous page)

had the necessary delicate instruments, we could discover that in this circuit would be flowing a large number of radio-frequency currents, all of different frequencies, corresponding to the frequencies of the broadcasting stations of the world, and all of different strengths according to the powers of the stations and their distance from the aerial. Furthermore, the instantaneous strengths of these radio-frequency currents would be constantly varying at audio frequency in accordance with the musical programmes being radiated from each station.

In the next diagram, Fig. 3, an addition to the circuit has been made—the tuning condenser, C_1. The effect of this is to make the circuit sensitive to the frequency of the "wanted" station and comparatively insensitive to all other frequencies. So we can consider, for all practical purposes, that the current circulating in the tuned circuit is of one selected radio frequency, and of an amplitude which constantly varies at audio frequency. Across this tuned circuit then will be developed a radio-frequency voltage which will be applied *via* the condenser C_2 to the grid of the detector valve (G_1).

Grid Variations

Note now that in Fig. 4 the filament circuit of the detector has been added. From the low-tension battery, and through the connecting leads and the filament of this valve, will flow a steady direct current which will heat the filament and cause it to emit electrons. A high-resistance grid leak, R_1, connects the grid of the detector valve to the positive side of the filament circuit, and this gives the grid a slight positive bias with respect to the filament. This means that, forgetting for a moment the existence of an anode in the valve, electrons emitted from the heated filament will be collected by the grid and will return to the filament *via* the grid leak R_1. The electron flow is called "grid current," and for steady conditions of grid voltage the grid current would be constant. But we have seen that a radio-frequency voltage is applied to the grid of the detector *via* the grid condenser, C_2, so that the actual grid voltage will vary above and below the initial positive bias, and because the increases in grid current during positive half-cycles of the radio-frequency impulses are greater than the decreases in grid current during negative half impulses, the high-frequency signal will be "rectified."

The net result is that the working potential of the detector grid varies at audio frequency, and we must now see what effect this has upon the current flowing in the anode circuit of the valve.

The Anode Circuit

In Fig. 5 the anode of the detector valve has been connected to the high-tension positive terminal through something labelled "anode load"—which will be more particularly described in the next paragraph. As the high-tension negative terminal is connected to the filament circuit, the anode current has a path from H.T. + through the anode load, through the anode to filament path of the valve, and back to the H.T.+ terminal *via* that part of the low-tension wiring marked XZ. If the grid voltage of the detector was constant, the anode current would also be constant, and it would be correct to say that the current in the anode load would be a steady, direct current equal to the anode current, while the piece of wiring between X and Z would carry two direct currents, one equal to the normal filament current and one equal to the anode current.

But we have seen that the grid of the detector varies at audio frequency, so that the valve acts not only as a rectifying or detecting device, but also as a low-frequency amplifier, that is to say, the audio-frequency voltage at the grid causes audio-frequency variations in the anode current. In addition, since grid rectification is a functioning factor not 100 per cent. efficient, there will be a high-frequency component in the anode current. So in Fig. 5 we can take it that the anode current can be split up into three components—a steady, direct current, an audio-frequency current, and a small high-frequency component. This complex current will traverse the whole of the anode circuit, and, in addition, the part XZ will carry the filament current of the detector valve.

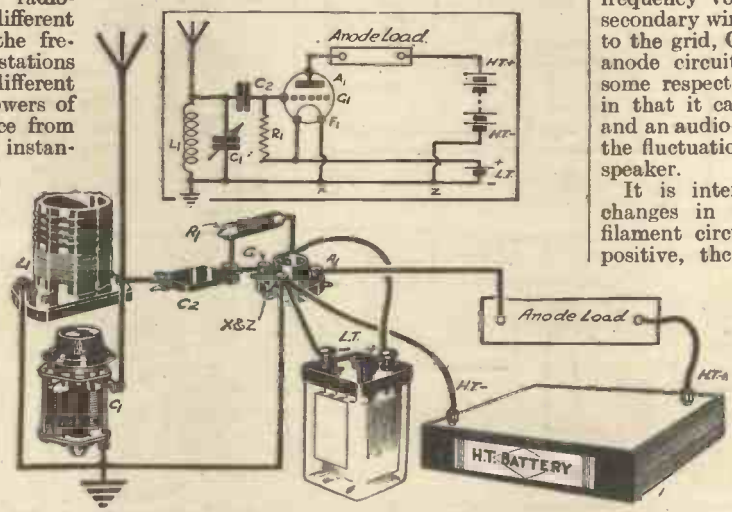


Fig. 5.—The addition of an anode load brings about three types of current flow in the anode circuit.

The Next Stage

A stage farther in building up the circuit is taken in Fig. 6. First of all, a high-frequency choke is included in the anode circuit. This filters out the small radio-frequency component and diverts it *via* the reaction condenser, C_3, to the reaction coil, L_2, where it assists in building up the signal strength, because it is transferred by electro-magnetic induction into the grid coil. Then the nature of the anode load is revealed as an intervalve transformer, the anode current passing through the primary winding TP.

Now, going back to Fig. 1 for the last stage, we see that the combined direct and audio-frequency current passing through the primary winding of the intervalve transformer causes an audio-frequency voltage to be developed in the secondary winding, which voltage is applied to the grid, G_2, of the output valve. The anode circuit of this valve resembles in some respects that of the detector valve, in that it carries a steady, direct current and an audio-frequency alternating current, the fluctuations of which operate the loudspeaker.

It is interesting to note the various changes in the current carried by the filament circuit. Commencing from L.T. positive, the circuit carries the filament current of both valves as far as point Q. Here the filament current of the output valve leaves the line and passes into the filament. From Q to S the circuit carries only the filament current of the detector, while the part from X to Y carries the filament current of the detector valve and also the anode current, comprising both direct and alternating components.

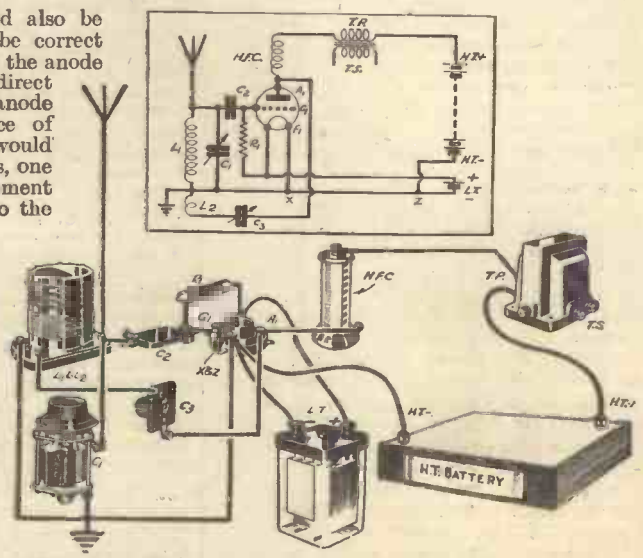


Fig. 6.—With an anode load of this character the current distribution is altered.

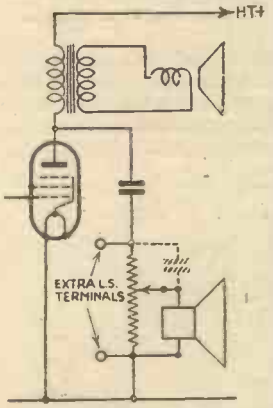
THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

CONNECTING THAT EXTRA LOUD-SPEAKER.

Important Points to Bear in Mind Concerning the Matching Between the Output Valve and the Speaker it is Intended to Use. By "ELECTRON"

USUALLY, when an amateur wishes to connect an extra loud-speaker to a receiver provided with sockets for this purpose, his natural impulse is to plug the two loud-speaker leads into the sockets, and hope for the best when the set is switched on. Sometimes, of course, he may be lucky enough to obtain very good results indeed. But if his optimism allows him to do this without any other considerations, there are almost equal chances that he will get poor results, and begin to wonder whether to blame his set or his speaker; the set, because he is led to believe that it has not sufficient energy to drive the two speakers, and the speaker, perhaps, because it is not sensitive enough, or, if overloaded, because it cannot handle the energy supplied to it. In either case he is probably doing one or the other a gross injustice.



Circuit diagram showing the potentiometer connected across the extra L.S. sockets.

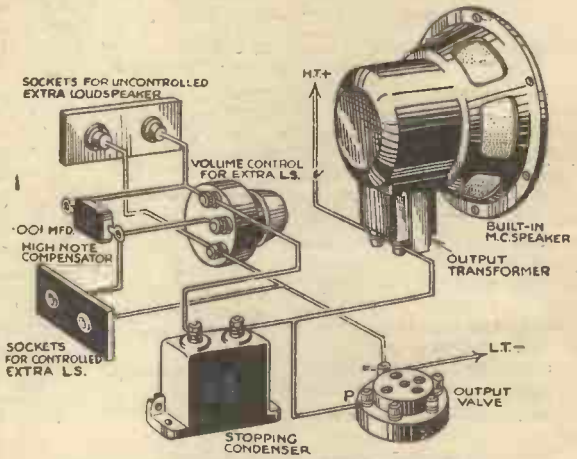
It would be wise, therefore, to consider for a moment other factors that have to be taken into account. In the first place, it should be obvious that a moving-iron speaker is not interchangeable with one of the moving-coil type. Primarily, our object should be to obtain suitable matching between the output valve and the loud-speaker we wish to use. To gain this end we shall either have to select a speaker that will be suitably matched or, if we already have a speaker, to take steps to match it to the output of the receiver. This, of course, will depend upon the type of output valve used. To obtain the maximum undistorted output from the valve, the impedance of the speaker circuit should be twice that of the valve; or, more correctly, it should be as near as possible to the "optimum load" for the valve. However, for our present purpose it will be sufficient to summarize a few points to bear in mind, and to remember also, should we wish to determine correct matching impedance by calculation, that we already have in circuit the impedance of the speaker incorporated in the receiver.

In the case of the triode, or ordinary power output valve being used, an additional speaker of the high-resistance moving-iron type may be connected direct to the extra loud-speaker sockets. Provided that the speaker in the set is of similar type, good results may be expected, and beyond a slight reduction in volume, owing to the available energy being divided between each speaker, no ill-effects should occur, unless they are introduced through other causes. We mention this because it sometimes happens, when connecting an additional speaker, that the use of long extension leads gives rise to instability in the low-frequency circuits. If the speaker in the receiver is a moving-coil, and we wish to use a moving-iron one externally, we may have a little difficulty owing to their being of different types.

Although the reproduction of the moving-coil may be slightly affected, the chief trouble will probably be due to the incapacity of the moving-iron speaker to cope with the energy imposed upon it, especially if the output valve is a super-power valve capable of handling large outputs. The external speaker, therefore, must have its available energy controlled, but it is obviously desirable that this should be made possible without seriously affecting the volume obtainable from the moving-coil speaker. This can be done by connecting a potentiometer of about 50,000 ohms across the extra loud-speaker sockets, the loud-speaker being connected between the centre point or sliding contact of the potentiometer and the earth end, as shown in the accompanying illustrations.

If, by this arrangement, there should be too much loss of high notes, we can compensate for it by inserting an extra condenser of about .001mfd. across the other half of the potentiometer, as indicated by the dotted lines in the circuit diagram.

In the case of a pentode output valve, which has a very much higher impedance, an output transformer or low-frequency choke is invariably employed in the output circuit to ensure correct matching. We can assume that the built-in speaker will already have a matched output, but the extra loud-speaker circuit seldom incorporates an additional output transformer, which, if needed, depends for its correct ratio on the impedance of the loud-speaker to be used in conjunction with that of the built-in circuit. Generally speaking, when a high impedance loud-speaker is connected externally to a receiver with pentode output, it is preferable, although not essential, to feed it through a small step-down transformer; whereas an additional speaker of the moving-coil type must always be fed through a fairly high ratio step-down transformer, whether used with power or pentode output. With the latter the ratio may be anything from 10–1 to 80–1, while for a power valve a ratio of 25–1 is seldom exceeded.



Wiring diagram of the complete arrangement.

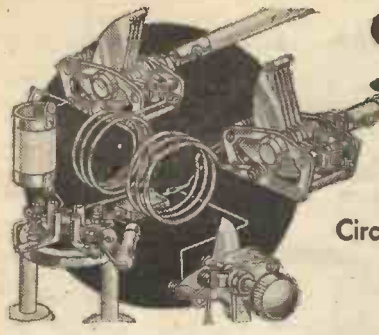
TOPICAL TECHNICALITIES

Electro-Magnetic Induction

THE principle of electro-magnetic induction is used extensively in electrical and wireless practice and the following brief description will enable the principles underlying the design of a generator, for instance, to be clearly understood. When a coil of wire is moved in a magnetic field an e.m.f. will be induced in the coil, and the direction of this induced force will depend upon the direction in which the coil is moving. Thus, if a magnet having north and south poles is arranged so that a coil may be rotated between its poles, the induced currents will be greatest when the coil is situated centrally between the two poles and at a minimum when it is at right angles to the poles. In this position the winding of the coil will be in a plane parallel with the lines of force of the magnet, and consequently the movement of the coil will result in only a small change of induced e.m.f. until it (the coil) approaches the central position. The magnetic poles produced in the coil are of the same nature as the fixed poles, thus tending to stop rotation, and as the coil is moved farther through its rotation it becomes necessary for the current to change its direction in order to oppose rotation and thus the cycle repeats, the current continually changing from zero to maximum in one direction, back to zero and then to maximum in the opposite direction, and thence back to zero. This complete change is known as one cycle, *whilst passage of the current from zero to maximum and back to zero is known as* one alternation. *The time required for a complete cycle is known as a* period. *The number of cycles produced each second is known as* the frequency.

Two Valves in Parallel

IT is well known that two valves in parallel give twice the volume that one alone would give, but it quite often happens that a constructor parallels up a valve with the existing output valve without making the least difference. This is due to the impedance in the anode circuit being left as before, whereas it should be halved. The point is that there is twice the available speech current, but the same voltage, so that the impedance must be halved. This will allow the unchanged voltage to drive twice the current through the loud-speaker transformer primary.

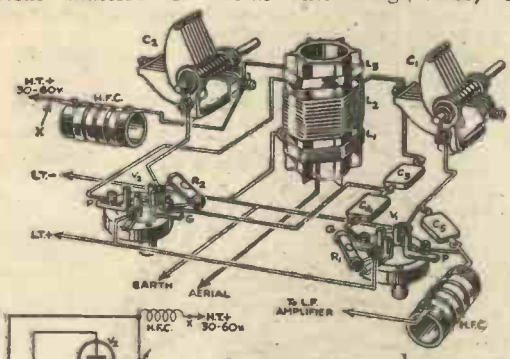


Short Wave Section

Circuits for the Short-Wave Experimenter

By "SHORT WAVER"

ALMOST all short-wave listeners are experimentally inclined, and usually are not content to use one circuit or lay-out for any length of time, and it is hoped that the circuits given here will provide material for some interesting



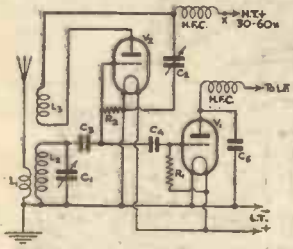
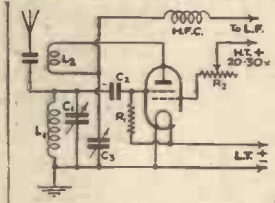


Fig. 1.—Using a separate valve for reaction purposes.

experiments, although from the point of view of improved results it will be found difficult to better the simple capacity controlled reaction detector circuit. One of the hardest things with this circuit is to get smooth reaction and good detector efficiency at the same time, because the H.T. voltage has to be kept low for smooth reaction, whereas the best detector action and subsequent amplification is obtained with high H.T. volts. In our first circuit (Fig. 1) therefore, these functions have been divided between two separate valves; V_1 does the detecting, and the second valve V_2 provides the reaction control. Each valve has its own grid condenser and leak, C_4 and R_1 for the detector and C_3 and R_2 for the reaction valve; C_3 and C_4 can be the same size, about .0001 to .0002 mfd., but R_1 may well be smaller than R_2, say 5 megohms and 7 to 10 megohms respectively; C_5 is a .0005 mfd. detector plate by-pass condenser. All other components have their usual values, although it may be found desirable to have a slightly larger reaction coil than ordinarily. Control of reaction is provided by C_2 or else by a 100,000



to 250,000 ohm variable resistance inserted at X. The H.T. to V_2 should be adjusted to obtain smoothest reaction, but the maximum recommended by the makers may be used on V_1. This circuit gives very smooth control of reaction, and largely eliminates the detuning effect of the average reaction control and the noisy background often experienced with reacting detectors. It may be used very well with a screen-grid detector at V_1.

"Space Charge" Detector

Mention of screen-grid detectors brings to mind an unorthodox arrangement, which makes use of the screen-grid valve, called the space charge detector. The circuit is given in Fig. 2, and it will be seen that, contrary to all usual practice, the screen grid is connected to the tuned circuit (*via* a grid condenser and leak), while a positive potential is applied to the control grid. Component values are normal except that L_2 will probably need to be larger than usual unless exceptional care is taken in laying out the circuit, and C_3 must be at least .00025 mfd. for satisfactory control. The potential of the control grid will be found to be very critical, so R_2 should be about 250,000 ohms to ensure an adequate range of variation. The chief feature of the arrangement is the remarkably smooth reaction control that is obtained, so smooth that it is often difficult to decide

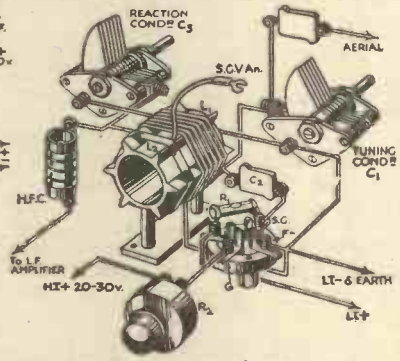


Fig. 2.—A novel way of using a screen-grid valve in a detector circuit.

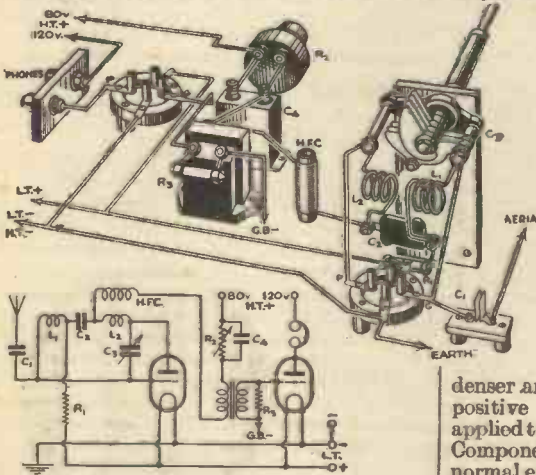


Fig. 4.—This arrangement provides splendid results.

whether the detector is oscillating or not. While not as easy to get going as some circuits, this is certainly a very interesting arrangement for the experimenter.

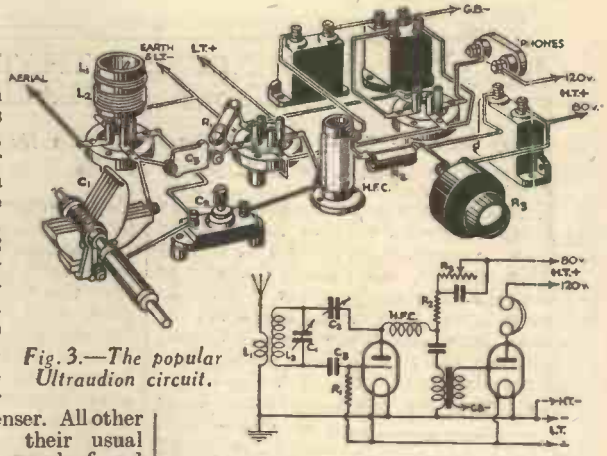
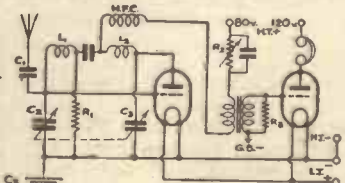


Fig. 3.—The popular Ultraudion circuit.

The "Ultraudion" Circuit

Reverting to three electrode valves, an old circuit which is worth attention is the Ultraudion. The circuit is given in Fig. 3, from which it will be seen that there is no separate reaction coil, a single coil fulfilling the functions of both grid and reaction coils. The aerial is shown coupled by a coil L_1, but it could equally well be tapped on to L_2, with a small condenser in series. If an H.F. valve is required to precede the detector, L_1 may be connected in series with the H.F. valve plate, and so become the primary of an H.F. transformer. The great advantage of the Ultraudion for this purpose is that since only two windings are

(Continued on page 738)



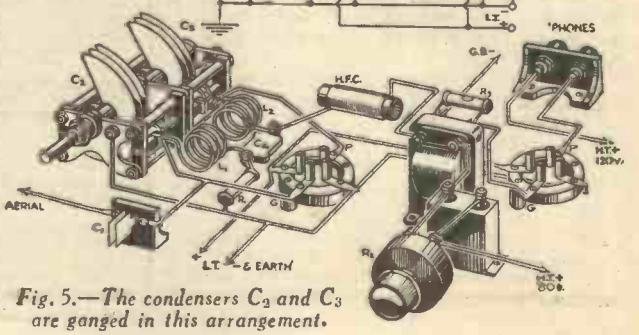


Fig. 5.—The condensers C_2 and C_3 are ganged in this arrangement.

(*Continued from page 736*)

required (L_1 and L_2) the transformer can be wound on the ubiquitous valve base, which is not possible when a third (reaction) winding is necessary. The chief disadvantage of the circuit is that both the tuning condenser C_1 and the reaction condenser C_2 are above earth potential, and hence must be mounted away from the panel and fitted with extension handles to avoid hand capacity effects. Suitable capacities for C_1 and C_2 are .00015 and .0002 mfd. respectively; if C_2 is a pre-set condenser mounted on the baseboard, reaction can be controlled by means of a 50,000 to 100,000 ohm variable resistance at R_3. Other values of components are normal, although it will probably be found that L_2 must be a little larger than the usual grid coil. This circuit has been found very satisfactory on five metres.

The "Hartley" Circuit

Another good circuit for five-metre work is the split Hartley arrangement, shown in Fig. 4, which is adapted from a transmitting circuit. This arrangement is very easy to get into operation, but has the same disadvantage as the Ultraudion, that the tuning condenser C_3 is above earth potential; this can be overcome by mounting C_3 on a sub-panel parallel to the main panel and using an extension handle, a precaution which would be necessary in any case on a five-metre receiver even if the tuning condenser was earthed. Reaction control is by means of the 50,000 ohm variable resistance R_2, the 2 mfd. condenser shunting it being to remove any noise resulting from manipulation of the slider knob. On five metres suitable values for C_2 and C_3 are .0001 mfd. and .000015 mfd. respectively. Self-supporting coils half an inch in diameter, and wound with number 18 tinned copper wire, are used; two coils of three turns each should cover the amateur five-metre band from 5 to 5.4 metres. C_1 is a very small condenser made from two plates of aluminium or brass half an inch square, and separated about an eighth of an inch. R_1 is the usual grid leak, and H.F.C. is a special five-metre H.F. choke containing 30 turns of 32 D.S.C. wire, space wound on a half-inch former. The circuit can be used on the longer short waves very satisfactorily also; in this case C_3 may have the more usual value of .00015 to .0002 mfd. while C_2 should be about .00025 mfd.; although this condenser may be used as a reaction control if desired, this is not recommended because of the very considerable detuning experienced. Probably R_2 will have to be larger than 50,000 ohms in order to obtain adequate reaction control over a large band of wavelengths. With regard to coil sizes, if L_1 and L_2 are both five turns on a two-inch former a .00015 mfd. condenser will tune from about 25 to 46 metres, while wavelengths below 25 metres could be covered by two three-turn coils. Above 5 metres C_1 may be a .0001 mfd. semi-variable condenser. This circuit is a little prone to threshold howl, hence the 250,000 ohm resistance R_3 across the L.F. transformer secondary.

Series Colpitts Circuit

A modification of the split Hartley that is rather interesting is the series Colpitts circuit shown in Fig. 5. In this circuit the tuning condenser C_3 of Fig. 4 is replaced by a double condenser consisting of two sections C_2 and C_3 of equal capacity operated by the same spindle. The chief advantage of this circuit is that the moving plates of both condensers can be earthed, and so help to remove hand capacity. This circuit is primarily an oscillator.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

Magnetostriction Oscillators

THIS term looks somewhat formidable, but is easy to understand, and offers some interesting possibilities. It is now well known to our readers that the coupling of a coil in the anode and grid circuits of a valve results in oscillation. A further well-known fact is that the passage of a current through a winding round a soft-iron rod results in magnetism being imparted to that rod. When a soft-iron rod is surrounded by the anode and grid coils of an oscillating valve a very high vibration is imparted to the rod, depending upon the frequency of the two circuits, and some wonderful effects are obtained with an instrument designed on this basic line. As some indication of the power it may be mentioned that during some experiments it was found possible to burn a cork inserted in the neck of a glass bottle filled with liquid. Some interesting developments in this class of experiment are expected in the future.

Reflected Short Waves

IT was recently mentioned in these pages that the short wave offers some peculiar possibilities in view of the fact that it is reflected from certain bodies. For instance, when wavelengths below 5 metres are radiated from a beam type of aerial it is found that they are reflected upon coming into contact with any earthed body. This idea has led to direction finders for ocean-going craft and aeroplanes being designed to incorporate a special short-wave transmitter. The radiation is directed downwards in both cases, and is reflected, in one case from the surface of the earth, and in the other from the ocean bed. By means of a receiver situated in another part of the craft the reflected wave is received, and the difference in time between transmission and reception is recorded and a specially calibrated dial shows in one case the airman's height above the nearest ground, and in the other the depth of the ocean, thus removing the necessity for soundings to be continually taken.

Proof of Our Popularity

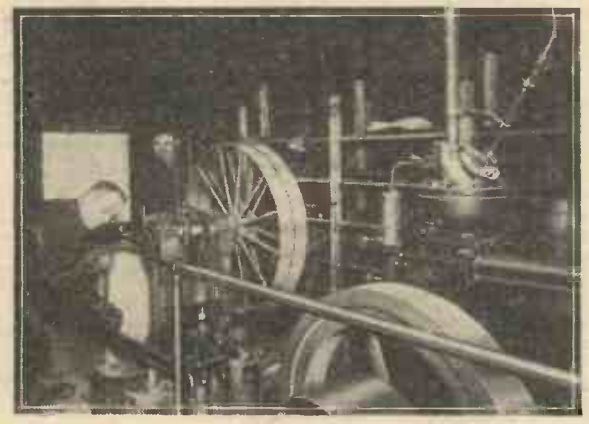
IT may interest our readers to know that the popularity of the circuits published in our pages has made Messrs. Graham Farish so busy that, notwithstanding the fact that they are working twenty-four hours a day, a still greater output is required. In order to cope with increasing business they have been obliged to scrap some of their plant, and substitute other more up-to-date appliances.

The illustration shows the new hydraulic machinery being put in for the production of bakelite mouldings, from which an increased output of nearly 50 per cent. is anticipated.

How the 10s. Licence Fee is Disbursed

ACCORDING to the B.B.C. Year Book 1934, for every fee of ten shillings payable in respect of each wireless licence, considerably less than that amount goes to the B.B.C. for the broadcasting service. In point of fact, the Corporation received in 1932 precisely four shillings and sevenpence from each ten shillings; the balance of five shillings and fivepence went to the Government, made up as follows: Post Office, 1s.; Treasury, 3s. 5½d.; Income Tax, 5d.; additional contribution to the Government's general revenue, 6½d.

The main items of the B.B.C.'s expenditure out of its own share of 4s. 7d. were as follows: Programmes, including artists' fees, orchestras, news service, performing rights, simultaneous broadcast telephone system, programme staff salaries and expenses, 2s. 6½d.; Engineering, including maintenance of plant, power, research, engineering staff salaries and expenses, 11½d.; Standing charges, including rents, rates, taxes, insurance, heating and lighting, upkeep of premises, telephones, bank interest, etc., 7½d.; Administration—staff salaries, travelling expenses, etc., 3½d.; Governors' fees, ½d.



New hydraulic machinery installed in the factory of Graham Farish Ltd.

Western Australian Air Survey

WIRELESS will play an important part in the air survey of Western Australia, which is to be made by the Western Mining Corporation in connection with their mining prospecting operations. The two aeroplanes to be used for the survey have been fitted with Marconi transmitting and receiving equipment, and a comprehensive service of air-and-ground wireless communication and direction finding will be provided by three mobile Marconi ground stations mounted in motor lorries. By means of this wireless organization the position of the surveying aeroplanes will be plotted on a chart in the office of the Manager of the Expedition during the entire operations in the air, and it will be possible to exchange messages, by medium and short waves, between any of the ground stations and the aircraft in flight, and also with Australian wireless stations outside the survey area. The expedition officials will thus have direct control over the vital operations of aerial photography, each pilot will be constantly informed of his position—a factor of considerable practical value when working over remote areas—and the geologists will be able to communicate any reports regarding visual reconnaissance direct to headquarters by wireless telephony.

Gramophone Companies and Lucerne Wavelength Plan

IT is understood that although the Lucerne Wavelength Plan comes into operation on January 15th, modifications to the wavelengths of British and the Continental stations may take place after this date, and it is unlikely that permanent wavelengths will be definitely settled until the middle of 1934. The "His Master's Voice" and Columbia Companies are consequently making arrangements to ensure that owners of their radio receivers and radio-gramophones, at present fitted with station and wavelength scales, will be able to use them during the next six months with the least amount of trouble. The companies are preparing special cards for each type of instrument, on which will be a replica of the present station dial and—side by side—the sketch of a dial based on the Lucerne Plan. Simple reference will show the listener the new position of any desired station. These cards will be available free of charge from the "His Master's Voice" or Columbia dealer from whom the instrument was purchased.

The B.B.C. and Television

IN September notice was given to Baird Television, Ltd., of the termination, on March 31st, 1934, of the arrangement under which regular television programmes are transmitted on a medium wavelength using their "30-line" system. Meanwhile, experimental work is being carried out with high definition systems transmitted on ultra-short wavelengths. Such systems offer more possibilities of future development than the low definition systems, although only the latter can be transmitted on medium wavelengths. If, however, the development of high definition television is not sufficiently stabilized by March 31st to justify regular transmissions by any of the methods tested, then the B.B.C. may continue transmissions, probably twice a week, using the low definition method on an ordinary broadcast wavelength, with a view to assisting those members of the public who are experimenting in television. These transmissions would depend on future development, with no guaranteed duration.

High Tension *from a* Low-Tension Accumulator

A Simple Converter Which Will Prove Very Efficient in Use

THIS converter consists of two sections. First an induction coil working off an input of 6 volts converts this up to 180 volts, and as the output is alternating current it has to be rectified and smoothed by the second section.

The primary of the coil absorbs about .75 ampères at 6 volts, but this can be reduced to .5 ampères at 4 volts with a corresponding decrease in output. The secondary voltage is stepped up to 150 volts on full input, and fed into a half-wave rectifier, R.

The rectified current is smoothed by choke Ch and condensers C1, C2. A second tap is provided by resistance P. The rectifier is an old 6-volt super-power valve obtaining its filament current from the primary supply.

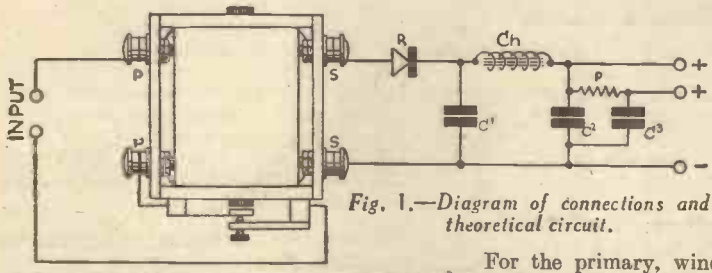


Fig. 1.—Diagram of connections and theoretical circuit.

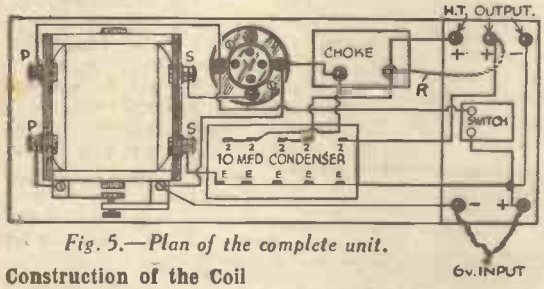


Fig. 5.—Plan of the complete unit.

Construction of the Coil

Cut two end pieces of hardwood 3in. by 3in. by ⅜in. and drill the centre of each to a diameter of ½in. (Fig. 2). Next obtain some iron wire, form this into a core ½in. diameter and 5½in. long. Slide on the end pieces till the inner faces are 4in. apart, and bind over the core with a layer of empire cloth. The tendency for the cheeks to slip off can be avoided by two brass washers placed over and soldered to the projecting core. Two similar washers can be fixed inside the cheeks.

The contact breaker next calls for attention, and this can be obtained from an old ignition or medical coil, or made according to Fig. 3, in which A is the support for armature, ½in. by ½in. by ⅛in. brass; B, support for adjusting screw, ⅜in. by ½in. by ⅛in. brass; C, arm for adjusting screw, 1½in. by ½in. by ⅛in. brass, threaded to take screw E; D, soft-iron armature riveted to spring (clock spring) S. The soft-iron armature is ½in. diameter by 3/16in., and the spring is 1 9/16in. by ½in. to ½in.; E, the adjusting screw, preferably with platinum point (this can be obtained from an electric bell); L is a locknut to hold E in adjustment. It is inadvisable to mount the contact-breaker till the coil is wound.

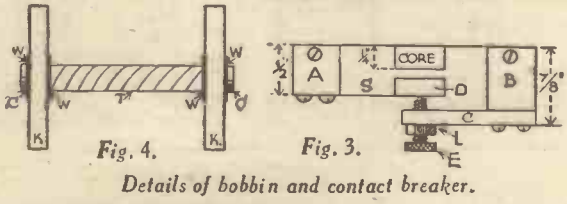


Fig. 4. *Fig. 3.*

Details of bobbin and contact breaker.

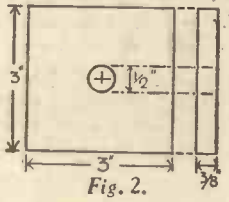


Fig. 2.

Winding the Coil

The bobbin for winding is shown in Fig. 4, in which W are washers, C the projecting ends of the bare core, KK hardwood end pieces and T the taped winding core.

For the primary, wind on three layers of 21-gauge enamel covered wire. This is equivalent to 348 turns at 116 turns per layer. Over this winding lap two layers of empire tape and apply a thin coat of shellac.

The secondary consists of 10,400 turns of 35-gauge enamel covered wire. This will take about 424 turns per layer, and 24 layers. When completed, the ends of the windings should be attached to terminals as in Fig. 1, marking the ends of the thick coil P, and the fine coil S.

After the contact breaker is fixed in place, the coil and rectifier can be mounted.

A complete unit is shown in Fig. 5. The spaghetti resistance R has a resistance of 25,000 ohms. This resistance can with advantage be a variable one, and separate condensers can be used in place of the block condenser shown, if desired. The rectifying valve V must be of the same voltage as the input, and almost any low impedance power valve will do, *e.g.* 6v. Mullard PM256 or PM256A, Six-Sixty 625SP or 625SPA, 4v. Mullard PM4, or Cossor 415XP.—H. B. SMITH (Kenton).

The Cause of a Valve Going Soft

A CORRESPONDENT who had trouble with a receiver traced the fault to a break in a bias resistor, and when this was duly replaced the associated valve was found to be dead soft. It would not seem possible for the resistor to have impaired the valve, bearing in mind that the anode current could not flow with a break in the bias resistor. Actually the reverse is the case; the anode is tied to the cathode by a small stray emission, and the cathode is then at, say, 200 volts positive (the anode voltage) compared to the heater which emits a stream of electrons which bombard the cathode and break it up, thus liberating occluded gases which render the valve soft.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

SLADE RADIO

The Sixth Annual General Meeting of this Society was held recently, when a large number of members were present and the Hon. Sec. was able to report a very successful year. Forty-nine meetings were held, at each of which there was a lecture, demonstration, or discussion. The Society still has plenty of room for anyone interested and will welcome inquiries. Full details of membership, together with copy of advance programme, will be forwarded on request.—Address, Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

INTERNATIONAL DX'ERS ALLIANCE

This organization, which has its headquarters at Bloomington, Illinois, U.S.A., was formed last winter by Count Alexis Ross, of Vallejo, California, and other well-known sponsors of verified long-distance reception. Its chief objects are to encourage amateurs in all parts of the world to co-operate in the logging and verification of long distance reception, and to bring about a better understanding between nations. Part of the work of the alliance, which already has members scattered over the globe, is the arranging of special broadcasts on both medium and short waves from stations in different parts of the world. The organization is now running a special DX contest which continues till March 31st next, and several valuable prizes are offered. The official organ, "The Globe Circler," is issued monthly to members. Particulars of membership can be obtained from the European representative, F. Wiseman, 90, Brighton Grove, Newcastle-on-Tyne, or R. A. Rawles, Publicity Dept., Blackwater Corner, Newport, I. of W.

ILFORD AND DISTRICT RADIO SOCIETY

On November 16th, the Ilford Society entertained the Southend and District Radio Society, and on this occasion a talk and demonstration of an experimental photophone was given by Mr. R. McV. Weston. After describing the principles involved, Mr. Weston mentioned the results he had obtained in the transmission of music along a modulated light beam, in daylight at a distance of 144 yards.

Mr. W. G. J. Nixon, of the General Electric Co., Ltd., lectured on Modern Valve Developments on November 30th, and showed a large number of lantern slides which demonstrated the improvements in design of Osram valves from 1919 to the latest types of catkins, including the new DA 60.

Visitors are welcome at any meeting and readers should write for details to the Hon. Sec., Mr. C. E. Largen, 44, Trelawney Road, Barkingside, Ilford.

EXETER AND DISTRICT WIRELESS SOCIETY

On December 6th, through the kindness of the Edison Swan Electric Co., the Exeter and District Wireless Society were enabled to stage the first public demonstration of Television ever given in this district. After an extremely interesting lecture and demonstration on the Cathode Ray Oscillograph, during which he dealt particularly on its applications to Television reception, Mr. T. D. Humphreys connected his apparatus to the output of a six-valve "straight" set, designed by an amateur member specially for television work.

Immediately the transmission commenced, a very clear image was obtained, showing as an emerald-green picture on the end of the cathode ray tube, and was clearly visible to everyone in the room. Apart from occasional black-outs, due to complete fading of the transmission, and a rather bad heterodyne from Frankfurt, which is unavoidable in this district, the whole programme was clearly followed, even the full-length dancing act coming over exceptionally well. The synchronization of the picture was remarkably good, even through complete fades.—E. H. Ware, Programme Sec., "The Beeches," Woodbury.

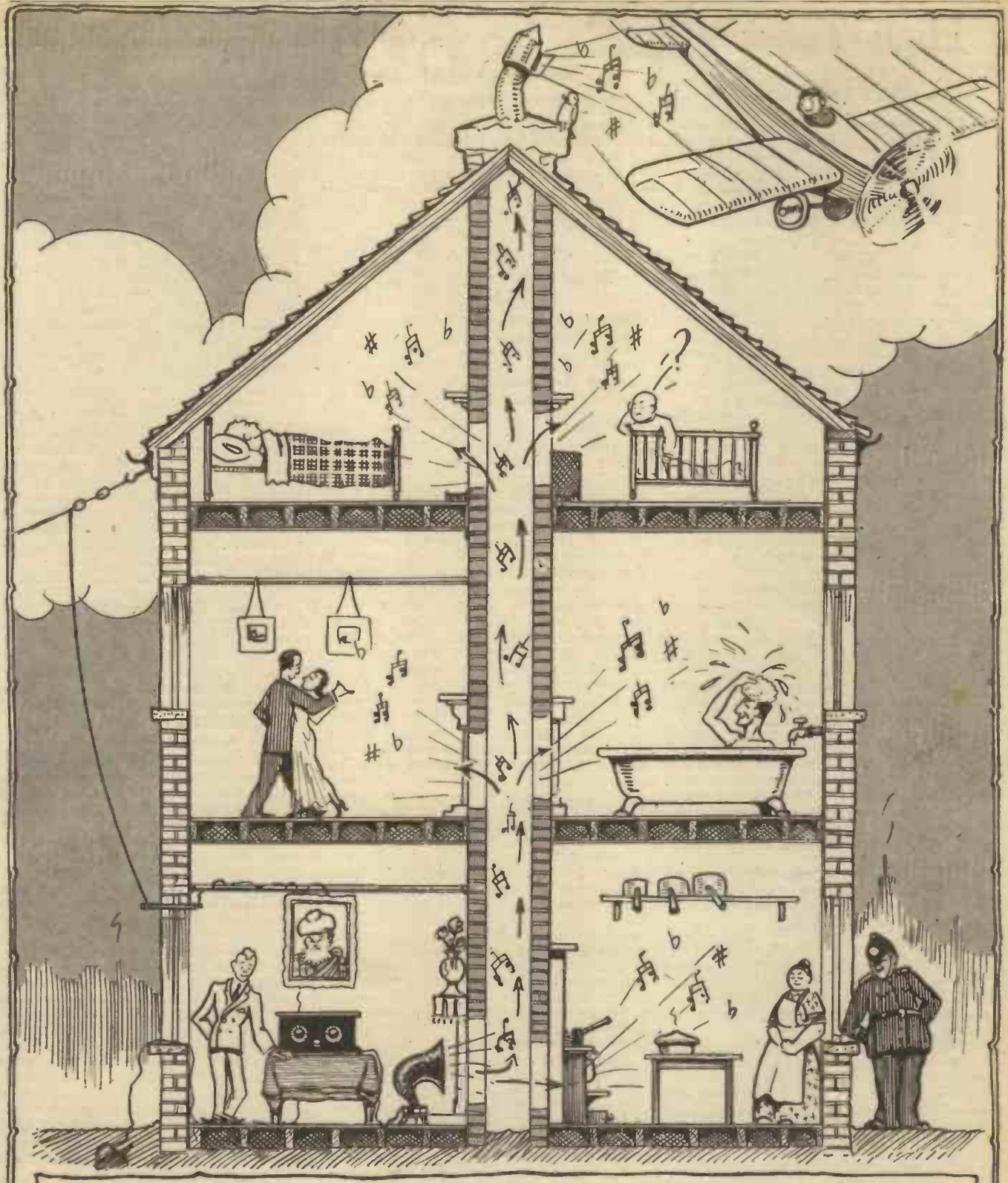
THORNTON HEATH RADIO SOCIETY

A meeting of this Society was held at St. Pauls Hall, Norfolk Road, Thornton Heath, on Tuesday, the 5th instant. Mr. S. J. Mears presided. The Chairman, in opening the meeting, extended a welcome to the members of the Croydon Radio Society. Mr. Basil Wardman (G5GQ) gave a talk and demonstration on short-wave transmission and reception. He stated that a transmitting apparatus was simpler than a receiver, and that any standard receiver would act as a transmitter by making certain adjustments.

Various types of aerial were then discussed and stress was laid upon the necessity of erecting an aerial the length of which corresponded to the wave being transmitted. The "beam" system was also fully described.

Mr Wardman then proceeded to demonstrate his transmitting apparatus, consisting of a crystal oscillator stage, a frequency doubler stage, and a power amplifier, operating on 40 metres. Mr. Wardman's call sign and test signal was very quickly picked up by EAR 324 n Cartagena (Spain).

Particulars of future fixtures can be obtained from the Hon. Sec., Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

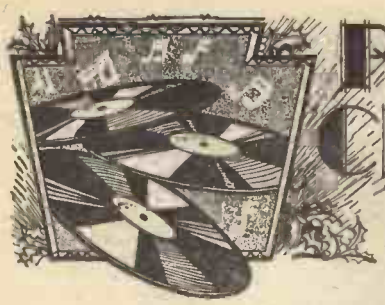


DEAR EDITOR—

"CUCKCOO COT"
COLNEY HATCH.

I AM SENDING YOU HEREWITH, MY "RADIO WRINKLE"—
ENTITLED— THE MAGIC FLUE"— FOR WIRELESS IN EVERY ROOM.
SO ECONOMICAL & CUTE— DON'T YOU THINK?— OR DON'T YOU?

YOURS HOPEFULLY— Arthur Ashdown.



RECORDS for CHRISTMAS

A Further Selection of Some Bright Numbers for the Festive Season

A VARIETY of entertainment is to be had from the British Homophone releases for this month. The Barnstormers, who recorded for this company last month for the first time, are heard again on *Sterno* 1298. This record, *Christmas Bells at Eventide*, a tune well in keeping with the festive season, and *Alice in Wonderland*, is well worth hearing. *Heatherland*, parts 1 and 2, *Sterno* 1305, include a number of well-known Scottish tunes played by Alexander's Accordeon Band. Whilst on this type of band, *Lover* and *Oh Ella*, *Sterno* 1304, played by Zigano's Accordeon Band, and *Merrie Soldiers* and *Waltz Espagnole*, *Plaza P*172, played by Devereux and his Accordeon Band, are two records that bring out these instruments at their best. For those who like dance tunes, *I Gotta Get Up and Go to Work* and *Ah, but is it Love?* from the film *Moonlight and Melody*, played by the Casani Club Band, *Sterno* 1294, *Gold Diggers of* 1933, which gives selections on both sides of the record from the film of that name, played by Sidney Lipton and his Band, *Sterno* 1297, *Swingy Little Thingy* and *Headin' for a Weddin'*, played by George Glover and his Band, *Sterno* 1300, are a few of the popular tunes that afford a fine selection.

Vocal Records

For those who like comedy records, *Eleven Good Lads*, an amusing football song, and *There are Many Good Reasons for Drinking* will no doubt suit their requirements. This record is played by Billy Hart and His Boys on *Homochord HR*26.

Two popular dance tunes that are very popular at the moment, *Love Locked Out* and *Happy and Contented*, are well sung by Eve Becke (Just a Singer of Songs) on *Sterno* 1306.

George Hocking, the well-known baritone who records for this company, gives us a very fine record in *Bless This House* and *In Happy Moments*. Both tunes are well sung and are well worth hearing, on *Sterno* 1282.

The Hymn that I Sang as a Boy, sung by Fergus Kelly, tenor, and *Make Believe*, sung by Roland and Ron, two fine duettists who have made a number of entertaining records, appear on *Plaza P*173. This is an extremely good record.

Light Music

This type of music is always appreciated by all music lovers, and *Lohengrin*, the introduction to Act Three, and the *Hungarian March*, played by the Plaza Military Band, *Plaza P*171; *None but the Weary Heart* (Tschaikowsky) and *A Night in May*, a waltz by Strauss, played by Leroy's Orchestra, *Plaza P*150, *Play of the Butterflies*, an intermezzo, and *The Cage in the Window*, played by Mantovani and His Tipica Orchestra, *Sterno*, 1302, are delightful and well-played tunes that will meet with their approval.

Brass Bands well recorded are always appreciated, and The Challenge Brass Band, who play *Two's Company*, which includes a fine trombone duet, and *The Enchantress March*, *Homochord HR*21, is well worth hearing.

Records by Stage and Film Celebrities

There are several new records by stage and film celebrities and one even appears by the famous stage impresario—C. B. Cochran—on *H.M.V. C*2628. He recounts his successes in the world of the theatre, whilst his favourite songs, from his own shows, are interpreted by Elisabeth Welch, Janet Joyce, Edward Cooper and Ray Noble and His Orchestra.

Jack Buchanan also introduces nine of his song successes, including *Her Mother Came Too*, *Fancy our Meeting*, *Who?* and *Two little bluebirds*, on *H.M.V. C*2630, whilst Jack Hulbert has recorded with sparkling gusto the two hits—*My hat's on the side of my head*, and *I want to ring bells*, from his new film *Jack Ahoy* on *H.M.V. B*8062. His wife—Cicely Courtneidge—treats us to an interpretation of four songs in her new film "Aunt Sally"—*If I had Napoleon's Hat*, and *We'll all go riding on a rainbow*, *H.M.V. B*8067 and *My wild oat*, and *The wind's in the West* on *B*8068. She conveys with amazing fidelity the particular brand of fooling in which she has made her name.

U.S.A. Cable Pronunciation of Word

Derickson and Brown, the popular American entertainers, have made a good record of a new song hit, *The last round-up*, *H.M.V. B*8076. In this song there is a very conspicuous phrase "Git along little dogie, git along." This does not refer to a young dog, but to a stunted calf which is sometimes seen in a herd. Derickson tells us that he and Brown were not sure how this word should be pronounced and unsuccessfully searched through nearly a dozen dictionaries. Eventually, he cabled to an uncle of his who had a big ranch in Texas, who cabled back "Pronounce as doh in dough-nuts."

Many hosts at Christmas parties will have their worries relieved this year by mystifying their guests with *Everyday noises as heard through the microphone* on *H.M.V.* C2609. There are twenty ordinary everyday sounds authentically recorded, but in some cases under or over amplified. The record will cause more controversy than any other that has been issued for some time. It would "let the cat out of the bag" to reveal now what sounds are heard, but they will cause much amusement at any party. Another record suitable for the same purpose is *H.M.V. B*8048—*Forfeits—Old and New*. On one side of this record are six forfeits for ladies and on the other six for men. Guests should be invited to place the soundbox of the gramophone on the record and then carry out the forfeit it commands. It is quite impossible to tell beforehand which forfeit, all of which are highly entertaining, each guest will have to undergo.

Old-time Dances

Hearts of Oak Lancers and *Valse Septembre* by Sydney Baynes and His Orchestra on *H.M.V. C*2632-3 will also add liveliness to the Christmas festivities, also *The Valeta* and *See me dance the polka* by the New Mayfair Dance Orchestra on *B*6418, whilst Don Bestor and His Orchestra's interpretation of *Who's afraid of the big bad wolf?* on *H.M.V. B*6420 will be considered by many to be the best recording of this Christmas Pantomime hit.

Another out-of-the-ordinary comedy disc is Ray Noble and His Orchestra's new edition of *More Turkish Delight* on *H.M.V. B*6424, in which the lyrics have been written by Max Kester, who has been responsible for many B.B.C. productions, the music being by Ray Noble.

Good Tenor Discs

To complete the first H.M.V. batch of December records there are three excellent vocal ones by tenors. *The Waltz Song* from "A Waltz Dream," which was recently broadcast by the B.B.C., sung by Richard Crooks, on *H.M.V. DA*1328, coupled with *Castles in the Air*. Two old favourites—*Roses of Picardy* and *Love's Garden of Roses*—are the subjects of Derek Oldham's new record, *H.M.V. B*8053, which will add to the popularity of this well-known artist.

Ketelbey's *In a Monastery Garden* has always been one of the most popular pieces of descriptive music, and now Peter Dawson's fans will be interested to hear that he has made an outstanding record of a vocal interpretation of this famous piece.

CHOOSING A MICROPHONE

(*Continued from page 719*)

The chief feature of the Roberts' microphone is that it is almost entirely non-directional; that is, it responds to sounds created at any angle to the enclosed diaphragms. Instead of the usual single diaphragm, this component has two flexible ones between which are placed the usual carbon granules. By this arrangement the microphone responds to sounds impinging upon it from any angle, due to the difference in phase existing between the pressure on the front and back diaphragms. This arrangement also results in greater efficiency at the higher frequencies, so that sibilants in speech and higher musical notes are reproduced better than with microphones of the ordinary type. Besides the model mentioned above, and which costs 12s. 6d., there are two others. These are, perhaps, not of such great interest to the average listener, but are worthy of note. One of these is a rectangular one which can be hung up or suspended in some other way, and the other is a small circular one which can be hung on the lapel of the coat for public-address work and similar purposes.

A More Elaborate Instrument

Although it is scarcely of the type which the average listener would care to employ for entertainment purposes, the moving-coil microphone made by Messrs. Epoch (makers of the well-known loud-speakers bearing their name) is a particularly interesting instrument. It is of the table type and is extremely sensitive, whilst giving a practically uniform response to the complete range of audio frequencies. It is illustrated on page 719.

8-11, Southampton Street, Strand, W.C.2

MY OPINION

BY THE EDITOR.

Soldered Joints or Terminals? Send Your Opinion Now!

FROM time to time it is stated, by those who claim to know, that home-constructed receivers which require soldered joints are not popular because very few people can solder. I do not subscribe to this view, and give it as my definite opinion that the amateur *can* solder and prefers a soldered joint. Obviously if terminal-equipped components are specified, he will back the designer's judgment and use them; and it may be that the popularity of terminal-equipped components is due to this. Nor can I admit that it is possible satisfactorily to build a set *entirely* without the use of soldered joints. Connections have to be made at points in the wiring where no terminals are provided, and unless clumsy methods are resorted to, the soldering bit usually provides the solution. The terminal method does not permit of the shortest possible leads being used. Surely, if soldering cannot be undertaken by most wireless amateurs to-day, the technical press of this country has failed in one of its duties? Articles by the hundred have appeared explaining how to solder, and if this information has failed to enlighten the reader on a comparatively childish process, the technical press should find fresh staffs of contributors. Most of the sets made by PRACTICAL WIRELESS readers which I have inspected have soldered joints.

With the object of guiding the component industry on this point, readers are invited to state, on a postcard, whether they prefer terminals or soldered joints—and why. The information supplied by our readers will be circulated to every member of the component trade. Books will be awarded to the senders of the twenty best opinions received. My own opinion of some of the terminals fitted to components is that they are far worse than a poor soldered joint. The contact or clamping area is totally inadequate, the screw threads easily strip, they are often of insufficient length to accommodate more than two wires, and (worst of all) those provided on transformers, etc., often rotate and snap the wire affixed to their inner extremities.

Wavelength Changes

IN reply to many readers who have written asking how the wavelength changes in January next will affect their receivers, I would say that those receivers which are calibrated in wavelengths only will be unaffected, except that the dial reading will be slightly different. In fact, the changes do not affect the operator of a home-constructed set at all, as none of the condensers supplied for home-constructors have station-engraved dials. Commercial receivers with the latter type of tuning scales will need to have a new scale fitted, calibrated according to the new plan, and a number of firms have already arranged to supply these at a nominal charge. It must be borne in mind, however, that further changes may take place even after the Lucerne Plan has been put into effect, and it is not considered by some manufacturers wise at the moment to issue new dials.

FACTS & FIGURES

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

UTILITY "MITE" CONDENSERS

THE new range of gang condensers manufactured by Messrs. Wilkins and Wright under the name "Mite" has been mentioned before, and further samples have now been received showing only one or two slight modifications. The illustration below gives some idea of the general appearance, and in this particular case the dust cover has been placed into position at one end of the entire assembly in order to show how the trimming adjusting screws are permitted to project from the cover, and also to show the method of making the moving vanes and spindle as a solid metallic mass. This is apparently accomplished by running molten metal round the assembly before finally placing the spindle into position and it gives great rigidity with no possibility of losses due to poor contact being set up due to oxidization, etc. The overall length of this three-gang model is only 4ins., and the total height is 3ins. It will be noticed that the first section

The Utility "Mite" condenser with one section enclosed to show the method of fitting the dust cover.

has the fixed vanes cut to permit of even tracking in a superheterodyne circuit and this model is known as the "Superheterodyne" model and costs slightly more than the standard three-gang type. The entire finish is in grey cellulose enamel, and at a cost of 24s. this represents very good value. A further example of the thoughtfulness which is expended in the Utility products is evidenced in the lower photograph, which shows one of the Micro Disc dials. It will be seen that every necessary screw and bolt is included with this dial, so that it may be mounted into its position without any difficulties whatsoever. The slotted metal strip on the right is employed for anchoring the lower portion of the dial to the edge of the chassis, and the dial may be obtained with bevelled or flat scale, as well as in full vision types. The reduction ratio is 50 to 1, and the flat type costs 8s., whilst the bevel type costs 8s. 6d.

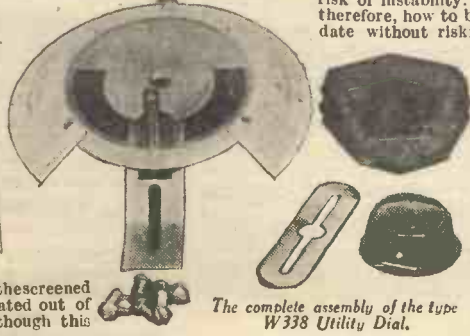
"REJECTOSTAT" INTERFERENCE ELIMINATOR

SEVERAL readers have asked for further particulars of the interference eliminating system invented by Messrs. Kolster-Brandes and known as the "Rejectostat" device. As the name implies, the device is developed for the rejection of static, not that kind which is due to natural electrical disturbances, termed "Atmospherics," for which no known cure exists, but the "man-made" variety, caused by electric motors, trams, trains, lifts, flashing signs and the many other electrical devices in daily use. The complete system comprises two units which are added to the aerial system and connected together by a length of metal-sheathed twin cable, termed a "transmission line," these being used in conjunction with a specially designed and completely screened receiver. The two units and the screened cable allow the aerial to be located out of the reach of interference, even though this may necessitate it being erected up to several hundred feet from the receiver, and this without noticeable loss of signal strength. In fact, so efficient is the system that with a transmission line of average length there is an effective increase of sensitivity over certain parts of the wave range of the receiver. The transmission line may be brought to the receiver by any convenient route (it may be laid underground if desired) and as it is screened, it does not pick up interference. The special screened receiver prevents interference reaching the wiring or from entering by way of the mains and thus all channels of entry are effectively closed. Provided the aerial is suitably located and the units and transmission line are properly installed, radio reproduction practically free from distracting background noises will be obtained.

Those who already possess a receiver may use the units and transmission line and will secure a very welcome measure of relief from "man-made" static.

Naturally, no assurance of complete immunity from interference can be given unless the complete system, including a "Rejectostat" receiver is employed, but, in all cases, a big improvement in reception will result.

In addition to its ability to eliminate or considerably reduce "man-made" static, the "Rejectostat" System possesses other valuable advantages. For example, it allows the aerial and receiver to be located in the most convenient places irrespective of their relative positions, so that the receiver may be at the front of the house and the aerial at the rear. In hotels or blocks of flats where normally it might be impossible to arrange an ordinary aerial system efficiently, a "Rejectostat" aerial can be placed on the roof while the receiver may be situate in any part of the building without impairing performance. Where it is not possible for each receiver to have its own aerial, several receivers may be operated from a single "Rejectostat" aerial without mutual interference or noticeable loss of efficiency.



The complete assembly of the type W338 Utility Dial.

R. & A. EXTENSION SPEAKER

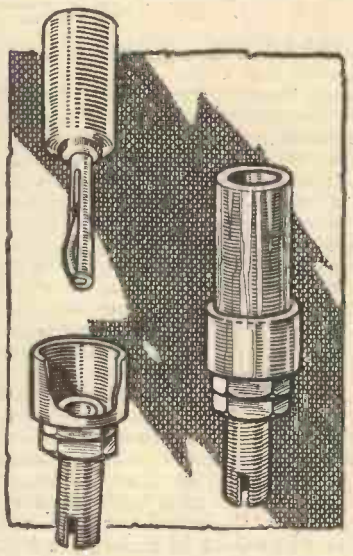
MESSRS. REPRODUCERS & AMPLIFIERS, Ltd., have now developed a special model of the well-known "Challenger" speaker, arranged for connection to existing receivers as an extension model. The principal feature of this new idea in radio is that an additional speaker may be added to a receiver and no loss of volume or distortion experienced. Many commercial receivers are designed to accommodate an external speaker, but this has to be of a certain impedance in order not to upset the balance of the output circuit which is fitted, and if attention is not paid to this point, not only will the added speaker produce an inferior tone and lower volume, but the speaker fitted to the receiver will also be affected. The new extension model is provided with an auto-transformer which enables an adjustment to be made to balance the impedance and thus obtain good quality and equal volume. The price of this speaker is 35s., and the speaker is known as the "Challenger" Model P.

NEW OSRAM S.G. VALVE

THERE are thousands of Kit and Portable sets in use which, owing to the fact that they were designed primarily from the point of view of ease of construction and simplicity of operation, could not use the high-efficiency valves in view of the risk of instability. The problem arose, therefore, how to bring such sets up to date without risking instability. The new Osram S.23 valve is the solution, and this has been designed by the G.E.C. primarily for the purpose above mentioned. It has the lowest possible anode current for adequate efficiency, lower even than the older S.G. valves fitted to kit sets. The screen current is also very low, and combined with a high impedance and slightly higher mutual conductance, the valve will prove extremely valuable to users of the types of receiver mentioned.

GRIPSO PLUGS AND SOCKETS

THE Gripso handy connecting devices are made in various types, and that illustrated is very suitable for mains connecting purposes. As may be seen the socket is protected with an insulated collar effectively preventing the fingers or other bodies coming into contact with the metal portion. The contact is quite substantial and there will be no risk of any losses being incurred, whilst the particular method of making connection with the plug will ensure that good contact without risks of shocks is maintained all the time. The price of these plugs and sockets is twopence each.



The Gripso power plug and socket.

THE PIX MODULA

A SPLENDID article of great utility which we unfortunately overlooked in our "Christmas Presents" article is the arm-chair volume-control, manufactured by the Pix people, and known as the Modula. As we have before pointed out, this enables one to control the volume given by the wireless receiver without moving from the arm-chair. The device may be fitted to any receiver so that one need have no fears that it might prove impracticable to fit it to certain sets, and there is also no technical skill or mechanical ability called for in the fitting. A small variable resistance form the mains portion of the device, and this fits over the arm of the chair by means of a leather strap or in any other desired manner, and the cable, which is supplied in either a 12ft. or a 36ft. length, is fitted at its opposite end with a cardboard disc, having a number of holes punched in it. A valve is removed from the receiver and plugged back with the cardboard disc interveuing. The device in its simplest form costs 2s. 11d., or with a neat armchair strap, 4s. If the long cable (36ft.) is required the extra charge is 1s. 6d.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Anti-Break-Through Choke

SIR,—I was rather interested in your reply to A. T. (Dewsbury) in your issue of November 11th. The trouble he complains of is by no means an unusual one, especially to those in close proximity to a powerful transmitter. The design of the coil is considered to be the real cause of the trouble, but I have experienced this form of interference in well-designed commercial coils. Sets having only one tuned circuit are particularly liable to it. The anti-break-through choke will prevent the local from "butting in" all over the dial, but there is the possibility that including too large a fixed inductance in series with the aerial, selectivity may be affected on the long waves. A. T. could try ordinary plug-in coils (I have done so with varying degrees of success), but if he cares to experiment with the choke described in your issue of November 4th, I think he will eliminate the trouble he complains of. As the writer of the article referred to in your reply, I have used it many times, and always successfully, but as this kind of interference varies in different localities, he will have to ascertain by trial just which tapping will give the best result. He might have to add a few more turns to the total winding, but once having found the correct number to suit his case he could make one up with the required number of turns and fix it inside the set with a shorting switch.

I have not had occasion to write you before, so I now take the opportunity of congratulating you on the excellence of PRACTICAL WIRELESS.

The first number you published set a very high standard, and you have maintained it week after week. I hope you will continue to do so.—WILLIAM B. ASPINALL.

"Such Good Value"

SIR,—I thank you very much for the Tool Kit which I received safely. I need hardly say how delighted I am with it. I may mention that the tools are finely made and are packed in a very compact case. I was surprised to receive such good value. I know a little bit about tools, as I am a smith by trade, and they are just the tools that those who like to experiment with wireless will find useful. In wishing your paper every success, I may mention it has passed many a pleasant hour away for me.—A. H. JAY (Halstead).

"A Real Christmas Gift"

SIR,—Many thanks for the Pocket Tool Kit, just received; it is a gem, and a real Christmas gift. My congratulations on your enterprise.—A. ASHTON (Twickenham).

"Surpasses Anything I Had Expected"

SIR,—I feel bound to express my appreciation of the Pocket Tool Kit I have just received from you. I can see that it is going to be most useful to me, and the quality of the tools surpasses anything I had expected.—JOHN S. CHANNON (Rugby).

"A Very Fine Production"

SIR,—I wish to thank you for the Pocket Tool Kit, which arrived safely. It is certainly a very fine production and is well in keeping with the high quality of your paper.—D. C. GREEN (Clevedon, Som.).

"Well Up To Your Standard"

SIR,—I have safely received your Presentation Tool Kit. It is well up to the high standard of all your previous presentations.—GERALD C. JERVIS (Redditch).

A Five-Valve Circuit Wanted

SIR,—Being a regular reader of PRACTICAL WIRELESS since it was first issued, I have one complaint to make, and that is that every circuit diagram you have published has been an ordinary one. Why not publish a five-valve circuit, with "Class B" and two screened-grid valves, to give good quality output, with tone control, but not A.V.C.? I think that most wireless fans like to have reaction control, as without it I always think that one is not getting all that is possible, especially on foreign stations. I trust that you will see your way to publish such a circuit in the near future.—G. W. FORTNAM (Sutton Bridge).

What do readers think?—Ed.

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT it is possible to construct a simple apparatus which will locate a short-circuited turn in a coil or transformer or choke winding.
—THAT a tapping point can be taken from some types of moulded resister by twisting a piece of bare wire round the outside.
—THAT the value of such tapping will be approximately proportional to the length; in other words, a wire wrapped round one quarter of the way along the resistance will tap off three-quarters or one-quarter of the total value.
—THAT for trimming a home-made intermediate-frequency transformer, or for other similar uses, a coil of wire may be used as a condenser, the requisite capacity existing across the total winding.
—THAT ordinary metal braiding such as is used for H.F. leads generally proves ineffective for screening leads carrying A.C. supplies.
—THAT copper tube is most effective for winding short-wave coils for use on wavelengths lower than 10 metres.
—THAT a D.C. milliammeter may be converted into an A.C. voltmeter by means of a midget metal-oxide rectifier.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

"IGRANICOR" COILS

THE Igranic Electric Co., Ltd., have, for a considerable time, been carrying out research work on coils, using magnetic cores in high-frequency inductances, with the result that a series of tuning coils have been produced which are as striking in departure from present practice as they are in performance. It is possible to reduce the number of turns upon a coil, and then bring up the inductance to the required figure by inserting a core of magnetic material. By suitably designing a core, and proportioning the number of turns with the amount of core, a coil has been evolved which possesses a high-frequency resistance lower than any practical air-cored coil on the market. The decrease in high-frequency resistance, apart from increased efficiency, means that selectivity is enhanced considerably, and the question of station separation becomes simplified. A further advantage is that the stray field, instead of spreading, as with an air-cored coil, is confined to a practically closed circuit in the core, and a close-fitting metallic screen can be placed close to the coil to remove static coupling effects without in any way impairing the efficiency of the coil.

The core of these new coils is composed of very finely divided iron mixed with other materials to insulate the particles of iron from one another. A very fine and thorough mixing is employed, and, finally, a percentage of resinous powder is added to the mixture. It is then moulded under the heat and pressure conditions which are used for bakelite products.

Full particulars and prices, together with circuit diagrams incorporating various types of Igranicor coils, are given in an attractive folder, copies of which can be obtained from Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.

BULGIN PRODUCTS

IF it's a high-class radio component you require, you will find it in the new edition of the Bulgin Radio Catalogue for the season 1933-4. It is, undoubtedly, one of the most comprehensive catalogues we have yet seen, and covers everything the constructor is likely to require. Included in the list is a fine array of switches for various purposes; screened H.F. chokes for chassis or baseboard mounting; tuning coils; valve-holders and adaptors; cartridge fuses; signal lamps and panel lights; and numerous other small components. In the back part of the catalogue there is a 24-page technical manual giving instructive information and showing how various Bulgin components are connected in different circuits. Copies of this useful list can be obtained on application to A. F. Bulgin and Company, Ltd., Abbey Road, Barking, Essex, enclosing 2d. for postage.

HANDBOOK OF TUNING COILS

THIS useful handbook, issued by the British Ebonite Co., Ltd., is full of information on the construction and winding of various types of coils used in present-day practice. All the coils described are wound on the well-known Becol Ebonite Formers, and the clear explanatory diagrams in the book make the task of coil winding a comparatively easy matter for the amateur. Amongst the coils dealt with are a Universal Dual-range Tuner, H.F. Chokes, Band-Pass Tuner, a Matched Dual-range H.F. Tuner, and a Triple-range Oscillator Coil. A handy table of wire gauges and turns per inch is included in the handbook, a copy of which can be had for 6d. post free. The address is Nightingale Road, Hanwell, London, W.7.

EDISWAN BATTERIES

USEFUL hints concerning Ediswan H.T. and grid-bias batteries is given in a neat booklet recently issued by Ediswan Swan Electric Co., Ltd. Users of these batteries who wish to know how to obtain the maximum length of life from them, together with the highest quality of reproduction from their sets, will find the information in this booklet, which also contains a handy two-page chart for logging stations. A leaflet giving particulars of the new Ediswan Multi-circuit charger is included in the booklet, a copy of which can be obtained from 123, Queen Victoria Street, London, E.C.4.

SOME INTERESTING USES FOR H.F. METAL RECTIFIERS

(*Continued from page 722*)

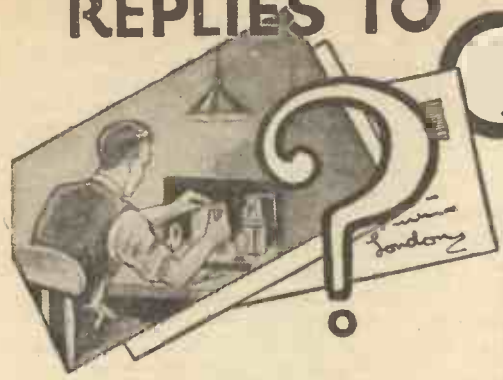
very much over-biased when no signals are being received. As soon as a station is tuned in, however, the bias automatically adjusts itself so that when the valve is fully loaded, the G.B. voltage is of the correct value specified by the makers. Because of this the anode current consumption of the output valve is always proportional to the volume of sound being delivered by the speaker. By this means, then, one of the most important advantages of the Class B valve can be obtained from a power or pentode valve of normal type. In Fig. 6 the values of the two resistances forming the potentiometer are given as 250,000 and 50,000 ohms respectively. These are average figures which usually suit power pentodes, but it is always best to try the effect of varying them, and choosing the lowest value for the "upper" resistance which permits of good quality reproduction when the output valve is fully loaded. An alternative method is to replace the 50,000-ohm fixed resistance by a variable one of about twice the value; increasing the value of that resistance will be equivalent to reducing the value of the other one. Another way is to replace both resistances by a 250,000-ohm potentiometer which can be mounted on the chassis of the set. After setting up the circuit shown in Fig. 6, all that is necessary is to adjust the G.B. voltage to the highest value at which good reproduction of loud passages is obtained. It should be pointed out that where two L.F. valves are employed, a separate G.B. battery will be necessary for the output valve, and it should have a voltage of twice that previously employed. The first L.F. valve will be biased in the ordinary way exactly as it was before.

REPLIES TO BROADCAST QUERIES

MUD (Tottenham): (1) OK2EA, amateur transmitter, Czecho-Slovakia, but cannot trace call in latest lists; we advise you to write: C.A.V. Box 69, Prague, Czecho-Slovakia; (2) CT1FU, Mario de Vasconcelos e Sa, 461, Rua das Valas, Porto, Portugal; (3) PA0OE, F. Bennick, Jnr., Breelaan 14, Bergen (N.H.), Holland; (4 and 5) Belgian amateurs, but cannot trace call-signs; for particulars write: *Réseau Belge*, 33, rue Alphonse Renard, Brussels, Belgium; (6, 7 and 8) French amateurs; for particulars write: *Réseau des Emetteurs Français*, 17, rue Mayet, Paris VIe., France; (9) F8PI, Samuel, 1, rue Gilbert, Epinal (Vosges), France; (10) F8PU, Bassus, 2, rue Saint-Vincent-de-Paul, Bordeaux (Gironde), France; (11) F8AE, Derasse, route de la Pyramide, Denain (Nord) France; (12) F8CC, Fernand Laye, 1, rue du Jasmin, Algiers, North Africa; (13) F8JC, Groizeiller, 12, avenue de la 42e Division, Verdun (Meuse), France; (14) VE9GW, Experimental station; Gooderham and Worts, Ltd., Bowmanville (Ontario); (15) W8XK, Westinghouse Electric and Manufacturing Co., East Pittsburgh (Pa.); (16) W2XAD, General Electric Co., South Schenectady (New York); (17) W2XE, Atlantic Broadcasting Corporation, near Wayne (New Jersey); (18) VK2ME, Amalgamated Wireless(Australasia), Ltd. Radio Transmitting Centre, Pennant Hills, New South Wales; (19) PLE, Bandoeng Radio Club, Java (Dutch East Indies); (20) G6DU, J. McOmish, "Curracheen," Perth Road, Crieff, Perthshire; (21) G6IA, T. H. Colbourn, "Ardchalligan," Selbonrne Drive, Douglas, Isle of Man; (22) CGA, Drummondville (Que.); (23) WQP, Radio Corporation of America, Rocky Point, New York; (24) YVR, Maracay (Venezuela); (25) LSY, Monte Grande (Buenos Aires); (26) CNR, Rabat (Morocco); (27) F8CA, Audureau, 29, rue de Bretagne, Laval (Mayenne); (28) F3DN, see reply to Nos. 6, 7 and 8; (29) F8ZW, Jean Wibrotte, 70, Avenue d'Italie, Paris, 13e, France; (30) See reply to Nos. 6, 7 and 8. J. G. ASTON (Dublin): We can trace the following call-signs: G2XA, M. Griffin, 101, Crossways, Heston, Hounslow, Middlesex; G6XN, Downside School, Stratton-on-the-Fosse, Bath, Somerset; cannot trace PA0EW; are you sure this was not PA0IDW, D. H. Wijkman, 13, Kanaalstraat 2, Amsterdam, Holland; F8EJ, Rene Trere, 36, Rue de Chateaudun, Cambrai, France; F8BI, M. Cassaigne, Rue Sadi-Carnot, La Magistère (T. et G.), France; cannot trace W2GOQ, but if W2GQ, William McClenahan, 5,324, Av. L., Brooklyn, New York, U.S.A. YANKEE (Derby): (1) WGY, Schenectady (N.Y.), 379.5 m.; (2) WJZ, Bound Brook (N.J.), 394.5 m.; (3) WJR, Detroit (Mich.), on 399.8 m., apparently relaying WRC, Washington (D.C.); (4) WEAF, New York, 454.3 m.; (5) WABC, New York, 348.6 m.; (6) KDKA, East Pittsburgh (Pa.), 305.9 m.; (7) WTAM, Cleveland (Ohio), 280.2 m.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Query Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. It is available only to genuine home constructors, not dealers or traders. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

TRANSFORMER BREAKDOWN

"I enclose a circuit of my receiver which has suddenly ceased to work. I was listening to a broadcast programme when, without any warning, the signals ceased. I have had the valves tested at a local shop and they are quite in order, so I should be glad to know what might be the cause of the trouble, or how to trace it out."—H. Y. T. (Peckham).

The circuit is the conventional H.F., detector, and power stage, and we think the most likely cause is a breakdown in one of the L.F. transformer windings. This is parallel-fed, and therefore it may quickly be checked by connecting the coupling condenser direct to the grid of the output valve. This will leave the circuit as a resistance-capacity coupled arrangement with the primary of the transformer in place of the customary grid-leak. If signals are then obtained it will denote that the secondary has broken down. If, however, no signals are heard the secondary winding should be joined between grid and earth (or grid bias) and the primary winding left disconnected. Signals now will indicate that the primary has broken down. If, however, neither of these tests enables signals to be heard we can only suggest that the circuit is tested stage by stage, using headphones in the anode circuit of each valve in order to ascertain that each is working correctly. Resistances and condensers are the most likely cause of a sudden cessation of signals.

CALIBRATED TUNING SCALES

"I have seen in the wireless shops lately one or two different makes of tuning scale of the slow-motion type on which the wavelengths are marked instead of the usual 0 to 100. I do not see how the dial makers can give this calibration, as they do not know what type of condenser will be used, nor the coil with which it may be associated. Is it intended that the scale shall only be used with their condensers and coils, or is it a ramp? I notice particularly in the case of the firm it does not make tuning coils."—F. P. O. (Preston).

The idea is perfectly sound, F. P. O., and you need have no fears that the idea is a ramp. If you examine one of these tuning scales carefully you will find that it states on the ivorine, or at least in the makers catalogues, that the scale is intended for a condenser of a given value and a coil of a certain inductance. For instance, the Utility dial, which was recently illustrated on the Facts and Figures page, is designed to work in conjunction with coils having an inductance of 157μ H on the medium waves and 1,900μ H on the long waves. Similarly, the other scales are designed for specific coil inductances, and used under those conditions the calibration holds good.

INSTABILITY

"My set periodically breaks out into motor-boating although it is decoupled. I have been all over it and tested each part and no part seems defective. I do not seem, however, to be able to get it to work for more than one night without the instability, and I should like to know how to set about finding the actual cause and effecting a cure."—S. L. (Birkenhead).

It may be that your decoupling is not complete enough, by which we mean that the capacity of the by-passing condenser is not sufficiently high to act in the manner intended. You should therefore try the dodge of connecting a further condenser in parallel with those which are at present in use. Try each stage in turn, adding a 2 mfd. condenser. It may be found necessary to increase the value in more than one stage, although it is most likely that the detector stage is responsible for the instability. If this does not effect a cure we would undoubtedly state that the resistance in one of the anode circuits is defective and when it warms up its value materially decreases. You can check this point by feeling the resistances after an evening's working. There should be no material rise in temperature.

NEW RECEIVING CIRCUITS

"After reading all your issues since No. 1, I have not been able to see that you have originated a single new idea in radio. All your circuits have been of the standard arrangement, using the ordinary sequence of valves, etc. Is it not possible that you have sufficient talent to design something entirely new? I should certainly be one of the first to try out the idea if I saw it written up in your pages."—A. J. R. (Oxford).

We cannot agree that we have not shown originality. A. J. R. appreciates, we assume, that valves can only be connected in a certain sequence, with the science as it is to-day, and any departure from these "standard" methods would be invention, and as such would surely not be published until sufficient patent protection had been obtained. The circuits which we have published have all shown originality, from the first introduction of the "chassis-type" of construction to the latest receiver, which employed the A.V.C. principle with battery-operated valves. Surely originality is evidenced when a circuit is designed round a newly obtainable component? However, we trust that A. J. R. is sufficiently interested to try out the various circuits which we publish, when we are sure he will find that the receivers are certainly modern in both performance and design.

PARTS FOR THE ORBIT

"I have been waiting now for three weeks to get the parts for the Orbit, and am becoming disgusted that you should publish a design before the components are on the market. Can you not do something to stir up the manufacturers? If things get much longer I shall certainly not try to make up your sets but shall be content to stick to my old set or buy one of shop-built design."—T. B. N. (Gloucester).

We are sorry to say that, owing to the enormous demand for components for the Orbit, the manufacturers of certain parts have disposed of their entire stocks and are working now at high pressure in order to keep pace with the demand. You will no doubt find that the makers themselves can supply you direct although your local supplier may have run out. In most cases of this complaint—and we have had many—it has been found that the local dealer has no stock, and as the manufacturers must deal with all orders in rotation, they have had to wait some time before receiving further supplies. It is regretted that this should occur, but we hasten to assure our readers that we do not publish any design until the components are on the market, and it is only in isolated cases like this where the demand is so phenomenal that supplies are quickly exhausted.

DATA SHEET No. 66.

Cut this out each week and paste it in a notebook

MULTIPLE DIODE VALVES NOW OBTAINABLE.

Type	Rating: Filament Volts	Rating: Anode Volts	Type of Base	Price	Maker
DDT	4	200	7-pin	15/6	Cosor
DD/PEN	4	250	do.	20/-	Cosor
DDT.16	16	200	do.	15/6	Cosor
H4D	4	200	do.	15/6	Ferranti
L2/D	2	150	5-pin	10/6	Lissen
AVC/2	2	150	4-pin	17/6	Lissen
AC/AVC	4	200	5-pin	20/-	Lissen
MHD.4	4	200	7-pin	15/6	Marconi & Osram
DHD	16	200	do.	15/6	Marconi & Osram
L2/DD	2	150	5-pin	9/-	Mazda
AC/DD	4	—	do.	13/6	Mazda
AC/HL.DD	4	250	7-pin	15/-	Mazda
H.A2	4	200	do.	15/6	Micromesh
TDD.4	4	200	do.	15/6	Mullard
SD.4	4	200	do.	20/-	Mullard
TDD.25	25	200	do.	15/6	Mullard
BA 1	250	300	do.	18/3	Ostar Ganz
BA 5	250	300	do.	18/3	Ostar Ganz
SS.4.DDT.AC	4	200	do.	15/6	Six Sixty
B.430.N	4	200	do.	13/6	Tritron
B.2030.N	20	200	do.	13/6	Tritron
DS.4100	4	200	do.	17/-	Tungsram
DS.2018	20	—	do.	17/-	Tungsram

FREE ADVICE BUREAU COUPON

This coupon is available until Dec. 30th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 23/12/33.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

PREMIER SUPPLY STORES Offer the following Set Manufacturers' Surplus New Goods at a fraction of the Original Cost, all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers, resistances and diagram, 120v. 20 m.a. 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T., L.T. 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps. with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working 2 mf. 3/6, 4 mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2 mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the following Lines 6d. each or 5/- per dozen: 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; .01, .05 and 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd., 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes, 20 hys., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

HARLEY Pick-up, complete with arm and volume control; 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15, our price 18/6.

PREMIER British Made Meters, moving iron, flush mounting, accurate; 0-15, 0-50, 0-100, 0-250 milliamps., 0-1, 0-5 amps., all at 6/-.

ORMOND Condensers, 2-gang, semi-shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 100-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v., 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a., L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a. L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms, 1/-. 250,000 ohms, 50,000 ohms and 500,000 ohms, 2/6.

ROLA F7 MOVING COILS, 1,000 Ohms. FIELD, 20/-; MAGNAVOX 142, 1,000 Ohms. FIELD, 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

FOLLOWING VALVES USED FOR TEST ONLY. CALLERS ONLY. MS4B, MS4, DSB, DS, PT4, S4VB, ALL HALF PRICE.

DOUBLE Spring Motors, made by Garrard, play five sides of 10in. record, complete with turntable and all fittings; 17/6.

SPECIAL Offer.—Accumulator chargers, input 200-250 v. A.C., to charge 2- and 4-volt accumulators at ½ amp.; owing to the high efficiency of the silver oxide rectifier employed charger may be used during broadcast; 9/6 each.

RELIABLE Canned Coils with circuit: 3/- per coil accurately matched; dual range.

PREMIER L.T. Supply Units, consisting of Premier transformer and Westinghouse rectifier, inputs 200-250 A.C., output, 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp. 19/-; 6v. 2 amp., 27/6; 30v. 1a., 37/6.

PREMIER Mains Transformer, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., c.t. L.T., 2/- extra; Westinghouse rectifier for above, giving 180v. 80 m.a., 8/6.

PETO-SCOTT

wishes his many customers throughout the WORLD a very Happy Christmas and an exceedingly prosperous New Year. He trusts that he has been in no small measure instrumental in making possible the former.

NEW YEAR'S RESOLUTION

Order everything Radio from Peto-Scott and ensure radio prosperity.

PETO-SCOTT CO. LTD.

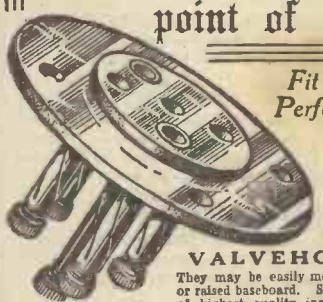
77, CITY ROAD, LONDON, E.C.1

Telephone: Clerkenwell 9406/7

West End Showrooms: 62, High Holborn, London, W.C.1

EST. 1919

CLIX trust your Christmas may be perfect from every point of view



Fit Clix for Perfect Contact

Chassis Mounting VALVEHOLDERS

They may be easily mounted on chassis or raised baseboard. Sturdily built Plate of highest quality insulating material. Resilient sockets guarantee full-surface contact with ANY type of valve pin and definitely prevent arcing. For easy entry and withdrawal the sockets move laterally and align with valve pins.

(Standard Type)
4-Pin ... 8d.
5-Pin ... 9d.
(Floating Type)
7-Pin ... 1/-

CLIX "MASTER" PLUG

Positive METAL to METAL wiring. Firm grip and full contact with ALL sockets with internal diameters from 1in. to 5/32in. battery socket. Curved ends for easy insertion. Price **1½d.**

CLIX PANEL TERMINALS

Type B, with Hexagonal Shoulder for easy mounting - - - - - **4d.**
Type A - **2½d.**

CLIX CHEAPEST PERFECT CONTACT

Write for New Clix Folder "N."

LECTRO LINX Ltd., 79a, Rochester Row, London, S.W.1

RADIO SUPPLIES

Send your list of Radio needs for our quotation. Kits, Parts, Sets, etc. Everything in Radio stocked, prompt delivery. 7 days' approval. Catalogue free. Taylex & Standard Wet H.T. replacements stocked.
N. TAYLOR, 9, GROVE RD., BALHAM, S.W.12

PREMIER Mains Transformers, output 250-0-250 volts 60 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350 volts, 90 m.a., 4v. 3-5a., 4v. 2-3a. (both c.t.), with screened primary. 15/-.

PREMIER Mains Transformers, output 400-0-400 volts, 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-110/200-250 volts, or vice versa, 60-watt, 7/9; 100-watt, 10/-.

B.T.H. Induction Type (A.C. only) Truespeed Electric Gramophone Motors, 100-250 v.; 30/- complete.

SPECIAL Offer of Manufacturers' Type Transformers, input 200-250v., output 250-0-250 volts, 60 m.a., 4v. 1a., 4v. 3a. (both c.t.), 8/6; H.T.8 transformer, with 4v. 3-4a. (c.t.), 8/6; with Westinghouse rectifier, 18/6.

WESTERN ELECTRIC Condensers, 250v. working 1 mfd., 6d., 2 mfd., 1/-; 500v. working, 1 mfd., 1/-.

T.C.C. Condensers, 250v. working 4x4x1x1x.5 mfd., 3/6; 6x4x2x2x2 mfd., 375v. working, 6/11; H.M.V. 4x4x1x1x1x.5 6/-. 400v. working.

SPECIAL Offer of Wire Wound Resistances.—4 watts, any value up to 10,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

MAGNAVOX P.M. M.C. Speakers, 7-inch cone, 18/6; Please state whether Power or Pentode Transformer required.

SPECIAL OFFER. Valves by World-Famous Continental Manufacturers. Fully guaranteed. All Standard Mains Types; 4v. 1 amp filament. H.L. L. SG. 350v. 120 mA Rectifier, 5/- each. SGVM Pentode Power, 6/6 each.

A LARGE stock of all types of Radio Cabinets at very low prices for callers.

WESTINGHOUSE Rectifiers, 120v. 15mA, 6/6; 200v. 30 mA, 8/6; 200v. 60 mA, 10/-.

GRAMPIAN Moving Coil P.M. Speakers, 9in. Cone, Handles 4 watts, 18/6.

BULGIN 3 amp. Mains Switch, 1/-; T.C.C. 6 mfd. Electrolytic Condensers, 50v. working, 1/-.

PLEASE mention PRACTICAL WIRELESS when ordering.

PREMIER SUPPLY STORES, 20, High Street, London, S.W.4. Macaulay 2188. Closed 1 o'clock Wednesdays, open to 9 o'clock Saturdays. Nearest Station, Clapham North Underground.

SOUTHERN RADIO'S Wireless Bargains.—Set manufacturers' guaranteed surplus.

VARIABLE Condensers.—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; all ganged condensers are fully screened, with trimmers and boxed; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1, 1,000 volt test, 7/- each; 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd., Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor screen-grid 3-valve kit, less valves, 26/-; with 3 Mullard valves (P.M.12a, P.M.2D.X., P.M.2a), 49/- (list £5/7/6).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2.D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6 each (list £4/17/6); all kits brand new in original sealed cartons.

MARCONI 1934 Pick-up No. 19, 26/- (list 32/6); Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/9 each (list 35/-); H.M.V. volume controls, 1/6 each (list 12/6). We have purchased the complete liquidated stock of large northern Manufacturer and Factor and can offer the following special bargains:—Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each. 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each. Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each, 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. assorted. Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

ALL Goods guaranteed New and Perfect and sent Carriage Paid.

PLEASE Note.—We have opened branches at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle Street, W.C.2, where callers are cordially invited to inspect our large stocks of wireless bargains. Please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 0324.

MEASUREMENTS made for Amateurs: Condensers, Inductances, Wavemeters. Resistances. Enquiries: BM/ZLME, W.C.1.

BIRMINGHAM RADIOMARTS Manufacturers bankrupt stocks; post free over 6/-, otherwise 6d. New list stamp.

RADIOMART Lotus all brass .0003 reaction condensers, 1/-; ditto bakelite differentials, 1/6.

RADIOMART Radiophone, 27/6; straight 3-gang dust cover and trimmers, 12/6.

RADIOMART Polar Tub 3-gang, fully screened, 7/6; ditto 4-gang semi-screened, 7/6. Both split end vane trimming only.

RADIOMART TCC electrolytic bias condensers boxed 50mfd. 12v. or 6mfd. 50v., 7½d.

RADIOMART Wearite transformers 300/300, 250/250. HTS. HT9., all with 4 x 4ACT., 10/6. Not stripped types.

RADIOMART. MetVick, 35/-, super transformers 250/250., 4v2a., 4v. up to 5a, fitted terminals boxed, 12/6; 110v. 25 cycles, same price.

RADIOMART. 440v. Electrolytics TCC. 8mfd., aqueous, 3/11. Hellesen do., 3/3. Hellesen 8 x 4mfd., dry, 3/3.

RADIOMART. Lotus, 2/-, jack plugs, 9d.; 6ft. Lewcos twin screened pickup cable, 9d.; ditto, single, 6d.; 5-way heavy cable, 6d. per yd.

RADIOMART non-inductive tubulars 1mf. TCC, 375wkg. .01mfd. 1,500v. test, 6d. each.

RADIOMART. Lotus 3½-1, pushpull intervalve transformers, manufacturing type, soldering tags, 2/-.

RADIOMART Milliammeters hand calibrated all readings above 20ma., 5/9; super 3in. model, 6/9.

RADIOMART HMV 3-gang with nonslip wavelength drum-drive trimmers, 9/6.

RADIOMART Centralab 100,000 ohm senior, 12/6, potentiometer, 2/6. Not midget type.

RADIOMART. Philips manufacturers' type transformers, 200/200v., 4v3a, 4v1a, with fixing feet, 4/6.

RADIOMART. Siemens & Halskespecial modulation hum suppression condensers .1 x .1mfd. 1500v., 1/6.

RADIOMART. Climax boxed binocular HF. chokes, 1/6. Utility 2/6 snap switches, 9d.

RADIOMART guarantees prompt despatch, perfect goods, no misrepresentation. THE SQUARE DEALERS, 19, JOHN BRIGHT ST., BIRMINGHAM.

THE following valves are guaranteed unused and perfect, and any valve differing from the makers' characteristics will be exchanged; and all latest types. A.C./Pens, P.T.4s, A.C.S.G/V.M.s, Pen. 4Vs, M.V.S.G.s, A.C.S.2/Pens, M.M.4V.s, P.T.625s, V.M.S.4s, D.C.2/Pens, D.P.T.s, P.M.24M.s, M.P.T.4s, V.M.4V.s, A.C.S.1/V.M.s, P.M.24B.s, D.C.2S.G./1V.M.s, 11/-; M.S.4s. M.S.4B.s, A.C.S.G.s, S.4V.A.s, S.4V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S./2s, D.C.2S.G.s, 9/6; U.14s, 10/-. "Class B": P.M.2B, P.D.220, 220.B, 8/6, M.L.4s, A.C./P.s, P.M.24s, 8/-; A.C./H.L.s, 164V.s, 354V.s, A.C.2/H.L.s, 41M.H.L.s, U.10s, U.U.60/250s, M.H.4s, M.H.L.4s, 7/6; V.S.2s, 2158.G.s, 220S.G.s, P.M.12s, P.M.12A.s, 9/-; 442B.U.s, D.W.3s, 8/6; 215 P.s, 220P.s, L.P.2s, 4/9; P.2s, 6/6; P.T.2s, P.M.22A.s, 9/-; H.L.210s, H.210s, L.210s, L.2s, 3/9. All Types of Brand New American Valves in Stock, first-class makes: 247s, 235s, 224s, 236s, 237s, 233s, 238s, 230s, 245s, 244s, 12/-; 227s, 226s, 280s, 9/6; 242s, 232s, 11/-; U.X.250s, 16/-; 281s, 14/6. Carriage Paid. Cash with Order or c.o.d.—Ward, 45, Farringdon St., E.C.1.

EVERYTHING to make your own transformers (mains and push-pull), chokes and coils. Lists free.—Lumen Electric Coy., 9, Scarisbrick Ave., Litherland, Liverpool, 21.

ERICSSON 3/1 L.F. Transformers, List price, 17s. 6d. New and guaranteed. Our price, 2s. 3d. post free U.K.—Pioneer Radio, Coptic St., London, W.C.1.

NEW AND USED RADIO COMPONENTS, Cheap for Cash.—Arlin, 44, Ranelagh Road, Westminster, S.W.1.

CHARGING WITHOUT MAINS!—Thousands are charging their own accumulators, why don't you? "Tonic" trickle-charger kits keep 2-volt accumulators fully charged. Ideal for remote districts. From 7/-, postage 9d. Full particulars, stamp.—Williams, Netherend, Cradley, Nr. Birmingham.

THE Exchange Specialists. Get your New Kits, Speakers, Radio Sets or Components from us. Your Old Set, Speaker or Components taken in part payment. Absolute satisfaction assured.—Rad-Auto-Gram Co., 39, Tulketh Street, Southport.

CHAL Electric offers Brand New Set Manufacturers' surplus Moving Coil Speakers. Magnavox Type D.C.144, 7-in. cones 100/190 D.C. (2500 ohms) (40/76 M.A.) and 190/280 D.C. (6500 ohms) (29/43 M.A.) at 19/- each. 152 Type, 9-in. cones same voltages at 26/- each. ROLAS F.6 (voltages as in Magnavox), 7½-in. cones at 18/-; F.7 9-in. cones same voltages at 25/-. Permanent Magnets, F.6 P.M., list 49/6, at 28/-; F.7 P.M., list £3, at 33/-. State if Power or Pentode Transformer. All fitted Humbuckers. Also number of Class "B". State requirements. All goods Carr. Paid. Cash with order or C.O.D. Chal Electric, No. 6, Conduit Street, London, W.1. Regent 6240.

REPAIRS TO ANY MAKE RADIO APPARATUS. 24 Hours service, guaranteed laboratory tested. Transformers, loud-speakers from 4/-. Eliminators, Mains Transformers, etc. New cones fitted to Moving-Coil speakers. Estimates free. Wates Volt/Amp meters a speciality, 3/6, other makes quoted for. Repair Dept. C. WEEDON POWER LINK RADIO CO., 185, Earlham Grove, London, E.7, Maryland 4344.

PRACTICAL HANDBOOKS

Clearly written and fully illustrated.

This series covers a wide field and will prove of the greatest value to everyone interested in models and how to make them; woodwork and other crafts.

ACCUMULATORS

An up-to-date handbook dealing with every type of accumulator, methods of charging them at home, care and maintenance, also explains how to erect a charging station.

MOTOR CAR UPKEEP AND OVERHAUL

Information covering the engine, decarbonising, valve grinding, the lighting system, the carburettor, cooling system, lubrication, springs and shock absorbers, steering gear, brakes, wheels, axles, tracing noises, etc., etc.

TOY MAKING FOR AMATEURS

How to make clockwork toys, model aeroplanes, model locomotives, model boats, ingenious toys operated by sand, wooden models and toys, electrical toys, steam toys, guns, kaleidoscopes, acrobats, etc.

TWENTY-FIVE TESTED WIRELESS CIRCUITS

All the sets described have been designed to meet modern needs. They range from simple crystal receivers to a seven-valve super-heterodyne, and all the sets have been made and tested before inclusion.

SIMPLE ELECTRICAL APPARATUS

An excellent little book for those who wish to make simple and useful electrical appliances, such as galvanometers, electric motors, dynamos and Leyden jars.

MODEL BOAT BUILDING

Contains designs for battleship, speed boat, paddle steamer and yachts. Excellent models can be built with the simple directions and diagrams given.

THE HOME WOODWORKER

Clear instructions on how to make a large variety of articles in wood, together with many useful hints on wood-working.

MODEL AEROPLANES AND AIRSHIPS

Contains full descriptions of easy-to-make models of every description that will fly.

THE HANDYMAN'S ENQUIRE WITHIN

Hundreds of practical ideas and hints of value to the man who is clever with his hands.

25 SIMPLE WORKING MODELS

Ingenious and practical designs for electric, steam and clock-work models.

NEWNES' HOME MECHANIC BOOKS

Obtainable at all Newsagents and Bookstalls, or by post 1/2 each from George Newnes, Ltd., 8-11, Southampton St., Strand, W.C.2.

1/- each

Geo. Newnes, Ltd.

WANTED Mains and battery valves also clean surplus components. 24a, Newport Court, Charing Cross Road, W.C.2.

RADIO BARGAINS. Full range of Lists for stamp. Valves, coils, condensers, etc.

MS4, 8/11; MM4V, 9/6; Pen 220A, 8/11. Many others all perfect. Let us quote you. 575, Mosely Road, Birmingham.

WANTED good Modern Wireless Parts, Sets, Eliminators, Meters, Valves, Speakers, etc. Spot Cash Waiting. Send or bring. We pay more than any other Dealer. Open 9-8.—University Radio, 142, Drummond St., Hampstead Rd., N.W.1.

BROWN M.C. SPEAKER UNIT

LIST PRICE 50/- OUR PRICE 32/6

New BROWN Permanent-magnet Moving-coil Speaker Unit and Chassis incorporating Tapped Transformer. Highly suitable to work with any set, giving deep, rich tone and wonderful volume without distortion. Overall size: 8½ in. diameter, 4½ in. deep, on baffle board 12 in. square. SEND ONLY 2/6; if satisfied pay further 5/- at once, then 6 monthly payments of 5/-. (Cash in 7 days, 32/6.) Limited number only. Send at once.

ONLY 2/6 DOWN

E. J. HERAUD, Ltd., Dept P.38, NUMBER ONE, EDMONTON, LONDON, N.18.

Satisfaction or Money Back Guaranteed.

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD., 146b, Qn. Victoria Street, E.C.4, offer "Advice Handbook" and Consultations free. 47 years' references. Write, call, or 'phone (Central 0682). Director, B. T. King, C.I.M.E., Reg. Patent Agent, G.B., U.S.A., and Canada.

THE WIRELESS CONSTRUCTOR'S ENCYCLOPAEDIA

By F. J. CAMM.

5/-, or 5/4 by post from Geo. Newnes, Ltd. 8-11 Southampton Street, Strand, W.C.2.

ADVERTISEMENT INDEX

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

RADIO RELAY SYSTEMS

Practical Wireless

3D

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 3.——No. 67.
DECEMBER 30th, 1933.
Registered at the G.P.O. as a Newspaper.

EDITED BY F. J. CAMM.

Making an ALL-PURPOSE TEST METER

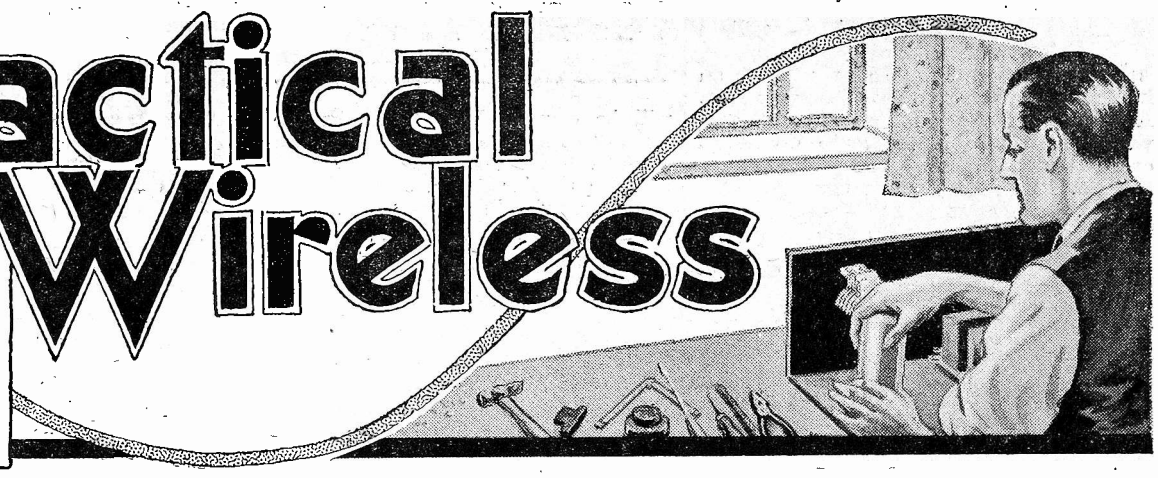
NEXT WEEK! BUILDING A PORTABLE TELEVISION RECEIVER

Practical Wireless

EDITOR: F. J. CAMM

Technical Staff: W. J. DELANEY, H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E., FRANK PRESTON, W. B. RICHARDSON

Vol. III, No. 67 Dec. 30th, 1933



ROUND *the* WORLD *of* WIRELESS

Collieries Band Concert

SWANNICK Collieries Band, which won the Junior Championship at the Crystal Palace this year, give a programme for Midland Regional listeners on January 4th. F. Skidmore conducts the band, which was founded thirty years ago. The players are drawn entirely from the colliery employees. Several part-songs will be sung by the Newlands Quartet.

Another Sims Reeves Recital

FRANK TITTERTON'S heroic efforts to revive the songs of his brilliant predecessor in vocal art, Sims Reeves, continue unabated, and on December 30th he is to give another of these Sims Reeves recitals in the National programme. Titterton started singing professionally after the war, during which he served in the Tank Corps, "and," he says, "I required a tank almost to myself, even at that time." His girth has since increased still more, and now, paradoxically, he uses one of the smallest cars on the market in order to get about all over the country to fulfil his numerous engagements. When he is driving there is scarcely room for anyone else in the car.

"The Streets of London"

STORIES of life in the 'eighties have a singular fascination for the modern age. There certainly seems to be less appeal about the 'sixties or the 'seventies; and even the 'nineties are not associated in the minds of most people with the same air of romanticism as the decade when Queen Victoria's Jubilee was registered, an event universally celebrated with as much fervency as the Diamond Jubilee ten years later. It is to the 'eighties, then, that Barbara Burnham and Mark H. Lubbock have gone for their programme of December 29th, "The Streets of London," which will be heard by National listeners. It is a drama of low and high life in eight scenes. A banking house in Cheapside, a mansion in Park Lane, a tenement in Seven Dials, and a cottage in Highgate are among the scenes to be included in this novel programme. The Theatre Orchestra will play.

You May Now Hear Manila

KZRM, the main broadcasting station operating at Manila (Philippine Islands), is now relaying the programmes of its medium-wave transmitter on 49.3 metres (6,085 kc/s). They have been picked up in the British Isles between G.M.T. 22.00 and midnight.

"Songs from the Shows"

A NEW series of "Songs from the Shows" will start in January. The first theatre to be dealt with will be the Adelphi, and the cast will include those popular microphone "stars," Anona Winn, George Baker, Reginald Purdell, and Olive Groves, with, perhaps, a famous Adelphi name or two. Stanford Robinson will conduct the orchestra, and the deviser of the "Songs from the Shows" series since their beginning, John Watt, will compère. An innovation will be that two performances will be given, one evening performance, probably on the Friday or Saturday night, and one afternoon performance, a Saturday matinée. The latter may replace "First Time Here," the present 4.30 tea-time entertainment by artists new to the microphone. Thus the programmes will cater for the large number of people who write to Broadcasting House, saying that they work all night and thus never hear any of the programmes which they want to hear.

Primitive Time Signals

IN Great Britain we are given the exact time by means of the "six pips" automatically supplied by the Greenwich Observatory, but many Continental stations still transmit signals at odd hours, taking the time from an electric studio clock. In Germany, except at certain periods of the day, the announcer strikes a gong and tells his hearers the number of minutes past the hour. A similar method has been used in France, but is gradually being replaced by clock carillons or so-called Westminster chimes, imitating Big Ben.

Eiffel Tower Will Not Close Down Yet

SO far as can be foreseen, only that part of the Lucerne Plan dealing with medium-wave stations will be brought into operation on January 15th, 1934; the "long-wave" stations will probably remain on their usual channels. Broadcasts from the Eiffel Tower, therefore, are expected to continue until further notice. Later, if agreement can be reached amongst the interested nations, alterations may be made in the wavelengths of transmitters working on channels between 1,000 and 2,000 metres.

Radio Splendid

IF on one night you leave your receiver tuned to North National and then return to the set towards 1.30 a.m., on twirling the condenser very slightly upwards—until the set is tuned to 302.8 metres, to be exact—you should easily capture a broadcast from LR4, Radio Splendid, Buenos Aires. At 2 a.m. you will hear a time signal consisting of ten flute-like notes followed by one long blast. As a rule the station, which announces regularly in Spanish and English, concludes its dance music transmissions by playing the opening bars of Jessel's *Parade of the Tin Soldiers*.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

INTERESTING and TOPICAL PARAGRAPHS

Additional B.B.C. Studios

AN old skating rink in the immediate vicinity of Maida Vale, London, is likely to become in the near future an important branch of Broadcasting House. A portion of the building will be converted to utilise it for large orchestral concerts such as those given in the past at the No. 10 (Wharf) studio near Waterloo Bridge. Arrangements will also be made to incorporate at the Maida Vale branch other smaller studios. It is expected that the building will also be required for the variety and vaudeville hours when the short lease of St. George's Hall, recently acquired by the B.B.C. for this purpose, comes to an end.

Listen to Buenos Aires

TWO Argentine stations which are now being well heard are, LR3 Radio Nacional on 315.8 metres and LR4, Radio Splendid on 303 metres; their power is respectively 18 and 15 kilowatts. For the purpose of identification it will assist readers to know that most announcements are made in both Spanish and English. Talks are usually given between 10 and 11 p.m., followed by a concert, and at 1 a.m. strains from an Argentine tango band may be picked up. The news bulletin is broadcast at about 3 a.m. shortly before the stations close down. The best time to make a search is between midnight and 3 a.m. G.M.T.

U.S.S.R. and United States

TESTS in trans-Atlantic telephony are now being regularly carried out between Moscow and New York. The Russian station RNE on 25 metres (12,000 kc/s) may be heard calling WQP, Rock Point, the latter replying on 21.58 metres (13,900 kc/s). An attempt will shortly be made to relay a concert from Moscow or Leningrad to the United States. The tests are usually carried out towards 1.30 p.m. G.M.T., the English language being used on both sides.

Poland Holds Musical Broadcast Record

OF all the European stations Warsaw is the one which holds the record for the greatest proportion of musical broadcasts made in the course of the week's wireless transmissions. Of the programmes given out by this studio, 68 per cent. is devoted to orchestral, vocal, or instrumental music. Gramophone records are not much used for the broadcasts, although their popularity in Poland for home entertainment is no less than it is in other countries.

Radio-Paris Temporarily Closed Down

FOLLOWING the transfer of the Remy St. Honoré high-power transmitter to the French State network, Radio-Paris suspended its broadcasts from December 8th to 17th. No doubt failure to receive concerts on 1,724 metres during this period must have greatly puzzled listeners, as notice was only given of this measure to the Press after the station had closed down. As it is now being worked by a totally different organisation, the time schedule will be completely altered; for the first week or so a skeleton programme has been devised, but the station will shortly take over its regular duties as the high-power channel of the P.T.T. network.

NEW POST OFFICE RESEARCH STATION

Testing the efficiency of head-phones at the new P.O. Research Station at Dollis Hill.

Spain's Radio Mushrooms

OWING to the indefinitely postponed reorganization of the broadcasting system in Spain, a large number of small transmitters have started up in various parts of the country with a view to an attempt to give radio listeners some kind of wireless entertainment. Most of these stations are worked by private and local associations. In addition to those already mentioned in these columns, something like twenty-five others have been launched on the ether during the past few weeks. As most of them, in power, do not exceed 150—200 watts and operate on channels between 200 and 218 metres, but few of the transmissions can be picked up in the British Isles.

Mexican Station Logged

CONDITIONS have been so favourable lately for the reception of trans-Atlantic transmissions in the early morning hours that a broadcast from Mexico was clearly heard on a recent date. The station logged was XED, Reynosa (Nuevo Laredo), on 310.9 m. (965 kc/s). The transmission was in Spanish and English, dance music being given at the time. The call picked up was XED *Companhia Internacionale Diffusoria de Reynosa*, Mexico, the latter word being pronounced: *Mayheeco*. In the latest lists the power of the transmitter is given as 10 kilowatts.

Budapest on Short Waves

PENDING the construction of a special transmitter to be utilised solely for the purpose, the main portion of the Budapest evening programmes is now being put out almost nightly through one of the Szekesfehervar short-wave stations. The transmitter is HAT2, working on 43.86 metres. It has been well heard between 9.0 and 10.30 p.m. G.M.T. on this side of the Channel.

Russian Stations Exchange Wavelengths

SINCE the advent of the Moscow Noghinsk 500 kilowatt transmitter, alterations have been made in the wavelengths of two high-power transmitters. Leningrad, previously on 1,000 metres, has exchanged channels with Moscow (T.U.) hitherto working on 1,304 metres. This frequency separation was desirable for the former transmitter in view of the fact that another station at Leningrad works on 857 metres.

New Station at Pretoria

THE South African Government has decided to erect a high-power broadcasting station at Roberts Heights, not only for the transmission of programmes, but also to be used for commercial purposes.

The World's Playground

OF the North American broadcasting stations one of the best heard on this side of the Atlantic is WPG, Atlantic City (New Jersey), on 272.6 metres (just below the Turin condenser reading). As a rule its signals can be picked up from 1 a.m. onwards. The studio is in the Columbia Broadcasting Network, taking a large portion of its programmes from WABC, New York, and the fact is mentioned in the call. Atlantic City is the "Brighton" of New York.

(*Continued on page 752*)

SOLVE THIS!

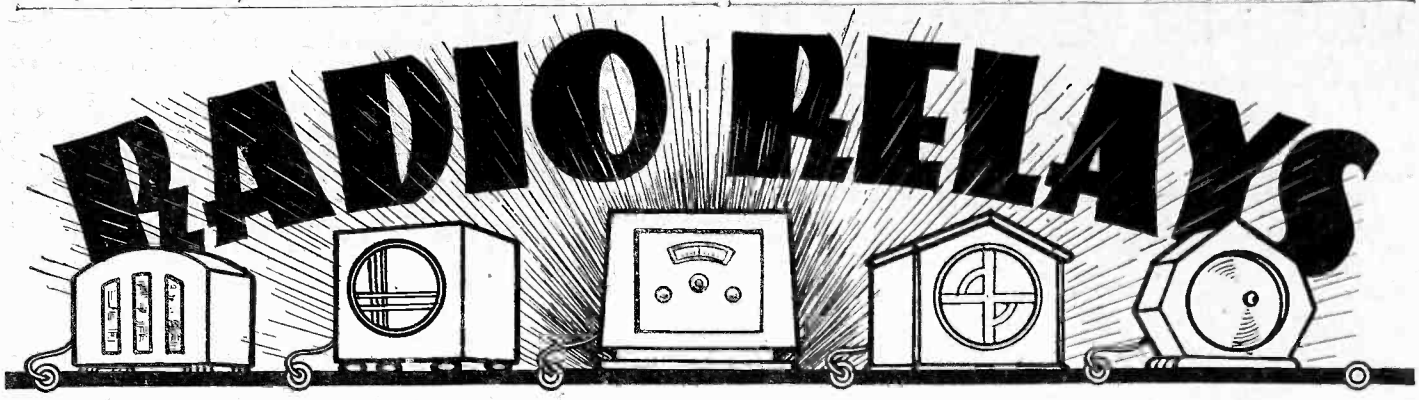
Problem No. 67.

Jones constructed a receiver which employed a variable-mu H.F. stage and got very satisfactory results. In order to increase selectivity he removed the tuning coil and fitted band-pass coils of the type which required connecting direct to earth. As he used a ganged condenser this also had to be earthed, and he was at a loss to know how to apply the necessary bias voltage to the H.F. valve. He suddenly thought of fitting a grid leak between the arm of the control potentiometer and the grid of the H.F. valve, and he, therefore, fitted up this arrangement but found that it had no effect. Why? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 67, and should be posted to reach us not later than January 1st, 1934.

SOLUTION TO PROBLEM No. 66.

The secondary of the transformer in Brown's receiver had become internally disconnected thus producing an open-grid circuit. Consequently no grid-bias was being applied to the output valve.

The following three readers successfully solved Problem No. 65, and books have accordingly been forwarded to them:—Mr. C. Weir, 3, Alnesford Road, Salford 6. Mr. G. H. Hudd, 89, Penrhys Road, Ystrad Rhondda, Glam. Mr. V. Webb, 12, Halesowen Road, Halesowen.



Radio Relay, or Re-diffusion, Stations are Now Actively in Operation in Various Parts of the Country, and although Readers may Not be Interested in Obtaining Their Broadcast Programmes from These Sources, they will find it Most Instructive to Study the Principles upon which These Stations Operate. By BERNARD DUNN.

FOR the last few years there has been a gradual increase in the number of relay or re-diffusion stations coming into operation, and the writer knows for a fact that there are now several thousands of subscribers to these "community" receivers. There might be some readers who are unaware of the existence of these stations, and therefore a brief description of their purpose will not be out of place. The idea is that a receiving station is set up near to a town and this station receives the broadcast programmes, passes the signals through powerful amplifiers, and distributes them to a number of subscribers. Every subscriber must have a broadcast licence, and pays a certain weekly fee to the company responsible for the distribution of programmes. The average fee for a single programme is about 1s. 3d. per week, when the subscriber buys his own speaker, whilst a slight extra charge is made if a speaker is had on loan.

The whole scheme is simply an enlargement of that whereby programmes are supplied to speakers in various rooms in a house from a central receiver, but, of course, there are many more factors involved and many more difficult problems to consider. This point will readily be appreciated when it is explained that very often the distance between the receiving station and the subscriber is as much as three miles, whilst there might be 2,000 subscribers to a single station. The problems become still more involved when two or more alternative programmes are to be made available to every subscriber, and various forms of "balanced" circuits are necessary to prevent interference between the lines carrying them.

Special Loud-speakers

Fig. 1 shows the general arrangement of receiver, amplifier, supply lines and loud-speakers for the simplest form of re-diffusion service. It will be seen that all the speakers are in parallel and that a fuse is included in the circuit of each. Another point is that all the speakers are fed by a two-wire system, it being contrary to regulations to make use of an earth-return and a single wire such as is generally done when using choke-capacity output filters.

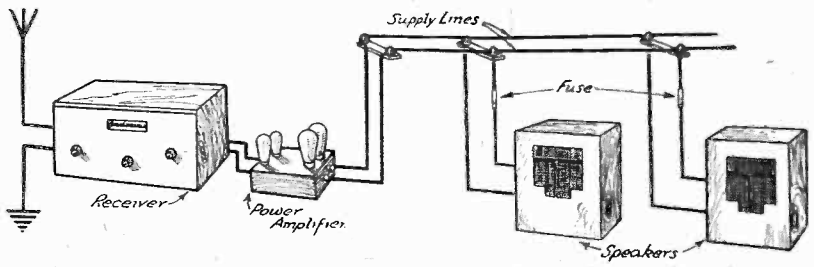


Fig. 1.—This sketch shows the general principles of the radio relay, or re-diffusion, service.

The reader will probably wonder how it is possible to choose an output transformer to match the resultant impedance of all the speakers in parallel; obviously if these had speech coils of about 7 ohms, as is common in normal wireless practice, the output transformer would require to have a ratio of thousands to one, which it would be impossible to provide. The fact is, however, that special permanent magnet moving-coil speakers having a speech coil resistance of 4,000 or 5,000 ohms are employed, and thus 500 of them in parallel would have a final resistance of something like 10 ohms, even neglecting the resistance of the supply lines.

Safety Fuses

At first it might be considered that the fuses would be unnecessary, but it must be remembered that the current flowing through the lines attains a value of several amperes and that a short-circuit might be definitely harmful to the apparatus. But that is not all, because if a single loud-speaker were short-circuited the supply lines would be shorted, with a result that every speaker would be silenced. When the fuse is in circuit a short can only put one speaker out of use, and all the others can operate normally.

Amplifier Details

The receiver is a perfectly ordinary one, generally a superhet, but the amplifier must be capable of supplying a tremendous output since it is found that at least 1 watt (1,000 milliwatts) must be allowed for each speaker in the circuit. Rather than build a single amplifier to supply, say, 1,000 watts, however, it is more usual to employ four or five, each supplying a portion of the total output. Each amplifier feeds a particular "line," so that any failure due to a valve filament or other cause can affect only a comparatively few subscribers. In any case a replacement can be made in a very short

(Continued on page 752)

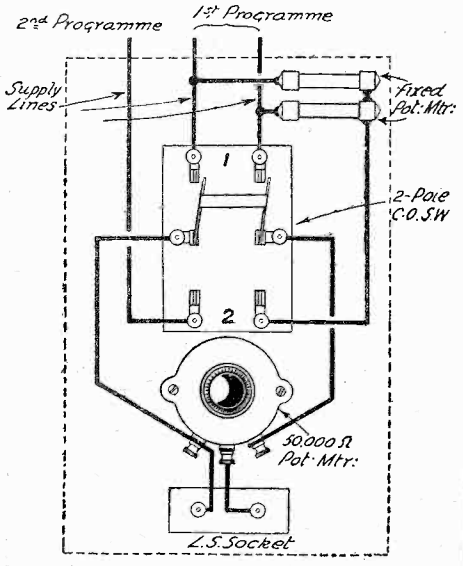


Fig. 3.—The connections and components used in the subscribers' switch for a three-wire two-programme service are shown above. A fixed potentiometer takes the place of a centre-tapped transformer connected as shown in Fig. 2.

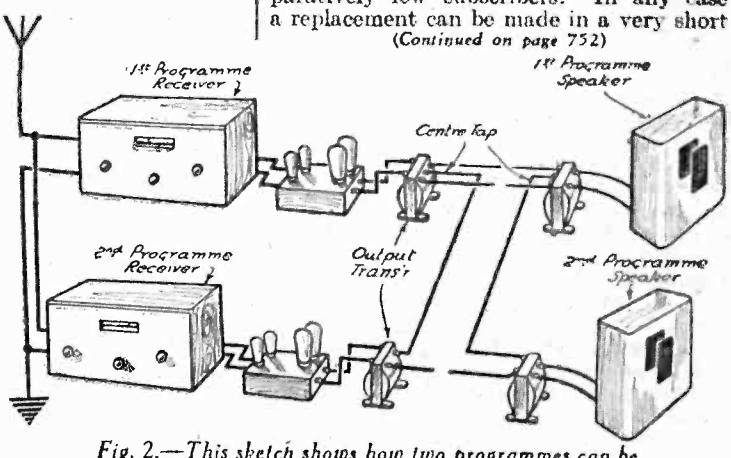


Fig. 2.—This sketch shows how two programmes can be distributed by using only three supply wires.

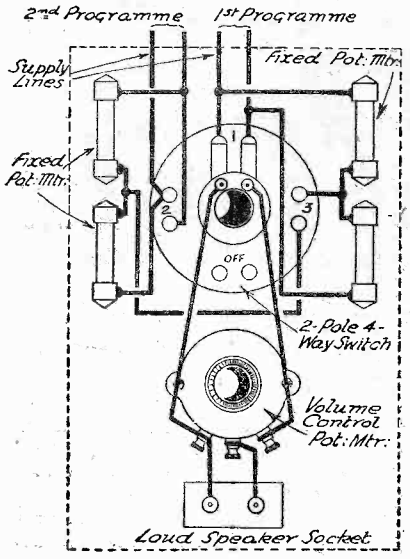


Fig. 5.—The wiring and components in the switch box for a four-wire three-programme service are shown here.

(*Continued from page 751*)

time, since it is usual to have at least one amplifier in reserve.

This is not the correct place to describe the amplifiers in detail, but it might be mentioned that the usual circuit arrangement, and one which has proved particularly satisfactory, is one in which four valves are used in two-stage push-pull. The first two valves are usually super-power ones designed to handle about 8 watts each, whilst those used in the output stage are transmitting valves capable of handling anything up to 150 watts each. These latter valves require an anode voltage of between 1,000 and 2,000; and this is obtained from a generator, which is found to be considerably better than stepping up the mains supply by means of huge transformers. It might be mentioned in passing that the total anode current consumption of a single amplifier is often as high as 1 *ampere*, whilst the *signal current* fed to the speaker supply lines can be anything from a quarter of an ampere to several amps.

Supply Lines

The supply lines are generally in the form of overhead wires similar to telephone wires, being supported on insulated brackets in the same way. No very especial care need be taken in arranging and erecting them when only a single programme service is in use, but when multiple programmes are being sent out, great care is necessary to arrange the wires in balanced loops to avoid interaction. With this end in view the positions of the wires are reversed at intervals, whilst artificial loading and other palliatives have sometimes to be resorted to so that interference may be avoided.

The wires are generally taken through a hole in the roof of the house, the safety fuse being fitted as near as possible to the point of inlet. The equipment at the receiving end is very simple, consisting (in the case of a single-programme service) of nothing more than a wooden switch box upon which are mounted the volume control potentiometer and speaker plug socket. When a multiple-programme service is provided a change-over switch must also be fitted on the switch box, and this has to be wired so that the volume control is operative on every programme.

Re-diffusing Multiple Programmes

Since two wires are required for a single programme it would seem that four would be needed for the distribution of two programmes, six for three, and so on. Actually, however, this is not the case, because there are various so-called "phantom" circuits in which one supply wire can be made to carry two signals. A common arrangement, by means of which two programmes can be transmitted on three wires, is illustrated in Fig. 2. In this case the first programme is transmitted in the usual way along a single pair of lines, but the second one is sent out quite differently. One side of the "second programme" output transformer at the amplifier end is connected to a centre-tap on the secondary of the "first programme" transformer, the other end feeding straight to the speaker line. At the listening end a special transformer is required for the speaker taking the first programme, and the centre-tapping on its primary supplies the second connection for the other speaker. This method has the disadvantage that transformers are required for the loud-speakers, and that adds to the expense. In a simplification of the latter arrangement, which is being used rather widely, the speaker transformers are dispensed with and a fixed potentiometer is connected across the "first programme" lines, a connection being taken from its centre-tapping to the "second programme" speaker. Switch-box connections for the system just outlined are shown in Fig. 3.

The "two-programme" system described above gives the basis of a more complicated one by means of which any number of programmes can be sent out. At least, that is true theoretically, but in practice it is found very difficult to deal successfully with more than three alternative programmes. Fig. 4 shows the general arrangement of a four-wire-three-programme system where centre-tapped potentiometers are employed for balancing purposes. Slightly better results are often to be obtained by using transformers of the kind shown in Fig. 2, but expense rules them out as being rather impracticable. It will be seen from Fig. 4 that interference between different programmes is practically impossible since the potential existing between each pair of lines is equal in respect to the third programme. At the same time there is the full signal voltage of the third programme between the two pairs of lines, and therefore these must be kept well apart. Also the leads-in inside the house must be screened from each other, or so arranged that there can be no inductive coupling between them.

The internal connections of a house supplied with a three-programme service are shown in Fig. 5, where it can be seen that a two-pole four-way switch is employed to change from one programme to another and to switch the speaker out of circuit. The switch is so arranged that the volume control remains in circuit on every programme. A method which may be used as an alternative if the volume control is attached to the speaker itself is to fit three alternative sockets into which the speaker plug may be inserted.

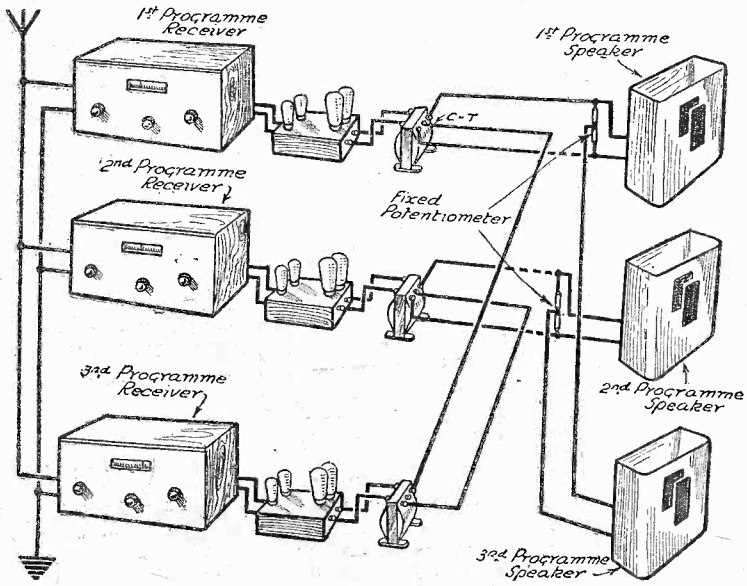


Fig. 4.—The general arrangement of a four-wire three-programme service is illustrated in this sketch.

ROUND THE WORLD OF WIRELESS

(*Continued from page 750*)

Using Gramophone Needles

THERE is an idea among gramophone users that it is quite in order to play both sides of a 10in. record with the same needle. There is absolutely no difference between this and playing one side of two different records, as the opposite faces have nothing whatever in common.

Make Sure before you Dismantle a Set

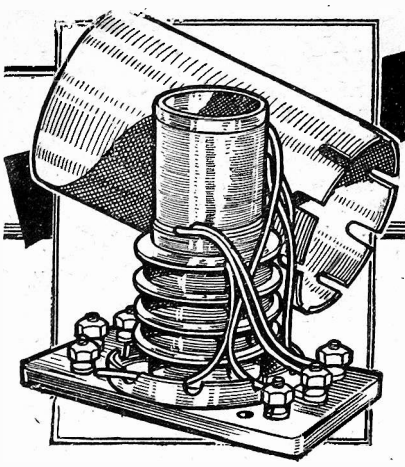
AN experienced engineer, who should have known better, took a portable set to pieces because it would not receive the local station, and did not discover until some time afterwards that the trouble was not in the set, but was due to the screening effect of a very large mirror which backed the sideboard upon which the receiver stood.

Those Midget Terminals

AT this time of year the large manufacturers start to think about next year's programme. Perhaps, if we all wish together hard, somebody might design a component with terminals a little larger than the midgets used at present, so that they could be properly tightened with the fingers, instead of stripped with the pliers.

Innsbrück on a Shipping Wavelength

TESTS are now being carried out by the Austrian relay station at Innsbrück on 578 metres, a channel allotted to this transmitter by the Lucerne Plan. Although the wavelength is one which would suit the authorities well, it is necessary to make sure that the broadcasts do not interfere with the telegraphy work of ships in the Mediterranean. If no complaints are made in this respect Innsbrück will increase its power to 2 kilowatts.



MAKING YOUR OWN Screened Coils

In this Fourth Article of the Series, the Author Describes the Construction of Oscillator Coils and Intermediate-frequency Transformers for Superheterodyne Receivers.

By FRANK PRESTON.

SUPERHETERODYNE receivers are justly popular at the present time, and most amateurs now realize that such sets are no more difficult to construct and operate than are "straight" ones of the more usual types. Despite this, the home constructor is very liable to gain the impression that the coils required for superhets are involved and complicated components which can only be made in well-equipped factories. This is by no means the case, for they are actually identical in construction with the ordinary coils employed in sets of any other kind. Once this idea is grasped any reader will find not the slightest difficulty in making an oscillator coil and also the necessary intermediate-frequency transformers. In order that the work may be tackled with every confidence, I am going to describe how the latter components can be made from almost the same materials as were used for the various coils dealt with in the previous three articles under the above heading.

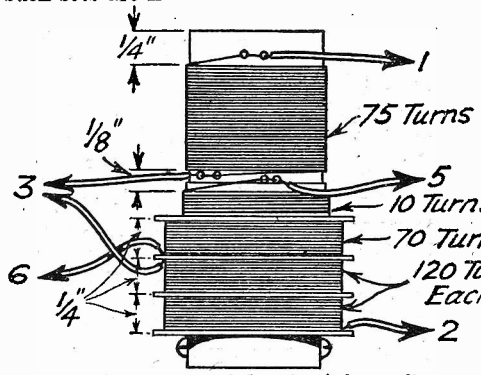


Fig. 1.—Constructional details of the oscillator coil described are given in the above drawing.

An Oscillator Coil

The oscillator coil can be considered as the opposite of a tuned grid coil with reaction, since it contains similar windings which are connected in the reverse order. That is, the tuned winding is wired in the anode circuit of the oscillator valve, whilst the "reaction" winding is connected in the grid circuit and is untuned. It is, of course, the object of the oscillator valve to produce oscillations which shall differ in frequency by a certain fixed amount from the frequency of the signals being received. The difference is generally made to be 110 kilocycles, and this is the figure which will be taken as a basis in the present design. To obtain that difference the oscillator coil is made to tune to a lower range of frequencies (or wavelengths) than those encompassed by the preceding tuning coils. In other words, the tuned winding of the oscillator coil contains fewer turns; the "reaction" winding, incidentally, is almost the same size although it can usually be made rather smaller with advantage.

Details of the windings for an oscillator coil complying with the conditions already laid down are clearly shown in the dimensioned drawing at Fig. 1. It will be evident from this that the medium-wave winding consists of seventy-five turns wound side by side, and the long-wave one of 240 turns placed in two similar sections arranged on the coil former. In order to obtain correct coupling on both wavebands, the reaction winding is arranged in two parts, one of which is wound as side-by-side turns comparatively near to the medium-wave winding and the other of seventy turns placed in a slot next to the long-wave sections. All the turns are of 34-gauge d.c.c. or enamelled wire and are put on in the same direction. It is unnecessary here to detail the method of construction, since that subject was adequately dealt with in the first article of this series. Suffice it to say that the coil is again mounted on an ebonite baseplate measuring about 3in. by 2in. with six terminals arranged in exactly the same positions as before. Leads to the terminals are made by passing the ends of the windings through suitable lengths of systoflex sleeving, and the screening can is earthed by means of a soldering tag fitted under the clamping nut of terminal number 5. The connections for the oscillator coil in a battery-operated superhet of the kind using a separate oscillator valve (which is generally better in home-constructed battery sets) are given in the circuit at Fig. 2. It should be pointed out, however, that the coil detailed can successfully be employed in almost any type of superhet, either mains or battery-operated, and the connections and arrangements of windings are more or less standard ones such as are of necessity employed by most coil manufacturers. For this reason the coil can be fitted into almost any average circuit without difficulty arising.

It would be possible, if sufficient testing and calibrating apparatus were available, to tune the oscillator coil with the third (oscillator) section of a superheterodyne gang condenser, but as such apparatus will not be in the possession of most readers, the suggestion is made that a separate tuning condenser of .0005 mfd. capacity should be used. By doing this, all difficulties of trimming will automatically be avoided, whilst the separate tuned circuits will always be correctly adjusted, with a result that optimum results will be secured.

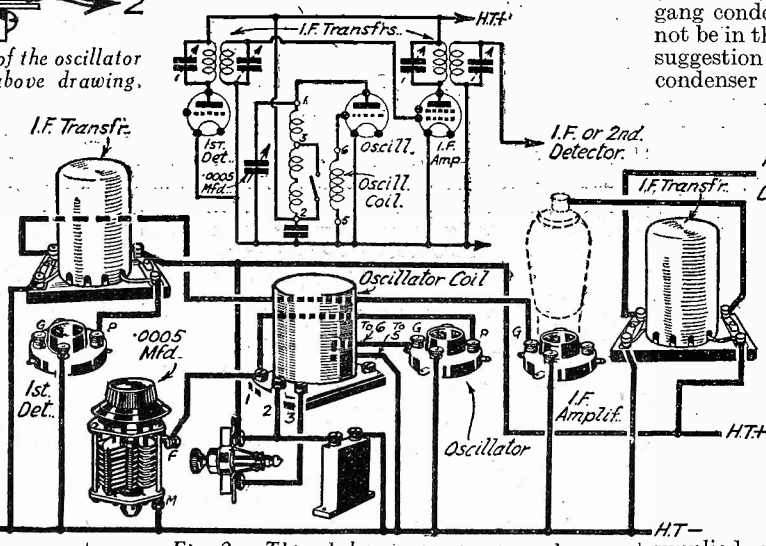


Fig. 2.—This skeleton circuit gives the connections for the oscillator coil and I.F. transformer described.

An Intermediate-frequency Transformer

An intermediate-frequency transformer of the band-pass type can be made with the greatest of ease, and all the necessary winding details are shown in Fig. 3. The 1in. diameter paxolin former previously specified is fitted with six of the washers supplied with it so that four winding sections are provided; two of these will

(Continued overleaf)

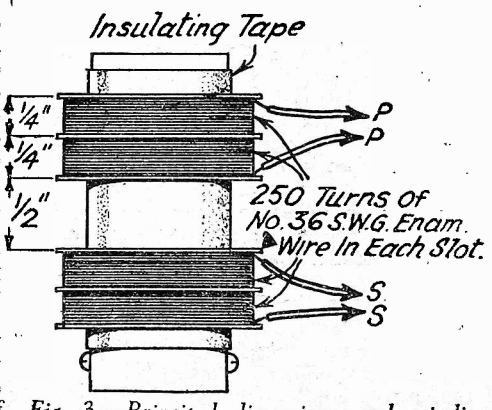
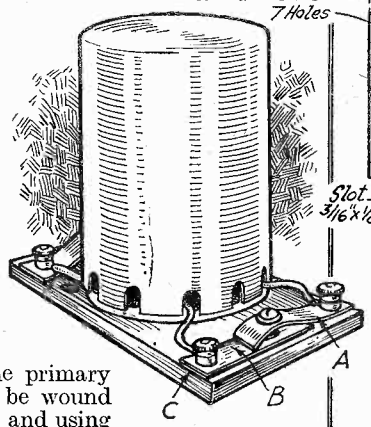


Fig. 3.—Principal dimensions and winding particulars for the I.F. transformer.

(Continued from previous page)

take the primary, and two the secondary windings. The same idea is made use of for positioning the washers as was previously used. First, a strip of insulating tape ¼in. wide is wound twice round the former, and then a washer is pressed closely against it. A second strip of similar width is then wound on at the other side of the washer, after which a second washer is fitted. Another strip of insulating tape and a third washer complete the winding sections for the primary.

So as to give correct spacing between the primary and secondary windings a ½in. wide strip of insulating tape is wound round the tube just touching the third washer. After that, another set of three washers can be fitted in exactly the same way as the first three were arranged. The "U" mounting bracket must, of course, be attached to the lower end of the former, as it was in the previous coils, and then the windings can be put on. Start with the primary and anchor the end of the wire in a pair of small holes made in the paxolin tube, wind on 250 turns in the first slot, pass over to the second slot and complete the winding by putting on another 250 turns, so making 500 in all. The "finishing" end of the wire can be anchored by passing it through two holes made in the former, or by running a spot of sealing wax on to it. When the primary is finished the secondary can be wound in exactly the same manner, and using the same number of turns.



The Ebonite Base

Finally comes the job of making the ebonite base and also two small and simple pre-set condensers which are necessary for accurate trimming; details of this part of the work are clearly shown in Fig. 4. It can be seen that the ebonite measures 4in. long by 2in. wide, and is drilled with eleven holes. Seven of the holes are to take terminals, and are 7/64in. diameter, and counter-bored ⅜in. to receive the rounded heads of the terminals, two are ⅛in. to take the mounting screws, whilst the remaining two holes are drilled 7/64in., and are then tapped out to 4 B.A. There will be no difficulty in tapping out the latter pair of holes if a 4 B.A. tap and holder are available, but even if they are not, there should be no difficulty in forming the thread by forcing a screw through the holes. The matter will further be simplified if one or two flats are carefully filed on the screw by means of a fine file; these will improve the cutting abilities of the improvised tap and prevent binding.

Trimming Condenser

After the base has been prepared the pre-set condensers should be made according to the dimensioned drawing at Fig. 4. A strip of hard springy brass ½in. wide, as well as a piece of thin mica or celluloid, is required. Two pieces of brass, each 1½in. long, are needed for each condenser and these are drilled according to the dimensions given. One piece has a 7/64in. hole ¼in. from the end and a 3/16in. hole 1⅛in. from the same end, whilst the other also has a 7/64in. hole ¼in. from the end, but has a slot 3/16in. long by ⅛in. wide ⅞in. away from the hole. The slot can be made by drilling a ⅛in. hole and then extending it by means of a small file, or by holding the metal in a vice and pressing the drill against the side of the hole, so cutting away some of the metal. Two holes must also be made in the mica (or celluloid) as shown, this being done most successfully by means of punches made from iron wire or nails. The process of assembling the condensers is as follows: fit the bolt of one terminal through its hole in the base and place the lower brass plate in position with the mica directly over it; next bend the other strip of brass so that it bows upward in the middle; now attach this under the clamping nut of the second terminal; finally a ¾in. round or cheese-headed brass screw, with a washer under its head, should be passed through the slot in the top brass plate, also through the larger holes in the mica and lower plate, into the tapped hole in the base.

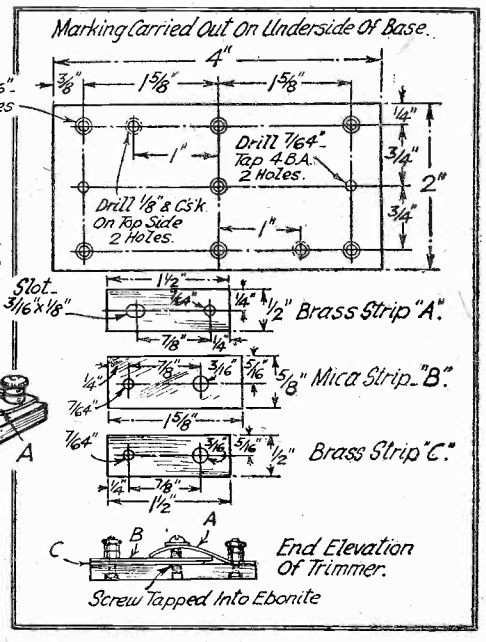


Fig. 4.—Full constructional details of the I.F. transformer and pre-set trimming condensers are given in this drawing.

When both pre-set condensers have been assembled the connections can be made to them from the ends of the windings. The two leads from the primary go to one condenser, whilst these from the secondary go to the other.

In mounting the finished intermediate-frequency transformer on the receiver chassis it will be essential to place spacers, consisting of a number of washers or of short lengths of brass tubing on the holding-down screws in order to allow the pre-set condenser adjusting screws to work without fouling the baseboard.

The transformer described can be connected in any superheterodyne circuit where an intermediate frequency of 110 kilocycles is employed and the connections are perfectly standard. That is, the primary terminals are joined to the anode of the first detector (or I.F.) valve and H.T. positive respectively, whilst the secondary terminals are connected to earth and to the grid of the following valve. A skeleton circuit showing the first detector, oscillator, and first I.F. valves is given at Fig. 2, from which the connections for both the transformers and oscillator coil can easily be obtained. After connecting up the primary and secondary sections, all the I.F. transformers must, of course, be matched up by adjusting the pre-set trimmers by means of a long insulated screwdriver. At least two, and often three, intermediate-frequency transformers are required for every superhet, and it need scarcely be mentioned that it is absolutely essential that they should all be very accurately matched. With this end in view the turns should carefully be counted as they are wound. For the same reason the plates of the pre-set condensers should be made as nearly as possible of identical dimensions. If these points are watched it is most unlikely that any difficulty will present itself. Further details regarding ganging sets of coils will be given in a later article.

The "Neutron"

WE have become accustomed to electrons and protons, the former being negative charges of electricity, and the latter positive charges. Now we have had thrust upon us the neutron, which we are led to understand is a charge that is neither. Can we hope that this is the end, as there would seem to be nothing that can be added to a positive charge, a negative charge, and no charge at all, although it is a charge all the same.

Disconnecting the Pick-up Plug

MOST commercial receivers have a pick-up plug and socket for use when reproducing gramophone records, and many listeners who do not possess a pick-up leave the plug in the socket to prevent losing it. While this practice may make no difference on the local station, or even on those stations that tune in at the top of the dial, it is to be strongly deprecated as it will mis-gang the receiver, and reduce volume considerably on those low-wave stations such as Fécamp.

PRACTICAL PARS

Changing Over to a Variable-Mu

WHEN replacing a battery screen-grid valve it is an excellent opportunity to change over to a variable-mu type. This naturally necessitates the fitting of a potentiometer for volume control, three point switch, and so on, which the owner may not be in a position to fit at the particular time that replacement is necessary. This is no reason why the old screen grid should not be replaced by a variable-mu type, as it will give similar performance without any additional components or alterations until the owner feels disposed to add the variable control, and gain the extra advantage of the variable-mu characteristic.

Electrical Zero

THE resistance of a conductor decreases as the temperature is lowered. It is thought that a current, once started in a loop, would go on running round for ever if the metal could be reduced to the "electrical zero," as it is believed that the loop would have no resistance.

D.C. A.C. UNIVERSAL MAINS RECEIVERS

The Chief Points which should be Considered in Designing a Receiver which can be Operated from A.C. or D.C. Mains are Simply Explained in this Article.

THERE are still thousands of listeners who are on D.C. mains which will soon be changed for A.C. ones. Because of this many listeners and potential listeners who are now supplied with D.C. draw the conclusion that they are either doomed to a battery set or to a D.C. one which will soon become useless. This need not be the case, since there is no difficulty whatever in making a receiver that can be operated equally well from either direct or alternating current supply. In fact, there are two distinct and different ways in which such a receiver can be designed. One is to employ special "universal" mains valves whose heaters work at the full mains voltage and can thus be fed from either A.C. or D.C., and the other is to make use of indirectly-heated D.C. valves by wiring their heaters in series with each other, and with a suitable voltage-dropping resistance. The former method is perhaps better in some ways, but suffers from the disadvantage that none of the "Ring" firms of valve manufacturers yet make universal valves. There are, nevertheless, two or three makes of such valves on the British market, a well-known one of which is the "Ostar-Ganz." On the other hand, there are probably many readers who already have D.C. valves on hand, and would prefer to use these in a new set that can be fed from either D.C. or A.C. supplies. Additionally, there is perhaps a rather wider range of D.C. valves available than that of universal ones. To cover the whole subject at all adequately it will be necessary to consider the two systems outlined above separately and in greater detail.

Using "Mains-Voltage" Valves

Despite the difficulty in designing universal valves so that the insulation between their heaters and cathodes shall be sufficiently sound to withstand the full mains voltage, there is no doubt whatever that such valves are absolutely reliable and capable of excellent results. This was adequately proved by the "A.C.–D.C. Two" described in the issues of PRACTICAL WIRELESS dated October 7th and 14th, 1933. For explanatory purposes the circuit of the "A.C.–D.C. Two" is reproduced on this page at Fig. 1, and from this it can be seen that the high-frequency portions of the circuit are more or less standard, and that a high-amplification detector-valve is followed by a power pentode. It is in the low- and high-tension circuits that the unusual features are to be found.

For example, the heaters of both "receiving" valves, as well as that of the half-wave rectifier, are connected in parallel between the mains supply leads. There is no mains transformer, as is usual in sets made for taking their power from A.C. mains, but the rectifier is simply placed in series with one of the high-tension leads.

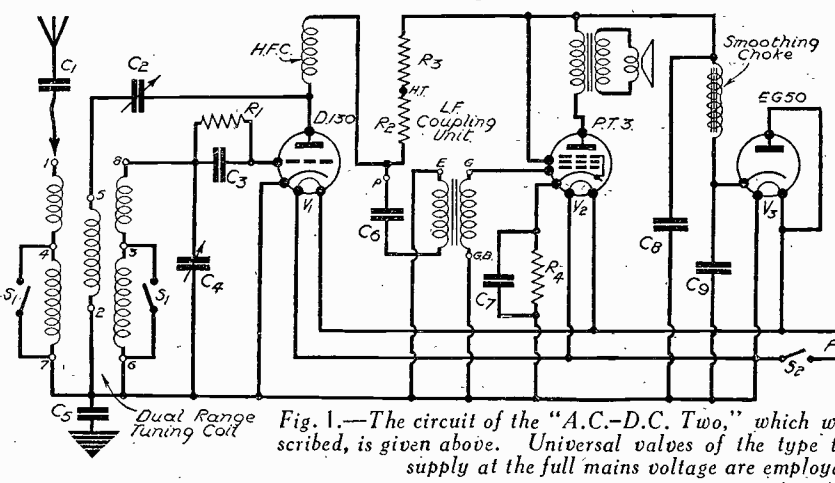


Fig. 1.—The circuit of the "A.C.–D.C. Two," which was recently described, is given above. Universal valves of the type taking a heater supply at the full mains voltage are employed.

Thus, when the set is connected to an A.C. supply the rectifier functions in a normal manner and supplies a voltage of rather less than that of the mains to the high tension circuit. When D.C. is used as a source of supply, however, the rectifying-valve acts merely as a series resistance, but the value is so low that it does not reduce the available high-tension voltage to any appreciable extent.

No reader with experience of receiver construction need hesitate to build a universal receiver, for the actual high- and low-frequency circuits are perfectly standard and do not differ in the least from those of sets with which we are all familiar. Moreover, universal valves can now be obtained in a wide variety of types so that a "universal" counterpart of nearly any battery or mains receiver can nearly always be designed.

Using Indirectly-heated D.C. Valves

It was mentioned above that a universal mains receiver can be designed around ordinary indirectly-heated D.C. valves, and a suggested circuit for such a set is given at Fig. 2. This circuit is a three-valve one employing the popular and extremely good combination of valves of Variable-Mu H.F., Detector and Power Pentode. In this case a metal rectifier is included for A.C. mains use, since there is not, of course, any rectifying-valve made which is intended to take its filament supply from D.C. mains. The heaters of the three valves are wired in series and, so that they can be connected to the mains supply, a suitable resistance (R) is inserted in circuit. The value of R depends upon the makes of valve employed, since some firms intend their D.C. valves to take 20 volts at .18 amp. whilst others make theirs to take 16 volts at .25 amp. In the case of a receiver having less than five valves the higher voltage (and lower current) valves are more economical, but where

(Continued on page 758)

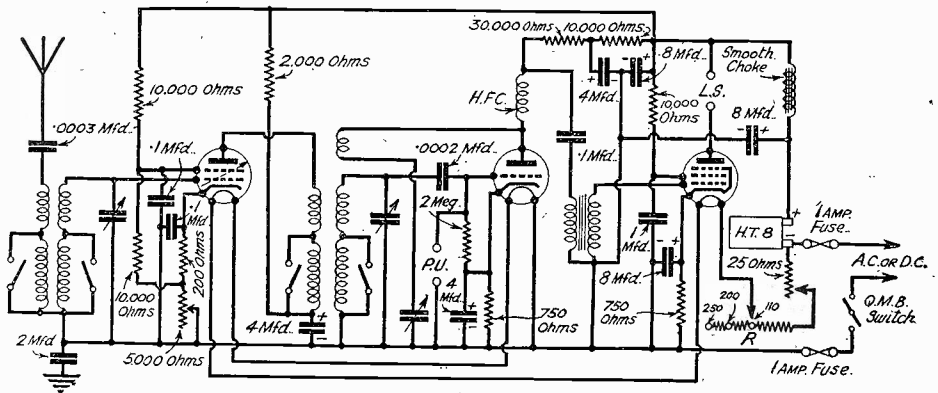
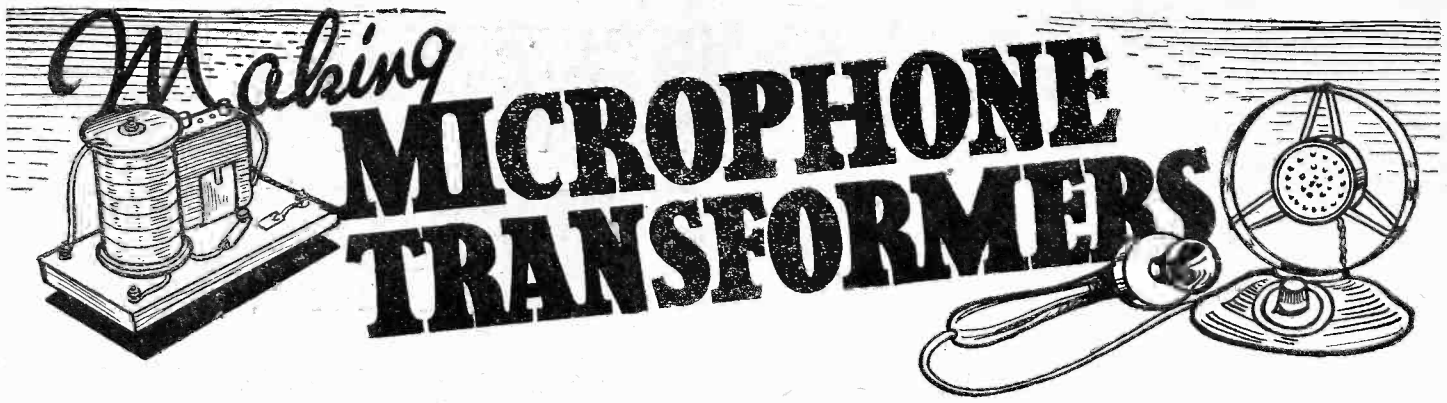


Fig. 2.—The above circuit represents an excellent three-valve receiver for use on either A.C. or D.C. mains. Indirectly-heated D.C. valves are employed, and the heaters are all wired in series, a voltage-regulating resistance being included in the heater supply.



Making MICROPHONE TRANSFORMERS

In this Article the Writer Describes One or Two Very Simple Methods by which the Constructor Can Make His Own Microphone Transformer.

MICROPHONES have recently become extremely popular with wireless-set users as a means of providing entertainment in various novel and interesting ways, and this fact explains the reason why there are now so very many different types of instruments on the market at such reasonable prices. Previous articles in PRACTICAL WIRELESS have dealt with the problem of choosing a microphone and with the method of connecting it to the receiver, but many readers who already have a microphone, taken from an old telephone installation or made at home, have written to ask for further information.

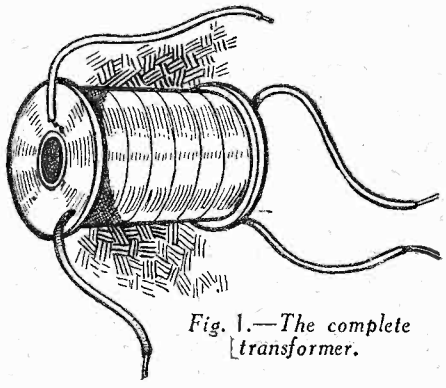


Fig. 1.—The complete transformer.

The point which has troubled most of these inquirers has been in regard to the use of a transformer between the microphone and the pick-up terminals of the set. Some cannot decide what type of transformer is required, whilst others do not appreciate the need for a transformer and inquire if it is really essential. As a matter of fact, a transformer *is* essential—quite essential—because the resistance of any ordinary type of microphone is very low, being in the region of but a few ohms. If such a low-resistance component were connected across the grid circuit of a valve it would act as a short-circuit, with a result that the valve would be prevented from functioning at all. On the other hand, if a resistance were wired in series with the microphone to increase the grid circuit resistance, the output from the microphone would be reduced to so great an extent that it could not operate the valve. Additionally, a direct current (generally taken from a small dry battery or accumulator) must be passed through the microphone, and this could not be done if the high resistance were in circuit. The only way to combine the requirements of high grid-circuit resistance and low microphone resistance is to employ a transformer with a low resistance primary and a high resistance (or more correctly, impedance) secondary. Besides giving the effects mentioned above, the transformer performs another important duty by increasing, or stepping up, the comparatively small fluctuating voltages passing through the primary and the microphone; this naturally results in a greater signal voltage being applied to the grid of the amplifying valve, and a consequent increase in output volume.

Transformer Requirements

The actual requirements of the transformer depend to a certain extent upon the particular microphone employed, but in nearly every case the principal need is for a primary having a resistance of no more than about 5 ohms and a secondary having an impedance, at average speech frequencies, of upwards of 50,000 ohms. These conditions are fulfilled by making transformers according to the particulars which are to be given, the component in this case having a step-up ratio of 100 to 1.

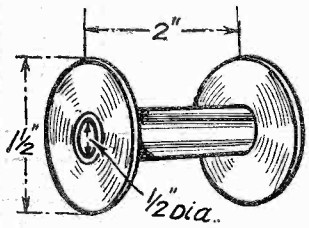


Fig. 2.—Details of the winding spool.

There are, of course, innumerable ways of making an efficient transformer, but the simplest and least expensive is to employ a core consisting of a bundle of soft iron wires fitted into a suitable bobbin containing the correct windings. A sketch of a component made according to the particulars just given is shown at Fig. 1. In making the transformer, a winding spool or bobbin must first be prepared, and details of this are given in Fig. 2. The first requirement is a cardboard tube about ½in. internal diameter and 2in. long, and if a suitable ready-made tube is not available it can be made quite easily by winding a 2in.-wide strip of paper on to a wooden rod. Whilst the paper is being wound on, glue or shellac varnish should liberally be applied to it. When the adhesive has properly set, the tube should be perfectly rigid, and then a pair of 1½in. diameter cardboard end cheeks should be fitted. If a hole is punched in the middle of these so that they fit tightly on to the tube no further strengthening should be required, but if they fit fairly slackly it is best to apply "tacky" glue and to give the whole bobbin a few coats of thin shellac varnish. After varnishing, the bobbin should be "baked" by placing it in a warm oven.

The Windings

The next step is to put on the windings. The primary comes first, and consists of 100 turns of 24-gauge d.c.c. wire. Start by making two holes through one of the end cheeks, and anchor the wire in these. After winding the correct number of turns, the other end of the wire can be anchored in the same way as before. Then cover the primary with a layer of empire cloth or insulating tape, taking care that it fits well up against the end cheeks. One hundred times as many turns are required for the secondary, and they are of 38-gauge enamelled wire. This wire is very thin, and the end must be soldered to a short length of flex anchored through a couple of holes in an end cheek, after which winding may be commenced. Attempt to keep the turns fairly even and approximately in layers, and after about every 2,000 turns insulate with a layer of thin waxed paper or oiled silk. It is rather a tedious task to wind on and count 10,000 turns, but the process is considerably simplified if the bobbin can be fitted on to a wooden rod which is gripped in the chuck of a hand-drill held in a vice. In that case it is most expedient to find the gearing ratio of the drill and to count the revolutions of the handle rather than the number of turns put on to the bobbin. It will be more helpful to know, however, that the

(Continued on page 758)

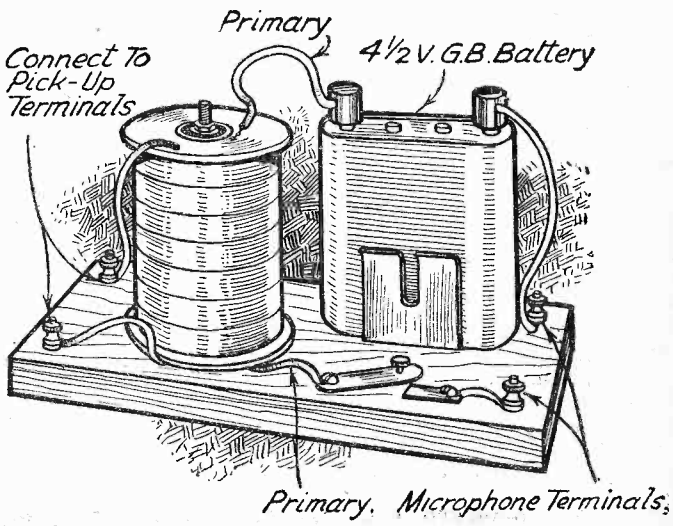
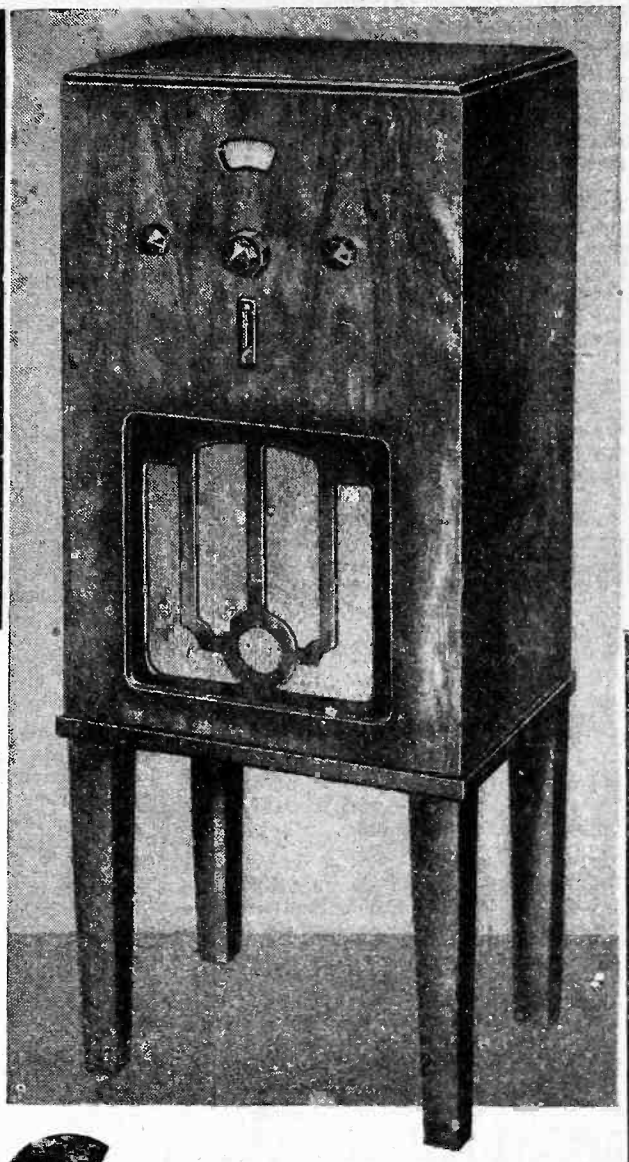


Fig. 3.—This sketch shows how a very convenient microphone unit (consisting of a transformer, battery, and switch) can be made.

VARIABLE-MU SCREENED-GRID CIRCUIT

MOVING COIL SPEAKER

SINGLE DIAL TUNING



Vivid, true-to-life reproduction—magnificent "all-Europe" performance—dignified cabinet design. These are the three great features which have made the Cossor Radio Console an outstanding example of moderately priced radio. Let your ears convince you of its superb tone—hear a Cossor Radio Console working at your local wireless shop.

COSSOR CLASS "B" BATTERY CONSOLE Model 3456

Complete Receiver, as illustrated, with Cossor 220 VS Variable-Mu Screened Grid, Cossor 210 HL Detector, Cossor 215 P Driver and Cossor 220 B Class "B" Output Valves. Single-dial tuning, selectivity control and combined volume control and "on-off" switch. Wavechange switch for 200-530 and 900-2000 metres. Handsome walnut finished Console Cabinet, 2 ft. 11 in. high, 1 ft. 2 in. wide, 11 in. deep, giving ample accommodation for batteries. Permanent Magnet Moving Coil Loud Speaker of the latest type. Gramophone Pick-up Plug and Socket. PRICE **£9.19.0**

Price does not include Batteries or Accumulator.

Hire Purchase Terms: 20/- deposit and 10 monthly payments of 20/-.

COSSOR ALL-ELECTRIC CONSOLE (for A.C. Mains) Model 3468

Specification similar to Battery Model 3456, but operating from Electric Light Supply. Complete with four Cossor A.C. Mains Valves viz.: M.V.S.G. (Met.) Variable-Mu S.G., 41 M.H. (Met.) Detector, 41 M.P. Output and 442 B.U. Rectifier. Mains Energised Moving Coil Speaker. Illuminated tuning-dial. For A.C. Mains only, 200/250 volts adjustable, 40/100 cycles. PRICE **£10.15.0**

Hire Purchase Terms: 25/- deposit and 10 monthly payments of 21/-.

COSSOR ALL-ELECTRIC CONSOLE (for D.C. Mains) Model 3469

As Model 3468, but for operation on D.C. Mains. Supplied complete with three Cossor D.C. Mains Valves viz.: D.V.S.G. (Met.) Variable-Mu S.G., D.H.L. (Met.) Detector and D.P. Power Output. For D.C. Mains only, 200/250 volts (adjustable). PRICE **£10.15.0**

Hire Purchase Terms: 25/- deposit and 10 monthly payments of 21/-.

Prices do not apply in I.F.S.

Legs are detachable on all Console Models and the receivers can be used as table models with legs detached.

COSSOR RADIO CONSOLES

To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5.

Please send me free of charge, your 20-page Catalogue of Radio Receivers B.20.

Name.....

Address.....

PRAC. 30/12/33

A. C. COSSOR LTD., Highbury Grove, London, N.5. Depots at Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Belfast, Cardiff and Dublin.

♡ 4271

MAKING MICROPHONE TRANSFORMERS

(*Continued from page 756*)

weight of wire required for the full 10,000 turns will be slightly over four ounces, and therefore, provided a four-ounce reel of 38-gauge wire is obtained, there will be no need whatever to count the turns, especially since the exact number is by no means critical.

Fitting the Core

When the winding has been completed the wire should be covered with a few layers of insulating tape to protect the fine wire from injury. After that the core must be fitted, and this will consist of a bundle of soft iron wires 2in. long. Suitable wire can be obtained from most ironmongers, being sold by weight in lengths of about 9in. to 10in., for use by florists and butchers. It is essential that the wire should be really soft, and if any doubt exists in regard to this it should be tied in a bundle, placed in a low fire on going to bed, and left until morning; this will anneal it perfectly. Cut the wire into suitable lengths and then fit it into the wound bobbin, packing it as tightly as possible to prevent any possibility of vibration.

The finished transformer can be mounted on a small board by means of brass straps, or by using the method illustrated in Fig. 3. In the latter instance a length of 4 B.A. screwed brass rod is fitted through the middle of the core and is used to mount the component in an upright position on a baseboard or on the chassis of the amplifier.

A Neat Microphone Unit

The complete unit shown in Fig. 3 is a convenient little microphone accessory, consisting of the transformer just described, a 4.5-volt G.B. battery for operating the microphone, and a simple on-off switch. The drawing is almost self-explanatory, but it might be mentioned that the switch is made from a couple of strips of brass attached to the hard-wood baseboard by means of two screws. The longer brass strip is made to pivot so that it can make or break contact with the smaller strip. By using this idea the microphone can permanently be left connected to the terminals arranged for it, whilst the other terminals are joined directly to the pick-up terminals of the receiver or amplifier. It is, of course, necessary to "open" the switch contacts when the microphone is out of use, so that the dry battery is not run down unnecessarily.

Other Forms of Construction

If an old and burnt-out L.F. transformer is available, a slightly better component than that described above can be made by using the core stampings and winding spool. The core clamps should first be removed, and then the core stampings are withdrawn and the spool unwound. After that, the spool should be rewound, using 50 turns of 24-gauge d.c.c. wire for the primary and 5,000 turns of 38-gauge enamelled wire for the secondary. The method of winding is exactly as described above, whilst information in regard to the method of reassembling the core stampings can be obtained from the article dealing with the construction of L.F. and smoothing chokes published in the issue of PRACTICAL WIRELESS dated December 23rd. It should be pointed out that the reason for employing only half as many turns in this case is that the iron core is "closed," so giving a similar inductance and impedance with fewer turns of wire.

When it is desired to make a transformer of the "closed core" type and an old L.F. transformer is not to hand, it can be done by obtaining three dozen No. 5 stalloy stampings and making a winding spool and clamps to fit it as explained in the previous article just referred to.

UNIVERSAL MAINS RECEIVERS

(*Continued from page 755*)

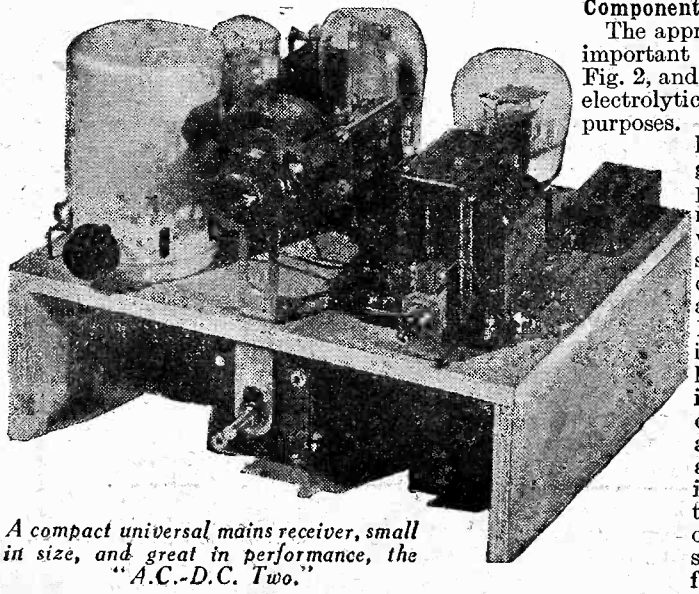
a greater number of valves is employed and the set is to work from 110 volt mains the lower voltage ones must be used.

The Series Resistance

For our present purpose let us assume that the 20-volt valves are being used. When three are connected in series a total of only 60 volts will be required to heat them, and, therefore, the difference in voltage between this and that of the mains must be dissipated by the resistance R. It will now be clear why the latter resistance is tapped at a number of points, each of which is marked with a particular voltage figure. If it is assumed that the highest voltage ever to be applied to the set will be 250, the maximum voltage to be eliminated by R will be 250—60, or 190. The total value of the resistance can then be calculated by dividing 190 by the heater current, which is .18 amp. (Ohm's law, of course). As a result of this simple calculation the resistance required is found to be just about 106 ohms, and by making other similar calculations the value required between the end of the resistance and the various tappings can readily be found. After that, a component can be made up from Eureka resistance wire and an asbestos former, or it can be bought ready-made from Messrs. Bulgin or some other firm of manufacturers.

If D.C. valves of the type taking a heater voltage of 16, and a current of .25 amp., were to be used, the above calculation would be slightly modified, since the total voltage required by the three valves in series would be only 48 and the current would be .25 amp.

In Fig. 2 it will be seen that a 25-ohm variable resistance is wired in series with the tapped one used for voltage-dropping, and the purpose of this is to regulate the heater current to the exactly correct value when the set is connected to mains of a voltage different to that provided for by any of the tappings. The correct setting of the resistance can be determined with sufficient exactness from the position of the slider, but if desired, an ammeter may be inserted in series with it and an adjustment made so that the current flowing is just right.



A compact universal mains receiver, small in size, and great in performance, the "A.C.-D.C. Two."

Component Values

The approximate values of all the important components are shown in Fig. 2, and extensive use is made of electrolytic condensers for smoothing purposes. In order that the electrolytics may easily be distinguished from the ordinary paper and mica components they are marked with positive and negative signs to indicate the correct polarity. It should also be noticed that two 1-amp. safety fuses are included in the mains leads to prevent damage in case of accidental short-circuits. Additionally, as a further safety measure, a 2 mfd. fixed condenser is inserted in series with the earth lead; the object of this is to prevent a short-circuit of the mains fuses when working on D.C. mains whose positive is earth-connected, or when the A.C. supply is so connected that the "live" side is joined to the earth line.

Safety Measures

There are certain precautions which must be taken in building and using any type of universal mains receiver, because the set is always in direct contact with the supply leads. The main precaution is to ensure that all controls are well insulated, and that grub screws in the knobs are well sunk to prevent the possibility of touching them. An additional safeguard is to fill in the grub screw-holes with sealing wax or other insulating material. It is also important that a fixed condenser should be included in both the aerial and earth leads so that the actual wires going away from the set to aerial and earth are ("electrically") quite "dead." Fuses should be a standard fitting in any receiver, but they are more than ever important in a universal mains instrument.

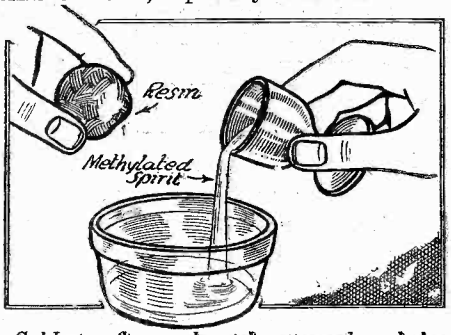
When connecting the set to A.C. mains it does not matter which way round the plug is fitted, but when D.C. mains are used it is absolutely essential that correct polarity should be obtained. Just as is the case with a normal D.C. receiver, no results will be obtained if the positive and negative leads are reversed. In addition to this, where electrolytic smoothing condensers are employed they would be in danger of being damaged if they were subject to the wrong supply polarity for any length of time. To check this latter point it is best, where possible, to determine the positive and negative sides of the mains and to mark the sockets in some way so that they can easily be recognized later. Of course, it is possible to determine the proper connections by trial and error methods, because the set will fail to operate if the leads are reversed, although the valve heaters will show a light. If the set has repeatedly to be connected and disconnected, it might be better to employ ordinary smoothing condensers in place of the electrolytics shown, or otherwise to fit a simple polarity indicator to the set.

READERS' WRINKLES

THE HALF-GUINEA PAGE

Making Soldering Flux

SOLDERING flux of sorts has been responsible for many breakdowns. If you use flux which has an acid content you must be prepared for trouble at some time or other, especially where it is used on thin wires. By making your own flux you can be sure that no acid exists. The only precaution to be taken is that the wire be well cleaned, a procedure which is generally done by the acid in the purchased flux. Get a knob of resin the size of a walnut, break up small and place in a container having sufficient methylated spirit to fill an ordinary egg cup. When the resin has dissolved the flux will be ready for use. Apply to the joint to be made and solder in the ordinary way.—W. G. HILL (JUN.) (Dagenham).



Soldering flux made with resin and methylated spirit.

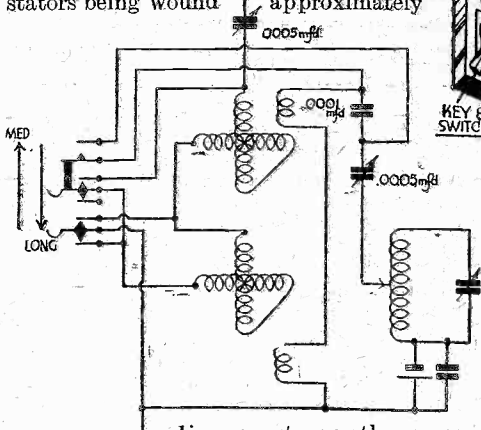
An Efficient Lead-in Insulator

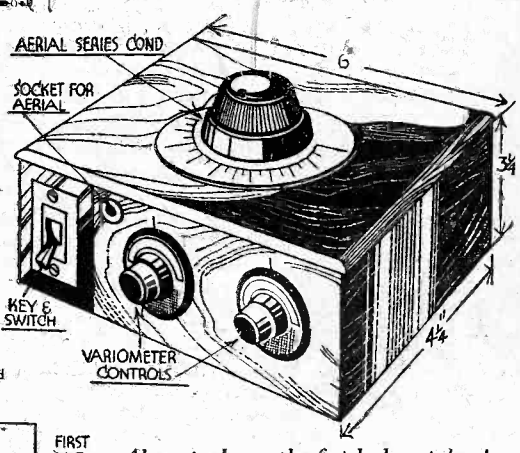
IN endeavouring to find an ideal lead-in that would give an infinity reading under most severe conditions, I have used the arrangement shown in the accompanying sketch. The glass bottles were easily cut by tying a methylated-spirit-soaked string around the bottle in the desired position, lighting the string, and when almost burned out, plunging the bottle into cold water, when a crack appears around the bottle. A gentle tap all round does the rest. The lead-in rod was made from 2B.A. studding and wing-nuts.—R. E. NEWITT (Balham).

Aerial Selectivity Unit

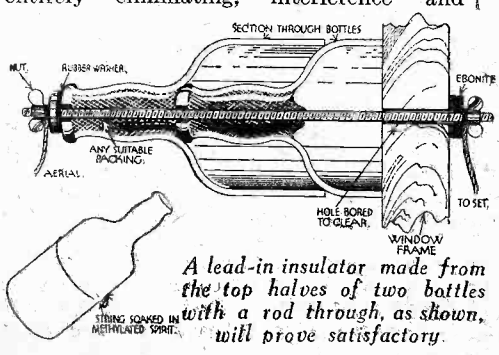
THE following is a brief description of what may be called an aerial selectivity unit, which has been found very effective in reducing, and in many instances entirely eliminating, interference and heterodyning from other unwanted stations. The performance of this unit has been equally effective on both long- and medium-wave bands. Two variometers are used, the rotor and stator of each being wound with 200 turns of 40-gauge enamel wire, and both stators being wound approximately 1in. apart on the same former, which has a diameter of 2¼in. The aerial series condenser has a maximum capacity of .0005 mfd., and is of miniature type (mica dielectric). The variometers are connected in parallel for medium wave, and in series for the long-wave band, the change being made by means of a Kellog type key-switch, which is indicated in the diagram. The coupling from the unit to first stage of the receiver is by means of two windings *i.e.* 15 turns of 26-gauge wire, which are wound over each stator and connected in series. One of the remaining outer ends is taken direct to earth, and the other end through a .0001 fixed condenser and also a .0005 variable. These are in series with each other, but it will be seen from the diagram that the .0001 fixed condenser is short-circuited when the unit is operating on medium waves, this being done by means of the two remaining springs on the key-switch.

It will be found that the .0005 variable condenser in the coupling coil circuit, besides aiding selectivity, acts as an excellent volume control. The great advantage of this unit is that most stations are received with very little loss of volume.—V. D. BROOKER (Chelmsford).





Above is shown the finished aerial selectivity unit and (left) the circuit diagram.



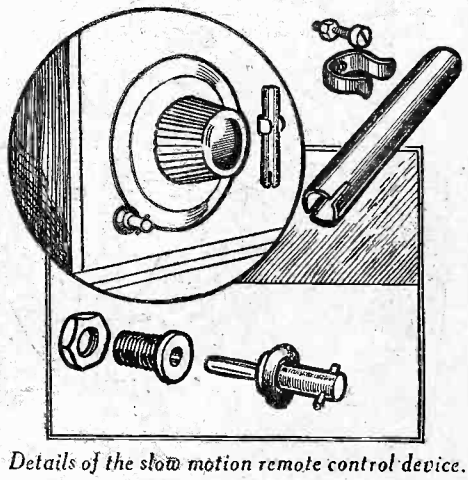
A lead-in insulator made from the top halves of two bottles with a rod through, as shown, will prove satisfactory.

THAT DODGE OF YOURS!

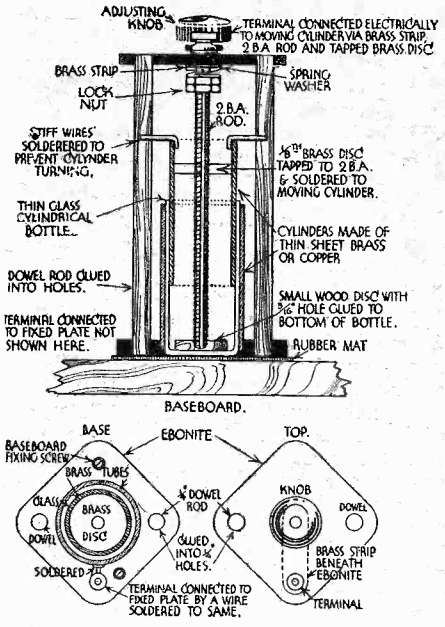
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

A Slow-Motion Remote Control Device

IN short-wave receivers particularly, a good slow-motion control, with anti-hand-capacity control, is essential. The arrangement illustrated may be made up to operate on the standard 3in. ebonite dials. A large socket, such as the Clix No. 14, is mounted on the panel close against one part of the dial. A plug to fit the socket is then provided with a rubber ring such as may be obtained for one penny for umbrellas. Through the upper part of the plug a piece of stiff wire is passed, projecting about ¼in. on either side. A piece of ebonite tubing having an internal diameter to form a fairly comfortable fit over the plug end is next obtained, and a saw-cut made for a depth of about ⅜in. at one end to accommodate the cross wire. A small spring tool-clip from the popular stores is next screwed on the panel or inside the cabinet lid to accommodate the ebonite handle when not required. In use, the handle is removed and placed over the cross wire and rotated, during which it is pressed slightly so that the rubber ring presses on the edge of the dial.—D. LANIE (Hendon).



Details of the slow motion remote control device.



Constructional details for making a tubular condenser.

A Tubular Variable Condenser

THE useful tubular variable condenser shown in the accompanying diagrams is quite easy to make. Although intended for base-board mounting, it is easily adapted for panel mounting, if necessary, by reversing the upper terminal, fixing a bent brass bracket to each ebonite square to support the condenser, and making the 2 B.A. rod a little longer.

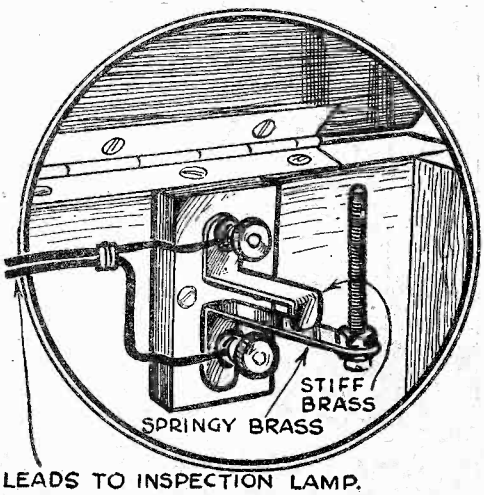
A cylindrical-shaped glass bottle is used for the dielectric, a piece of thin sheet brass is placed around the glass, the ends of both being placed in a hole cut to the required size in the ebonite base, and fixed with strong adhesive. An elastic band keeps the top pressed close to the bottle, or adhesive may be used for the purpose.

Another piece of thin brass sheet is bent to shape and slipped in the glass. A disc of ⅛in. brass is then made with a central hole drilled and tapped 2 B.A. This disc is soldered inside the tube, as shown in the diagram.

The 2 B.A. rod is fitted with a knob, spring washer, and two nuts. The upper terminal is connected to the 2 B.A. rod by a brass strip, as shown.

The diagram clearly explains the fitting of the dowel rod pillars, which are just over twice the height of the bottle.

By rotating the knob the capacity of the condenser is altered with a slow-motion effect. The component will be found very useful, especially in short-wave experimental work.—C. E. GREAVES (Birtley).



An automatic switch for a radiogram.

An Illumination Refinement

THERE are several devices upon the market for dial lighting and "wave-range" indicators. They are mostly mechanical appliances actuated by cams controlled from the coil bases, etc.

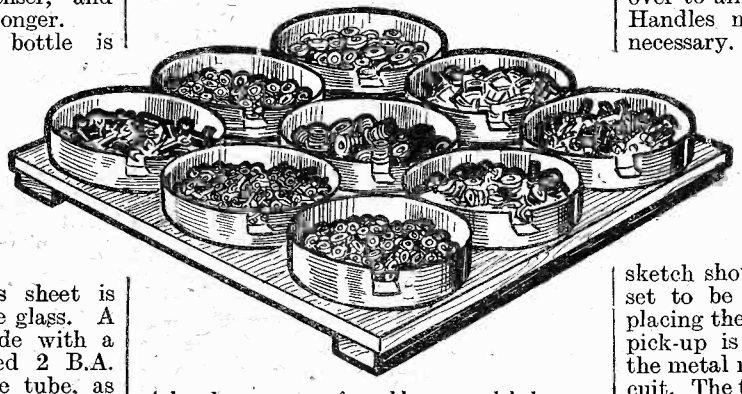
The accompanying sketches show a simpler and cheaper substitute to give a similar effect.

The controls for this arrangement may easily be constructed by the provision of additional contacts placed at the rear of the wave-change-over push-pull switch. The diagrams are self-explanatory—the contact strips being detailed in Figs. 1 and 2, and the connections in Fig. 3. Furthermore, a few more applications may be made of this principle. Suppose an enthusiast has a triple-wave set and a dual reading dial carrying two (long and medium) illuminating bulbs; it is a good scheme to provide facilities to light both these lamps as a visual short-wave indication. This facility is easily catered for by adding the connections shown chain-dotted in Fig. 3.—W. A. HARRISON (Aintree).

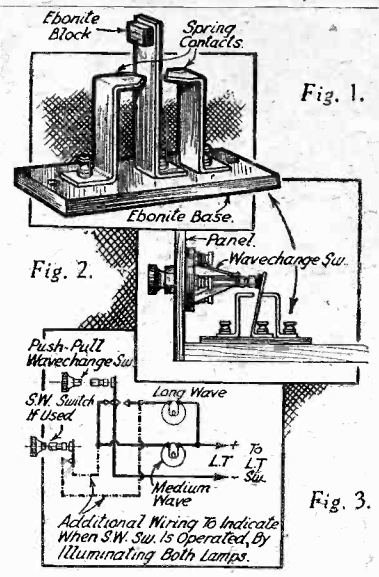
Automatic Switch for Radiogram

THE accompanying sketch should make the construction quite clear. The materials required are an odd bit of ebonite 1½in. by 1in., two terminals from an old component, a small nut and bolt, a strip of stiff brass 1¾in. by ¼in., and a strip of springy brass 2in. long (from an old torch battery). Drill a hole ¼in. from each end of the springy brass, put the bolt through one hole and lock it tight by its nut. Bend the other end at right-angles ½in. from the end, drill hole ¼in. from one end of stiff brass strip, and bend this at right-angles at this end; also bend it at right-angles in opposite direction ¼in. from the other end. The switch can now be wired in series with a screw-in bulb holder, which can be placed at any convenient place in cabinet. Connection can be made either to a dry battery or across the filament terminals of one of the valve holders.

When the lid is closed it bears on top of the bolt and the contact is broken, but on opening the lid the contacts are closed, thus completing the circuit.—S. C. DUFFETT (Kettering).



A handy container for odd nuts and bolts, etc. Tabs are cut and bent to allow a small label to be stuck on.



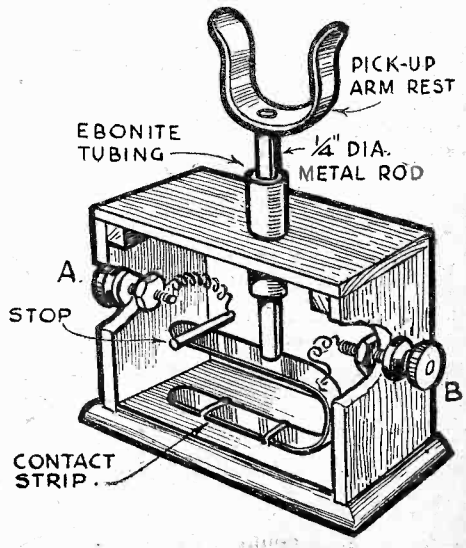
A cheap and simple lamp for dial lighting and wave-range indicators.

A Useful Dodge for Storing Small Parts

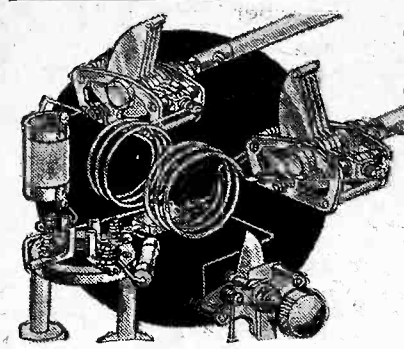
FOR storing and keeping handy the multitude of wireless bits and pieces, such as nuts, bolts, washers, etc., I have adopted the following simple plan. I collected a dozen round 2oz. tobacco tins and fixed them on a board, as shown in sketch, by means of a wood screw through the bottom of each tin. For identifying the various sections, the side of each tin is slotted in a convenient place and bent over to allow a small label to be stuck on. Handles may be fixed to the board, if necessary. I also make use of this idea for holding wood screws, nails, etc., and find it saves a lot of time.—L. A. GINGER (Barnes).

Radiogram Switching Device

MANY people who possess a radiogram forget to switch off after using the pick-up. The accompanying sketch shows a method which enables the set to be switched off automatically by placing the pick-up on the rest. When the pick-up is placed on the rest it forces the metal rod down, thus breaking the circuit. The two leads, A and B, are connected in parallel with the L.T. switch.—W. G. VINCENT (Walforth).



A switch for automatically switching off the radiogram, worked by simply placing the pick-up arm on the rest.



Short Wave Section

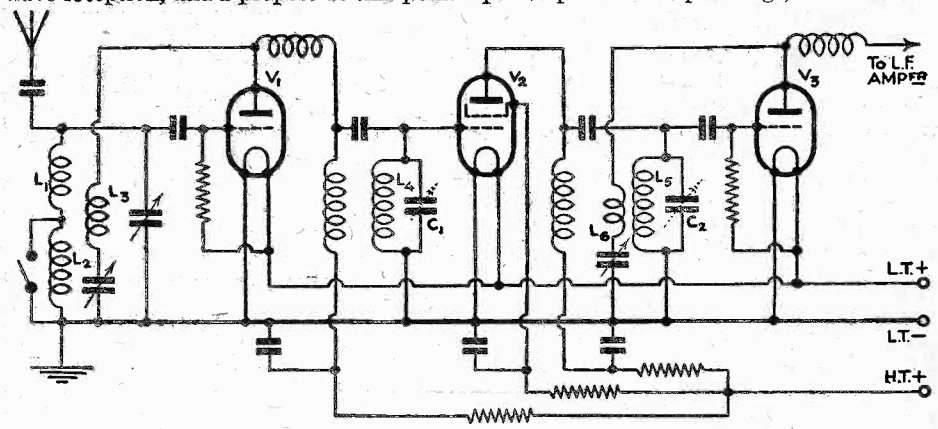
NOTES ON SHORT-WAVE SUPERHET. RECEIVERS

By MANDER BARNETT

IN previous notes on short-wave matters I have made reference to the superheterodyne type of receiver for short-wave reception, and I propose at this point to go rather more closely into the short-wave superheterodyne question, as it is a matter worthy of the serious attention of all amateurs who have any interest at all in short-wave reception. The construction of a short-wave superheterodyne receiver can well be the starting-point for an amount of really interesting work for those amateurs who have perhaps already built one or two short-wave receivers of the straight type. Due, no doubt, to an amount of prejudice to this type of receiver in the past, many people have got hold of the idea that a superheterodyne receiver is necessarily a costly affair owing partly to the fact that a large number of valves is supposed to be necessary. Present-day practice, however, proves this to be wrong and actually, indeed, the very simplest form of superheterodyne receiver need have but two valves. Now, that may sound rather startling at first, but it is nevertheless quite correct, the valves being used in the sequence of (a) combined first detector and oscillator and (b) second detector—that is, the bare superheterodyne principle is used without employing any amplifying stages, either at high, low, or intermediate frequency, other than the amount of amplification which is given by these two valves themselves.

Adding a Pentode Output Stage

Such a receiver, of course, is not of very much practical value, but by adding a power pentode output stage, a useful and extremely selective receiver can be made on these lines for use on the medium and long-wave bands, selectivity being the chief feature. However, for short-wave work, we are not particularly concerned with selectivity, and we require to use the superheterodyne system mainly for the increase in signal strength available and for the added ease of tuning, which this system does provide *in a way which no other type of receiver can*, and this is a very important point for short-wave reception, as any amateur who has had any experience at all of short-wave work will know.

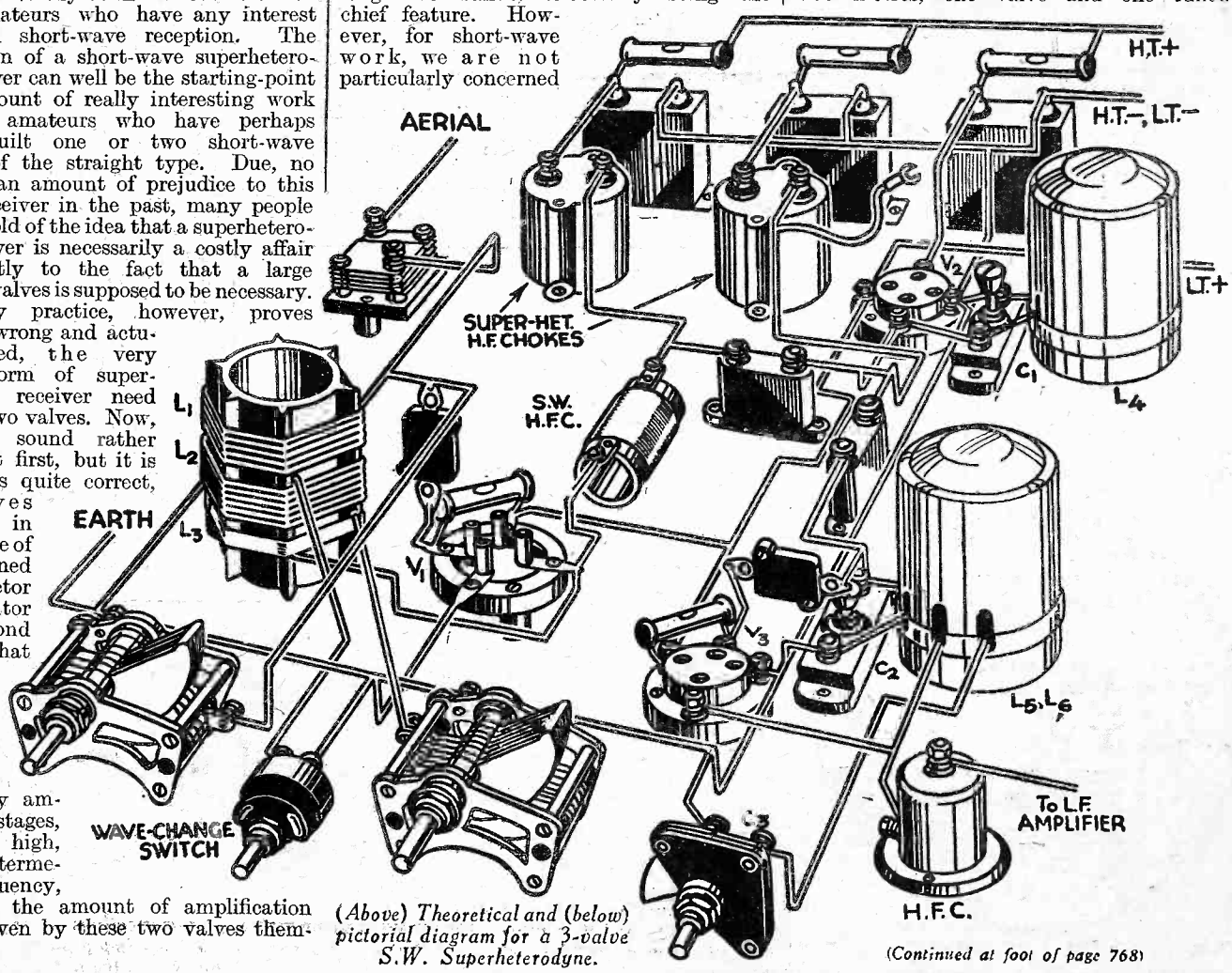


A short-wave superheterodyne receiver does not need to be a costly affair, and a very satisfactory model for loud-speaker operation need not have more than five valves—if A.C. operation is required, this can often be cut down to four, taking advantage of the superior characteristics of mains valves. In a battery model, these valves may take the sequence of (a), combined first detector and oscillator, (b), intermediate frequency amplifier (hereafter referred to as the I.F. amplifier), (c), the second detector, (d), the first L.F. amplifier, and (e), the power output stage. We can thus bring the number of valves down to a reasonable figure, and the final results from five valves arranged in this manner will certainly be vastly superior to those to be obtained from a "straight" receiver using the same number of valves.

If an even more powerful receiver is required, further amplifying stages can be added between (b) and (c) in the sequence referred to above, or high-frequency amplifiers can be added at signal frequency ahead of the first valve on the lines of a normal high-frequency amplifier for short-wave work.

Reception on 100 Metres

For satisfactory reception up to about 100 metres, one valve and one tuned



(Above) Theoretical and (below) pictorial diagram for a 3-valve S.W. Superheterodyne.

(Continued at foot of page 768)

Where the CURRENTS FLOW

Part 2.

Some Further Aspects of the Complex Nature of the Currents Flowing in Various Radio Circuits.

By H. BEAT HEAVYCHURCH

IN the first instalment, the circuit of a fairly simple receiver was traced through and the complex nature of the currents flowing through the various parts of the network were examined. The circuit chosen, while representative of a large number of standard sets, could not, of course, permit of an exhaustive analysis of the current distribution in every type of receiver—those, for example, operated from A.C. mains or from D.C. mains; those employing straight or variable-mu high-frequency stages; super-hets; sets with automatic volume control; and the hundred and one other special features the various permutations of which make the difference between one design and another.

Complex Nature

This week I shall deal with two further aspects of the complex nature of the currents flowing in radio circuits. You have probably noticed that in most circuits a single connecting wire, or, perhaps, a certain component, may actually form a part of two or even more different circuits. A very simple example of this is the low-tension network of a battery-operated receiver, such as is shown in skeletonized form in Fig. 1.

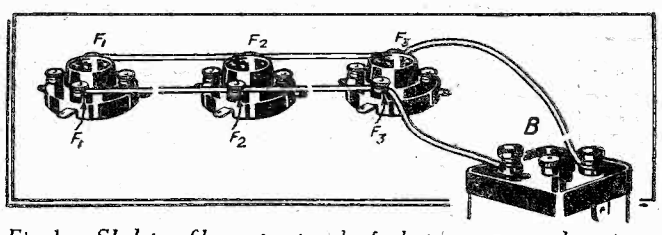


Fig. 1.—Skeleton filament network of a battery-operated receiver.

Here, F_1, F_2, and F_3 are the valve filaments, and B is the low-tension accumulator. It is clear that the circuit of F_1 can be considered as the filament itself plus the low-tension leads and the battery B. Similarly, the circuit of F_2 consists of F_2, part of the low-tension wiring, and the battery; and the circuit of F_3 is composed of F_3, part of the wiring, and the battery. So you see, the battery is common to all three circuits.

Now suppose that for some reason, variations of voltage were produced in that part of the network which is common to all three circuits, that is to say, in the battery. Obviously, corresponding current variations would take place in each of the filament circuits. There is very little chance of serious variation of this sort occurring in the low-tension network of a battery set, but there are innumerable other places in a set where effects of this kind may take place, and may give rise to serious trouble.

An Example

Here is a very common example. Fig. 2 shows the essential anode circuit connections of a 3-valve battery or H.T. eliminator set, from which it will be noted that the high-tension supply unit is common to all three circuits. The anode current of V_1 consists of a direct current with both radio-frequency and audio-frequency components. The anode current of the detector valve V_2 is a direct current with audio-frequency variation, while the anode current of V_3 is also a direct current, with a very large audio-frequency component. All these complex currents will flow simultaneously in the high-tension supply unit, and because the H.T. source possesses a far from negligible resistance, the variations in load current will cause voltage variations—in other words, an alternating voltage will be developed across the resistance of the high-tension unit.

As the actual values of the anode currents of the early stage valves are small, and their variations at radio frequency or audio frequency are not very great, the voltage fluctuations in the total anode feed caused by them may not be serious. But the audio-frequency pulsations in the anode current of the output valve form a fairly large percentage of the total rectifier load, and give rise to really substantial audio-frequency voltage variations, which will appear also in the high-tension feed currents of all the other valves. These variations will then be transferred *viâ* the inter-valve couplings to the grid circuits of the succeeding valves, and will be amplified therein, finally appearing as a spurious signal voltage at the grid of the output valve which, in turn, causes still greater variation in the anode current of that valve, resulting in increased voltage variations in the high-tension supply.

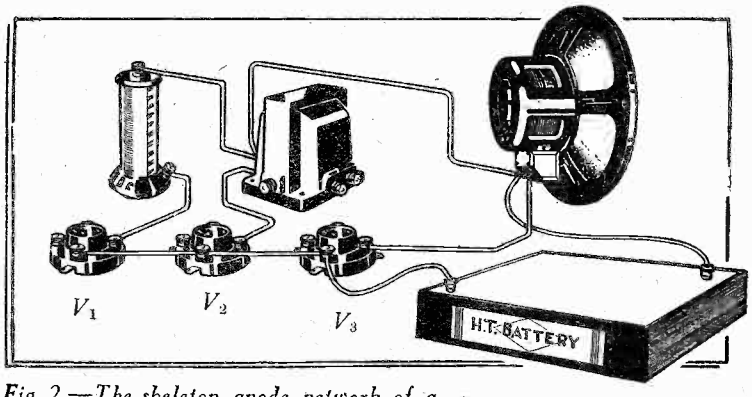


Fig. 2.—The skeleton anode network of a three-valve battery set.

From a Ticking to a Howl

Thus the whole cycle starts again, with the result that the "back-coupled" voltage eventually upsets the stability of the set, and the low-frequency oscillations developed are made manifest in the speaker by noises which will range from slight ticking sounds to a popping reminiscent of a motor-boat, or even to a full-throated howl, according to the electrical characteristics of the circuit.

Fortunately, it is not difficult to avoid the troubles due to "back coupling," as it is termed. The cure is "decoupling." It is a recognized electrical law that if a current is passed through a circuit possessing impedance, a voltage drop occurs across that impedance, and the voltage drop is proportional to the strength of the current and to the value of the impedance. Further, if the current is passed through two impedances in series, the total voltage drop across the pair will be divided between them in the proportion of their impedances. Thus, if a high and a low impedance are connected in series, the voltage drop across the high impedance will be very great compared with that across the low impedance.

This principle can be applied to decoupling circuits in which there is a risk of instability due to back coupling. The method consists in connecting in the circuit to be decoupled a resistance or choke having a high impedance to alternating current, and by-passing this to earth by a condenser having a relatively low impedance to alternating currents.

Harmful Voltage

A typical example is shown in Fig. 3, in which the variations in

(*Continued on page 764*)

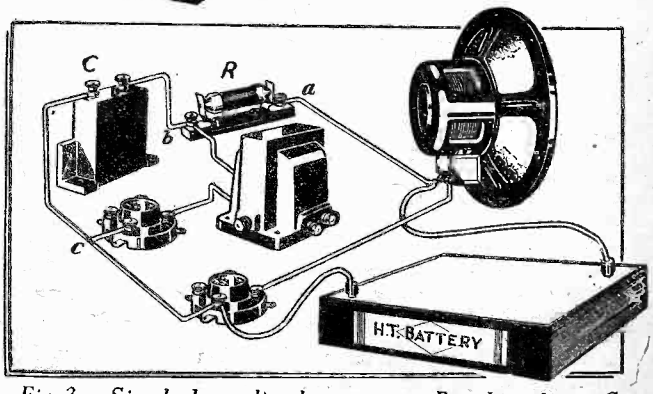


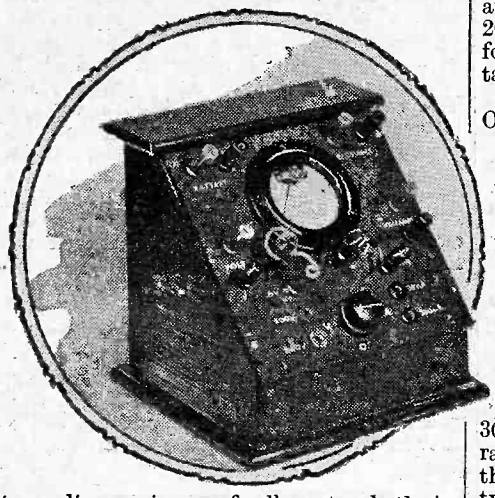
Fig. 3.—Simple decoupling by resistance R and condenser C.

Making an All-Purpose Test Meter

In this Article the Author Explains its Construction and Operation.

By DAVID SUTTON

EVERY serious radio experimenter needs a good-quality testing set, for to-day efficient radio reception is more than ever a matter of exact design and adjustment. The instrument here described was built to provide a handy means of measuring the various currents and voltages



in radio receivers of all sorts, both in connection with "fault tracing" and for those precise preliminary adjustments which are essential if sets of modern design are to be operated at maximum efficiency. Provision is also made for taking fairly accurate measurements of resistances up to about 75,000 ohms.

Before describing the test set in detail it may be well to indicate the considerations which governed the choice of the instrument proper. It was decided at the outset that a fairly high standard of accuracy was essential, and therefore a good quality moving-coil milliammeter was selected.

Moreover, in order to avoid erroneous low readings when measuring the voltage of batteries on load, it was obvious that a low-range milliammeter, taking a maximum drain of, say, 2 milliamps should be employed in conjunction with line resistances for the voltmeter ranges.

Components Incorporated

The actual instrument selected is a 2in. dial flush-mounting moving-coil milliammeter giving a full scale deflection with 2 milliamps, but actually having two scales, one graduated 0—2 and the other 0—6. This double scale immediately suggested the following ranges: 6, 200 and 600 volts, and 2, 20 and 200 milliamps. These ranges are extremely convenient in practice, for the 6-volt range is just right for low-tension battery testing; 200 volts covers high-tension measurements in all battery sets and most mains receivers, while the 600-volt range is useful when dealing with the larger high voltage output valves employed in powerful mains sets, and small public address gear.

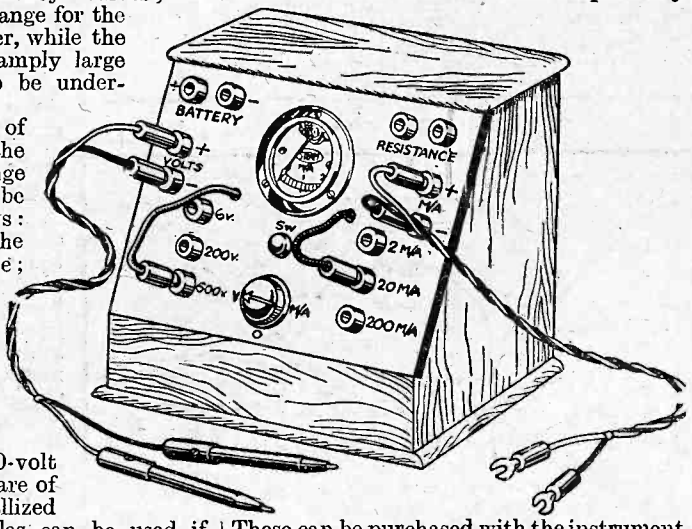
The 2-milliamp range will be found extremely useful for checking the screen currents of high-frequency valves; 20 milliamps is a useful range for the average battery receiver, while the 200-milliamp range is amply large for any work likely to be undertaken by the amateur.

A simple application of Ohm's law enabled the values of the volt-range line resistances to be determined as follows: 30,000 ohms for the 6-milliamp range;

Two views of the completed meter.

100,000 ohms for the 200-volt range, and 300,000 ohms for the 600-volt range. These resistors are of the popular 1-watt metallized type. Standard samples can be used if great accuracy is not desired, but the writer considered it worth while to pay a few pence extra for resistors guaranteed accurate to 1 per cent. of the rated values.

The 2-milliamp range is the normal range of the instrument, while shunts of one-ninth and one ninety-ninth of the instrument resistance are used as multipliers for the 20- and 200-milliamp ranges. The instrument specified has an internal resistance of exactly 90 ohms, so that the shunts must be of 10 and 0.9 ohms respectively.



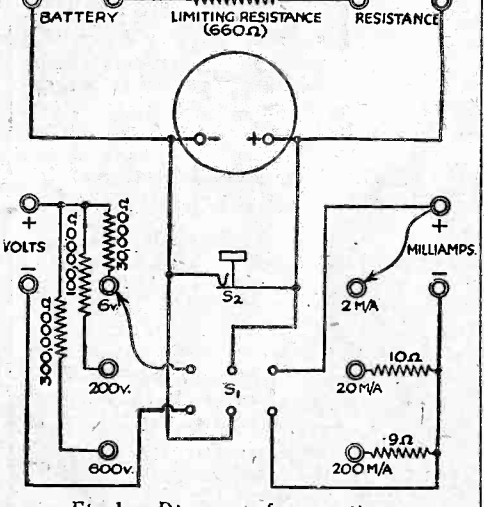


Fig. 1.—Diagram of connections.

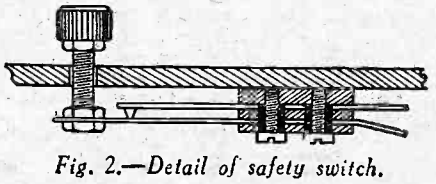


Fig. 2.—Detail of safety switch.

These can be purchased with the instrument, thus saving considerable trouble, or the constructor can make his own if he prefers.

For resistance measurements, provision is made for connecting the milliammeter in series with a dry cell and with the resistance under test, and the accompanying table will enable the value of the resistance to be found from the milliammeter reading. In order to avoid risk of damaging the meter when measuring low resistances, a limiting resistance is included in the ohm-meter circuit. This resistance is of 660 ohms, which, with the instrument resistance of 90 ohms, makes 750 ohms permanently in circuit and limits the current to 2 milliamps when using a 1½-volt dry cell. The resistance table takes account of this limiting resistance, that is to say 750 ohms have been subtracted from the values found by calculation.

Theoretical Circuit

Fig. 1 shows the theoretical circuit of the test set. It will be observed that a double-pole, double-throw switch, S1, permits the instrument to be changed over from the milliamp range to the volt range. This useful provision allows milliamp and volt readings to be made in rapid succession without disconnecting the milliamp leads. This switch has also an "off" position and should always be moved to this position when taking resistance measurements, especially if any apparatus is connected to either the volt or milliamp terminals.

Choice of voltage and milliamp ranges are made by two selector plugs on short

(Continued overleaf)

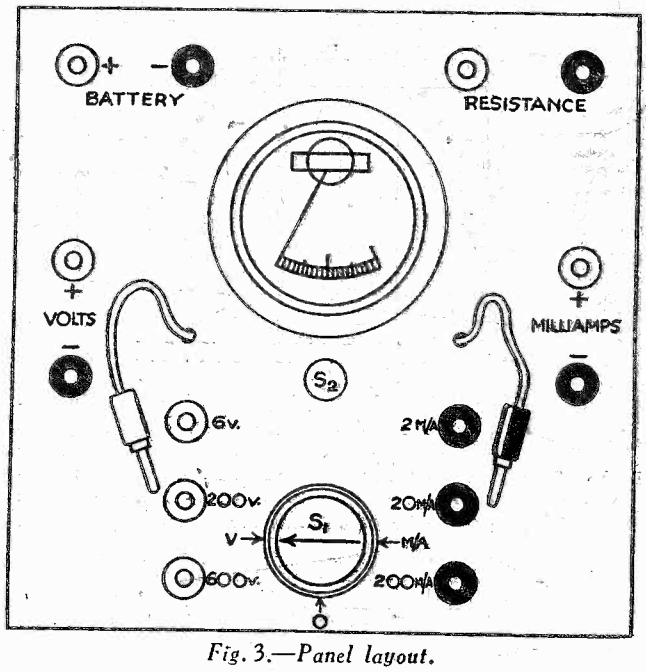


Fig. 3.—Panel layout.

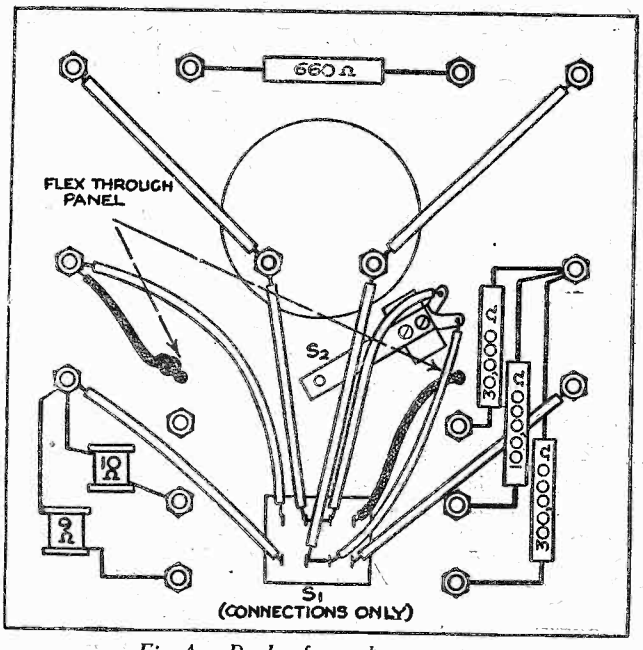


Fig. 4.—Back of panel connections.

(*Continued from previous page*)

flexible leads which must be inserted into the appropriate sockets.

The switch S2 is a safety switch which normally short-circuits the instrument. When taking a reading the switch must be depressed, thus breaking the short circuit. This gives a final opportunity for examining the connections and settings of the switch and it avoids the risk of passing excessive current through the instrument when changing from one milliamp range to another, as when the selector plug is withdrawn for this purpose the instrument is left temporarily with no shunt in circuit.

ESSENTIAL COMPONENTS

- One milliammeter, moving-coil type, 0—2 milliamps and scaled 0—2 and 0—6 (Sifam, Type R.T.R.)
- Two shunts for above instrument, 10 ohms and 0.9 ohms (Sifam).
- Four 1-watt metallized resistors—660 ohms, 30,000 ohms, 100,000 ohms and 300,000 ohms (Erie).
- Fourteen bushed sockets, 7 red and 7 black (Clix).
- Ten plugs to match, 5 red and 5 black (Clix).

No particular type of change-over switch is specified. The writer used an old Igranic anti-capacity switch which happened to be handy. Care must be taken that the switch makes very good contact, especially on the milliamp range, for high contact resistance will seriously upset the accuracy of the readings when using the multiplying shunts.

The shorting switch was home made, using two of the contacts of an old telephone switch. The construction is indicated in the detail sketch, Fig. 2. The contacts are bent so that they normally make contact. A long brass stud is bolted to the bottom contact strip and passes through a hole drilled in the panel, terminating in a small knob which, when depressed, displaces the bottom contact downwards and breaks the circuit.

Panel Layout

The panel layout is shown in Fig. 3. A panel 6½ins. square just accommodates the whole of the apparatus nicely, but the actual size to be used will, of course, depend upon the constructor's taste in cabinets. For the instrument illustrated, an old sloping-panel box, which originally housed a crystal receiver, was used, a form of cabinet which is very convenient because the slope of the panel brings the instrument to the best angle for reading.

The actual wiring is simplicity itself, and the back-of-panel sketch reproduced at Fig. 4 is self-explanatory. The whole of the connecting wires are covered in systoflex; joints at the various switches are soldered, but all others are screwed connections, with the exception of the shunts, which are soldered to short lengths of stout tinned copper wire attached to the terminal sockets. The shunts are wound on small ivory bobbins, and are supported in the set by threading the bobbins on the systoflex of two convenient connecting wires.

Using the Instrument

For voltmeter readings the test leads or prods should be connected to the two sockets marked "Volts" at the left-hand side of the panel, the selector plug (red) inserted in the socket marked with the appropriate range, the switch S1 turned to the left, and the switch S2 depressed at the instant of taking the reading.

For milliamp readings the terminals on the right-hand edge of the panel and the black selector plugs must be used, while the switch S1 must be turned to the right.

When using the instrument for measuring resistances, the switch S1 should first be turned to the central position marked "O." A single 1½-volt dry cell should be connected to the sockets marked "Battery" at the top left-hand corner of the panel,

(*Continued on page 768*)

WHERE THE CURRENTS FLOW—

(*Continued from page 762*)

the anode current of the output valve transfer corresponding variations to the anode circuit of the previous valve through the common resistance of the high-tension unit. There is, however, a high resistance, R, in the anode circuit of the previous valve, and the condenser, C, connected between this resistance and the high-tension negative wire.

The harmful alternating voltage can be considered as existing between the points "a" and "c"; and because the impedance of R between "a" and "b" is much greater than the impedance of the condenser, C, between "b" and "c," the alternating voltage will exist chiefly between "a" and "b," while the voltage fluctuations across "bc" (*i.e.*, across the valve and its anode load), due to back coupling, will be negligible.

Another frequent source of back coupling is the automatic grid bias arrangements of an alternating-current all-mains set, especially one in which the anode current of all the receiving valves flows through the bias resistance of the output valve. The smoothing of the grid-bias voltage is very essential to prevent unwanted modulation of the anode currents in early valve stages, and it is also desirable to decouple the grid circuits in the way indicated in Fig. 4, to prevent unwanted alternating voltages being transferred to the grids of these valves.

A Current Diversion

There are several conditions under which high-frequency voltages are transferred to portions of the circuit where they can cause instability. Usually, this is the result of high-frequency components being allowed to circulate in parts of the audio-

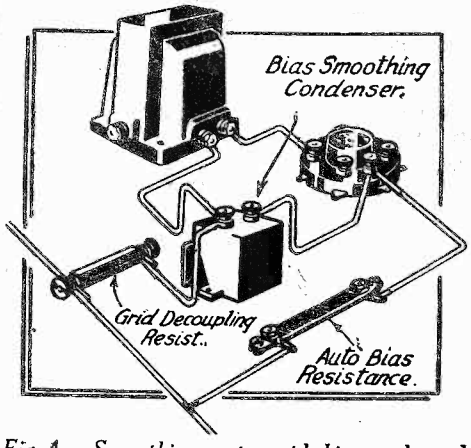
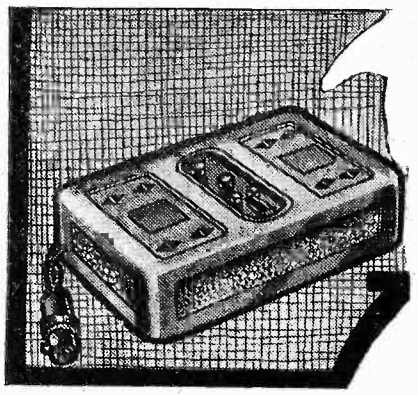


Fig. 4.—Smoothing auto grid bias and good decoupling arrangements.

frequency network, where they are re-amplified, and then, if by any peculiarity of the layout of the set they can be re-transferred to the aerial circuit, or to any other radio frequency portion of the wiring of the set, they will be re-amplified to an extent which may cause instability.

Trouble of this kind can be prevented by diverting all high-frequency currents from the low-frequency amplifier. Most receivers have an H.F. choke in the anode circuit of the detector valve in order to divert the high-frequency portion of their anode currents through the reaction condenser. A further condenser, of about .0003 microfarads capacity, may be connected from the end of this choke to the filament or cathode, or, alternately, across the primary winding of the low-frequency transformer.



CHOOSING AND USING A BATTERY ELIMINATOR

In This Article the Author Discusses the Important Points to be Considered in Choosing an Eliminator for Use with Various Types of Receivers.

By J. NORMAN

DESPITE the popularity of all-mains receivers there are still thousands of set users who prefer receivers of the battery-operated type, or who have to use battery sets which were bought some years ago. At the same time, such listeners naturally wish to run their sets in the most economical and reliable way, which means that the high-tension supply (and perhaps also the low-tension) should be obtained from the electric supply mains. There is, of course, no difficulty whatever in operating a set originally designed as a battery model entirely from the mains supply, all that is necessary being a reliable eliminator of suitable pattern. Moreover, it is in nearly every case considerably less expensive to convert a battery set to an all-mains one by employing an eliminator in conjunction with it than to attempt to convert the set to work with A.C. valves. This scarcely ever necessitates any alteration to the normal wiring of the set, and gives results which are perfectly satisfactory and reliable. It also prevents the possibility of a particularly interesting programme item being missed due to the accumulator or high-tension battery suddenly running down.

The choice of eliminators on the market is so extremely wide that the amateur who proposes to buy a new eliminator is likely to be confused and to have extreme difficulty in deciding just which unit he should buy. In addition to this, it is quite an easy matter to purchase an eliminator of a type totally unsuited for use with the set for which it is intended, or to buy one that will be useless at a later date should the set be changed for one of a newer type.

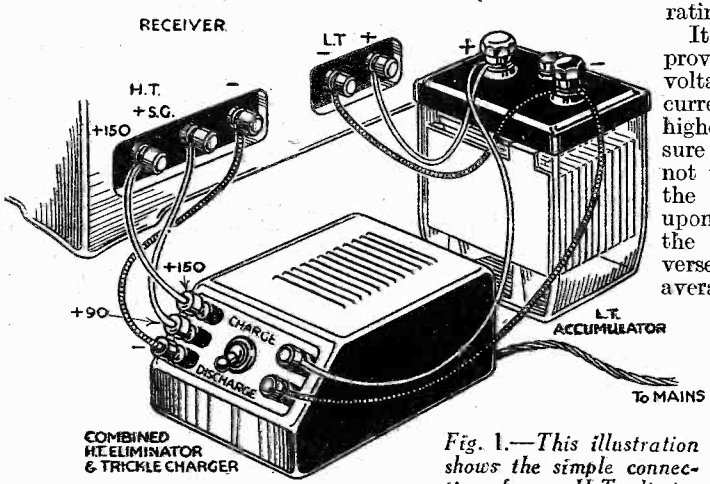


Fig. 1.—This illustration shows the simple connections for an H.T. eliminator of the type fitted with an L.T. trickle charger.

Eliminator Output

Once it has been decided to buy an eliminator, the first question which must be decided is in regard to the output current and voltage required. The set will have battery valves, and since these take a maximum anode voltage of 150, such a voltage will be adequate for the eliminator. As the current output is entirely dependent upon the type of receiver in use the only satisfactory method of deciding what it should be is to measure the H.T. current consumption of the set whilst it is in use. This can be done quite easily by inserting a milliammeter in series with the negative lead from the high-tension battery. There is one point to be remembered in this respect, however, which is that the voltage of the eliminator will be appreciably higher than that of the battery, and, consequently, the current consumption will be greater when the eliminator is in use. In most cases it will be sufficiently accurate to increase the measured current by fifty per cent. in order to decide upon the correct rating of the eliminator.

It might be thought that, provided that the eliminator voltage were correct, a current rating up to the highest obtainable would be sure to be in order. This is not the case, though, since the voltage is dependent upon the current load and the two values vary inversely. For example, the average eliminator which is designed to give 20 milliamps. at 150 volts would easily supply 180 to 200 volts if the drain were reduced to 10 milliamps. In the same way, if the drain were increased to, say, 30 milliamps. the voltage would only reach a figure of 120 or so.

Voltage Tappings

Having settled the question of the maximum output, the problem of lower-voltage tappings must be considered. In the case of any modern battery receiver in which the detector valve is adequately decoupled, it will be quite unnecessary to use any tappings, and if a unit is chosen which is already provided with alternative tapping points these may simply be ignored. On the other hand, if the set is of a somewhat obsolete pattern, and decoupling is not provided, it will be essential to feed the detector valve (and possibly the first L.F. one, if two L.F. stages are employed) from a separate tapping point. In such instances it is better to choose a unit which has a variable tapping (not a screen-grid one), giving a voltage of from about 30 to 80 at about 4 to 2 milliamps. This tapping will be correctly decoupled inside the eliminator, and no further consideration need be given to that point.

Where the set has separate H.T. leads for both the detector and first L.F. or detector and H.F. valves the eliminator should have the variable tapping mentioned above and also a fixed tapping which will supply a voltage of about 90 at 5 milliamps.

S.G. Voltage Supply

Yet another variable tapping will be required if the receiver employs a screen-grid or variable-mu valve, due to the fact that the screening grid must be fed from a separate voltage source. Moreover, this tapping must not be like that for the detector valve since the variable voltage output must be derived from a potentiometer rather than from a variable resistance. Every make of eliminator can be obtained in a type provided with an S.G. tapping, and the appropriate socket is invariably marked "S.G."; it should provide an output of from 30 to 80 volts at about 1.5 milliamps.

It is only occasionally that an eliminator will be called for to give all the various outputs mentioned above, but one can generally be chosen to provide the actual tappings required.

Eliminators for Class B

When the set is of a type employing a Class B or Q.P.-P. output stage, quite a

(Continued on facing page)

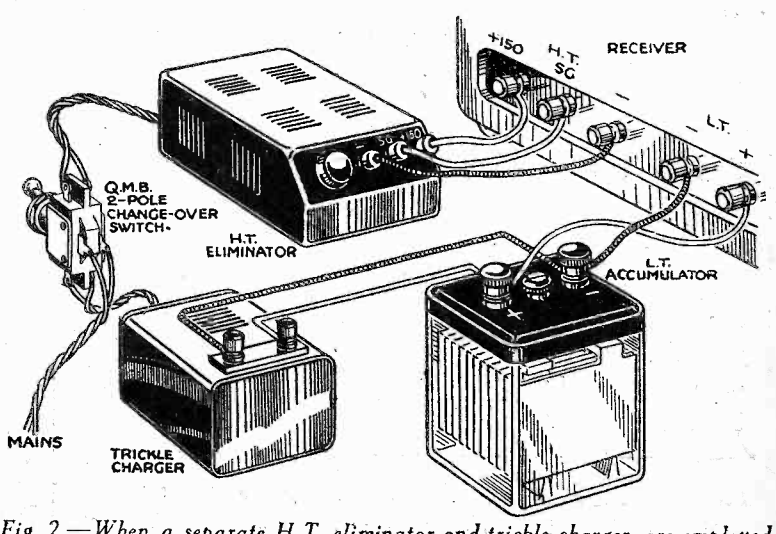


Fig. 2.—When a separate H.T. eliminator and trickle charger are employed the units should be wired up as shown above.

(Continued from previous page)

different kind of unit is called for, due to the fact that the current consumption of such an amplifier constantly varies between some 3 and 35 milliamps., despite the fact that the average consumption may be no more than 10 milliamps. or so. Because of this, the voltage of an ordinary eliminator would constantly be changing inversely with the current. Now, the chief reason for the variation of voltage with the current is the resistance of the rectifier (in the case of an A.C. unit), and also of the smoothing choke and decoupling resistances. This objection can be overcome in three ways; one is to employ a rectifier of lower resistance, another is to cut down the resistance of the smoothing choke and resistance network, and the third is to make use of a neon stabilizer. Valve rectifiers are normally of sufficiently low resistance in their standard form, whilst metal rectifiers of special low-resistance types are now being made especially for use with Class B eliminators. The neon stabilizers referred to are voltage-regulating devices which are connected between the negative and positive H.T. output terminals, in which position they act rather like tremendously large fixed condensers, "absorbing" a certain amount of current when the voltage across them exceeds a certain figure, and passing a negligible current under low-voltage conditions.

All the three different methods briefly described are made use of by various manufacturers, with a result that any one of them can supply an eliminator suitable for Class B working. Such eliminators are always described as being intended for Class B use, but they can, of course, be used with any kind of set taking up to the maximum current output. As a matter of fact, eliminators of this type have many uses in sets not fitted with Class B output, since they give a uniform voltage regardless of the current drain. Due to this, they can be used with every success in conjunction with sets requiring a current of only 15 milliamps. or so, and yet they are perfectly suitable for use later on with a more powerful type of set requiring an H.T. current of any value up to the maximum; this is naturally a great advantage.

Perhaps it should be mentioned at this stage that most D.C. eliminators of standard type can satisfactorily be used with Class B sets, due to the fact that the only resistance in circuit between the main positive supply and the anodes of the Class B valve is that of the smoothing choke, which in many cases is very low. This does not always apply, and, therefore, intending purchasers should check this point by consulting the makers' catalogue.

Trickle Charging

When buying any kind of eliminator it is always a great advantage **to** choose one which, in addition to the H.T. tappings required, is fitted with a trickle charger by means of which the accumulator can always be kept fully charged. By following this course the battery receiver is really converted into a completely mains-driven one and requires no attention whatever, apart from the occasional "topping-up" of the accumulator with distilled water to compensate for evaporation. It would appear that many amateurs consider the idea of using a combined eliminator-trickle charger rather complicated, and needing a rather elaborate switching system to change over the accumulator from "charge" to "discharge." This is by no means the case, and many combined eliminators are

(Continued on page 768)

CUTTING OUT STATIC

A Few Practical Hints on the Elimination of Various Kinds of Electrical Interference. By E. PARKER.

THE increase in use, during the past few years, of electrical appliances both in the home and elsewhere, has brought with it an increase in the associated evil—interference. There must be many listeners who have been introduced to this bug-bear during the last few

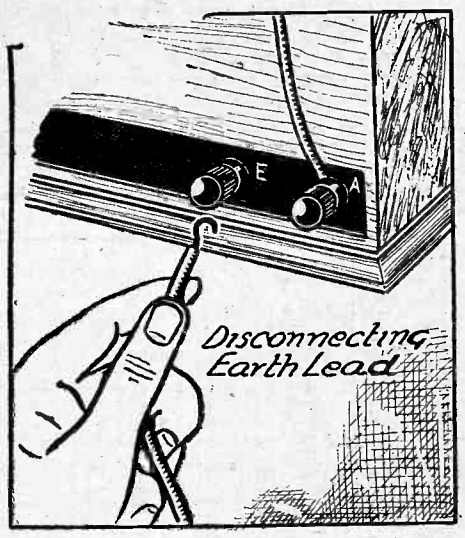


Fig. 1.—The earth lead often introduces noises into a receiver.

months, and to these the following remarks may be of some use.

Interference can be caused by practically any electrical mechanism, from a tiny motor to a power station and, note this carefully, the now-common neon sign is by no means innocent of this trouble, particularly the smaller varieties.

It is practically impossible to cure the interference at the receiver end, the cure must be applied at the root of the trouble; so all we can hope to do is to eliminate at least some of the noise at the receiver end. A temporary measure of relief can often be obtained by disconnecting the earth lead and using the set with the aerial only or, for permanency, try another earth, preferably a buried one. This is because a great deal of electrical apparatus is earthed; consequently, interference reaches the set through this source, particularly so if the water pipes of the house run near the earth of the apparatus, and if you are using these pipes for an earth, interference is a certainty.

Further relief can often be obtained by altering the position of the aerial. I have two aerials, one running diagonally across the room and the other a vertical aerial, parallel to the outside wall of the house, and I find that the latter picks up a great deal less interference than the former from an electric motor about thirty yards away.

If you are using an outdoor aerial, why not try an indoor one? Or, alternatively, alter the position of the present one? If an aerial is running parallel with tramlines or with a power-cable, interference can be very easily picked up. Trams are a noted sort of trouble, and one reason can easily be seen any evening. Just watch the trolley-arm as it runs along the overhead wire; the sparks you will see mean trouble for the majority of sets in the immediate neighbourhood, so keep your aerial well away from trams if at all possible.

If the trouble is caused in your own house, there may be several ways out of the difficulty. One method is to "silence" the apparatus itself. In the case of an electric motor, possibly in a vacuum cleaner, sewing-machine or similar apparatus, the commonest cure is to connect two condensers in series across the brushes, the centre point of the condensers being connected to earth. The condensers should be of good make, and each capable of standing the full mains voltage. The capacity of these condensers is not critical—one to two microfarad will usually be sufficient, but do not use "shoddy" condensers.

"Shielded Lead-in"

Perhaps the interference is being picked up from the house wiring; in that case relief can probably be obtained by fitting a "shielded lead-in." This particular wire consists, in principle, of a copper conductor held centrally in a metal-shielded casing. When fitted, this metal shielding is connected to earth, signals from the aerial coming to the set via the central copper conductor. There are several examples of this type of lead-in now on the market, and there is certainly nothing to be lost by fitting it, the only point to remember being that the length used should be kept within reasonable limits.

An alternative to fitting the shielded lead-in is to have a greater length of supporting cable (or rope) between the point of suspension nearest the house and the lead-in. This means that the point where the lead-in leaves the aerial, assuming that it is one of the usual types, is moved farther from the house, with the result that the lead-in forms more of an angle with the house than when in the previous position.

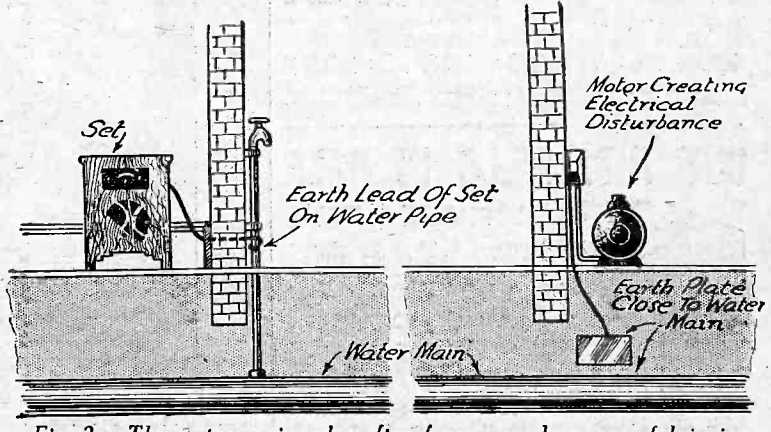


Fig. 2.—The water mains also often form a ready means of bringing in interference.

CHOOSING AN ELIMINATOR

(Continued from page 767)

provided with the necessary (two-pole-change-over) switch and a pair of leads for connecting to the accumulator terminals. With this idea it is only necessary to connect up the H.T. leads to the set in the normal way and join two pairs of leads to the accumulator. Of the latter two sets of leads, one is that from the L.T. terminals on the set, whilst the other is that from the unit. In order to make the arrangement quite clear it is shown in a simple sketch at Fig. 1.

If an eliminator of the ordinary type, intended for H.T. only, is at present in use it is a perfectly simple matter to use a trickle charger of any type with it by connecting up the units as shown in Fig. 2. When the double-pole change-over switch is in one position the mains are connected to the H.T. eliminator, and the accumulator is joined up to the appropriate terminals on the set. By operating the switch knob, however, the mains supply is transferred from the H.T. unit to the trickle charger, and the accumulator is automatically put "on charge" without any other alteration being called for. It should be mentioned, incidentally, that the set should be switched off by means of its switch before charging of the accumulator is commenced, since if this were not done there might be some chance of damaging the valve filaments due to the application of an excessive voltage to them.

UNIVERSAL TESTING SET

(Continued from page 764.)

and the resistance to be tested should be connected between the sockets marked

1 Milliamp. Reading	2 Resistance in Ohms with 1.5v. battery	3 Resistance in Ohms with 7.5v. battery	4 Milliamp. Reading	5 Resistance in Ohms with 1.5v. battery	6 Resistance in Ohms with 7.5v. battery
0.1	14,250	74,000	1.1	610	6,100
0.2	6,750	36,700	1.2	500	5,500
0.3	4,250	24,000	1.3	400	5,000
0.4	3,000	18,000	1.4	320	4,600
0.5	2,600	14,000	1.5	250	4,250
0.6	1,750	11,500	1.6	190	4,000
0.7	1,400	10,000	1.7	130	3,600
0.8	1,125	8,600	1.8	83	3,400
0.9	900	7,600	1.9	40	3,200
1.0	750	6,700	2.0	—	3,000

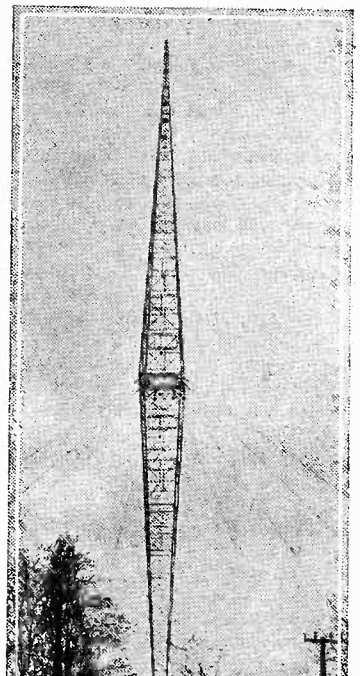
"Resistance" at the top right-hand corner of the panel. Press the safety switch knob S2, and note the reading of the milliammeter, using the 2-milliamp scale. Then turn to the table and against the milliamp reading in columns (1) or (4) read the value of the unknown resistance in column (2) or (5). If the resistance so found is so high that the milliamp reading is too small to be read accurately a 7½-volt grid battery can be substituted for the 1½-volt cell, when the resistance values corresponding to the various milliamp readings will be as shown in column (3) or (6).

It is very important not to use the 7½-volt battery unless the resistance under test is known to be over 3,000 ohms. Otherwise, excessive current will pass through the instrument and may cause serious damage.

SHORT WAVE SECTION

(Continued from page 761)

circuit can very satisfactorily do service for both the first detector and oscillator stages, provided that a fairly low I.F. is used. The output from this valve is fed directly to the I.F. amplifier, and it should be noted here that it is not essential to use any of the accepted types of I.F. transformers as used in superheterodyne receivers of the medium and long-wave types. We can instead use almost any type of fairly compact tuning coil which is capable of being tuned to about 2,000 metres when used with a pre-set condenser of .0005 mfds. capacity. The diagram on page 761 indicates a receiver of this type, and the coils L4, 5 and 6 are those referred to here. It will be appreciated, of course, that these coils must be shielded. The two I.F coils are brought into step by means of the pre-set condensers C_1 and C_2 which, when once set, will not require further adjustment, unless further changes are made in some other part of the receiver equipment



New Budapest aerial mast. See paragraph on this page.

Unique Budapest Wireless Mast

THE photograph on the left shows the new aerial mast of the Hungarian station at Lakihe, near Budapest. The mast is of unusual and unconventional design, and tapers from the base to its widest point, the centre, and again from there to the top where it comes to a point. This mast is 314 metres high and is of American design.

The Pentagrid

THE pentagrid is already on the English market, and it is probable that the triode-pentode will not be long in following it, but where is all this going to end, and what is more important, is it leading anywhere? The old and much despised bi-grid is about three years old and the wonderful (?) pentagrid is to kill it completely, but when all is said and done, is there much difference in them from the point of view of those who use receivers for listening to broadcasts rather than to lecture about them?

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

PREVENTING H.F. LEAKAGE

Some Suggestions for Keeping Stray High-Frequency Current Out of the Low-Frequency Circuit. By G. W. DAVEY.

EVERY reader must by now have learnt sufficient about wireless to know the difference between the terms H.F. and L.F. or, that is to say, high frequency and low frequency. Roughly speaking, H.F. currents are the currents which are received by the aerial, are tuned, passed into the high-frequency stages, if any, and so on to the detector, where they are detected, or turned into low-frequency currents. Of course, we know that many low frequencies are referred to as "high," those round about 10,000 cycles, for instance, but such frequencies are low compared with those known as "high frequencies."

The detector, then, can be looked upon as the dividing line between high and low frequencies in a wireless set, and it is, for efficient working, essential that the H.F. and L.F. should be kept strictly to their own spheres of work. This more particularly applies to H.F., which is very prone to stray into the L.F. circuits unless rigidly excluded.

A Few Symptoms

Let us briefly run over a few of the symptoms which suggest that H.F. is getting into the L.F. circuits, so that those of you who are suspicious of the behaviour of your sets can check up on them. First, instability may be caused. Besides feed-back in the anode circuits, the most common cause of instability, stray H.F. is a very likely offender. Secondly, overloading of the valves: for besides carrying the normal L.F. load, they would have imposed on them an extra H.F. content, and so overload more easily. Again, generally bad quality, "fuzzy" top notes, hissing sibilants, violins that sound like flutes, and a certain harshness of tone, all would indicate to the expert that H.F. has strayed into the L.F. side.

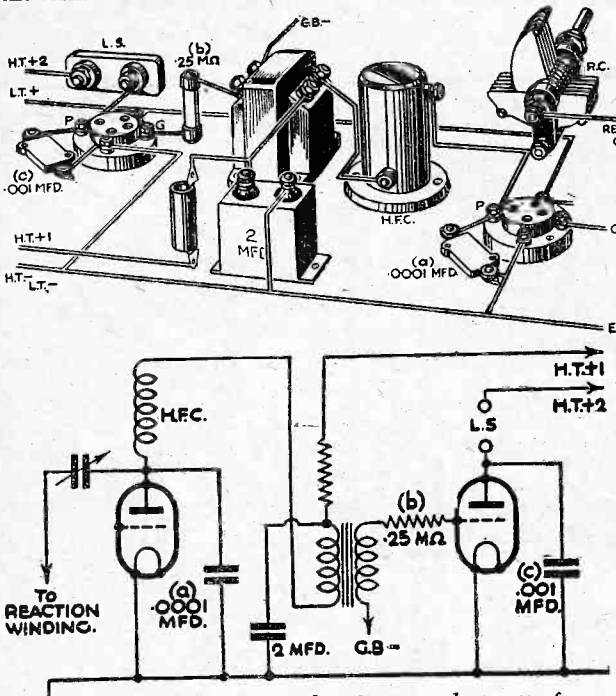


Fig. 1.—Theoretical and pictorial circuits for a detector-L.F. receiver.

Having decided upon a little more rigid tightening up of the barrier to H.F. from the L.F. circuits, we must look into the various schemes we can employ.

Some Remedies

In Fig. 1 a diagram is given of a typical detector and L.F. side of a set. The first barrier to H.F. we have inserted is the H.F. choke which, as its name implies, should choke back the H.F. currents. Now, if this choke is a poor one quite a lot of H.F. will leak past it, besides which, if we are stopping the H.F. here we should provide an alternative path for it. This path in most sets nowadays is provided by means of a differential reaction condenser. Where ordinary reaction is fitted there should be a path back to earth for the H.F. through a .0001 mfd. condenser marked (a) in Fig. 1. A real "de Luxe" arrangement for stopping H.F. at the detector anode is indicated in Fig. 2.

A condenser of .00005 mfd. capacity is connected between earth and either side of the H.F. choke.

With R.C. coupling there is a direct path for H.F. currents through the coupling condenser to the grid of the L.F. valve and the following hint is of primary importance with such couplings. It may so happen, however, that the capacity between the windings of the L.F. transformer may be sufficiently large to allow an H.F. leakage, in which case the idea is equally applicable. It is to insert a resistance of between 100,000 and 250,000 ohms in the lead from the coupling component to the grid of the L.F. valve.

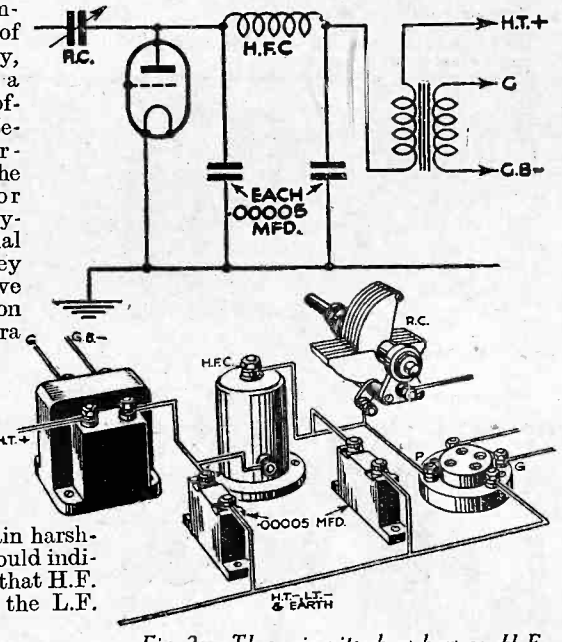


Fig. 2.—These circuits show how an H.F. "stopper" circuit can be arranged.

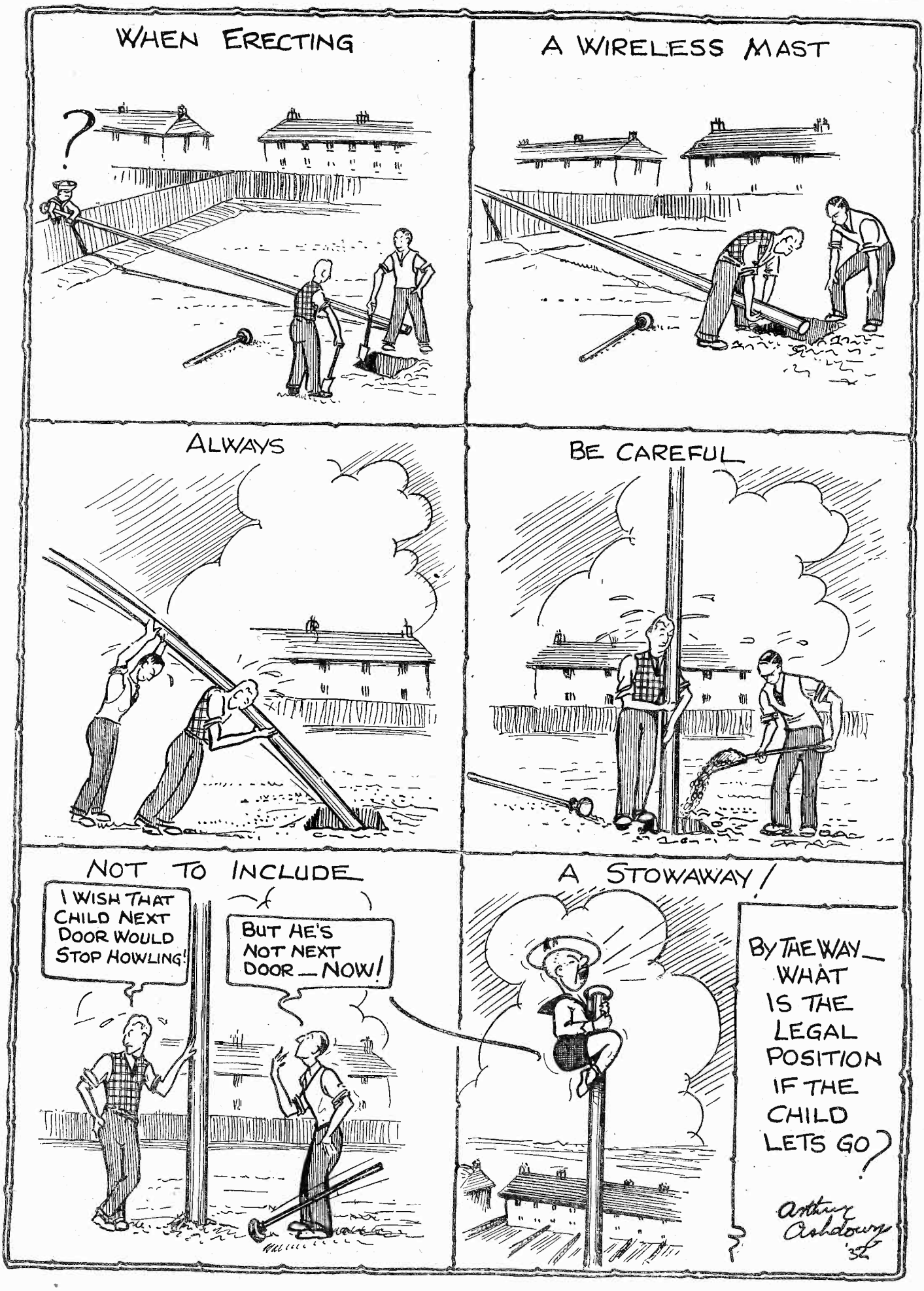
Stray H.F. in Phone Leads

The next suggestion is of particular use in short-wave sets where stray H.F. in the phone leads can cause hand and body capacity effects. It is also of good use in portable sets as also in any others where it is deemed an improvement. It is a condenser (c) in Fig. 1, of .001 mfd. capacity connected between the plate of the output valve and earth. A special refinement is to put an H.F. choke in each loud-speaker lead as well. In superhets special care must be taken to keep the H.F. in its place, and chokes of extra high inductance should be used.

TOPICAL TECHNICALITIES.

Rectification.

Rectification is the name given to the process of changing alternating current into direct current. It has previously been explained under this heading that the voltage and polarity of alternating current constantly change from maximum to zero and from positive to negative, respectively, whilst a D.C. supply is at a uniform voltage and constant polarity. The object of rectification, therefore, is principally to render the current of constant polarity, and this object may be achieved in various ways. All are similar in principle, though varying slightly in their methods of application. Any device used for rectification is called a rectifier, and operates by reason of its property of allowing current to flow through it in one direction only. To take a simple analogy, a rectifier can be considered as the electrical counterpart of the mechanical valve which allows fluids or gases to pass through it in one direction only. The simplest type of rectifier is the valve, and this will easily allow a current to flow from its filament or cathode to the anode, but does not permit of a current flow in the reverse direction. When A.C. is applied to the valve, current flows only when the cathode receives the negative half-cycle, there being no current passing on the alternate half-cycle.


WHEN ERECTING
A WIRELESS MAST
ALWAYS
BE CAREFUL
NOT TO INCLUDE
I WISH THAT CHILD NEXT DOOR WOULD STOP HOWLING!
BUT HE'S NOT NEXT DOOR — NOW!
A STOWAWAY!
BY THE WAY — WHAT IS THE LEGAL POSITION IF THE CHILD LETS GO?
Arthur Ashdown '32

RADIO RAMBLINGS

By IACE

Jottings from my Notebook

Safety-fuse Connections

I WAS recently asked to investigate what, on first appearances, seemed to be a rather intricate difficulty in connection with a battery receiver said to have been built to a design published in PRACTICAL WIRELESS. The owner of the set found that when he switched on the set was quite "dead" so far as signals were concerned, but, peculiarly enough, the fuse showed a fairly bright light. He at first thought that there must be a high-resistance short-circuit somewhere in the set, and had, therefore, thoroughly examined the wiring in addition to testing all the components. During the course of his tests the fuse was accidentally short-circuited, when signals could be received in the normal manner. Apart from this, however, no clue as to the peculiar behaviour could be traced. What would you have said the difficulty was due to? The answer is pretty easy, really, because the low-tension negative lead had been joined to the wrong side of the fuse, with a result that when the switch contacts were closed the fuse was in series with the valve filaments. The fuse acted as a series resistance of sufficiently high value to prevent the valves from functioning. On the other hand, though, the resistance of the valve filaments was low in comparison, and they, therefore, passed quite sufficient current to light up the fuse bulb. It is surprising how such little points as this can often give so much trouble

Electrical Interference

COMPLAINTS are still received from listeners who find interference-free reception at certain hours of the day quite impossible, due to the fact that some form of electrical device in the neighbourhood happens to be in use. This electrical interference, or man-made static (as the Americans prefer to call it) business is becoming increasingly important, and it seems quite time that the powers that be should institute some regulation whereby interference would be made a punishable offence. After all, it is by no means impossible in these days to design electrical apparatus in such a way that it is practically non-radiating, whilst existing apparatus can almost invariably be "silenced" by fitting suitable condensers, or, better still, by making use of one of the many disturbance suppressors now on the market and obtainable at quite a low price. It should also be pointed out that the Post Office engineers are only too willing to give assistance by locating the source of interference and offering to fit the necessary "silencing" equipment for the bare cost of the parts.

In case of trouble due to interference, all that the listener has to do is to obtain a form from the Post Office, give brief replies to the simple questions printed thereon, and return it to the Engineering Department connected with the local P.O. Almost immediately upon receipt the Post Office send out experienced engineers to go into the matter and suggest the most suitable remedies. Before calling in the P.O., however, it is best to make sure that the interference is not being created by loosely-fitting electric lamps, defective switches or domestic appliances such as carpet sweepers, hair driers and the like. When the origin of the disturbance is found to be due to a particular piece of apparatus in the house the remedy is fairly obvious. A fault in the lighting system can be rectified by the local electrician, whilst disturbance suppressors for any kind of motor can now be bought from any radio dealer. Certain manufacturers make a wide range of suppressors of all types, each of which is suitable for some particular form of interference. These firms will also supply a questionnaire, the replies to which will enable them to say exactly what type of unit will be most suitable for the particular case.

A Very Neat Iron-core Tuning Unit

A NEAT and compact tuning unit, the "Colpak," which is fitted with three type "G" Ferrocart iron-core coils, has recently been tested in our laboratories. The unit is assembled on an aluminium chassis measuring 6½in. by 7¼in. by 1¾in., and all the necessary terminals are mounted on the side, where they are readily accessible. The coils are arranged as an aerial band-pass filter, followed by a tuned-grid coil with reaction, and are tuned by means of a screened three-gang condenser. The latter is not provided with a dial and drive, so that the user may obtain one of the full-vision drives now on the market in any pattern which he prefers. A very complete switch assembly is provided, and this is operated by a single knob which can be turned into one of four positions to give "Gramophone Pick-up," "Long Waves," "Medium Waves" and "Off"; the knob is clearly marked to show which position it is in. By making use of this excellent tuning unit the constructor can build any set of the single screened-grid type with the greatest of ease, and by using only a few additional components. As the coils and tuning condenser are perfectly balanced and matched, the preliminary adjustments which remain for the constructor to make are of a particularly simple nature, since it is only necessary to compensate for the capacity between connecting wires, by operating the trimmer condensers which are conveniently placed on top of the gang condenser. By adjusting these when the receiver is first made the entire task of matching will be completed, and all subsequent tuning can easily be carried out by the single knob. The "Colpak" described can be obtained for use in either battery or mains receivers, and the particular type required should be stated when ordering.

A Neon Potential Divider

THE neon stabilizer is fairly well known as a device for maintaining the output voltage of an eliminator constant irrespective of the current drain, and now we learn of a modification of this idea. A new form of neon has recently been evolved which really performs the work of several stabilizers, one each of which is connected in the positive tappings from an eliminator. This latest development is known as a glow-gap potential divider, due to the fact that it operates on the multiple output leads instead of on one only. In principle the new device is similar to the neon stabilizer, but, in addition to the normal anode and cathode, it contains a number of other electrodes which are situated between the main anode and cathode. In consequence of this, the total voltage drop across the component is divided into various steps by the various intermediate electrodes. Each of the intermediate electrodes can be employed to feed a particular valve anode, and the various voltages obtained remain constant, whether or not the current fluctuates or remains at a uniform figure.

A New Television Transmitter

NEWS comes from Chicago that Dr. Zworykin, a scientific investigator, has evolved a new instrument for television transmission which he has called an "Iconoscope." The device is particularly interesting and consists of a combination of a photo-cell of large dimensions and a cathode-ray tube. The cathode ray is produced in the usual manner by an emission of electrons by a filament, and the ray is directed in the appropriate direction by means of anodes or deflecting plates, on to the large photo-cell (or really a bank of small cells) which replaces the normal fluorescent screen. The object to be televised is focused on to the outside of the screen, with a result that the small cells become charged proportionately to the intensity of the incident light. Then, as the electron beam or ray passes over the cells the latter are discharged and the current impulses so obtained are amplified and passed on to the transmitter. For reception, an ordinary cathode-ray receiver is employed and the transmitting process is actually reversed.

H.T. Eliminator Output

THE discharge rate of an eliminator varies considerably with the current, and, as a consequence, the voltage from a tapping intended to be taken to a screen-grid valve may be much higher than the normal value. For instance, when the eliminator is giving a total of 25 milliamps. the voltage of the screen-grid tap may be 65 and the output voltage of the power tapping 120, which is about right for normal working. If, however, the current is reduced to, say, 15 milliamps., the voltage at the screen-grid tapping may rise to about 85, which would cause instability in some sets.

In mains units having fixed tappings it is as well to arrange for the voltages to be brought down if necessary. Usually a bigger power-valve will have the desired effect of increasing the load and reducing the pressure, but if this is not a desirable change a resistance can be connected between the power-output tap and the negative terminal. An "artificial" load, which will produce the same effect as a larger power-valve, might take the form of a resistance in parallel with the H.T. supply.

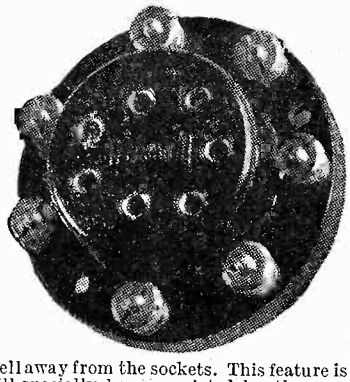
FACTS & FIGURES

Components tested in our Laboratories

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

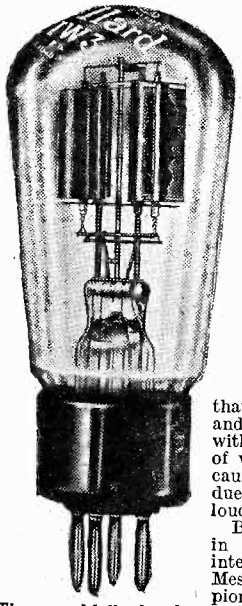
NEW FERRANTI VALVE HOLDERS

AN interesting new Ferranti line, in the shape of chassis-mounting valve-holders, has recently been placed on the market, and we have received samples in 4-, 5- and 7-pin types. These holders can only be described as excellent components well in keeping with the tradition of the firm of Ferranti. They consist of a neat moulding into which are fitted the necessary sockets, the latter being of a new spring type with which perfect contact with the valve pins is assured. In every case the holders are of the soldering-tag type, a special feature being that the tags are long



The Ferranti baseboard-mounting 7-pin valve-holder.

and project well away from the sockets. This feature is one which will specially be appreciated by the constructor, particularly when using the 7-pin component. With most varieties of 7-pin holders it is by no means an easy matter to make connection to all the seven sockets without running the risk of causing a short-circuit, but no such difficulty can possibly arise in connection with the Ferranti components under review. We have thoroughly tested holders of every type submitted and found them entirely satisfactory in every way. Valves fitted them perfectly and no undue pressure was required to press the valve pins right "home," despite the fact that the spring sockets are amply strong to make true contact and are so designed that their efficiency cannot become impaired by long usage. Incidentally, we might add that these holders are identical with those used in all Ferranti receivers, which are renowned for their trouble-free service. The prices are 9d., 1s. 3d. and 1s. 9d. respectively for the 4-pin, 5-pin and 7-pin types.



The new Mullard indirectly-heated rectifier, type I.W.3.

TWO NEW RECTIFIER VALVES

THERE are certain advantages to be gained by using rectifier valves of the indirectly-heated type, especially in conjunction with sets which employ an indirectly-heated valve in the output stage. The chief advantage is that, since the rectifier and receiving valve cathodes heat up at the same rate, perfect safety for the smoothing condensers and allied equipment is obtained without having to make use of a thermal delay switch. In addition, indirectly-heated valves are slightly more robust than those having a filament and are thus better able to withstand a certain amount of vibration such as is often caused in a powerful receiver due to the proximity of the loud-speaker.

Bearing the above points in mind, it is particularly interesting to observe that Messrs. Mullard, one of the pioneer valve firms, have now introduced a pair of indirectly-heated rectifiers which are "companions" to their popular D.W.2 and D.W.3 types. The new valves are styled the I.W.2 and I.W.3, the "I" and "D" standing for "indirectly" and "directly" (heated) respectively. They have characteristics almost identical with those of the two directly-heated counterparts, being, in fact, slightly different only in respect to the L.T. current which they consume. Both are full-wave valves, and the I.W.2 has a maximum rectified output of 250 volts at 60 milliamps when a voltage of 250 is applied to each anode. The heater consumes 1.2 amps. at 4 volts, or .2 amp. more than the D.W.2. The I.W.3 is capable of providing an output of 350 volts at 120 milliamps, whilst its heater requires 4 volts at 2.4 amps.; this latter figure is .4 amp. more than is taken by the D.W.3. Despite the slightly higher L.T. current consumption, these valves can in nearly every case be substituted for their directly-heated counterparts without any modification being called for. A slightly heavier load will naturally be placed upon the mains transformer but, provided that this component is of sound manufacture and has good "regulation," it will easily be capable of dealing adequately with the slight overload. It should be added that the indirectly-heated rectifiers are exactly the same price as the others with which they have been compared, namely, 12s. 6d. and 15s. for the I.W.2 and I.W.3 respectively.

SIEMENS BATTERIES FOR COSSOR RECEIVERS

OWNERS of Cossor battery receivers, type Nos. 335, 341, 342, 344, 3,456, 735 and 634 will be interested to learn that Messrs. Siemens, by arrangement with Messrs. A. C. Cossor, have introduced two new "Full o' Power" double-capacity batteries specially designed to fit the cabinets of the new Cossor receivers mentioned. The smaller battery, type No. 1,172, measures 10⅝ins. long by 8½ins. wide by 3ins. deep and will fit exactly into the cabinet of all the above receivers except the No. 634. This battery is of 120 volts rating and is listed at 15s. 6d. A type No. 1,175 is made for the Cossor No. 634 receiver, and this gives 120 volts as well as supplying 9 volts for grid bias purposes. It is somewhat larger than the model previously described, being 12¾ins. long by 8½ins. wide by 3ins. deep, and is retailed at 20s. Owners of the new Cossor receivers will know that these batteries can be purchased with every confidence and in the knowledge that they are officially approved of by the makers of their set. The type No. 1,172 battery is illustrated on this page.

Siemens new battery for Cossor receivers.

SOME INTERESTING MAINS UNITS

WE have just taken the opportunity of testing some of the high-grade mains units made by Messrs. Mains Power Radio, Ltd., and are of the opinion that these should be known to our readers. The range is a wide one and embraces every type of eliminator normally required for battery sets. There are three units for D.C. use, and these cost from so little as £1 1s. to £2. The smallest gives an output of 18 to 20 milliamps and has three fixed positive tappings, one of which gives 120 to 150 volts, another, 75 to 90 volts for a detector or first L.F., and the third, 75 to 90 volts for screening grid supply. A second unit, called the type No. D.C.2, has three similar tappings but, supplying up to 25 milliamps, it will operate receivers having up to five valves. The largest (type D.C.3) unit gives a maximum voltage of 185 at 25 milliamps and has two lower-voltage tappings just the same as those on the smaller models. This eliminator can be used with practically any receiver, including one using a small Class B valve in the output stage.

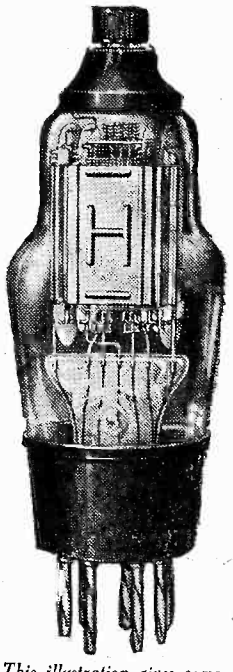
The A.C. models give similar output to those provided by the D.C ones just mentioned and are sold for £1 19s. 6d., £2 10s. and £3 respectively. None of them are designed for Class B use, however, but they can be used with receivers of the more normal type, taking up to the rated current outputs. An interesting feature of the A.C. units is that any of them can be obtained fitted with a trickle charger for charging a 2-volt accumulator for an extra charge of £1 2s. 6d.

Additionally, a trickle charger alone is included in the list and this is suitable for charging a 2-volt accumulator at ½ amp. The price of the charger is £1 9s. 6d.

On test we found these M.P.R. units extremely good, both mechanically and electrically. They are soundly constructed and housed in attractive frosted metal containers, which provide complete protection and a full measure of safety.

COMBINED DRIVER AND CLASS B VALVE

OUR congratulations are due to the High Vacuum Co., Ltd. (makers of the popular "Hivac" valves) who are, so far as we know, the first to introduce a combined driver and Class B valve. This valve should go a long way towards still further increasing the popularity of Class B amplification, since it makes for economy both in prime cost and running expenses, besides simplifying construction and effecting a saving in space. This latest valve, called the "Hivac" "Driver + B," is a true combination of the "Hivac" types L.210 and B220 valves, and though giving a maximum undistorted output of 1.25 watts, its filament consumes only .2 ampere, or the same as that of an ordinary small power valve. Its quiescent anode current is only 2.5 milliamps in all, this figure rising to a maximum of 32 milliamps at full load. The new valve is illustrated on this page, and it can be seen that, in addition to the seven-pin contacts on its base, there is a terminal mounted on top of the glass envelope. Six of the pins are identical in regard to their connections with those on a plain Class B valve of standard type, whilst the seventh pin, which is normally not used, is connected to the grid of the driver section. The driver anode is joined to the terminal on the cap. Priced at 15s. 6d., this valve is sure to prove popular with constructors.



This illustration gives some idea of the new combined Hivac valve.

BELLING LEE INTERFERENCE AID

WE have already drawn attention to the ingenious and useful Disturbance Suppressor which is manufactured and sold by Messrs. Belling and Lee. We have now received some additional literature from this firm which shows that they are really making a strong endeavour to assist the listener who suffers from interference, and this additional assistance is in the form of a printed questionnaire which is enclosed with each Suppressor, and which is also obtainable by any reader who is not certain whether or not to purchase one of these devices to alleviate or entirely remove any form of disturbance which he may experience on his particular receiver. The questionnaire, in addition to a number of queries relating to the apparatus and residence, etc., lists no fewer than thirteen well-known forms of interference suppressors. By filling up this form and sending it to Messrs. Belling and Lee they will do all in their power to assist a listener in fitting some device which will enable them to obtain good reception free from interference. There are twenty-two questions, and any reader may obtain a copy of this sheet upon application to Messrs. Belling and Lee. An interesting booklet dealing with the question of interference, and dealing also with the results which have been obtained in varying circumstances with this Suppressor, is also being published by Messrs. Belling and Lee and should be studied by all listeners who wish to know more about this subject.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

"Wireless Constructor's Encyclopædia" in Fiji

SIR,—I would like to thank you for the copy of the "Wireless Constructor's Encyclopædia" and to express my appreciation of it. Although I have not yet had the opportunity of reading it completely through, I am sure that I shall find it of the utmost value.

I read with interest in my last copy of PRACTICAL WIRELESS your preliminary remarks on "all-wave tuning coils," and hope that we shall soon be favoured with data for their construction. Wishing your paper every success.—G. F. FLEMDUS (Suva, Fiji).

[*A series of articles on "Making Your Own Screened Coils" commenced in the issue of* PRACTICAL WIRELESS *for December 9th.*—ED.]

Another Reader's Congratulations

SIR,—I thank you very much for the tool kit received safely. It is certainly the finest kit obtainable at anywhere near the price, and I do not know of another kit so adaptable. PRACTICAL WIRELESS is to be heartily congratulated on producing such a fine gift.—F. N. BEDWELL (Stratford-on-Avon).

"A Great Book"

SIR,—I wish to thank you for the "Wireless Constructor's Encyclopædia" which has just come to hand. It is indeed a very fine book, written in simple language, so that beginners can easily understand it, in fact the beginner finds something here to fascinate him, and the more advanced man finds just the information he wants. It is truly a great book.—J. M. L. LAWRIE (Dundee).

"A Splendid Kit"

SIR,—I take this opportunity of acknowledging the receipt of your Presentation Kit of Tools. I should like to thank you very much indeed for such a splendid kit, and I can assure you, sir, that I think it is the most practical and efficient gift idea thought of up to the present. I have shown it to some friends of mine (wireless "fans," needless to say), and they are, like me, of the opinion that it is an excellent and compact little tool kit. I have been a reader of PRACTICAL WIRELESS for some time now, and have found your articles and illustrations most interesting and instructive. I have been building sets, and experimenting with sets, for something like nine years now, but I have never found any of the wireless publications so interesting or lucid in detail as PRACTICAL WIRELESS. More power to your elbow!—GEORGE M. BUTCHART (Glasgow).

"Delighted With It"

SIR,—I have received my PRACTICAL WIRELESS pocket tool kit safely, and wish to express my thanks for same. I am delighted with it, and shall find it very useful. I am pleased to be one of the lucky recipients.—HORACE DOWDS (Belfast).

"In Very Good Condition"

SIR,—I beg to acknowledge receipt of PRACTICAL WIRELESS kit of radio tools for which I thank you. They appear to be in very good condition, and should provide excellent help in my repairs and construction work in the future. I read PRACTICAL WIRELESS with very great interest.—MARTIN T. FORD (Wells).

Six- or Seven-valve A.C. Mains Superhet Wanted

SIR,—I enjoy your paper very much but would be grateful if you would give us particulars and diagrams of a 6- or 7-valve A.C. mains superhet short-wave set with automatic volume control suitable for the Indian Empire broadcast. Battery sets are of little value here on account of the moist climate conditions. Atmospherics, too, make reception at times unbearable, and one is glad to shut down the set. Fading is another of our difficulties, hence the request for automatic volume control. I am sure your Eastern readers would very much appreciate such a design, and no doubt some of your home readers would also be interested.—GORDON HARROWER, F.R.C.S. (Singapore).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT a new television transmission system has been developed in which cathode-ray tubes and photo-electric cells are combined to produce greater detail than normally obtainable.

—THAT a new multi-valve is now on the market in which a Class B valve and its Driver are contained in one glass envelope.

—THAT it is not essential to use an intermediate frequency of 110 k/cs in a super-heterodyne receiver.

—THAT the frequency above mentioned is chosen only because it affords least interference.

—THAT the permanent magnet system used in a modern moving-coil loud-speaker has a flux density equivalent to many of mains-energised types.

—THAT the normal average flux density is in the neighbourhood of 10,000 lines per sq. cm. A power auditorium type of speaker may have a strength of 70,000 lines per sq. cm.

—THAT a combined reaction condenser and variable-mu potentiometer is now on the market.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Moving-coil *versus* Moving-iron Speakers

SIR,—As a retail branch manager, I am constantly being confronted with the fallacy, upon explaining the advantage of a moving-coil speaker from the frequency point of view, that conversion to this type of loud-speaker incurs additional battery expense. If you could find room in your valuable paper for this letter I think it would clear up a very confusing point.

Consumption from batteries is, of course, governed entirely by the valves employed in any receiver, and not at all by the amount of volume obtained, *except* in the case of the new type valves, where consumption is at a minimum during an interval in the programme and at a maximum when full volume is obtained.

These valves, known as "Class B," are, as most readers know, two separate "high-mag." valves in one glass bulb, working on a push-pull principle, each valve amplifying alternate half-cycles from the incoming signal applied to the grid.

Getting back to our point, the average moving-coil loud-speaker is not as sensitive as a good quality balanced-armature unit, and will therefore not give equivalent volume when compared upon the same radio signal.

This may have led to the fallacy before mentioned, and has probably arisen from the fact that upon replacing a moving-iron unit with one of the moving-coil type there is a noticeable loss of signal strength. When reconnecting a moving-iron loud-speaker, the leads must, of course, go to the proper terminals, otherwise it will become demagnetized, and consequently, the volume will decrease. With compliments and sincerest wishes for a prosperous and successful season.—E. G. PEARSE (Liverpool).

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

NUVOLIAN SPEAKERS

A FINE range of these high-class speakers is given in a folder we have received from Nuvolion Electrics, Ltd. The speakers are well known for their beauty of tone, largely due to the use of a patent cone which is moulded in one piece with the speech-coil former. By a special device an annular recess is compressed in the speech-coil former part of the cone to accommodate the speech-coil windings, with the result that with a gap of given width, a gain in clearance is obtained in the magnet gap. The speech coil end of the cone is reinforced by a special process which makes possible the more even reproduction of both bass and top, resulting in a remarkable brilliance of tone.

There are several permanent magnet models, ranging in price from 22s. 6d. to 42s. 6d., and also the P/7 mains-energized speaker, capable of handling up to 5 watts without distortion. This speaker is made in three sizes, priced at 22s. 6d., 25s., and 30s. respectively. Well-finished cabinets of modern design to suit the speakers are also listed at very reasonable prices. The address is Meredith Works, Park Crescent, Clapham Park Road, London, S.W.4.

FERRANTI RADIO PRODUCTS

THE excellence of Ferranti electrical apparatus is well known, and this excellence extends to every radio component produced by this firm. A complete range of these products, together with prices, is given in a thirty-four page pamphlet just issued by Ferranti, Ltd., Hollinwood, Lancashire. Included in the list are L.F. transformers, mains transformers, fixed and variable condensers, speakers, valves, test sets, receivers, and a fine range of high-grade radio meters.

TANNOY COMPONENTS

TANNOY PRODUCTS are well known for their power amplifiers and other radio apparatus, particulars of which are given in a loose-leaf folder issued by this firm. Amongst the apparatus dealt with in the leaflets are various types of power amplifiers, heavy duty speakers, radio-gramophone equipment, microphones, and receivers. The address is Dalton Street, West Norwood, London, S.E.27.

MULLARD VALVE GUIDE

THE new season's Mullard Master Valve Guide is a very useful book of pocket size, giving the operating data and characteristics of the complete range of Mullard valves. The application of each valve is simply explained and useful hints concerning such matters as grid-bias voltage, operating notes, and so forth are included for each type. The technical appendix, which occupies thirty-four pages, includes a useful article with many diagrams on automatic grid bias, an authoritative article on the operation of rectifier valves, a handy method of calculating the correct ratios for output transformers, a guide to the standard connections to the new seven-pin base, and many other informative articles. Copies of the handy book can be obtained from the Publicity Dept., Mullard Wireless Service Company, 111, Charing Cross Road, London, W.C.2.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE NEW ZEALAND DX CLUB

Now we want to ask a special favour of all members and non-members. A special short-wave station list with time schedule is being prepared, and any member who has any up-to-date schedules of America and Continental stations is asked to kindly send them in, together with a stamped addressed envelope, when a copy will be posted to them when ready. Lists will be published once a fortnight, and can be had by anyone enclosing 1½d. stamp. All communications for membership should be addressed to Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge, or Mr. Stephen Cullen, 33, Dilston Grove, London, S.E.16.

SLADE RADIO

The third annual dinner, and also the 300th meeting of this Society was held at the Imperial Hotel quite recently. Dr. C. H. Harcourt, the chairman and founder, and also Mrs. Harcourt were present, together with a large number of members and friends. During the evening the Challenge Cup was presented to Mr. J. Walley and replicas to Messrs. S. Phillips and G. T. Peck.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

NEW LEEDS RADIO CLUB

A new club has been formed in Leeds for youths interested in radio, and would welcome new members. Lectures are frequently given on all subjects from crystal and one-valve sets to short-wave work and television, and are accompanied with demonstrations. Persons interested are invited to call or write to the Hon. Sec., E. H. Page, 6, Bridle Path Crescent, Crossgates, Leeds.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

The Uxbridge Branch held its second meeting on December 13th. An enjoyable time was spent by all present. Several stations were tuned in upon the branch receiver, whilst gramophone records of WOR, WTIC, WIOD, WGY, WPG, WJZ, 2XAF, 3XAU, 9XF, 1XAZ, etc., were played over. These records are of actual reception. The making of gramophone records with the aid of an acoustic gramophone was demonstrated, Rome, London and members being recorded in this way. This was done by inserting an aluminium disc upon the turntable of the gramophone, and shouting into the horn whilst the needle in the soundbox was placed against the revolving disc. There is no charge for joining this Branch, and all interested are invited to write to Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge, for details.

We are notified by the Connecticut State College that they are putting over a DX concert, dedicated to the A.-A.R. and T.S., I.R.S., and DX listeners in general, on January 6th, 1934. The concert will be broadcast between 9.30 and 10.30 a.m., and the station will operate upon 600 kc/s, using the call letters WCAC. Reports should be addressed to Wm. J. Van Beynum, Connecticut State College, Storrs, Conn., U.S.A., or to L. W. Orton at the address given above.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of the Smethwick Wireless Society, Mr. C. D. Gwinn, B.Sc., of the Telegraph Condenser Co., Ltd., gave a lecture on "Electric Condensers." He dealt in detail with the construction and properties of the three main types—paper (inductive and non-inductive), mica and electrolytic. An interesting series of lantern slides was shown, illustrating the actual processes of manufacture.—Hon. Sec., Mr. E. Fisher, 33, Freeth Street, Oldbury, Nr. Birmingham.

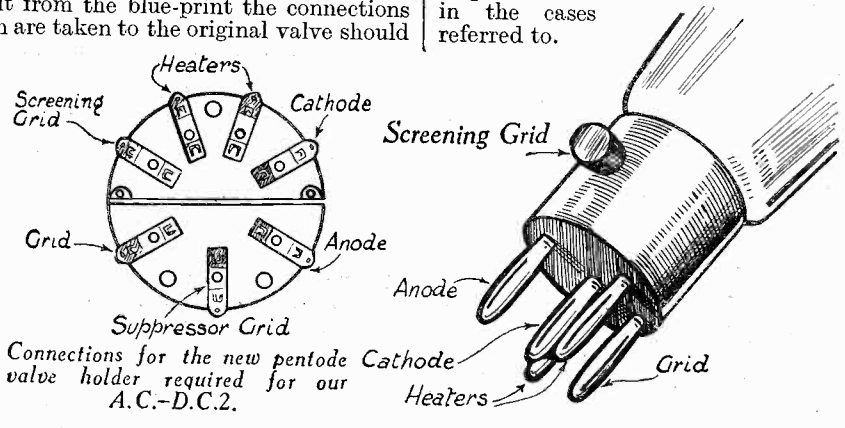
REPLIES TO BROADCAST QUERIES

RECEIVER (Stockton-on-Tees): G2HS, in the latest lists, is advertised as an amateur transmitter: G. W. Hale, 1, Bijou Villas, Grand Drive, Raynes Park, London, S.W.20; G5PL, J. A. Philpot, 21, Casino Avenue, Herne Hill, London, S.E.24; VU2DX, India. Further information regarding the latter can be obtained from: John G. MacIntosh, Dinjan T. E. Rangagora P.O., Assam, India. F. WILFORD (Eston): We can trace the following call-signs: WQP, Rocky Point (New York), 21.58 m.; GBB, Rugby, 22.08 m.; W2AOE, Dana A. Griffin, 3, Oakridge Avenue, Summit, New Jersey, U.S.A.; F8VL, Caradec, 177, Rue Croix-Nivert, Paris, 15, France; F8FG, Jillon, Rue Laplace-Chalette (Loire), France; FYH, Oran (Algeria); GMQ, Ongar (England). 21.85 m.; G2UC, E. J. Nock-Winstone, 1, Auriol Road, London, W.14; G6FG, N. Hendry, Hertford House, Sanderson Road, Newcastle-on-Tyne; G6US, N. E. Read, 32, Earls Court Road, London, W.8. For further information regarding the British amateurs, we advise you to write to The Radio Society of Great Britain, 53, Victoria Street, S.W.3.

THE A.C.—D.C.2 NEW PENTODE.

IN PRACTICAL WIRELESS dated September 2nd, we described a Universal receiver bearing the above name. The valve employed in the output stage of this receiver was an Ostar Ganz PT.3, and in the original model was fitted with a five-pin base and a side terminal. The stock of these valves has now been exhausted, and the latest supplies bear a 7-pin base. In order to assist readers who are constructing this receiver and who may obtain the new type of valve the accompanying illustration shows the new holder together with a diagram of the old pattern valve, and the numbering on these two sketches has been made to agree. Thus when wiring the circuit from the blue-print the connections which are taken to the original valve should be joined to the terminals on the new valve which bear identical markings. It should be noticed that the suppressor grid must also be connected direct to the cathode.

In some cases it has been found that the particular mains which are in use are rather noisy and this gives rise to hum troubles. In such cases the expedient of changing round the 8 and the 1 mfd. condenser should be tried. At present the 8 mfd. condenser is used as a smoothing device across the pentode biasing resistance, whilst the 1 mfd. is joined across the receiver side of the smoothing choke. Reversal of these two connections may result in an improvement in the cases referred to.



Connections for the new pentode valve holder required for our A.C.-D.C.2.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service in intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

SCREENED PRIMARY WINDING

"In an advertisement for a mains transformer recently I noticed that the term 'screened primary' was used. As I understand that a transformer operates by virtue of induction from the primary winding to the secondary winding, I am rather at a loss to understand how a transformer can transform when the primary is screened from the secondary. I should, therefore, be glad of your remarks regarding this point."—S. C. (Gloucester).

You are quite correct in your understanding of the working of a transformer, but you have omitted to differentiate between low-frequency and high-frequency currents. The transformer operates at low frequencies, and to screen low-frequency oscillations it is essential to use iron screening shields. The point with which we are concerned in a mains transformer, however, is the prevention of instability due to H.F currents finding their way either from the mains leads to the receiver, or in the opposite direction, and, therefore, a thin copper sheet, or, alternatively, a small winding of copper wire is arranged between primary and secondary windings, and when this is connected to earth H.F. currents are short-circuited and thus instability from this cause is prevented. Naturally, if the primary was enclosed in an iron box which was earthed, the transformer would not function.

MICROPHONE DESIGN

"Owing to the recent microphone articles which you have published I have been looking into the mike problem, and think I have discovered a new idea. You have shown how the carbon granules alter the resistance between the two poles of the microphone in order to convert to speech or music, and I tried to make one of these instruments up. My experiments were not very successful and I was thinking round the arrangement when I decided that the granules were not necessary. All that is required, to my mind, is two poles with some variation between them, and I, therefore, tried using two very thin copper sheets with air separation, and I arranged these like a condenser. By speaking on to the top plate the capacity is varied owing to the movement, and this ought to work. I was not able to get any results, and should like to know where my idea has gone wrong."—G. H. (Hampstead).

Your idea is quite sound, and the arrangement which you made up is known as a "condenser microphone." It is used extensively in America and has certain applications in wireless practice on this side of the Atlantic. The method of using it, however, is not exactly the same as in the case of the ordinary microphone, and you must include the device so that the capacity variation, as distinct from a resistance variation, will produce results. For instance, if an oscillating valve has the condenser microphone connected in its grid circuit, variations in capacity will vary the frequency of the oscillation and produce the required effects. Alternatively, the device may be used to link together two valves, the coupling between them serving to vary the total effect. You will find, however, that the carbon type of instrument will prove most suitable for home use and, in addition to its greater sensitivity, it may be used without any critical circuit modifications.

D.C. POLARITY

"I have made up the A.C.-D.C. 2 which you recently described, and I find that this suffers from some peculiar form of trouble. Some nights when I plug in I get very good results, but on some evenings it refuses to work altogether. I plug in and the set seems absolutely dud, no signals or reaction being obtainable anywhere. I have tried all through the evening with the same results and have given up in disgust, but the next day when I try it out it goes right away. I should be very glad if you could give me some idea as to where this trouble might originate."—S. K. (Surbiton).

We see from your address that you are on D.C. mains, and this is no doubt the cause of your trouble. When you insert the plug into the mains socket you must do so in order to obtain the correct polarity, and when once you have found which way round the plug should go you must mark it in some way so that it is always inserted in that position. If you do not do this you will find that the plug may have to be turned round when you fit it sometimes, and it is this which is preventing your signals on some evenings.

DATA SHEET No. 67.

Cut this out each week and paste it in a notebook.

MISCELLANEOUS VALVES NOW OBTAINABLE

Type	Reference No.	Filament Volts	Filament Amps	Anode Volts	Base	Price	Maker
Bi-Grid	210 DG	2.0	.1	100	5-pin	20/-	Cossor
	41 MDG	4.0	1.0	200	,,	19/-	
or	DG 2	2.0	.2	100	,,	20/-	Marconi
Double	SS 210 DG	2.0	.1	80	,,	20/-	& Osram
	SS 4 DG AC	4.0	1.0	200	,,	19/-	Six Sixty
Grid	DG 210	2.0	.12	100	4-pin	15/-	Tungsram
	DG 4100	4.0	1.0	100	5-pin	17/-	
	DG 2018	20.0	.18	100	,,	17/-	
Barretter for D.C. Sets	200/25	—	—	—	4-pin	—	Lissen
	251	—	—	—	4-pin	12/6	Osram
	180 R	—	—	—	—	5/6	Tungsram
Heptode Frequency Changer	VHT 4	4.0	1.0	200	7-pin	20/-	Ferranti
Special Diode Rectifier	CR 2	2.0	1.5	1,000	4-pin	15/-	Ediswan

FAULTY SWITCH

"My three-valve battery switch has now been working for nearly two years, but it has become erratic in its behaviour. When I wish to listen-in I find that I have to pull the switch very hard, and sometimes it does not work very loud. Is the valve worn out, or is the switch responsible for the trouble. It appears to be all right, but I do not know very much about the mechanical side of these switches."—T. B. A. (Newark).

The switch can be the cause of a lot of trouble, especially if it has been in use for a long period. You will probably find that the pear-shaped metal part at the top has become corroded, or the small springs into which it fits are weak and do not press tightly on the plunger. The best thing would be to purchase a new switch and fit this in place of the present one, noting the method of connection. Alternatively, you can remove the plunger by unscrewing the ebonite knob, and then press the two springs inwards and carefully clean the contact faces with fine emery. Do not be tempted to oil or grease the switch to make it work easier.

REDUCING MAINS OUTPUT

"I have been given a very neat mains unit for Christmas, but it gives 200 volts, and my set only wants 150 volts. How can I reduce the output without damaging the unit, and get the required voltage."—E. C. F. (Dover).

In order not to damage the unit, it is preferable to connect a resistance across the output, external to the unit. You will, of course, have to ascertain the total output of your set in milliamps and endeavour to find a resistance which, together with the receiver, will result in a voltage drop of such a value that the total drain on the unit will not be in excess of that for which it is designed. That is to say, if the unit is rated at 200 volts 60 milliamps, you must arrange that the total drain of set and resistance does not exceed 60 milliamps. This is necessary to ensure that 200 volts is obtained at the positive terminal, and also that the rectifier is not damaged.

THE BEST INSTRUMENT

"I am thinking of taking radio really seriously in the new year, and, therefore will buy some sort of measuring instrument as a start off. What would you advise me to get? A voltmeter, milliammeter, or a combined instrument? I want something which will not have to be thrown away when I really understand the subject, and one which will help me to understand many of the mysteries of the subject."—P. O. (Highbury).

Undoubtedly, the best thing for you to do is to buy a really good milliammeter. This will enable you to take various readings as the valves are functioning, and so help you to understand the mysteries of anode-current, etc., and with the aid of shunts it will also be able to measure voltages. An instrument really 0 to 2 milliamps will prove highly desirable as this may be converted to read higher currents by the simple expedient of short-circuiting it with various resistances, according to the range desired. Do not get a cheap instrument as it will not prove so accurate on the various ranges, and will also lead to troubles eventually.

BATTERY BIAS FOR MAINS VALVE

"I have built up a mains set, and it is nearing completion, but I am in doubt about one point. I bought some second-hand valves, and the H.F. and detector valves are standard and bear markings, but the output valve (a pentode) has had the name rubbed away from the glass, or it was badly engraved. Consequently I do not know what make it is or what bias to give it. How can I find out the best value for the bias, or other values to ensure that I work it at its best point?"—Q. L. K. (Hornsey).

Provided that your mains unit does not deliver more than 200 or 250 volts you may be certain that you will not be applying too much H.T. to a standard mains valve. With regard to the heater supply, also, this will no doubt be quite in order at 4 volts. The grid bias is the only really doubtful value and this would best be ascertained by connecting the cathode of the valve to earth, and joining a standard grid bias battery between the earth line and the G.B. terminal of the L.F. transformer. This would enable you to adjust the bias to obtain best results, and the value of the required resistor could then be ascertained by measuring the anode current of the valve and dividing this (expressed as a fraction of an amp.) into the grid bias voltage. The answer will be the ohmic value of the resistor, which may then be joined in the cathode lead in the ordinary way. The G.B. terminal of the transformer will, of course, then have to be joined to earth.

WIRE FOR COILS

"There is a little point regarding the wire used for tuning coils which I should like advice upon. I am told that cotton-covered wire is not very suitable, because of some property contained in the cotton. Could you please tell me if this is correct?"—A. B. (Rhyll).

The only real difficulty in connection with using cotton-covered wire for coil construction is that cotton absorbs moisture very readily, and therefore if the coil is likely to be placed in a damp position the moisture might cause a high-resistance short between adjacent turns.

FREE ADVICE BUREAU

COUPON

This coupon is available until January 6, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 30/12/33.

PRACTICAL WIRELESS
Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must by prepaid.

PREMIER Supply Stores, 20, High Street, Clapham, S.W.4. See our advt. on Page 748 of last week's issue.

THE following valves are guaranteed unused and perfect, and any valve differing from the makers' characteristics will be exchanged; and all latest types. A.C./Pens, P.T.4s. A.C.S.G/V.M.s, Pen. 4Vs, M.V.S.G.s, A.C.S.2/Pens, M.M.4V.s, P.T.625s, V.M.S.4s. D.C.2/Pens, D.P.T.s, P.M.24M.s, M.P.T.4s, V.M.4V.s, A.C.S.1/V.M.s, P.M.24B.s, D.C.28.G./1V.M.s, 11/-; M.S.4s. M.S.4B.s, A.C.S.G.s, S.4V.A.s, S.4V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S./2s, D.C.2S.G.s, 9/6; U.14s, 10/-. "Class B": P.M.2B, P.D.220, 220.B, 8/6, M.L.4s, A.C./P.s, P.M.24s, 8/-; A.C./H.L.s, 164V.s, 354V.s, A.C.2/H.L.s, 41M.H.L.s, U.10s, U.U.60/250s, M.H.4s, M.H.L.4s, 7/6; V.S.2s, 215S.G.s, 220S.G.s, P.M.12s, P.M.12A.s, 9/-; 442B.U.s, D.W.3s, 8/6; 215 P.s, 220P.s, L.P.2s, 4/9; P.2s, 6/6; P.T.2s, P.M.22A.s, 9/-; H.L.210s, H.210s, L.210s, L.2s, 3/9. All Types of Brand New American Valves in Stock, first-class makes: 247s, 235s, 224s, 236s, 237s, 233s, 238s, 239s, 245s, 244s, 12/-: 227s, 226s, 280s, 9/6; 242s, 232s, 11/-; U.X.250s, 16/-; 281s, 14/6. Carriage Paid. Cash with Order or c.o.d.—Ward, 45, Farringdon St., E.C.1.

EVERYTHING to make your own transformers (mains and push-pull), chokes and coils. Lists free.—Lumen Electric Coy., 9, Scarisbrick Ave., Litherland, Liverpool, 21.

ERICSSON 3/1 L.F. Transformers, List price, 17s. 6d. New and guaranteed. Our price, 2s. 3d. post free U.K.—Pioneer Radio, Coptic St., London, W.C.1.

REPAIRS TO ANY MAKE RADIO APPARATUS. 24 Hours service, guaranteed laboratory tested. Transformers, loud-speakers from 4/-. Eliminators, Mains Transformers, etc. New cones fitted to Moving-Coil speakers. Estimates free. Wates Volt/Amp meters a speciality, 3/6, other makes quoted for. Repair Dept. C. WEEDON POWER LINK RADIO CO., 185, Earlham Grove, London, E.7. Maryland 4344.

CHARGING WITHOUT MAINS!—Thousands are charging their own accumulators, why don't you? "Tonic" trickle-charger kits keep 2-volt accumulators fully charged. Ideal for remote districts. From 7/-, postage 9d. Full particulars, stamp.—Williams, Netherend, Cradley, Nr. Birmingham.

THE Exchange Specialists. Get your New Kits, Speakers, Radio Sets or Components from us. Your Old Set, Speaker or Components taken in part payment. Absolute satisfaction assured.—Rad-Auto-Gram Co., 39, Tulketh Street, Southport.

CHAL Electric offers Brand New Set Manufacturers' surplus Moving Coil Speakers. Magnavox Type D.C.144, 7-in. cones 100/190 D.C. (2500 ohms) (40/76 M.A.) and 190/280 D.C. (6500 ohms) (29/43 M.A.) at 19/- each. 152 Type, 9-in. cones same voltages at 26/- each. ROLAS F.6 (voltages as in Magnavox), 7¾-in. cones at 18/-; F.7 9-in. cones same voltages at 25/-. Permanent Magnets, F.6 P.M., list 49/6, at 28/-; F.7 P.M., list £3, at 33/-. State if Power or Pentode Transformer. All fitted Humbuckers. Also number of Class "B". State requirements. All goods Carr. Paid. Cash with order or C.O.D. Chal Electric, No. 6, Conduit Street, London, W.1. Regent 6240.

TELEVISION Guaranteed Receivers from £3, leading makers components. Constructor's Handbook, 1s.—Bennett Television, Jesmond House, Redstone Copse, Redhill.

WANTED good Modern Wireless Parts, Sets, Eliminators, Meters, Valves, Speakers, etc. Spot Cash Waiting. Send or bring. We pay more than any other Dealer. Open 9-8.—University Radio, 142, Drummond St., Hampstead Rd., N.W.1.

TELEVISION Constructors Guide, 1/3, illustrated catalogue free, notes 1d.—Ancel Cine Co., 16, Highbury Terrace, Nr. Highbury Station.

The Pilot

the world-famous figure-head—always to be associated with PETO-SCOTT Radio-by-Mail Service—wishes a happy and prosperous New Year to his many thousands of customers throughout the World, with specially cordial greetings to those friends who have been regular customers since the inception of PETO-SCOTT in 1919.

PETO-SCOTT CO. LTD.
77 CITY ROAD, LONDON, E.C.1
Telephone: Clerkenwell 9406/7 EST. 1919
West End Showrooms: 62 High Holborn, London, W.C.1

EASY TERMS PROMPT DELIVERY

Any Amplion, Blue Spot, Baker, Celestion, Epoch, R. & A. Rola, Sonochorde, Grampian, Igranic, Lamplugh, Magnavox, Ormond, W.B. or Ferranti Moving Coil Speaker Supplied.

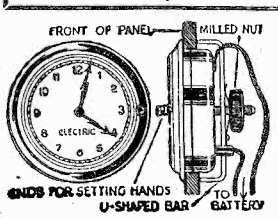
Send **5/-** *only*

and pay the balance by monthly instalments. No references. Entirely private and confidential.

KITS, PARTS, SETS, ELECTRIC CLOCKS ON EASY TERMS.

Write for Catalogue and state requirements.

TURNADGE AND PARTNERS, LTD.
Ludgate House, Fleet St., London, E.C.4.
Telephone: Central 1903.



FIT THIS ELECTRIC CLOCK TO YOUR SET!
NO MAINS NEEDED! KEEPS CORRECT TIME! NO WINDING!

Works off small battery lasting 12 months, or can be plugged into G.B. battery without affecting reception. Uses practically no current. Fits into hole 3⅛in. dia. in any panel up to ¼in. thick. Easy to fix—no screws required. Only ⅝in. from front of panel to back of case. Swiss movement. Hands set from front. Nickel-plated bezel. Useful addition to any set.

RIVERSIDE MFG. Co., Ltd., Dept. 21, Crisp Road, Hammersmith, W.6.
Telephone: Riverside 6392.

12/6
COMPLETE WITH BATTERY
POSTAGE 6D

RADIO SUPPLIES

Send your list of Radio needs for our quotation. Kits, Parts, Sets, etc. Everything in Radio stocked, prompt delivery. 7 days' approval. Catalogue free. Taylex & Standard Wet H.T. replacements stocked.
N. TAYLOR, 9, GROVE RD., BALHAM, S.W.12

SOUTHERN RADIO'S Wireless Bargains.—Set manufacturers' guaranteed surplus.

VARIABLE Condensers.—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; Lotus Dyblock Single Variable 0.0005 Condensers with dial, knob escutcheon, 4/9, (list 9/56; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1. 1,000 volt test, 7/- each· 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-. Block condensers 1,500 volt, with terminals 20 mfd. (2+2+2+2+2+2+2+2+1+1) 12/9; 10 mfd. (2+2+2+2+1+1) 8/3.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd., Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); Magnavox D.C. speakers, M.C. latest type "154" all voltages, 17/6 each. G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2.D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6 each (list £4/17/6); all kits brand new in original sealed cartons.

B.T.H. Senior Pick-ups, 1934, complete with volume control, 28/6 each (list 37/6). Blue Spot Pick-ups, with volume control, Model "88," 26/- each (listed 63/-). Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/- each (list 35/-); H.M.V. volume controls, 1/6 each (list 12/6). Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each. 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each. Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each, 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. assorted. Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

ALL Goods guaranteed New and Perfect and sent Carriage Paid.

PLEASE Note.—We have opened branches at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle Street, W.C.2, where callers are cordially invited to inspect our large stocks of wireless bargains. Please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

RADIOMART BIRMINGHAM.—New and revised list of surplus manufacturers' surplus and bankrupt stocks. The largest selection in country. No rejects or substandard goods. No misrepresentation. Send stamp and save pounds.—The Square Dealers, 19, John Bright Street, Birmingham.

"PRACTICAL WIRELESS"
MAINS TRANSFORMER
for Mr. Camm's A.C. Three. For any mains input 250-0-250 v. 60 m/a. 2-0-2 v. 1 amp. and 2-0-2 v. 3 amps for Usual price 21/-.
10/6

HOME BROADCASTER.

Why not be your own Announcer and give your voice a microphone opportunity? OUR NEW LESDIX No. 11 SUPER MICROPHONE in bakelite case is a marvel for speech and music reproduction on your radio set. For hand or stand. **5/6**

PHONES, PHONES, PHONES

120-ohm Sullivan Headphones, W.D. model, at a tenth of cost. For circuit testing, fault spotting, broadcast listening, microphone experiments, line signals, morse reading, A.C. Bridge work, condenser calibration for use with H.R. transformer. All one type and new. Aluminium body and headbands. Maker's price to-day is 15/- Our price 2/6 per pair, 3d. postage or 4/6 for 2 pairs post free.

ELECTRADIX RADIOS,
218, UPPER THAMES ST., E.C.4.
'Phone: City 0191.

ADVERTISEMENT INDEX

Practical New Year Gifts for Gardening Friends

THERE can be no better choice of gift for a garden-loving friend than a really good gardening book. Here are works written by men whose names are famous in Horticulture. Collingridges have specialised in gardening books for half a century, and each of those mentioned represents the best of its class.

10/6
Postage 9d. extra.

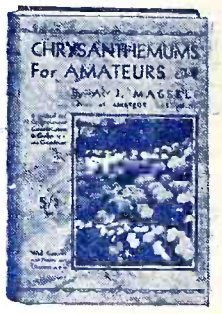
Flower Garden ... ... *T. W. Sanders*

7/6
Postage 6d. extra.

Amateur's Greenhouse ... ... *A. J. Macself*
Encyclopædia of Gardening ... ... *T. W. Sanders*
French Intensive Gardening ... ... *A. J. Macself*
Fruit and its Cultivation ... ... *T. W. Sanders*
Popular Hardy Perennials ... ... *T. W. Sanders*
Rock Gardens and Alpine Plants ... *T. W. Sanders*
Roses and their Cultivation ... ... *T. W. Sanders*
Vegetables and their Cultivation ... *T. W. Sanders*

5/-
Postage 6d. extra.

Alphabet of Gardening ... ... *T. W. Sanders*
Carnations for Amateurs ... ... *J. L. Gibson*
Chrysanthemums for Amateurs ... *A. J. Macself*
Garden Foes ... ... *T. W. Sanders*
Grapes, Peaches, and Melons ... ... *T. W. Sanders*
Orchids for Amateurs ... ... *T. W. Briscoe*
What Shall I do with My Garden ... *H. Sedgwick*

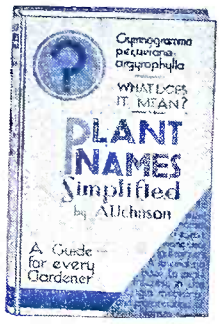


3/6
Postage 6d. extra.

Plant Names Simplified ... ... *A. T. Johnson*
Special Manures for Garden Plants ... *A. J. Macself*

2/6
Postage 6d. extra.

Wild Flowers through the Seasons ... *S. Hibberd*
Bulbs and their Cultivation ... ... *A. J. Macself*
Flower Beds ... ... *S. Ashmore*
Garden Doubts and Difficulties ... ... *H. Smith*
Gay Gardens from Seed ... ... *S. B. Williams*
Hardy Border Plants ... ... *T. W. Briscoe*
Simple Fruit Growing ... ... *P. K. Bear*
Simple Gardening ... ... *A. J. Macself*
Simple Greenhouse Management ... *J. S. Dakers*
Simple Pruning ... ... *N. Catchpole*
Simple Rose Growing ... ... *A. G. L. Hellyer*
Simple Rock Gardening ... ... *A. J. Macself*

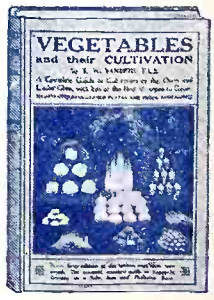


2/-
Postage 3d. extra.

Amateur Gardening Month by Month *T. W. Sanders*

1/6
Postage 3d. extra.

52 Week-end Jobs in My Garden ... *A. G. L. Hellyer*
101 Things about Gardening ... ... *H. A. Smith*
Gladioli and Dahlias ... ... *C. W. J. Unwin*
Sweet Peas for All Purposes ... ... *A. J. Macself*
Tomatoes and How to Grow Them ... *F. R. Castle*



The practical and beautifully illustrated series of Books listed above offers helpful usefulness to Gardeners beyond all comparison.

THERE ARE NO BETTER BOOKS ON GARDENING

OBTAINABLE BY RETURN OF POST FROM COLLINGRIDGES, PUBLISHERS OF THE BEST GARDENING BOOKS

"AMATEUR GARDENING" OFFICES, 148-9, ALDERSGATE STREET, LONDON, E.C.1

P. W. Gift Stamp No. 66

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

P. W. Gift Stamp "Popular Mechanics" No. 10