THE LUCERNE WAVE PLAN EXPLAINED!

Practical Wireless

3D

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Making the PORTOVISOR

The First PORTABLE TELEVISION RECEIVER

INSIDE! BUILDING THE NUCLEON CLASS B FOUR

EDITOR:
Vol. III. No. 68 || F. J. CAMM || Jan. 6th, 1934.
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ROUND *the* WORLD *of* WIRELESS

The Lucerne Plan

IT has previously been announced in these columns that the new "Lucerne Plan" would come into operation on January 16th, and many readers have written to ask in what way this would affect them. Briefly, it can be stated that the wavelength changes will have only a very slight effect upon the listening public, and that reception will be no more difficult than before. As a matter of fact, the modified wavelengths will, in nearly every case, simplify the selectivity problem, but so that every reader may have a thorough understanding of the new position which will be created we have had prepared a special article on this subject. The article appears on page 781 of this issue, and, since it has been written at the last moment, it is right up-to-the-minute, including even those wavelength adjustments which have been called for at the very last moment. This article gives further proof of our policy of keeping all readers well abreast of the latest developments.

Television *is* Hero

THERE are still a few sceptics who claim that television is not popular, and even that it cannot be so until vast changes have taken place in regard to the method of transmission and reception of light. These sceptics are generally of the "Micawber" type who are "always waiting for something to turn up" instead of helping in the development of new sciences. Whilst such people are dreaming, PRACTICAL WIRELESS is *acting*, and all readers will welcome the essentially-practical constructional article in this issue which tells you how to make a really efficient *portable* television receiver. This new piece of apparatus is easy to make, and by no means costly, so that there is no reason why every PRACTICAL WIRELESS reader should not proceed at once to enjoy to the full the many television broadcasts which are now made by the B.B.C. It is a true fact that the present television broadcasts are of distinct entertainment value, and any intelligent person who has lately "looked-in" with an efficient receiver such as the "Portovisor" will not dispute this fact.

The "Portovisor" is the *very first portable television receiver to be offered to the home constructor* and it marks a really definite forward step in modern television technique — yet another proof that "PRACTICAL WIRELESS" ALWAYS LEADS!

New KDKA Broadcast Feature

IN addition to the special transmissions made for the benefit of trappers, police, and other inhabitants of the Polar circle, the KDKA and W8XK stations of East Pittsburgh broadcast on every fourth Sunday of the month a brief sacred service and special messages to foreign missions throughout the world. This is carried out on the lines adopted by the Vatican station at Rome, except for the fact that the transmissions in this instance are destined to Baptist, Methodist, and Presbyterian denominations. The broadcasts may be picked up in the British Isles at G.M.T. 04.30 (Mondays) on 308 metres (KDKA) and 48.86 metres (W8XK).

France's High-Power Stations

THE seven high-power transmitters which the French State System is erecting have now been given official names in order to distinguish them from other private stations which are operating in the same districts. When reference is made to them they are to be known as follows: Toulouse-Muret, Lyon-Tramoyes, Nice-La Brague, Paris-Villejuiste, Lille-Camphin, Marseille-Realtor, and Rennes-Thouries. Their power varies between 60 and 100 kilowatts.

Germany Nearing Five Million Listeners

IN the course of November, 202,000 new registered licences were taken out in Germany, thus bringing up the total to 4,837,539. It is hoped that the five million mark may be reached by the New Year. To beat England's figures Germany still has a long way to go, as we are over one million ahead.

INSIDE!

No. 2 OF

"PRACTICAL TELEVISION"

MAKING A PORTABLE TELEVISION RECEIVER

AMATEUR TELEVISION IS HERE!

Wireless in Taxis

IN the United States, whence the idea originated, some two thousand taxi-cabs which were equipped with wireless sets for the entertainment of both driver and passengers were ordered by the police to remove the apparatus or to have their licences revoked. The decision was taken following an accident in which a man was knocked down and seriously injured. The New York authorities, in taking their decision, stated that in addition to distracting the attention of the drivers, radio broadcasts in such vehicles would increase street noises to the extent of making the taxicabs a public nuisance. Although they had become popular with the general public, the disadvantages of the innovation far outweighed its benefits.

More Powerful Broadcasts from U.S.A.

A RECENT decision taken by the American Radio Commission permits three of the most important U.S.A. stations to increase their power to 50 kilowatts. In these circumstances it is expected that the range of WGN, Chicago (416.7 m.), WBZ, Boston (303 m.) and WHAM, Rochester, New York (260.9 m.), will be greatly extended, and their broadcasts should be picked up more easily in the British Isles. It is anticipated that a similar licence may be given to them. They are: WMAQ, Chicago (447.8 m.); WHAS, Louisville (365.9 m.); KNX, Hollywood (285.7 m.); and WBT, Charlotte (277.8 m.).

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

Ekco Bakelite Factory

AT the bakelite plant at the Ekco works, fourteen hydraulic presses are in operation at the present time, including one 1,500-ton and two 1,100-ton machines. Each of these presses weighs over 100 tons, and stands 35ft. high from its base. This base is situated in vaults below the main floor of the plant. Nearly 2,000 tons of concrete were used in preparing the foundations, which are sunk 13½ft. into the ground. The hinged dies used for moulding cabinets weigh over 5 tons each, except on the 1,500-ton press, where the die weighs 15 tons. Two cabinets are produced simultaneously by this machine. The electricity consumed by the power plant amounts to nearly 10,000 units a day, or three and a half millions a year. Movement of an electrically worked lever plunges the upper die into the mould. A specially prepared sand-glass is used for timing, in preference to a clock or other mechanical device.

When the die is released, the cabinet is lifted out of the mould. Mortised screw sockets and metal inserts are firmly moulded in place, and the only operation needed to complete the cabinet is to break off a thin "flesh" of bakelite, and to give the edges a slight polish.

Concerts of British Music

IN addition to the seven new works to be introduced at the Six Concerts of British Music to be held in Queen's Hall, under the auspices of the B.B.C., some fifteen or so major works already well-known to the public are included in the programmes. On January 1st Delius's *A Song of the High Hills*, for chorus and orchestra, will be given, as well as Constant Lambert's *The Rio Grande*, for solo piano, chorus, and orchestra. The former is one of Delius's most beautiful works, and "is full of a sense of spacious solitudes and far horizons." Few contemporary works have won such wide popular approval as Lambert's *The Rio Grande*, which is undoubtedly one of the most successful attempts yet made to apply the rhythmic idiom of modern dance music to a serious symphonic work.

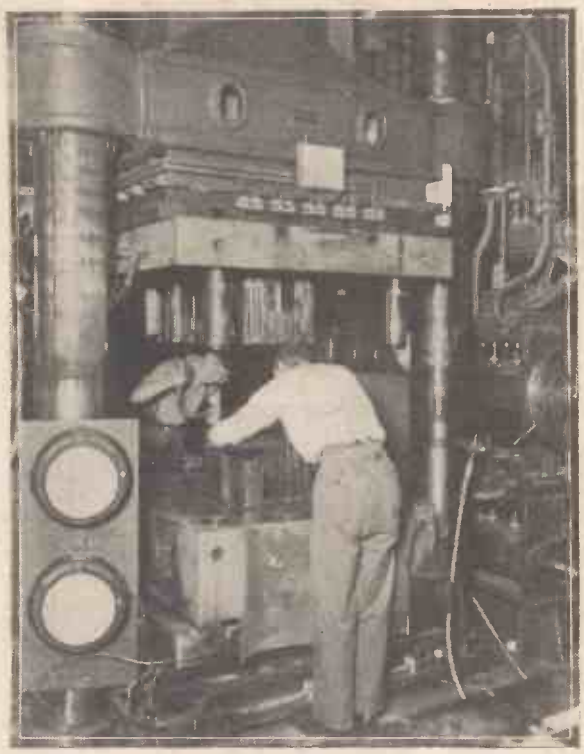
January 5th brings Arthur Bliss's *A Colour Symphony*, a work of outstanding merit deriving "its name from the fanciful attachment of a colour to each of the four movements." Another important work is Eric Fogg's Bassoon Concerto which is dedicated to Archie Camden, the renowned principal bassoon of the B.B.C. Orchestra, who is to be the soloist on this occasion.

Revue Fare from Birmingham

ON January 12th, listeners will hear on the Midland wavelength both a play and a revue. The play is Philip Johnson's one-act comedy, *To-day's the Day*, and it will be given by the Birmingham Repertory Theatre Company from the specially equipped studio at this theatre. The revue, a Martyn Webster production, is entitled *Hold That*, and represents an hour in a film studio. The book and lyrics are by Michael Barringer, author of many scenarios, and the music by Reginald Bristoe, who has also written many compositions for the films. Alma Vane and Hugh Morton will be in the cast.

INTERESTING and TOPICAL PARAGRAPHS

THE POWER OF THE PRESS!



How bakelite is moulded at the Ekco Factory. (See the paragraph on this page.) This press produces two Model 74 Cabinets at one stroke.

Musical Comedy Excerpts

THE name of David Wilson (baritone) has become synonymous with the Belfast station's programmes of musical comedy excerpts. He will make another appearance before the microphone on January 8th, in a programme of this type. It includes excerpts from *The Desert Song*, *The Maid of the Mountains*, and *The Lady of the Rose*.

Aladdin

THE first relay from the Opera House, Belfast, comes into the programmes on January 9th, when an excerpt from the pantomime *Aladdin* will be heard by Belfast listeners. This is the thirty-ninth annual pantomime which has been performed in this theatre, and a long list of "stars" has been assembled for it.

Missing Links

A COMEDY in three scenes by Charles K. Ayre, *Missing Links*, will be heard by Northern Ireland listeners on January 12th. Charles K. Ayre is one of the most popular of the Ulster playwrights, and a number of his plays have been broadcast, including *Loaves and Fishes* and *The Wee Moiley Cow*. *Missing Links* is a witty story of golf and science intermingled.

Military Band Concerts

THERE are two band programmes from the Midland Regional studio during the week—one by the Creswell Colliery Band, conducted by David Aspinall, on January 9th, and the other by the Birmingham Military Band, conducted by Wt Arthur Clarke, on the 11th. Interludes in the two programmes are occupied respectively by Patricia Rossborough (syncopated pianisms) and Harold Pollard (entertainer)

Interesting Talks from Midland Regional

TWO talks of special interest to the Midland coalfields will be given in the week's Midland Regional programmes. On January 8th, Robert Tredinnick interviews a Midland miner for the Boyhood in Industry series, and on January 10th Professor K. Neville Moss, of the University of Birmingham, gives a talk on the development of mining in the region during the past century. Professor Moss had several years of practical experience in Staffordshire coalfields before coming to Birmingham University.

Television in Italy

ENGINEERS of the E.I.A.R., the Corporation responsible for the broadcasting system, have installed the first Italian television transmitting and receiving station at the Palace of Electricity at Turin. Broadcasts will be made on short waves, namely, between 5 and 8 metres, and will consist of relays of topical events, public performances from theatres, and scenes from streets. A regular service will not be started until a similar station has been completed at Rome; it is being built for the transmission of sound films on 180 lines and 25 images.

SOLVE THIS!

Problem No. 68

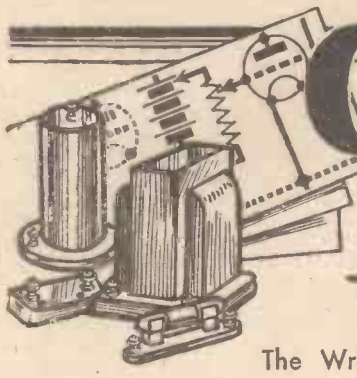
Jenkinson made up a mains receiver employing an S.G. H.F. stage, detector and L.F. stages. When tested results were very poor, and he accordingly connected a milliammeter in the anode circuit of each valve in turn. The detector and output stages were quite in order, but the H.F. valve showed no anode current at all. The H.F. choke was tested and found continuous, and an H.T. reading could be obtained between the anode and the earth line. All connections to the valve-holder were found to be soundly made and the valve was tested and found up to standard. What was wrong? 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. 68, and posted to reach here not later than January 8th.

SOLUTION TO PROBLEM No. 67

In joining the grid leak to the first valve, Jones overlooked the fact that a condenser was also needed in order to avoid short-circuiting the grid-bias control. It should have been joined between the grid and the top end of the coil.

The following three readers successfully solved Problem No. 66, and books have accordingly been forwarded to them:

K. Goldsmith, 47, Sycamore Grove, Southend, Essex. J. J. Keegan, 7, Hulton Street, Salford 5, Lancs. H. Jones, 67, Trehorne Road, Caerau, Bridgend, Glam.



Old Components in New Circuits

The Writer Explains in this Article How Many of the Newer Circuit Arrangements Can Be Tested by Using Old Components in Various Ways.

By BERNARD DUNN

ANY enthusiast who does a fair amount of experimenting collects so much surplus gear that there is some difficulty in knowing how best to dispose of it. Many of the parts could be used to make up an obsolete set, but that would not interest the keen experimenter in the least. The difficulty is that most of the newer circuit arrangements entail the use of new components of special design and having characteristics in keeping with the modern circuit, and there are undoubtedly many possessors of old parts who are not prepared to go to the expense of buying new ones and scrapping those which are already on hand. In this article it is hoped to show how old parts, perhaps taken from the junk box, can be employed with fair success in the latest types of receivers. It is not going to be suggested that the old parts will give results equal to those to be obtained by using modern ones of special design, but they will, at least, enable the experimenter to try out some of the newest circuit ideas at a minimum of expense.

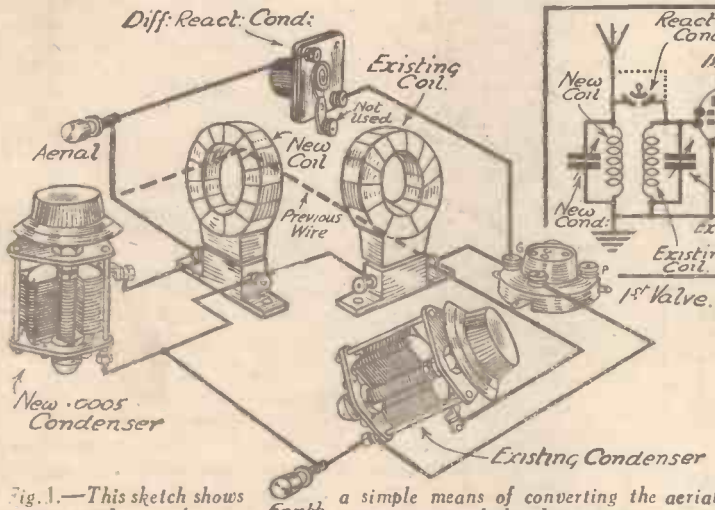


Fig. 1.—This sketch shows a simple means of converting the aerial tuning condenser of a receiver to a simple band-pass arrangement.

A Simple Band-Pass Scheme

Nearly every set built more than a couple of years ago suffers from comparatively flat tuning, so that anything which will give increased selectivity is to be appreciated. A very simple, and yet reliable, method of obtaining really sharp tuning with practically any type of set is shown in diagrammatic form at Fig. 1. In that drawing it is assumed that plug-in coils are employed in the existing set, but it should be mentioned that the very same idea is equally applicable to a receiver in which tuning is carried out by means of a more up-to-date dual-range tuner. It will be seen that the wire which previously joined the aerial terminal to the aerial tuning coil has been removed and another wire taken from the aerial terminal to one end of a second coil, across which is connected another .0005 mfd. tuning condenser. A connection is taken from the "top" end of each coil to the "fixed plate" terminals of a differential condenser, which may be of any capacity between .0001 and .0003 mfd.; the centre terminal of the condenser (moving plates) is not used. The arrangement shown and described is that of "top-capacity" band-pass tuning, the differential condenser providing the small capacity coupling. This condenser behaves like two small variable condensers connected in series, with a result that the actual capacity in circuit is only a few microfarads. Capacity is at a maximum when the moving plates are half in mesh with the two sets of fixed ones, and can be reduced almost to zero by fully meshing the moving plates with either set of fixed ones. This method of tuning not only increases selectivity, but makes the degree of selectivity easily variable. Thus the circuits tune most sharply when the capacity is at a minimum, and vice versa.

In trying the band-pass system described the new and old coils (or tuners, as the case may be) should be arranged with their axes at right angles, or else they should be screened from each other. If the two coils are identical the settings of the variable condensers will be practically the same for any particular wavelength, but in any case both condensers should be tuned accurately and with care. The simplest way to tune to any station is first of all to set the capacity of the differential to its maximum and find the rough tuning positions; after that the capacity can gradually be reduced and the condensers finely adjusted at the same time.

A.V.C. with a Spare Valve

Every experimenter wants to try automatic volume control, but it is not everyone who feels prepared to buy special apparatus until the efficacy of the scheme has been verified. Provided that a spare valve (of practically any type) as well as two high-tension batteries (which need not be in new condition) and a few odd resistances and condensers are on hand, an excellent form of A.V.C. can be tried out by using the connections given in Fig. 2. The drawing shows that a lead is taken from the "top" end of the detector H.F. choke to the positive socket of the 60-volt G.B. battery, whilst a 50,000 ohm potentiometer is connected between two tappings on the same battery, its slider being joined to the grid of the A.V.C. valve. Low tension for the A.V.C. valve is taken from the common source, but high tension and grid bias are obtained from the new batteries already mentioned. It will be seen that the negative lead from the H.T. battery is taken to the filament of the A.V.C. valve through a .25 megohm resistance, and it is across this that the A.V.C. voltage is set up. Consequently, a lead is taken from the negative end of this

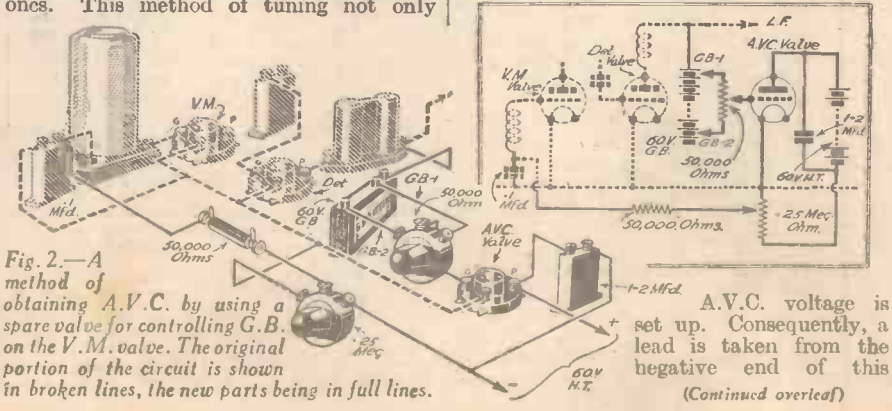
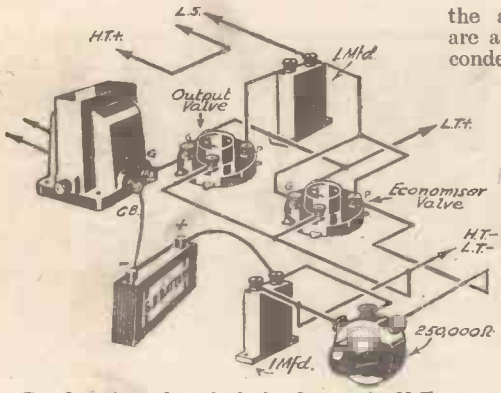


Fig. 2.—A method of obtaining A.V.C. by using a spare valve for controlling G.B. on the V.M. valve. The original portion of the circuit is shown in broken lines, the new parts being in full lines.

(Continued overleaf)



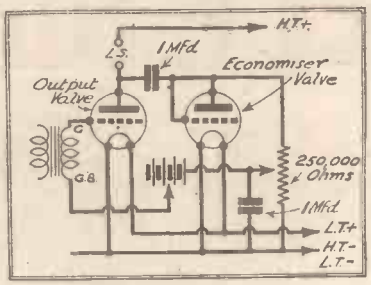


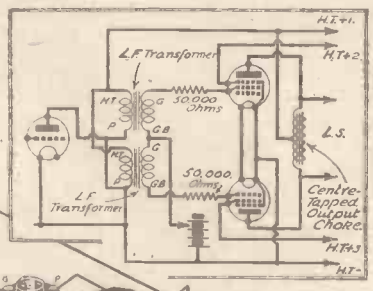
Fig. 3.—A good method of reducing the H.T. current consumption of the output valve by using an additional valve as an "economizer."

(Continued from previous page)

to the grid circuit of the V.M. valve, through a 50,000 ohm decoupling resistance. In order that the arrangement can be followed more easily, the new parts and wiring are shown in full lines, the normal portion of the receiver being represented by broken lines.. The method of adjusting this A.V.C. arrangement is as follows. First remove both G.B. wander plugs and tune in a weak station in the usual way; next insert the plug marked "G.B.—1" and find a position for it at which signal strength is unaffected; finally insert the second G.B. plug into a socket giving about 9 volts less than that occupied by the first plug. If signal strength then becomes less, adjust the potentiometer until it is brought back to the previous level. Should it be decided to retain the A.V.C. as a standard fitting a switch should be included in the lead from the potentiometer to the G.B. battery to prevent the latter from being run down whilst the set is out of use.

H.T. Current Economizer

Another interesting use for a spare valve is represented by the arrangement shown in Fig. 3. In this case the valve acts as an H.T. economy device by reducing the current consumption of the output valve, which may be either a triode or a pentode. The valve now acts as a half-wave rectifier and therefore the grid and anode may be joined together. The two are then connected to the anode of the output valve through a 1 or 2 mfd. condenser, a 250,000 ohm potentiometer being joined between the anode and filament of the valve. If two L.F. valves are employed in the set it will be necessary to use a second G.B. battery, but if there is only one the original battery may be used, and the connections to it altered as shown. The principle upon which the scheme works is fairly simple and is that some of the signal currents appearing in the anode circuit of the output valve are allowed to "leak" through the fixed condenser to the anode of the "economizer" where they are rectified, so setting up a difference of potential across the ends of the potentiometer. As the positive side of the G.B. battery is connected to the potentiometer, it thus becomes more positive in respect to the filament. This is the same as making the grid bias voltage applied to the output valve less negative. It will be understood that the voltage developed across the potentiometer varies in proportion to the signal voltages being handled by the output valve, and thus the negative bias actually applied becomes less as the signal voltages increase. Because of this it is possible to apply a nominal G.B. voltage much greater than that required by the valve when it is fully loaded, without running the risk of introducing distortion. The connections are self-explanatory, and it need only be added that the negative grid-bias wander plug should be inserted in a socket providing about twice the voltage previously employed, after which the potentiometer should be adjusted to a position at which there is no distortion on either weak or loud signals. A certain amount of initial experiment might be called for in order to find the most suitable voltage, but once that has been done the "economy" device is perfectly self-compensating. Try it!



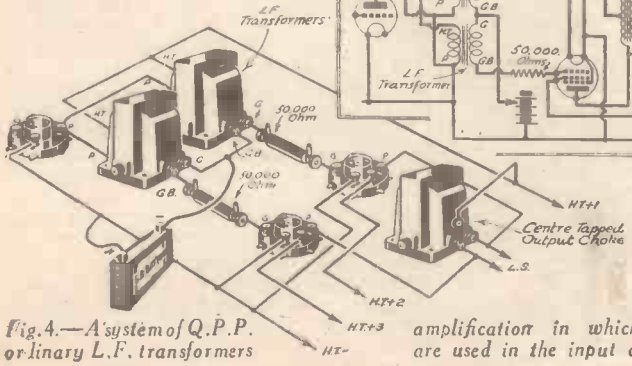


Fig. 4.—A system of Q.P.P. amplification in which two ordinary L.F. transformers are used in the input circuit.

Q.P.P. with Old Transformers.

Quiescent push-pull amplification is not used very widely now, due to the fact that Class B is cheaper and equally effective, but it gives a much greater output than can be obtained from an ordinary power or pentode valve. This system of amplification can be tried fairly easily and in a form that will prove reasonably effective by following the connections shown in Fig. 4. Two ordinary L.F. transformers are used, the primary windings of these being connected in parallel and the secondaries in series in order to obtain a high step-up ratio. "Stopper" resistances of 50,000 ohms each are included in the grid leads to the push-pull valves, but these will not be essential if the valves have similar characteristics and if the transformers are alike. In any case, however, it is desirable that the valves should be of the same types and that both transformers should have the same ratio. The valves represented are pentodes, although triodes can be used instead, merely by omitting the two leads marked "H.T.+2" and "H.T.+3." For preference, the output choke should be a special Q.P.P. one, but it is sometimes possible to obtain good results by using an ordinary centre-tapped choke, provided that it has a low D.C. resistance and a high inductance. As an alternative, a pair of plain chokes may be joined in series, the H.T. positive lead being taken from their junction. Of course any form of output choke would be unnecessary if a loud-speaker of the special Q.P.P. type were to be used with the set.

In using the improvised Q.P.P. amplifier the G.B. voltage to the last two valves should be increased to about twice the value normally required by the valves. It is also desirable that the preceding (detector) valve should be of comparatively low impedance; one of the "detector" or "L.F." type will fill the bill.

(Continued on page 803)

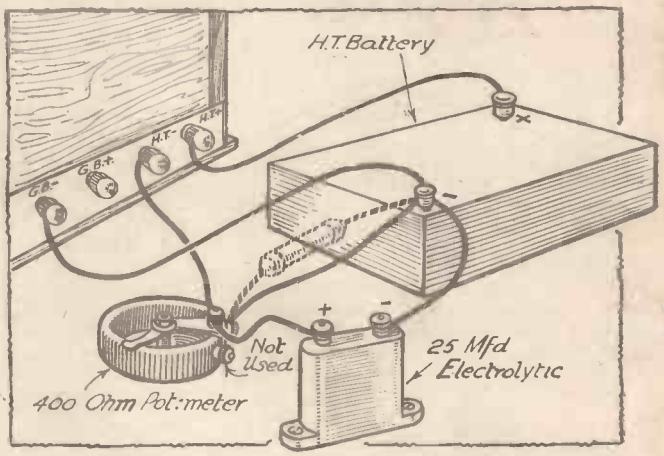


Fig. 5—Automatic grid bias can be provided in the manner shown above by making use of an old potentiometer.

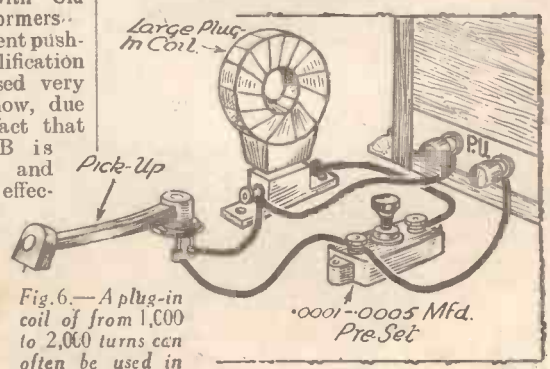


Fig. 6.—A plug-in coil of from 1,000 to 2,000 turns can often be used in series with a pre-set condenser as a pick-up scratch filter.

The LUCERNE WAVE PLAN and its CONSEQUENCES

In this Article, Mr. J. Godchaux Abrahams Discusses the New Wavelengths and Their Effect Upon Your Particular Receiver.

THE alleged revolutionary upheaval of the broadcasting world due to the coming into force of the new Lucerne Wave Plan on January 15th appears to have aroused some anxiety in the minds of many listeners. From the letters we have received on the subject it would seem that many readers are labouring under the impression that the game of "general post," played by the European transmitters on that date, is likely to cause considerable inconvenience, inasmuch as such a change in channels will necessitate a complete re-dialling and will render the present condenser scales obsolete.

Let it here be said that however drastic the re-allocation of wavelengths appears at first sight, the practical result of the allotment of new channels to the individual stations will not affect listeners to any appreciable degree. As will be explained later, the actual adoption of the new wave plan will only restrict the number of broadcasts available to the energetic knob-twiddler; it means that such advertised features as "logs of eighty and one hundred stations" may become a thing of the past. The number of transmissions receivable may be curtailed, it is true, but on the other hand the placing of the transmitters in the wave-band having been carried out in a more judicious manner, the relatively fewer programmes tuned in will be less marred by interference and thus a greater proportion of worth-while broadcasts should be available to the ordinary listener.

How the Stations are Divided Up

To understand the reason for which a lesser number of stations will be capture-able, it is necessary that some explanation should be given of the new Lucerne Plan. It must be borne in mind that at present wavelengths have had to be found for over two hundred and thirty different European stations, and this number is still likely to grow. Do not forget that in addition to providing a "place in the sun" for the broadcasting studios, clear channels must exist for wireless transmitters connected with such vital services as shipping, commerce, meteorology (weather forecasts, storm warnings, etc.), fog beacons, and for the police, military and naval authorities of the various States. For this reason the band which can be allocated for the use of wireless education and entertainment is strictly limited, and its boundaries are well defined. To place, therefore, over two hundred and thirty stations, it has been necessary to create one hundred and thirty separate channels comprised in three different bands, namely, (*a*) 1,000–2,000 metres (300–150 kilocycles), (*b*) 600–1,000 metres (500–300 kilocycles), and (*c*) 200–600 metres (1,500–500 kilocycles). Of these (*a*) and (*c*) may be said to be mainly reserved to broadcasting stations, but (*b*) is merely "lent" for the purpose on the understanding that the use of it may be withdrawn if it is found that any interference is caused to other services.

The reason for which exclusive channels for all stations has not been found possible is attributable to the fact that if mutual interference between two neighbouring stations is to be avoided, a definite separation of at least nine kilocycles must exist between their respective transmissions. It is, consequently, this necessary separation which has restricted the number of available wavelengths throughout the three wave-bands and which, for the same reason, has compelled the authorities to create four different classes of channels. These are (1) exclusive, (2) shared, (3) national common and (4) international common. Let me make this clear. In the first case we have, without doubt, a channel coveted by all, namely, an exclusive one to the station to which it has been allocated; in the second we find a wavelength which must be shared with some other transmitter. In this instance the geographical position plays an important part; where such a split channel has been allocated the choice has fallen on two stations at the greatest distance possible from each other. The disadvantage of this arrangement as against the exclusive wavelength will be seen later. The national and international common waves are self explanatory; the former are channels reserved to one country for a number of stations, and on which a programme may be simultaneously broadcast—it will be mainly used for relays—the latter represents a channel allotted to a number of different countries and, as may be realised, can only be used for low power stations in view of the fact that they may be operating at the same time, and will be broadcasting individual entertainments.

How the Listener is Affected

Now, before going into the question of power, let us see in what way this new plan can affect the listener. If we consider the exclusive channels nothing much has happened as, whether we tune in Rome on 420.8 metres as against its present position on 441 metres, we are not affected in any way. We may change the exclusive channels all round with the sole result that in the case where dial readings are in degrees we shall have to make a fresh list of the stations. Where the dials of manufacturers' receivers have been made out in station sequence, most of them have taken steps to provide their clients with new readings to conform with the wave plan.

If your neighbour, Mr. Brown, moves from No. 78 in your street to No. 20 in the next, there is nothing to prevent your telephoning to him; all that has happened is that his calling number has changed and you will require a new telephone list by your instrument.

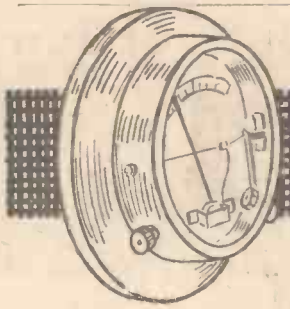
But what about shared waves? Well, here we are not so well off because, to use the same illustration, Mr. Brown and Mr. Smith may be living in the same house and now possess the same telephone number. In reality, in the case of shared channels, although a clean transmission may be secured locally, it is unlikely that a listener at a distance will be able to receive the transmission without interference.

If you happen to be living at a point situated half-way between the two stations and your receiver is capable of capturing signals from both, it is evident that the jumble of sounds originating from different programmes will be an unpleasant one. Such a contingency, however, so far as is possible, is warded off, as already stated, by allocating the channel to two transmitters at a great distance from each other. As an example let me cite Limoges (France) and Dniepropetrovsk (U.S.S.R.), both ordered to work on 328.6 metres. As there is little chance of your hearing the latter in the British Isles, there is a good possibility that the French concerts through the former will still be picked up fairly free from interference. Most of the trouble which might have arisen through the sharing of channels has also been obviated by limiting, in either or both cases, the power of the transmissions.

Allocating the Power

The new wave plan, however, had many snags to contend with, one of the most troublesome lying in the power to be used by transmitters already under construction. The limitation of energy permissible in the different wave-bands in respect of the various classes of waves could not be enforced without exceptions, a matter which increased the difficulty of compiling the plan. Roughly speaking, the power allowed to the stations is as follows: For those working on wavelengths between 1,000 and 1,980 metres, up to 150 kilowatts, with a special dispensation granted to Moscow, already in operation, to use 500 kilowatts; transmitters located on channels between 272.7 and 545 metres, 100 kilowatts (Budapest, Vienna, Prague, Leipzig, Paris PTT, Toulouse PTT and Rennes-Thouries were exempt from this restriction); 60 kilowatts maximum if working between 240 and 272.7 metres and 30 kilowatts for waves between 200 and 240 metres. For the common waves allotted to stations in one specified country, not more than 5 and 2 kilowatts, and for international waves in the last class 200 watts is not to be exceeded.

(*Continued on page 784*)



MAKING A HOT-WIRE AMMETER

An Ammeter has Many Applications in Wireless, and This Article Describes How a Simple and Efficient Instrument can be Made at Home.

THE construction of a meter for measuring current is not a task that is generally undertaken by the amateur, principally because it is considered to be outside his scope. This might be true so far as instruments of the moving-coil or moving-iron type are concerned, but a hot-wire instrument can easily be made by anyone who is accustomed to using simple tools, especially if he has some knowledge of electricity. A hot-wire ammeter of the kind to be described is illustrated in Fig. 1, and it can be seen from this that there are very few parts required, whilst none of these are of an intricate or complicated nature.

How It Works

Before dealing with the actual constructional work it will be better to describe briefly the principle upon which the type of meter under discussion operates, so that later remarks will more easily be understood. As the name implies, a hot-wire ammeter reads the intensity of a current due to the heating of a length of wire. The wire used has a (comparatively) high resistance, being made of german silver, nichrome or some similar alloy, and thus as current is passed through it the wire becomes hot, just in the same way as does the element of an electric fire or the filament of an electric lamp. It is well known that when a metal is heated it expands, and it is this property which is made use of in the hot-wire type of meter. The length of resistance wire in the meter is so arranged that when it expands it is caused to sag, due to the tension exerted upon it by a thread attached to a spring. In passing from the wire to the tension spring the thread passes over a small pulley or roller to which is attached a pointer. Thus, as the resistance wire expands (and sags), the thread moves, rotates the pulley, and so drives the pointer over a scale, which may be calibrated in amps or volts as required.

Parts Required

Rather than give a specific design entailing the use of exact parts, which might in some case make it necessary to employ a lathe in their construction, more general information will be given so that it may be applied in utilizing small parts, as well as odds and ends, that might be on hand. The principal parts are shown in Fig. 2, and in that illustration it is assumed that the reader will have facilities for turning up in a lathe the wooden case. Failing such facilities, it will be found quite possible to employ a rigid cardboard or paxolin tube mounted on a wooden baseboard. Yet another alternative is to use a short length of metal cylinder attached to a baseboard, but in that case insulating washers must be provided for all the terminals and screws. The casework is dimensioned, although the figures given are really arbitrary ones, which may be modified in accordance with the actual component parts which are made use of. Assuming the use of a wooden case, the first thing to make is the "bridge" that serves as a mounting for a steel spindle, on which are mounted the pulley and pointer. All dimensions are given, and the most convenient metal is mild steel hoop, but those who prefer to make a rather better-looking job will prefer to use a stout gauge of brass sheet. First make the piece marked "A" by cutting off the metal to length and bending it in a vice. Next drill the necessary holes; three of these are about ⅛in. diameter, the third being drilled 5/32in. and tapped out with a 3/16in. Whitworth tap. After that the piece marked "B" can be cut to length and suitably drilled, using a ⅛in. bit. It is essential that the holes in "A" should register exactly with those of "B," and this can be ensured by using the former part as a template. The final task in connection with the spindle-mounting "bridge" consists of making a small indentation with a centre punch in the centre of the piece marked "B" and also in the centre of the 3/16in. grub screw marked "C." Here again accuracy is an important feature, so great care should be taken that the two punch marks are directly opposite to each other. This can be ensured by first making a pointed screw to fit in place of "C," mounting "A" and "B" on a flat piece of wood and tightening down the screw until its point makes a mark on "B"; this mark will then indicate exactly where the point of the centre punch should be placed. Another way is to use the ordinary screw, turn this down until its end touches plate "B," and then carefully scribe round it, afterwards finding the centre of the small circle.

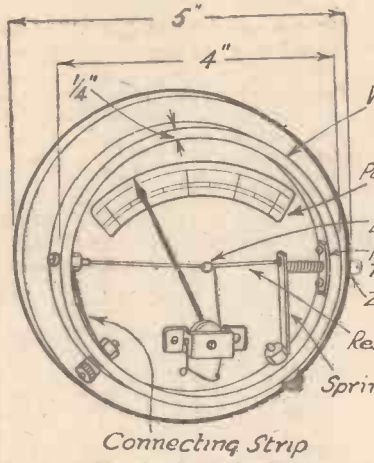


Fig. 1.—Sketch of the finished hot-wire meter described: dimensions are only approximate.

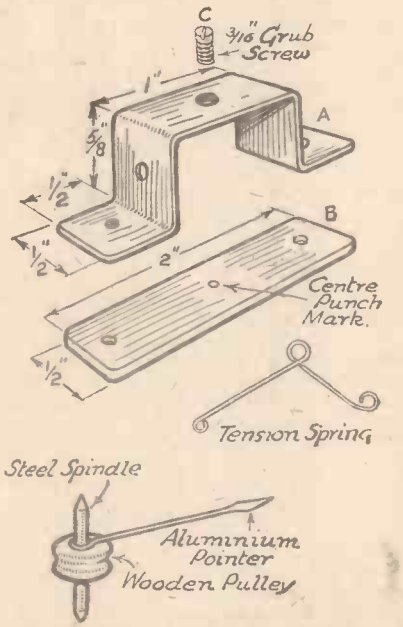


Fig. 2.—The above sketches give all constructional details for the more important parts of the meter described.

Fig. 4.—This sketch shows how the paper scale is calibrated in fractions of an ampere.

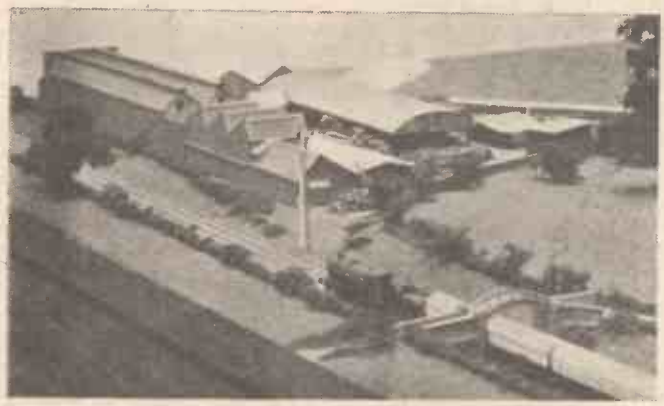
The Spindle and Pointer

The small spindle can next be made from a short length of steel wire. Both ends are pointed, and the points can be formed most satisfactorily in a lathe, but failing that, they can be made with a file, or on a small grindstone or emery wheel. The points should be really hard, and, therefore, if the wire has been filed or ground, it will be best to harden them by heating the wire to redness, allowing it to cool to the point at which it is just changing from yellow to blue and then plunging it in water. A small pulley must next be made to fit tightly on to the spindle, and this can be done most easily in a lathe. On the other hand, a suitable pulley might be found in the junk box, whilst failing that, it can be

(Continued on page 784)

TABLE-TOP CINEMATOGRAPHY

How interesting Movies can be Taken with Models.



This model looks like "the real thing" in a home cine film.

Studio pictures, whether "stills" or "movies," go on through winter, undeterred by the short days and poor natural light. But you do not need to be a professional to take good indoor shots. It is quite sufficient to use the ordinary lights of the room, together with an inexpensive lamp in a good reflector. One of the simplest forms of indoor photography is the "table-top" picture. Model railway engines and accessories in these days are built with careful regard to detail, therefore a good imitation of the real thing can quite easily be made up and an interesting movie table-top film can then be taken. Amateur photographers are given still more scope for ingenuity in movie table-top pictures which have an increasingly popular future.

Other Features

A HOME-MADE TALKIE APPARATUS FOR TWELVE SHILLINGS AND EIGHTPENCE

How a reader solved the cost problem.

SECRETS OF TITLING

By the Editor.

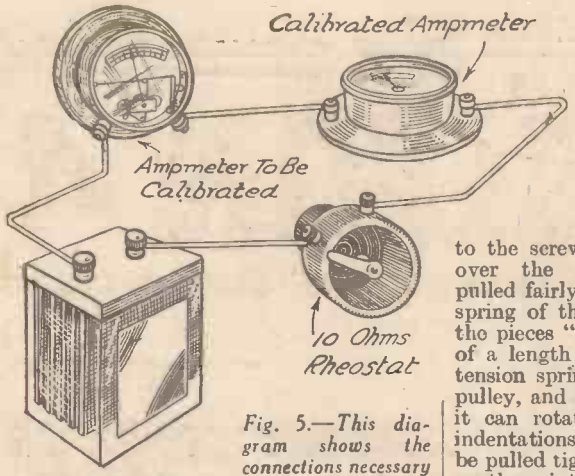


Fig. 5.—This diagram shows the connections necessary when calibrating the hot-wire ammeter.

(Continued from page 782.)

built up by winding a narrow strip of thin paper round and round the spindle, applying thin glue while winding.

The tension spring is called for next. A suitable shape is indicated in Fig 2, although the exact form is by no means important provided that it maintains a (rather weak) steady tension on the thread. A short length of 24-gauge spring-steel wire is most suitable, and if this is not on hand it can be obtained from practically any ironmonger. At first it will be quite hard and springy, so that it is impossible to bend it to shape without first annealing it by holding it in a gas flame until it becomes red hot. Allow the wire to cool slowly, and then bend to shape with a pair of small round-nose pliers. The wire must then be tempered again by heating it and plunging in water when it cools to the temperature indicated by a blue coloration. The spring is attached to the piece we have called "A" by means of a short 4 B.A. bolt and nut.

When that has been done the spindle can be fitted with a pointer made from a length of 22-gauge wire. Copper wire of this gauge can be used, and it should first be straightened and then looped round the spindle and secured with a spot of solder. Later it can be cut to the correct length, after which the end should be flattened out to enable more accurate readings to be taken.

The Zero Adjustment

The final step in regard to the constructional work is to fit the terminals (either 4 B.A. or 2 B.A. can be used) to the case, mount the length of resistance wire, and fit the "zero adjuster." The latter name might not be quite understood, so it should be explained that after prolonged use the resistance wire will become permanently elongated, and therefore some provision must be made for tightening it and setting the needle to read zero when no current is being passed through the meter. The method of complying with these requirements is straightforward enough, since it is only necessary to attach one end of the resistance wire to a strip of springy brass, which is held under the head of one terminal and arranged so that it can be moved by means of an adjusting screw. The latter is merely a 2 B.A. brass bolt passed through a strip of brass or steel tapped out and screwed to the inside of the case. If the latter were made of metal, the tapped plate would, of course, be sweated on instead of being held by screws.

Assembling the Parts

In assembling the meter the terminals and zero adjuster should first be fitted. After that, a screw should be attached to the inside of the case diametrically opposite to the adjusting screw. One end of a length of resistance wire should then be soldered to the screw, a small glass bead slipped over the end, and the wire then pulled fairly tight and soldered to the flat spring of the zero adjuster. Now mount the pieces "A" and "B," attach the end of a length of thin thread or silk to the tension spring, wind this once round the pulley, and fit the spindle in place so that it can rotate easily in the centre-punch indentations. Finally, the thread should be pulled tight and tied to the bead. Now set the pointer to a zero (left-hand) position, when the meter will be ready for calibration. Before this can be carried out a scale, consisting of a strip of paper glued on to a thin strip of wood, must be made as shown in Fig. 3. This should be fitted inside the case by means of two screws which can easily be removed again later on.

Calibration

For calibration purposes the meter should be connected up in series with an ammeter (any type) of known accuracy, a filament rheostat of between 10 and 20 ohms, and an accumulator (see Fig. 4). By turning the knob of the rheostat into various positions a number of current readings can be taken, and the positions of the pointer corresponding to, say, .25, .5, 1, 1.5, and 2 amps. can be marked off in pencil on the blank scale. After that the scale can be removed and neatly divided up into suitable parts as shown at Fig. 4. It will be found that the divisions are not proportional to the current passing, but that they are more "crowded" toward the bottom of the scale; this is due to the fact that the sag of the wire is not proportional to the expansion, nor is the expansion proportional to the current.

So far no mention has been made of the gauge of resistance wire needed. As a matter of fact, this depends upon the maximum current reading required, the particular kind of wire employed, and the size of the meter (more correctly, the length of the wire). When using Eureka wire and making the case to the approximate dimensions shown, the wire should be about 32 s.w.g., when a maximum reading of 1 amp is required, or 26 s.w.g. when the instrument is to read up to 2 amps. If a still lower maximum reading is called for, such as when measuring the aerial input current from a transmitter, 36 or 38 s.w.g. wire will prove more suitable. It might be mentioned that it is always best to make the meter so that the full-scale deflection is only slightly greater than the value of current to be measured most frequently. By following this rule the most accurate results will be obtained, since it is obvious that more correct readings are to be obtained on the "open" part of the scale.

The instrument described can be used as a voltmeter for reading up to 10 volts or so, if the resistance wire is of about 32 gauge. In that case it can be calibrated with fair accuracy by connecting it in *parallel* with a *high-resistance* voltmeter which is known to give true readings.

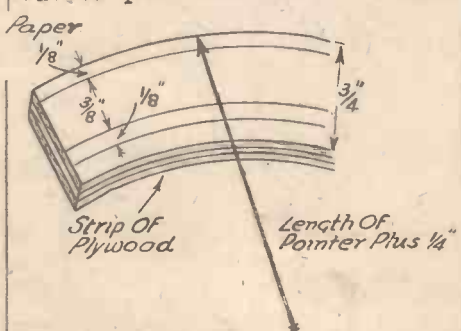


Fig. 3.—Showing how the paper scale is drawn and mounted on a strip of wood.

THE LUCERNE WAVE PLAN

(Continued from page 781)

In addition, stipulations were made as regards direction of aerials and also in some instances transmitters must reduce their power after sunset. As you will see, many points have been considered and much has been done with a view to making the plan the best possible in the circumstances; it would be a great pity if in practice its results fell far short of its theoretical possibilities.

The British listener who is content to limit his wireless entertainments to those provided by the B.B.C. stations has no cause for complaint; the B.B.C. authorities have successfully fought out his case and, as will be seen by the channels secured, the majority of wavelengths are exceedingly favourable. There is, in general, very little change from those used to date.

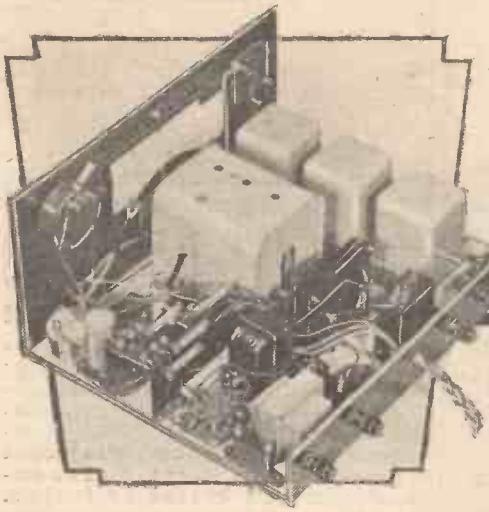
When, however, the 150-kilowatt station at Droitwich is ready to take over its duties as a National transmitter in lieu of Daventry, some further alterations will be made. The power of the London, North, West and Scottish Regionals will be raised to 70 kilowatts and the London, North and West National on the medium-waves will close down. This will permit a slight change over in channels which will prove to our advantage.

Re-shuffling May Be Necessary

It is to be remembered that of the thirty-six European States interested in the Lucerne discussions, delegates of only twenty-seven countries agreed to the decisions on the day the Convention was signed. As Finland, Luxembourg, Sweden, Poland, Lithuania, Hungary, Holland and Greece refused to recognise the wave plan—at least in some of its findings—a certain amount of re-shuffling may still take place.

As far as can be foreseen the failure of the dissenting States will not affect the medium broadcasting band, but there is every likelihood that much alteration must be made in the allotment of channels between 1,000 and 2,000 metres before these countries will declare themselves satisfied. In these circumstances, it would appear that stations working on the "high" waves may not change over on January 15, but until further notice will continue in their present positions.

It is evident that the Lucerne Plan was only compiled as a *modus vivendi*, and that if it is to satisfy all interested parties, some concessions may be needed. As it is, it is supposed to stand good for two years, but revisions are not barred, and it forms an excellent basis for negotiations. It will be given a thorough trial when stations take up their allotted channels in January, and as may be seen from the list published, it should go far to alleviate the present congested state of the ether.



Building the NUCLEON 4

A Simply-Constructed and Highly-Efficient Four-Valve Receiver Which Employs Iron-Core Tuning Coils and a Class B Output Stage

A LARGE number of readers have asked for a receiver which embodies the two most recent improvements in battery-receiver design, and also has a wavelength calibrated dial. The great difficulty with this type of tuning device is that it is not always possible to obtain an accurate indication of the exact wavelength to which the receiver is tuned owing to the use of coils and condensers of different makes, or which are not adapted to one another. The condensers which are supplied by Messrs. Wingrove and Rogers are designed to be fitted with full-vision scales having an accurately calibrated wavelength scale, and these are designed for coils having a certain inductance value which must agree on both wave-bands. Thus, in this particular case we find that the scale is suitable for coils which on the medium wave-band have an inductance of 157μH and on the long wave-band an inductance of 2000μH. The Nucleon coils manufactured by Messrs. Wright and Weaire are found to have these precise figures, and thus it should be possible to combine the two components to provide an accurately tuned receiver. Our experiments have confirmed this point, and we are thus able to introduce to the reader an easily constructed receiver which does not employ an expensive combined tuning pack, but which does, at the same time, enable him to obtain one of the great advantages of the commercial receiver, namely, a calibrated receiver. Station searching is greatly facilitated when this type of receiver is employed, as all that is necessary is to look up the wavelength of the desired station and to set the pointer to that portion of the dial. If the station is within range it will be heard, and there will be no loss of time due to searching for a station which is probably out of range of the receiver.

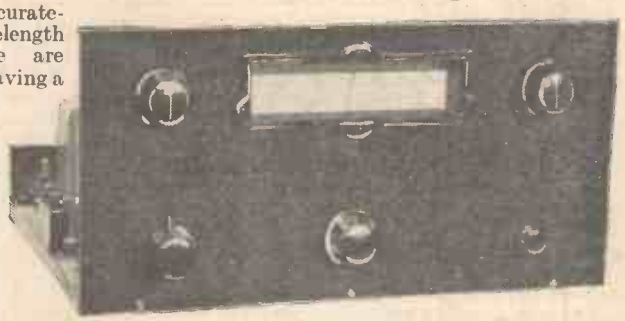


Fig 1.—Neat panel layout of the Nucleon Class B Four.

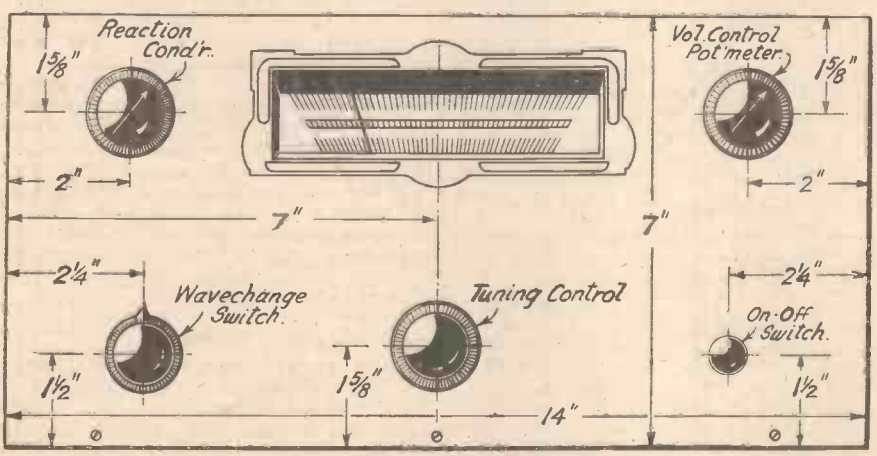


Fig. 2.—Front of panel layout.

The Circuit

Having described the principal feature of this circuit, and the reason for its adoption, we may examine the remainder of the receiver, and see in what manner it differs from other sets which we have described in the past. Firstly, it will be seen from the theoretical circuit, Fig. 5, that the tuning of the aerial circuit is carried out by means of one coil, and this is coupled to a second coil in the grid circuit of the variable-mu H.F. valve,

(Continued overleaf)

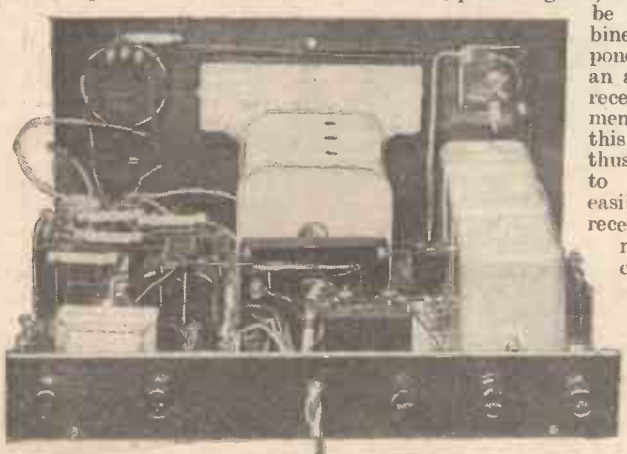


Fig. 3.—Rear view of the Nucleon Class B Four.

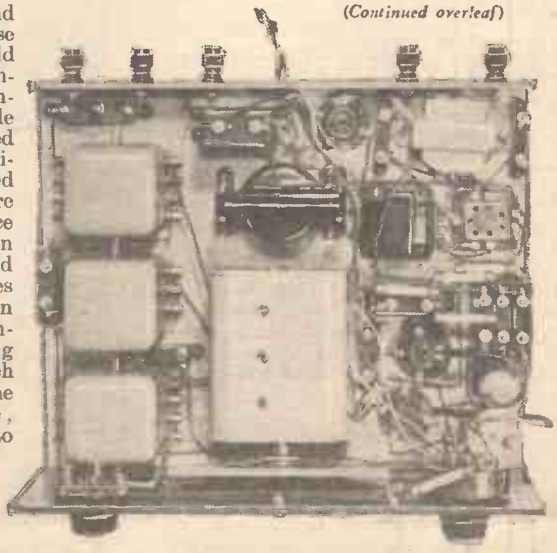


Fig. 4.—Top view of the Nucleon Class B Four.

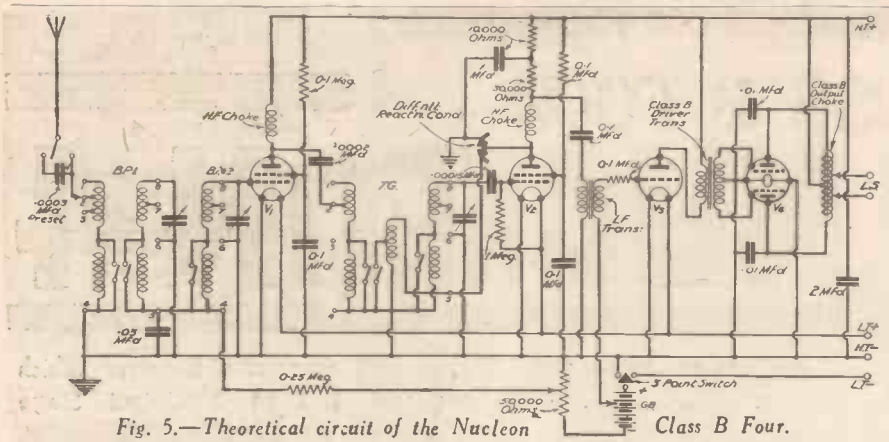


Fig. 5.—Theoretical circuit of the Nucleon Class B Four.

(Continued from previous page)

the complete arrangement forming a highly-efficient band-pass tuner, giving a high degree of selectivity with good signal strength. The combination of this type of tuner with a variable-mu valve thus gives one of the most efficient types of H.F. amplifier which can be built for battery operation at the present day. The H.F. valve is coupled to the detector valve by means of a similar coil, which is provided with a winding for reaction purposes. This may be used to augment signal strength and also to assist in selectivity where this is found necessary. The three tuned circuits are tuned by the separate sections of a ganged condenser as already mentioned, and trimmers are provided on this condenser in order to balance out stray capacities when the receiver is first put into commission. The detector valve is transformer-coupled to a valve of the small L.F. type, and this in turn is transformer-coupled to an output valve of the Class B type. A tone modifier is fitted in the output circuit, and this supplies a moving-coil loud-speaker. It will be seen, therefore, that the circuit is perfectly straightforward and possesses no "frills" or other stunts which might render it freakish in operation. It may thus be built up in the certain knowledge that it will function straight away, and no time will have to be spent in carrying out intricate circuit balancing.

The Layout

From the photographs it will be seen that in this instance we have departed from the usual chassis construction. Quite a number of readers have asked for a receiver of this design, as they apparently object to the wiring of a receiver on two sides of a baseboard. They find that they get confused when passing wires from one side to another, and, although we do not think that the majority of readers experience this difficulty, we have arranged this receiver on the older method of construction in order to cater for everyone. It will be seen that this unfortunately results in a rather crowded layout, many

(Continued on page 804)

LIST OF COMPONENTS FOR THE NUCLEON CLASS B FOUR

- One set Wearite Iron-Core Coils (Types BP. 1, BP. 2 and T.G.). (Wright and Weaire.)
- One Polar Star Minor Three Gang Condenser with Horizontal Drive. (Wingrove and Rogers.)
- One Polar Pre-Set Condenser (.0003 mfd.) (Wingrove and Rogers.)
- One 50,000 ohm Megite Potentiometer. (Graham Farish.)
- One .00015 Differential Reaction condenser. (Graham Farish.)
- Three 4-pin valveholders and one 7-pin. (Graham Farish.)
- One .03 mfd. Non-inductive condenser } T.C.C.
- Three .1 mfd. Type 81 ditto } T.C.C.
- One .0002 mfd. Type 34 ditto } T.C.C.
- One .00015 mfd. Type 34 ditto } T.C.C.
- One 1 mfd. Type 50 ditto } T.C.C.
- Two .01 mfd. Type 34 ditto } T.C.C.
- One 2 mfd. Type 50 ditto } T.C.C.
- One 250,000 ohm 1 watt resistance } Dubilier
- Three 100,000 ohm. ditto } Dubilier
- One 30,000 ohm. ditto } Dubilier
- One 10,000 ohm. ditto } Dubilier
- One 1 megohm ditto } Dubilier
- One 3-point On/Off Switch Type S.39. (Bulgin.)
- One Type H.F.P.A. Screened H.F. Choke. (Wearite.)
- One Midget Screened H.F. Choke. (Bulgin.)
- One A.F.3 L.F. Transformer. (Ferranti.)
- One Hypernik Class B Driver Transformer. (Lissen.)
- One Metaplex Baseboard (14in. by 11 in.). (Peto-Scott.)
- One Panel (14in. by 7in.). (Peto-Scott.)
- One Terminal Strip (14in. by 1½in.). (Peto-Scott.)
- One 7-way Battery Cord. (Belling and Lee.)
- Five Type B Terminals (Aerial, Aerial, Earth, L.S.— and L.S.+). (Belling and Lee.)
- Two Coils Connecting Wire, Length of Screening Braid, Screws, etc. (Peto-Scott.)
- One 220 VSG valve } Cossor
- One 210 DET valve } Cossor
- One P.215 valve .. } Cossor
- One 240B valve .. } Cossor
- One 120-volt Lion Battery } Vinces
- One 16-volt Lion Grid Bias Battery ..... } Vinces
- One 2-volt 40 amp. Accumulator. (Lissen.)
- One Rola P.M.F4 Loud-speaker. (Rola.)

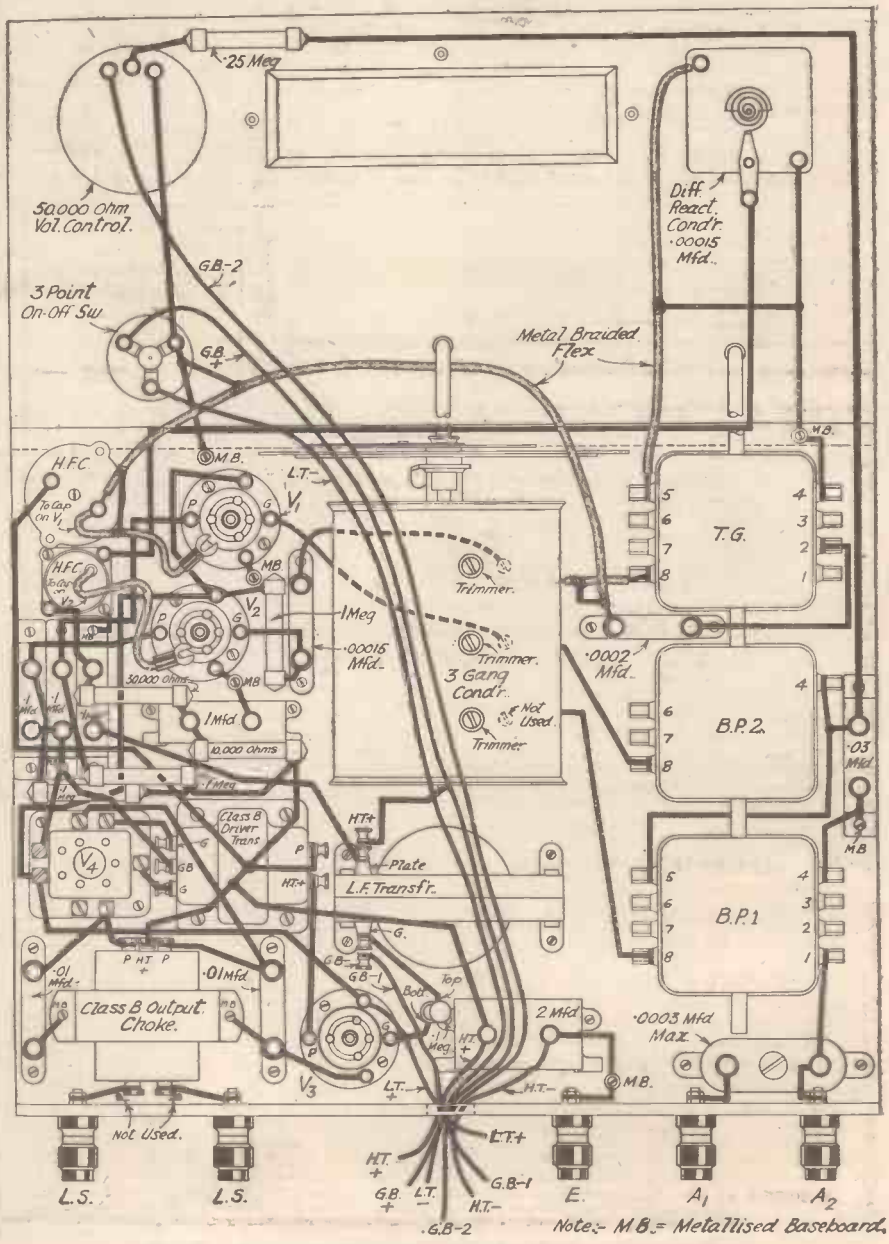
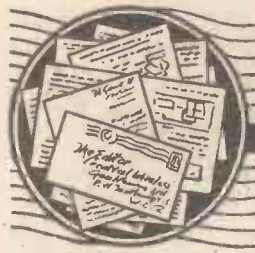


Fig. 6.—Complete wiring plan for the Nucleon Class B Four.

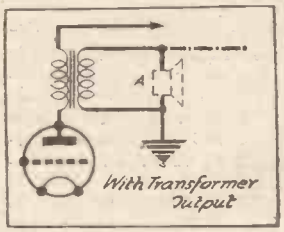


READERS' WRINKLES

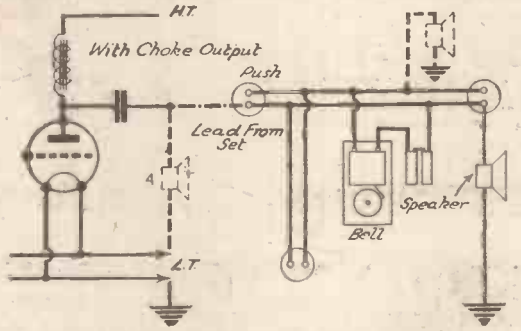
THE HALF-GUINEA PAGE

Using Bell System for Speaker Connections

IN these days of "a Speaker in Every Room" the following is an easy way of leading the set's output through the house for those who possess the usual house bell system. The latter is usually fairly well insulated, has a low resistance, and is not earthed. Transformer or choke output is necessary in the set, the usual speaker connection being shown at "A." The positive lead is taken to any convenient point on the bell system. If connected at a "push" it is worth trying the door bells for outside use if required. A useful point is found in the fact that when the bell rings a loud buzz is heard on the speaker.—S. R. RUSHBROOK (Glasgow).



Wiring diagrams showing how a bell system may be used for speaker extensions.



effect of connecting to alternative sides of the contacts. If one lead from the speaker is now connected to any other point in the system, and the other lead connected to earth (usually a convenient gas pipe) reproduction will be obtained with very little loss of signal strength. Alternative connections should also be tried when tapping off at a "push." This latter point is more important when using a bell system run from a mains transformer, as in some cases slight "mains hum" is picked up on one side of the wiring. For convenience two pin plugs can be arranged alongside the bell pushes, one wire connected to wiring, the other being earthed. A fine wire led down the wall and covered by a narrow strip of paper to match has been used in my case, and is almost invisible. Connection may also be taken from the

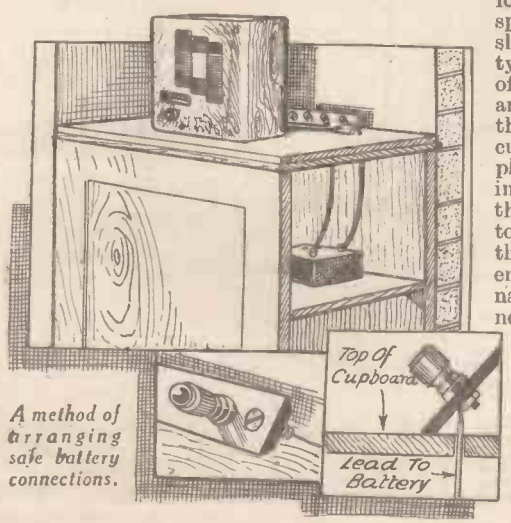
THAT DODGE OF YOURS!

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.

Safe H.T. Connections

THOSE amateurs who use accumulators for H.T. (and some battery users) usually keep them in a cupboard, bringing the wires through a hole in the top, and taking them either direct to the set, or to a terminal board. Both methods have objections, the former owing to the fact that the leads may short when disconnected, and the latter that in the event of any metallic object falling on the terminals, either the front or the back, the results will again not be advantageous to the battery.

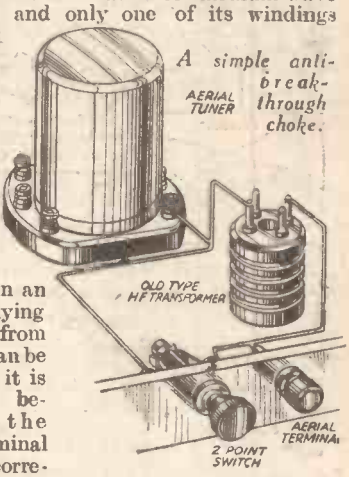
The terminal board illustrated will be found to be absolutely fool-proof in spite of its simplicity. The terminals should be of the completely insulated type, and they are mounted on a strip of ebonite or wood, the edges of which are chamfered at 45 degs. This fits into the corner formed between the top of the cupboard and the wall, and is held in place by two screws driven diagonally into the corner. The leads are taken through a hole drilled as near as possible to the corner, thus the connections at the back of the terminals are totally enclosed, and the lettering on the terminal tops is easily read. For quick connections insulated plugs and sockets could be used, but whichever method is adopted the result is a neat and fool-proof terminal board.—E. L. PARKER (London, S.E.15).



A method of arranging safe battery connections.

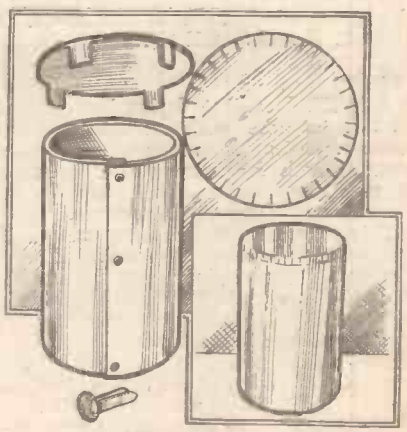
A Cheap Anti-Breakthrough Choke

AN excellent anti-breakthrough choke, which will effectively prevent medium-wave interference when listening on long waves, can be made from an H.F. transformer of the old-fashioned plug-in type. The transformer must be one intended for medium-wave reception and only one of its windings (either the primary or secondary) is actually made use of. The method of connecting the "choke" is shown in an accompanying sketch, from which it can be seen that it is inserted between the aerial terminal and the corresponding terminal on the first tuning coil. In order to put the "choke" out of circuit when reception is being carried out on the lower waveband, an ordinary two-point on-off switch is connected in parallel with it. For those who do not happen to have a suitable transformer on hand it might be mentioned that these components can often be picked up for a penny or so from "junk" stores dealing in obsolete wireless apparatus. The pins on the base are arranged in the same order as those on a valve, the "filament" pins being connected to the primary winding, and the "grid" and "anode" pins taking the secondary connections. In using the transformer for the purpose mentioned above wires may be soldered to the pins or a neater job can be made by fitting the component into an ordinary valve holder. There should be no necessity to screen the choke, although it may be found worth while to vary its position in relation to other unscreened coils, etc.



A simple anti-breakthrough choke.

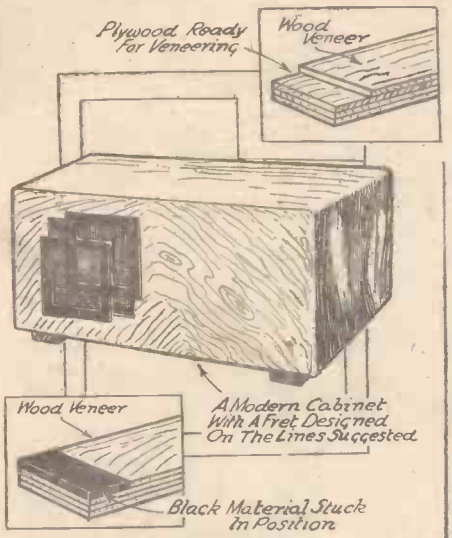
(Continued overleaf)



Details for making emergency coil screens

READERS' WRINKLES

(Continued from previous page)



How to inlay cabinet fronts.

Emergency Coil Screens

WHEN experimenting with a set the constructor often wishes to try the effect of screening the coils (providing they are not "canned"), the H.F. choke, or similar components. A coil screen can easily be made from copper foil, and thin cardboard or stiff paper.

A rectangular piece of cardboard should be cut, the width being equal to the height of the required screen, and the other dimension being sufficient to go round the coil. If the required diameter is known, the length will be about three and a half times this dimension. A piece of foil of similar size is cut, and is wrapped with the cardboard to make a tube. It is fastened by means of paper clips.

A circular piece of cardboard is cut with four lugs. A piece of foil with a slightly larger diameter is also prepared. Cuts are made about ¼in. deep towards the centre, and it is then placed on the circle of cardboard, the edge of the foil being wrapped underneath. The lugs are bent down, and the whole is inserted in the top of the tube. A little adhesive will secure it in position, and a short wire joining the foil top to the side will complete the screen.—E. L. PARKER (London, S.E.15).

Inlaying

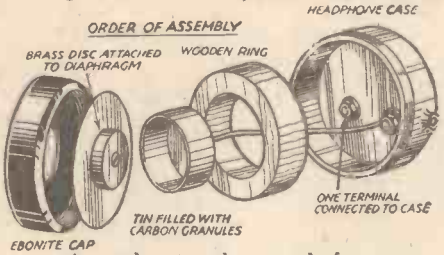
MODERN cabinet design has certainly kept pace with set design during recent months. A survey of the present models, both for home constructors and those incorporating sets, possibly make one's own set appear quite meagre.

It is not a difficult job, however, to build a modern cabinet, and the part which seems the most difficult is, in reality, the simplest. I refer, of course, to inlaying. If veneered plywood is used in the construction, it is an easy matter to cut the top ply with a sharp knife, guided by a straight steel edge (a twelve-inch steel rule will answer the purpose). The veneer can then be "prised" off, leaving a recess not quite 1-32in. deep.

Any black material can then be cut to fit the design required, thin ebonite or bakelite can be used, or a black "celluloid" material known as xylonite, and obtainable commercially, will be found very suitable. Any of the well-known adhesives can be used, but if the black material is polished on both sides, the side that is to be stuck should be roughened with sand-paper. The edges of the fret should be sand-papered quite smooth, and then given a coat of black. Failing any alternative, two coats of India ink will be found very suitable. The drawing shows a presentable cabinet with a fret made on these lines.

A Simple Microphone Made from a Telephone Earpiece

A SIMPLE and fairly effective microphone for experimental use can be built into the case of an old telephone earpiece in the manner shown in the accompanying sketch. First of all the magnets and all connections must be removed from the old earpiece and then a wooden ring should be made to fit into the case. The ring should be made a tight fit, and should have a hole about 1in. in its centre. A small circular tin (one of the kind used for samples of pills or manicure powder is quite suitable) which is a tight fit in the hole should then be obtained, and a wire soldered to it and connected to one of the terminals. All insulation must then be removed from the second terminal so that it makes good contact with the metal case. The metal diaphragm is used to take the second connection, and, therefore, if it is enamelled it should first be scraped bright. In the centre of the diaphragm is attached a brass disc about ¾in. diameter by ¼in. thick, the purpose of this being to make contact with carbon granules with which the tin should be lightly packed. It will be obvious that the small tin must be sunk very slightly below the surface of the wooden ring to prevent its making contact with the diaphragm. Connections are taken from the terminals in the normal way.

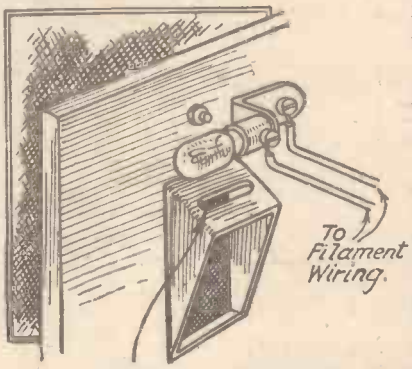


A simple microphone made from a telephone earpiece.

Some readers might find difficulty in obtaining the ring and might not have facilities for turning it up in a lathe; in such cases an equally effective one can be built up by windng a strip of paper round a wooden rod, applying glue whilst winding, so as to make the finished ring reasonably solid.

A Useful Indicator Light.

THOSE amateurs who used drum-drive for tuning, and who have fairly deep escutcheons, will probably find that the latter project some little way through the panel. If a narrow slot is cut in the top part and a bulb fitted, as shown in the sketch, the light will shine through the slot on to the dial, serving the double purpose of illuminating the dial and indicating that the set is switched on. The slot can be made by drilling a few small holes in a line and then filing them into the slot. If a bulb of the .06 amp. rating is used the increased current consumption is practically negligible, being much less than that of a single valve.—E. PARKER (London, S.E.15).



Slot Cut In Escutcheon.

A useful indicator light.

A Simple Wavetrap

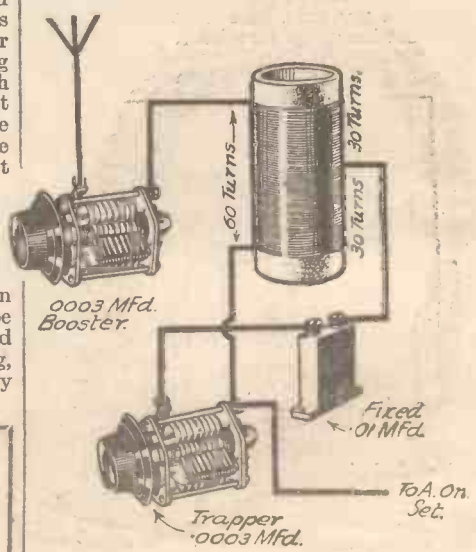
AN efficient wavetrap which gives excellent results is shown in the accompanying sketch.

The selectivity is splendid and there is no loss of volume; in fact, the volume is greater using the unit than without it. All that is needed are two .0003 variable condensers, one .01 fixed condenser, and a 60-turn centre-tapped coil. These components are connected up as shown in the sketch.

In practice, it will be found that the lower half of coil and its two condensers will trap the station required, and the .0003 condenser with the first half coil will boost up or suppress volume as desired, the station remaining stationary on dial, and not moving about as it does when using some wavetraps.—WM. TUCKER (Swansea).

Easing Screws

A POINT worth remembering when driving screws into hard woods and plywood is that risk of turning off the heads of small or brass screws is avoided if the screw is first rubbed on a piece of grease or soap. A clearance hole should, of course, be drilled before the screw is driven home.



An efficient type of wavetrap.

Practical Television
PUBLISHED MONTHLY.
Presented Free with "Practical Wireless."
JANUARY, 1934. Vol. 1. No. 2.

THE "PORTOVISOR"

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

THE "Portovisor" provides a satisfactory reply to those critics who say that television is expensive, and will, I hope, encourage all "waverers" to make a start straight away.

First of all, as will be gathered from the accompanying illustrations, the machine is transportable, quite unobtrusive in appearance, and is entirely self-contained. The reader, if he so desires, can build up the design in stages, and the results obtained from the "Portovisor" will undoubtedly come as a revelation to those who have not looked in before. The cost involved is only a few pounds, and, provided the complete instructions are followed carefully, nothing can go wrong or in any way upset anticipated performance.

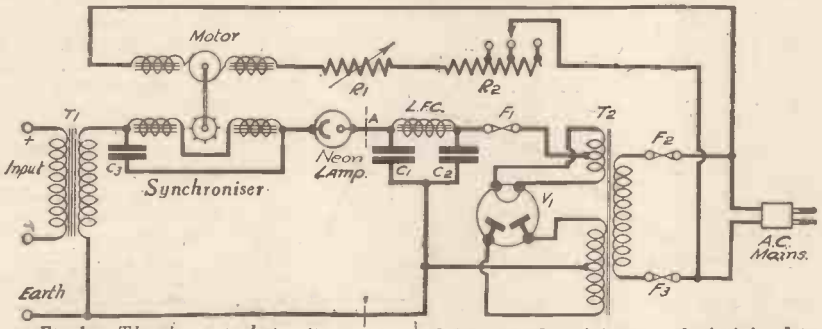


Fig. 1.—The theoretical circuit employed in the "Portovisor."

The image as built up at the cabinet aperture is true disc size, as is the case with all machines of this type. From experience I find this small image suited best to the carrying out of any individual experiments by the constructor as far as his radio receiving set is concerned. He can watch the effects of any changes with greater ease, but when it is desired to "magnify" the image so that three or four people can watch the television programme in comfort, then a lens frame complete with lenses can be removed from the cabinet, where it is housed for convenience, and placed in front of the aperture.

As far as the *complete* design is concerned it is suitable only for those readers with A.C. mains, and after being plugged into the house electricity supply is joined to the radio receiver by three wires only. Surely that is reducing "trouble" to a minimum,

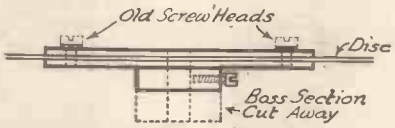


Fig. 2.—How depth is saved by cutting away a portion of the boss.

and a reference to the theoretical diagram of Fig. 1 will show how it is done.

Dissecting the Circuit

First of all the A.C. mains supply passes to one side of the motor, which has to drive the disc at its speed of 750 revolutions per minute, a tapped fixed resistance R_2 and a variable resistance R_1 being included for the dual purpose of cutting down the volts to the value required for driving the motor and also to control the speed.

The lower part of the diagram illustrates a mains eliminator whose function is to supply the polarizing current required to render the neon lamp incandescent, and also to pass through the synchronizing coils. As a measure of protection to the eliminator a pair of one amp. fuses F_2 and F_3 are included, it being noted that these are *not* in the motor circuit. A dual wound secondary winding on the mains transformer T_2 feeds the rectifying valve V_1, and, after passing another protective fuse F_1 (150 mA), the usual smoothing equipment consisting of a low-frequency choke (L.F.C.) and reservoir condensers C_1 and C_2 complete the eliminator section.

Across A and B, therefore, we have our H.T. supply, and to this is joined the neon lamp (flat plate type), pair of synchronizing coils (this being part of the motor equipment as supplied, having the thirty-toothed cogwheel mounted on the motor shaft as shown diagrammatically), and the secondary winding of the transformer T_1. This transformer is of the one-to-one ratio type, and serves the purpose of passing on the television signals from the radio receiver so that the intensity of glow of the neon lamp will respond to the fluctuations, and so produce the television image when scanned by the disc. The two input terminals join to the nominal loud-speaker output terminals of the set, the extra terminal being linked to the earth point of the receiver.

Flexible Design

The description just furnished covers the complete design but actually the instrument is quite flexible in character. The motor is of the universal type, and in consequence runs equally well on both A.C. and D.C. supplies. The reader who has a direct current supply, therefore, has merely to omit the eliminator section and join his mains across the points A and B (positive to A and negative to B), a variable resistance being joined in series with the

(Continued overleaf)

COMPONENTS FOR "PORTOVISOR."

- 1 Output Transformer, Type OPM1C (Ferranti).
- 1 L.F. Choke, List No. 731 (Heayberd).
- 1 Television Disc (Peto-Scott).
- 1 Mains Transformer, for 506 B.U. Rectifying Valve (British Radiogram).
- 3 Type B Terminals, Input +, Input —, and Earth.
- 2 Terminal Mounts (Belling-Lee).
- 2 4-mfd. T.C.C. Condensers, Type 87 (T.C.C.)
- 1 .1-mfd. Condenser, Type 65 (T.C.C.).
- 1 Universal Motor complete with mounting bracket and syncbronising gear (Peto-Scott).
- 1 150-mA. Fuse and F12 Holder (Bulgin).
- 1 Twin Fuse Holder, Type F11 (1 amp. fuses) (Bulgin).
- 1 Baseboard Valve-holder (W.B.).
- 2 Mervyn Lenses.
- 1 506 B.U. Rectifying Valve (Cossor).
- 1 Fixed Resistance, Type MR12 (Bulgin).
- 1 Special Neon Lamp and Bakelite Holder (Peto-Scott).
- 1 150-ohm Variable Resistance (50-watt rating) (Peto-Scott).
- 1 6in. Extension Rod (Bulgin).
- 1 Portable Cabinet (Peto-Scott).
- 1 Baseboard with Motor Platform (Peto-Scott).

Fig. 3.—Front view of the apparatus.

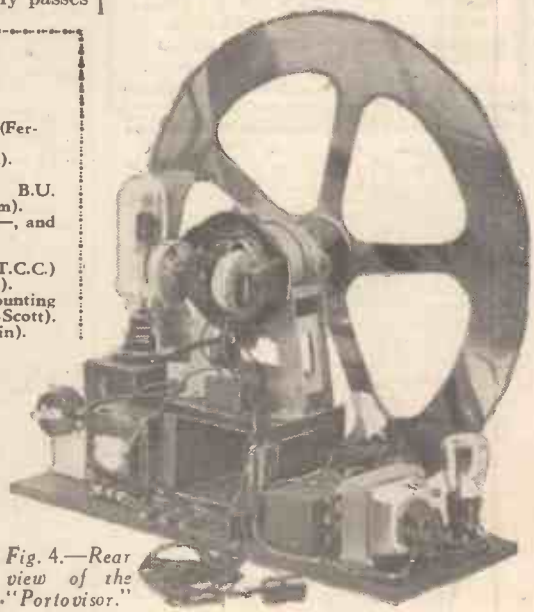
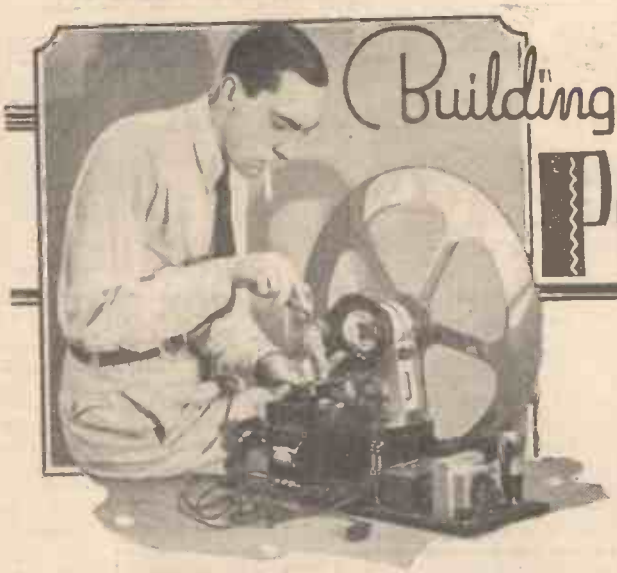


Fig. 4.—Rear view of the "Portovisor."

Building the PORTOVISOR

AN EFFICIENT TELEVISION



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positive main and A so as to regulate the current passing to the neon lamp.

Finally, if the reader does not want to feed the points A and B from mains at all, he can connect a 200-volt battery across, using batteries of the super-capacity type. This last-named course must also be followed by those who have no mains available at all, while the motor instead of being a mains-driven type is replaced by a six-volt machine and fed from accumulators.

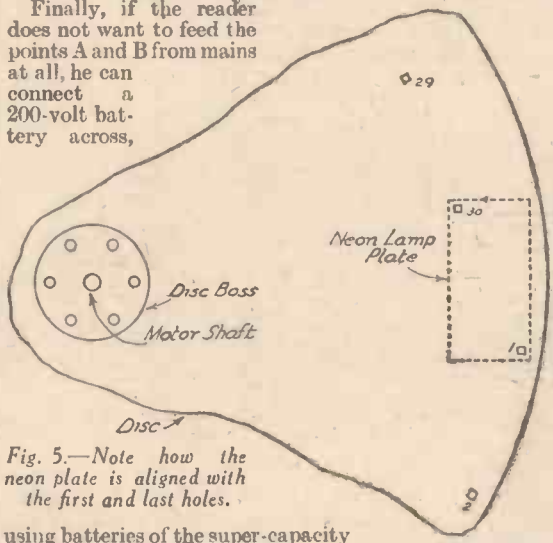

Fig. 5.—Note how the neon plate is aligned with the first and last holes.

The First Step

We can now turn to the practical side and see how easy it is to duplicate the design featured in the illustrations. A complete list of the components is included elsewhere, every one of the items being quite standard, and hence readily obtainable from the makers mentioned.

If the combined wooden baseboard with motor platform is not obtained complete, then it must be built up to conform exactly to the dimensions given in Fig. 9. First of all there is the main baseboard 20½in. by 8in. by ½in. A piece 5in. by 1in. must be cut out from the front edge in the centre as shown to enable the disc to run freely. Then make up the motor platform which, of course, has to be built very solidly. A piece of wood 4½in. square and ½in. thick has two side pieces 4in. by 4½in. by ½in. screwed to it, with three long screws on each side as indicated. Before adding the top platform screw the base to the baseboard after having accurately marked off its position from the dimensions given in Fig. 9. Finally, add the top platform 6ins. by 4½in. by ½in. and it will be found that the structure is very rigid.

Now comes the wooden block on which stands the neon lamp and its holder. This is 4½in. by 3in. by 2½in. Before screwing on the block by three countersunk wood screws passing right through from the underside of the baseboard, drill three holes. Two of these are ⅛in. holes centrally displaced and 3in. and 3⅞in. from the bottom and drilled right through. Now drill another ⅛in. hole in the top so that it meets the top hole. This will then allow the pair of leads from the neon lamp holder to make connection, while the lower hole is for the extension rod to the variable motor resistance to pass through. The block can now be screwed in place, measuring up its position accurately according to the dimensions furnished in Fig. 9.

Changing the Motor Direction

In nearly every disc television receiver described so far, the synchronizing

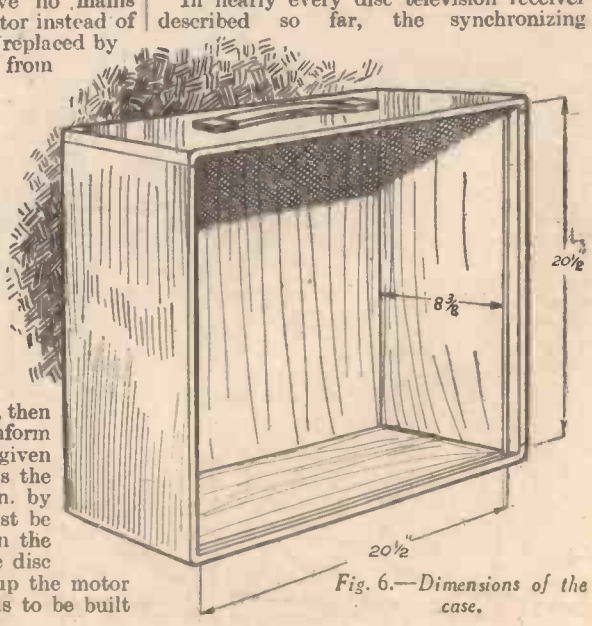

Fig. 6.—Dimensions of the case.

AND SIMPLE
RECEIVER

VISOR

mechanism is at the front of the motor, the disc at the back and, of course, the neon lamp on the right. With the "Portovisor," however, I decided to have the disc at the front, and in order to maintain the disc rotation correct, and give the normal scanning of bottom to top and right to left, it became necessary to reverse the motor direction. This is a very simple process and is carried out in the following way:

Remove the synchronizing gear complete by withdrawing the two screws holding the springs against the movable framework. Take off the cogwheel, and then pull out the brushes, after unscrewing the two caps. The aluminium end casing of the motor at the synchronizing gear end may then be pulled off gently, and the motor armature withdrawn at the same time. To reverse the motor direction we must reverse the field winding. At the brush end of the motor casing will be noticed two leads, one at each brush point, which are just sprung into place. Ease off each lead and interchange their positions, then replace the armature, brushes and end plate, screw back the synchronizing mechanism in place and fit the cogwheel once more to the motor shaft. The motor now runs counter-clockwise when viewed from the end remote from the synchronizing equipment.

A Question of Space

Being anxious to reduce the cabinet width as much as possible, and to allow the disc to be as close as possible to the front aperture, the following steps have to be taken. First of all, saw off a piece of the motor shaft at the disc end so that only ¼in. remains. Then take the disc which is supplied with a fairly long boss, and has cheese-headed screws holding the disc between the two flanges, and cut off a piece of the cylindrical boss so that the length remaining is 11/32in. This will necessitate drilling and tapping a new grub screw hole, but that is quite an easy matter. Now remove the cheese-headed screws one at a time and replace with countersunk head screws, and quite a substantial saving in depth will be effected, as indicated by the sketch Fig. 2.

Complete Assembly

The constructor can now make a start on the assembly of the apparatus. The pictorial diagram, Fig. 8, the wiring plan, Fig. 11, and the accompanying photographic illustrations will assist in this connection, and should be studied carefully for there is little room to spare. First of all, the motor and its stand must be screwed to the platform. The motor must be quite square with the baseboard edge so that the disc when mounted revolves in a plane parallel to the baseboard edge. Fixing dimensions for the feet are given in Fig. 12, and these must be adhered to. Next comes the neon lamp holder, and

(Continued on page IV)

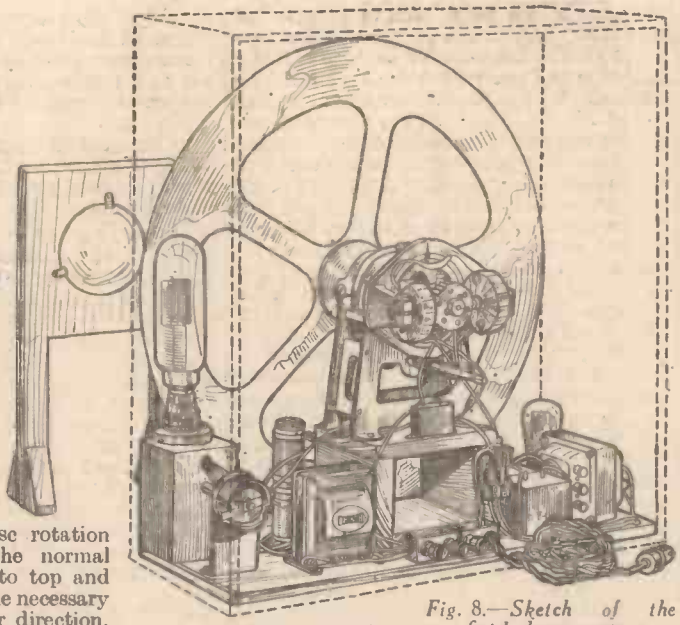

Fig. 8.—Sketch of the finished apparatus.

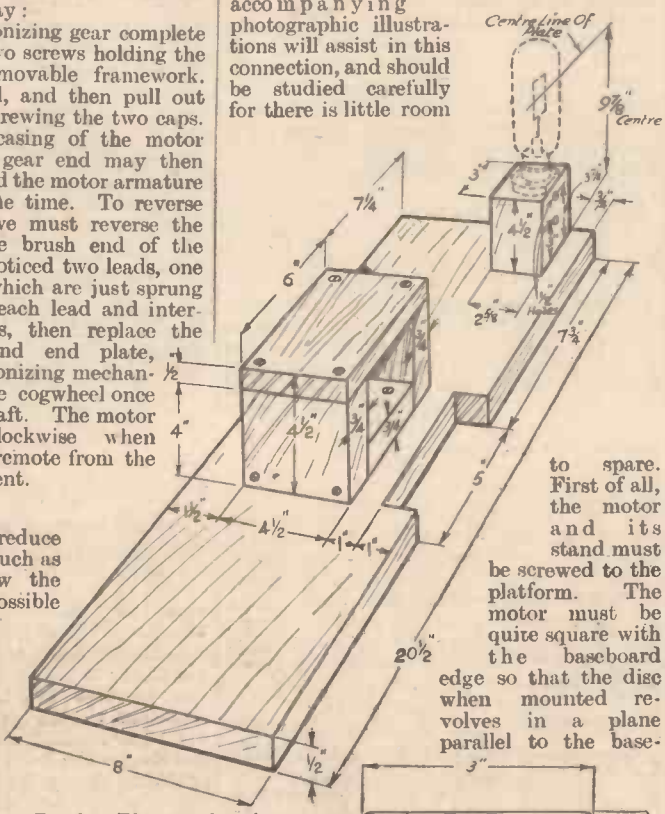

Fig. 9.—The wooden base and motor support.

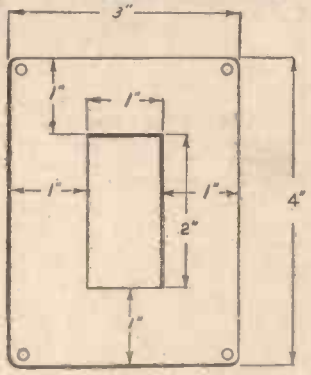

Fig. 7.—The aluminium mask should be cut to these dimensions.

here again we must remove superfluous material. With a hacksaw cut off a segment of the lamp-holder base, so that the flat edge is flush with the circular holder portion. This is shown very clearly on the left of Fig. 12. See that the centre of the holder, and hence the centre of the flat plate of the neon lamp, is 8⅜in. from the centre of the motor shaft. Another important point to note is that when cutting off the segment of the bakelite neon lamp-holder, position the cut so that the neon lamp when in its holder has its flat plate parallel with the baseboard edge. Two new screw holes must be drilled before the holder can be held down on its wooden mount.

Next make up a small right-angled bracket to hold the 150-ohm variable resistance R_1. The position of this bracket on the baseboard is fixed automatically if the extension shaft is added, and the bracket moved forward until the shaft flange is ¼in. away from the front of the wooden neon lamp-holder mount.

Next screw down in position both the vertical tapped tubular resistance R_2 and the 0.1 mfd. fixed condenser C_3.

I have detailed the work up to this point, for this completes the task of assembly for those who desire the simple television receiver alone without the eliminator and transformer feed. In addition, those constructors using a six-volt motor to be driven from accumulators will omit the vertical tubular resistance, and replace the 150-ohm variable resistance with a 6-ohm one. Only one or two leads need be added now by these constructors, and the apparatus is complete.

Completing the Work

Naturally, the best course for those with A.C. mains is to carry out the complete design, and then the remainder of the components can be screwed to the baseboard as indicated in the wiring diagram, Fig. 12. When this is done complete the wiring. For convenience this has all been carried out in single rubber-covered flex. The runs of each wire are shown in Fig. 12, and care should be taken to trace out each lead so as not to go wrong. As far as the output transformer is concerned, although this is a push-pull type, the centre tap points of each winding are ignored. The lead connecting one terminal of the variable resistance R_1 to the tapped resistance R_2 terminates in a crocodile clip to enable the correct tapping to be ascertained. Also be sure that the mains transformer primary winding is joined to the proper voltage tapping to correspond with the house mains electricity rating.

A Preliminary Trial

At this juncture it is as well to give the "Portovisor" a preliminary trial to ensure that both the wiring and assembly are free from errors. Place the neon lamp in its holder and the disc on the motor shaft, holding the latter in place by its grub screw. Turn the disc gently by hand to see that it does not foul any of the components. Owing to its flimsy nature it tends to flap somewhat, but this is not harmful and when you run up to its isochronous speed it will whip out flat.

Clip in the pair of one amp. fuses and the single 150 milliamp. one, and insert the rectifying valve in its holder. Tap off the maximum resistance on R_2, insert the A.C. mains plug into a convenient socket and switch on. The first thing to notice is whether the neon lamp lights up correctly. The flat plate should glow uniformly with a fairly bright orange red colour, but if the short horizontal bar behind the plate glows instead, switch off the mains, reverse the two connections in the bakelite lamp holder, and matters will be rectified.

Next note that the motor is rotating the disc in an anti-clockwise direction when facing the disc, and, of course, see that the blackened side of the disc faces the observer.

It now becomes necessary to see that the motor, disc and neon lamp are in the correct relative positions, so as to scan the whole of the glowing neon lamp plate. Disconnect the mains and temporarily remove the crocodile clip from the tubular resistance. This will break the motor circuit and prevent it from running. Switch on the mains once more, so that the neon lamp glows, and turn round the disc by hand until the first and last of the scanning holes are positioned as in Fig. 5. The dotted rectangle represents the glowing plate, and the first and last holes (Nos. 1 and 30) of the disc should be just accommodated within the bottom right-hand and top left-hand corners respectively. If this is so, then every hole will scan a strip of the neon plate. If the lamp is a trifle too far to the left or the right, then ease the screws gripping the lamp holder to its wooden base, and adjust the lamp position until the condition shown in Fig. 5 is obtained. Switch off the mains, replace the crocodile clip and prepare to accommodate the apparatus in its cabinet.

Cabinet Details

The appearance of the cabinet can be gathered from the accompanying photographic illustrations. It has *internal* dimensions of 20½in. by 20½in. by 8⅜in., being made of ½in. wood and having a detachable back. Fig. 6 gives all the details, and if the constructor prefers he can have it made up in any wood desired by Messrs. Peto-Scott, Ltd., who regularly advertise in this journal. The back is detachable, having one hole drilled to allow the synchronizing framing shaft to pass through, and also a rectangular section cut away at the bottom to allow access to the three terminals and give the mains lead free passage.

At the front, on the right, an aperture (midway between top and bottom) is cut out 2½in. wide by 3in. deep, so that its centre coincides with the centre of the neon lamp plate. Below this is a hole to take the bush of the extension rod, and to enable an easy control of the variable resistance to be effected from outside. When the aperture and hole have been made, slide the whole apparatus into the cabinet from the back. See that the disc boss does not touch the back of the cabinet front, and then once more connect the plug to the mains socket and switch on. The disc as it gathers speed will flap a little and knock against the cabinet frame slightly, but this is quite normal and as soon as it is revolving fast it will run quite flat, and not in any way foul anything. The strips of light area of the neon lamp will now be observed through the disc holes, and it becomes necessary to mask off the cabinet aperture with a *blackened* aluminium plate ⅛in. thick cut to the dimensions shown in Fig. 7. Position this over the aperture while the apparatus is running, so that the hole in the mask just exposes the glowing light area, and then attach it to the cabinet front by four small wood screws.

(Continued on page VI)

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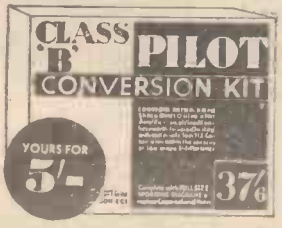

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1. Oz. of 34 gauge single cotton covered wire		1	0
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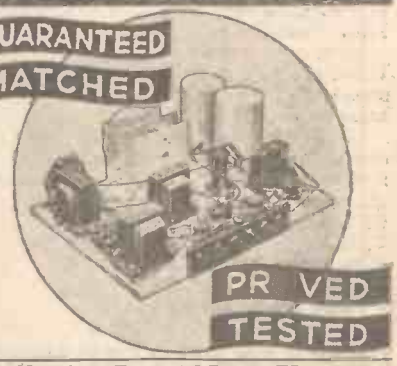

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(*Continued from page IV*)

Enlarging the Image

The television image observed through the rectangular hole in this mask will be the true size as traced out by the disc holes, that is approximately 2in. by 1in. For certain experimental purposes this is sufficient, but on many other occasions when it is desired to sit down and watch the programme provided by the B.B.C. transmissions, lens magnification must be resorted to.

Details of a simple outfit for this purpose are shown in Fig. 10. First of all obtain two lenses, one a 4in.-diameter double convex of 11.5in. focal length, and a second of 6in. diameter, single convex, having a 17in. focal length. Now make up the wooden structure indicated in Fig. 10. When the hole centre has been marked off, scribe off with dividers or compasses two holes on one side of 3¾in. and 4in. diameter respectively. On the other side two similar concentric circles of 5½in. and 6in. diameters respectively. Cut out the inner circle of 3¾in. with a fretsaw, and then with a spokeshave chamfer off sufficient wood so that there is a bevel between the 3¾in. diameter hole at the back and the 5½in. diameter circle at the front.

Place the large lens central with the 6in. diameter circle so that its flat face touches the wood, and hold it firmly in position with three small brass clips as shown in Fig. 10. Turn the structure over and mount the smaller lens in place, that is central with the hole, and fix it securely with three small clips. This can now be painted black, and in use just stands in front of the cabinet mask, and in this way magnifies the image considerably. As the cabinet has rubber feet at the bottom, the height of the lens centres just corresponds with that of the aperture centre.

To house the assembly when not in use make two U-shaped clips and fix these to the inside of one cabinet side, on the right facing back preferably, to accommodate the feet of the lens stand. Then screw a short length of 1in. thick wood to the inside top of the cabinet, nearly flush with the top end of the lens frame, and add two clips to hold it in place with the feet resting in the U clips.

The "Portovisor" is joined to the receiver through the pair of input terminals and earth terminal. Join the former direct to the normal loud-speaker terminal if there is not a *step down* output transformer already included in the set. If there is, join the pair of terminals to the plate of the output valve and H.T.+ after having first disconnected the set's output transformer primary.

Having connected the earth terminal to an earth point on the set, switch on the "Portovisor" five or ten minutes before the television transmission is due to start to allow the motor to warm up and run steadily. Assuming the London National station which broadcasts the television programme has been previously tuned in on the set, then as soon as the transmission begins, some form of image, very probably distorted to start with, will be seen in the right-hand cabinet aperture.

A series of black lines will be noticed sweeping upwards or downwards, depending on whether the motor is running too fast or too slow, the correct speed being 750 revolutions per minute. The variable motor resistance must be adjusted carefully until the lines lie horizontal, it being noted that if this does not happen, then another tap on the tubular fixed resistance must be tried.

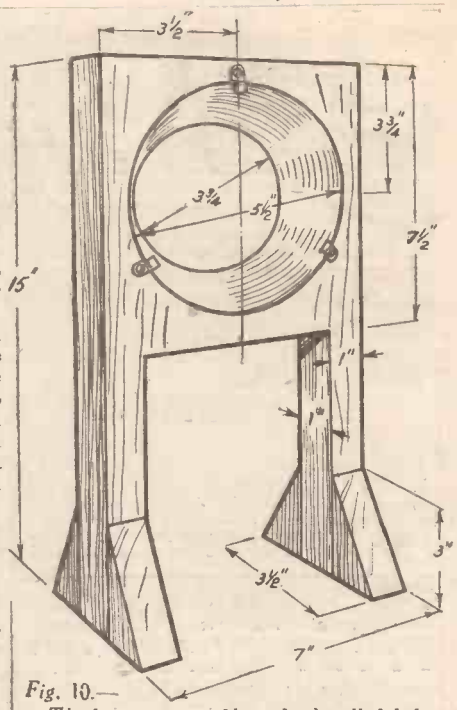
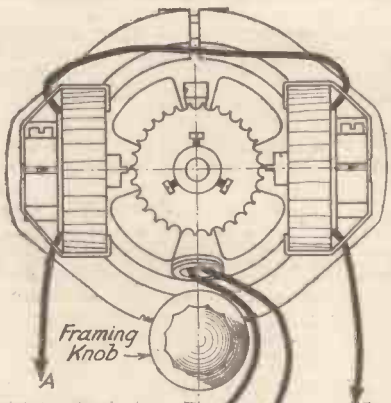


Fig. 10.— The lens mount. Note the bevelled hole.

When this state of affairs is reached, the synchronizing equipment will come into action, and maintain the image steady. If, however, the condition of synchronism is brought about with two sections of the image lying side by side, then increase the motor speed slightly until the images move slowly upwards and drift to the left. Let this go on until the double picture resolves itself into a single one, and then quickly bring back the speed of the motor to normal again. This is called phasing the image.

Again, it may happen that two portions of an image appear one vertically above the other. To rectify this, turn slightly the knob at the back and so "frame" the image centrally.



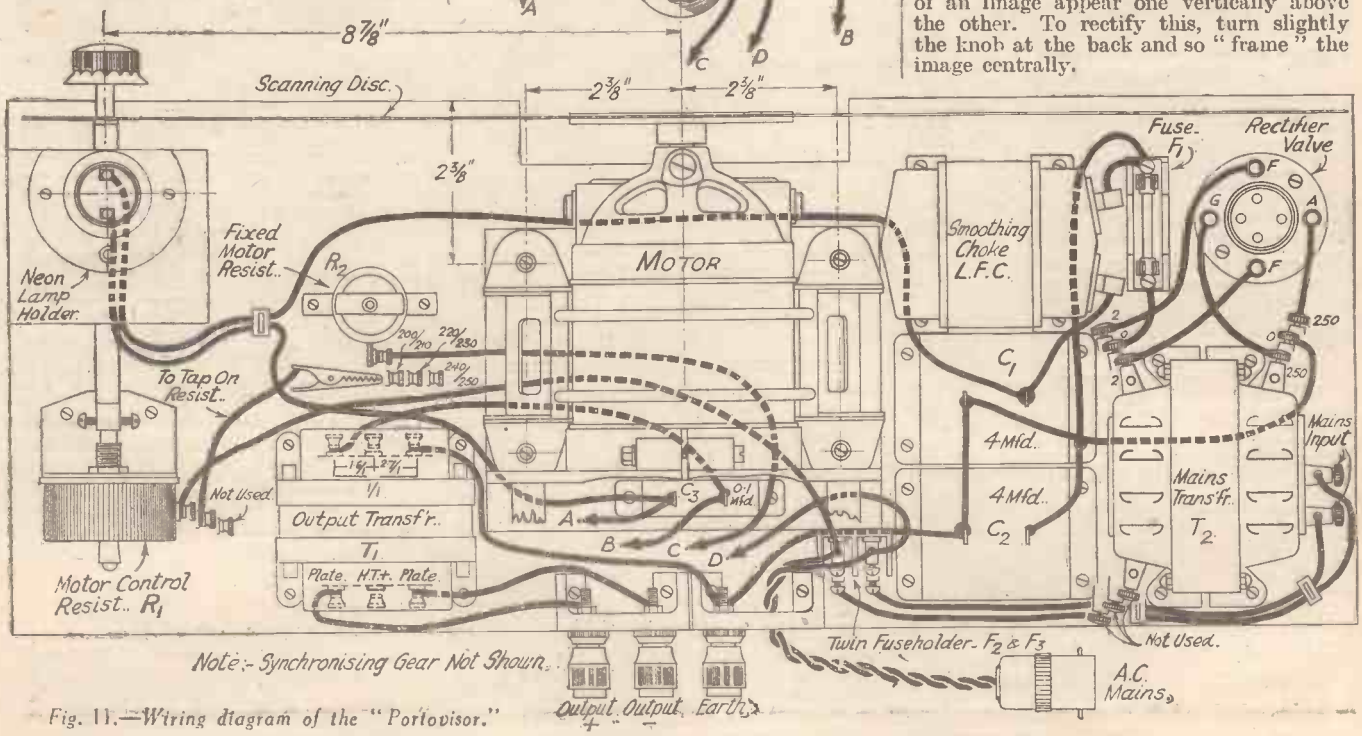
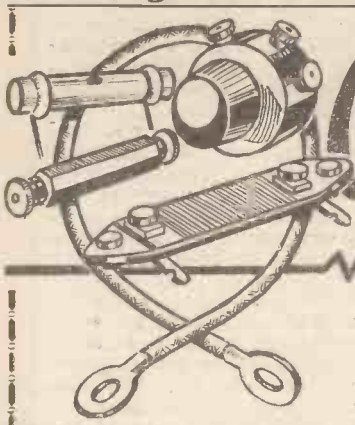


Fig. 11.—Wiring diagram of the "Portovisor."

The Beginner's Supplement



Choosing and Using RESISTANCES

In this Article the Author Simply Explains How the Correct Type and Value of a Resistance for any Purpose can be Decided Upon.

WITH the evolution of new and up-to-date circuits it appears that resistances (or more correctly resistors) are being required in rapidly increasing numbers. A few years ago the only resistance that one was likely to find in a standard type of receiver was the grid leak, but nowadays quite an ordinary three-valve battery set might have as many as a dozen, whilst more complicated circuits (especially those for mains working) frequently contain a score of resistances of various patterns. There is no doubt that, although many of the resistances are not absolutely essential, they do improve the performance of the set, in addition to simplifying the operation to a considerable extent. That is all very well for the advanced experimenter who understands the function of each component, but the beginner is very apt to find himself quite "at sea" in trying to decide upon the correct type and pattern for any particular purpose. It is hoped to remove any such difficulty by explaining the applications of each pattern, and showing how the resistance value can most easily be determined.

Types of Resistances

In the first place let us consider the principal varieties of resistances. First, there is the wire-wound one which is generally employed in positions where a good deal of current has to be carried, and where a certain amount of self-inductance is of no consequence. Then there is the so-called metallized resistance, which usually consists of a thin "lead" of metallized material running through the centre of a porcelain rod which has metal connecting caps or wires at each end. Another type of resistance is the "composition" one in which the resistance element consists of a composition made principally of finely-divided carbon, this being enclosed in a bakelite, glass or porcelain tube. Lastly there is the so-called spaghetti resistance in which the element is very thin wire wound in helical fashion on a core of asbestos string. This kind of component is very convenient, since it can generally be connected directly to the terminals of other components; but it is somewhat fragile, due to the very thin resistance wire which must be used in making it. Consequently, it cannot carry heavy currents, and it is liable to be fractured if it is "kinked" or bent to a sharp angle.

Neglecting the spaghetti resistance for a moment, it can be broadly stated that the wire-wound component is most suitable for carrying heavy currents, partly because the wire has a higher current-carrying capacity than have carbon compositions, and partly because the heat developed can more readily be dissipated. Moreover, this kind of resistance is "permanent" and cannot cause crackling sounds due to its resistance value fluctuating frequently. The carbon composition type, on the other hand, is more liable to introduce crackling sounds, due to the variable contact between the particles of conducting material. In making this statement it should be pointed out that there *are* a few composition resistances on the market which are practically as reliable as wire-wound ones, especially when they have to deal with comparatively low currents. Metallized resistances are rather similar in their properties to composition ones, but on the whole they are probably more reliable. The last kind of resistances, those in which a conductive film is deposited on a porcelain or similar rod, can be classed along with metallized ones, since their properties are found to be very similar indeed. It would appear that they would better be able to dissipate any heat developed, but this does not seem to be the case in practice.

Variable Resistances

All the above remarks have actually been applied to fixed resistances, but most of them are equally applicable to variable resistances and potentiometers, the only difference being that there are but two general types of variable resistances. One type is wire-wound, and should be used when there is any appreciable current (more than 1 milliamp. or so) to be carried, and the other is the carbon composition type, where a layer or film of carbon is traversed by a rotating arm. For illustrations of the various types of resistances mentioned see Fig. 2.

Finding the Correct Value

The first thing that the beginner requires to know about resistances is how the correct value for any particular requirement can easily be determined. This brings us to the old favourite, Ohm's Law, which states that the current flowing in a circuit is equal to the applied voltage divided by the circuit's resistance; the three factors must be in amperes, volts, and ohms. As, however, it is generally milliamps. which are dealt with in a wireless set, it is better to modify the law by saying that the current (in milliamps.) is equal to the applied voltage multiplied by a thousand, and divided by the resistance in ohms. By re-arranging the expressions in the formula we can get the equation that the voltage dropped by a resistance is equal to the current (in milliamps.) multiplied by the resistance in ohms and divided by a thousand. Similarly we

(*Continued overleaf*)

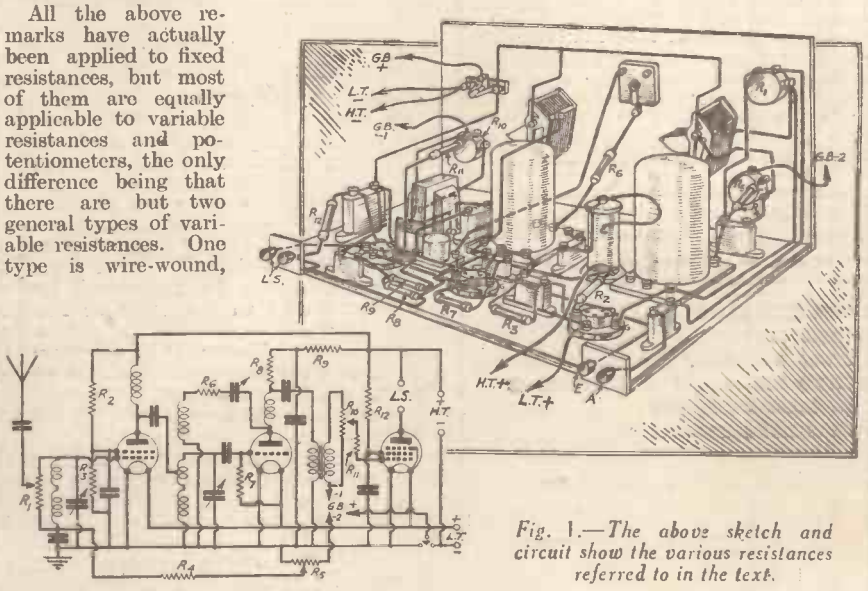


Fig. 1.—The above sketch and circuit show the various resistances referred to in the text.

(Continued from page 797)

can obtain the equation that the resistance required for any circuit (in thousands of ohms) is equal to the voltage to be dropped divided by the current in milliamps.

The Wattage Rating

Another factor which must be decided before a resistance is bought is its required wattage rating. Every reader will have noticed that resistances are stated as being of 1, 2, 3, 4 watts, etc., and will perhaps have wondered what is the meaning of this. Power, in watts, is determined by multiplying voltage by current (in amps.): thus a valve filament which takes .1 amp. at 2 volts consumes .1 multiplied by 2, or .2 watt. On the other hand, a resistance which, when passing 20 milliamps., "drops" 100 volts will consume .02 (20 milliamps. expressed in amps.) multiplied by 100, or 2 watts. Another way of finding the power consumption of a resistance is by squaring the current which it passes (in milliamps.),

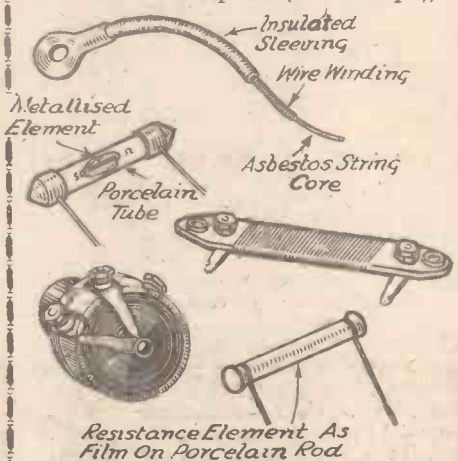


Fig. 2.—Various types of resistances are shown in the above sketch; some of these are sectionalized to indicate the form of construction.

and multiplying that by the ohmic value of the resistance. For example, a resistance of 5,000 ohms which carries a current of 20 milliamps. must have a power rating of .02-squared multiplied by 5,000, or .0004 times 5,000 which is just 2 watts.

Resistances in H.T. Circuits

The simple calculations which have been explained are applicable to most resistances required in the high and low-tension supply circuits of a wireless set, but are of little value when deciding upon the resistances called for in high-frequency circuits. These latter require rather special consideration, and their functions will best be understood by making reference to the more or less standard circuit arrangement for a three-valve variable-mu H.F. detector-pentode receiver such as that shown at Fig. 1. All the resistances, both fixed and variable, have been numbered for easy reference. The purpose of R.1 is to act as a volume control by varying the amount of signal energy passed on to the first tuned circuit from the aerial. Its total resistance must be much higher than the (high-frequency) impedance of the tuning coil, and a value of from 100,000 to 250,000 ohms is generally correct. The resistance element must be entirely non-inductive or else it will create various "resonance peaks" which will affect tuning; it has not to carry any D.C. current, and therefore a component of the composition type is to be preferred on every count.

R.2 and R.3 act together as a fixed potentiometer, their purpose being to apply the correct potential to the screening grid of the first valve. Assuming that they had to carry no D.C. current at all their resistances would be in the same ratio as that of the S.G. potential to the total voltage of the H.T. battery. For example, if the screening grid required 50 volts and the battery gave 100 volts, the two components should be of equal value; if the screening grid required 40 volts, and the battery gave 120 volts, R.2 should be half the resistance of R.3, or one-third of the sum of the resistances of R.2 and R.3. Actually, R.2 does carry a small D.C. current, and this fact modifies the calculation slightly, although for most purposes this can safely be ignored. It is generally best to choose R.2 and R.3 so that their combined resistance is approximately 100,000 ohms.

R.4 and R.11 are for the purpose of preventing the passage of H.F. currents, although they must offer little impedance to L.F.; values from 25,000 ohms upwards would serve the purpose. Both resistances should be non-inductive, but, as they have to deal with alternating current only, this is not any disadvantage.

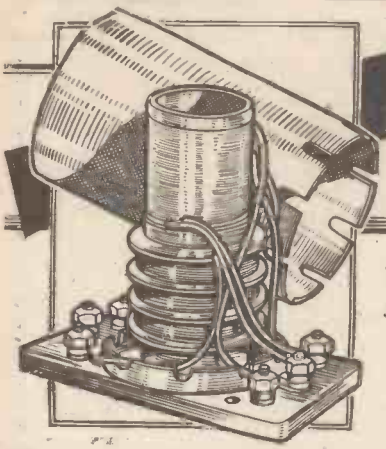
R.6 is to prevent the passage of L.F. into the reaction circuit, and may have a value of between 100 and 500 ohms.

R.5 is a potentiometer, the purpose of which is to apply a variable potential to the grid of the first valve. Theoretically it could have any value from about 5 to 100,000 ohms, but if the value were so low as the first figure the G.B. battery would rapidly be exhausted, whilst if it were so high as the latter it would not provide the "nicety" of control that is desirable. Thus the value generally chosen is either 25,000 or 50,000 ohms, and it does not matter very much whether the component is wire-wound or of the composition type, although the former is likely to be somewhat more reliable. It is also desirable that R.5 should be "graded" in order that its resistance value should change by a lesser amount for any given movement of the knob when the latter approaches the "positive" position.

R.8 is used to couple the detector valve to the L.F. transformer, and it should have a resistance equal to from two to two-and-a-half times the impedance of the valve. In most cases it will have to carry but a small D.C. current, and therefore any type of half or 1-watt component will serve. Where the valve operates on the power-grid principle, the current will be considerably higher, so that in some cases a 2-watt resistance will be called for, that can be decided by making the calculation previously described.

R.9 decouples the anode circuit of the detector, and at the same time reduces the total H.T. voltage to a figure suitable for the anode of the detector. Generally its value will require to be between 10,000 and 50,000 ohms, but this can be determined by calculation, as also can the necessary voltage rating.

(Continued on page 800)



MAKING YOUR OWN Screened Coils

This is the Fifth and Concluding Article of the Series, and in it the Author Describes Some Simple Methods of Ganging Sets of the Coils Previously Described, Besides Giving Some Useful Circuits and Other Information.

By FRANK PRESTON.

IN previous articles of this series I have described in fair detail the construction of practically every type of screened tuning coil normally required, so that some further information in regard to the use of the coils described will prove useful. Different types of single coils have been dealt with and circuits have been given to show how two or more of these could be employed together. The principal difficulty in using a number of the coils, however, has been that a separate wave-change switch has been required for each, thus complicating matters to a certain extent. Fortunately, a new switch has lately been placed on the market by Messrs. Wilkins and Wright (of "Utility" fame) which is an excellent adjunct to the coils under discussion. The switch is a flat one, occupying a minimum of space and having an entirely negligible self-capacity, and it can thus be mounted alongside the coils without adding greatly to the space they occupy. This flat switch can be obtained in two or three different types, but the one which will be most useful in connection with our home-made coils is the three-pole shorting switch. The latter can be used for wavechanging on three ganged coils of the type normally requiring a push-pull switch for each, but when one of the coils is of the kind requiring a three-point switch for wavechanging, a four-pole switch can be used to operate on three coils. A photograph of a switch of the kind referred to is given at Fig. 1, whilst various methods of connection for different coil combinations are clearly shown in Fig. 2.

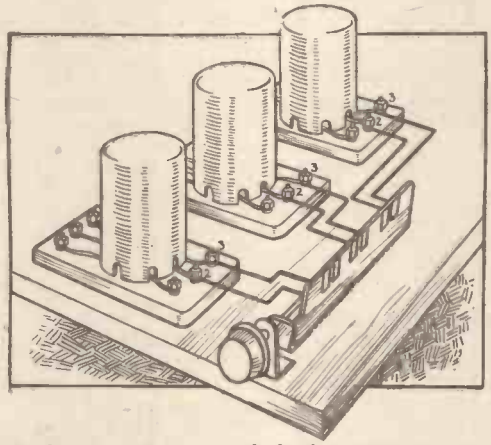


Fig. 3.—A convenient method of mounting the flat wave-change switch beside a set of coils.

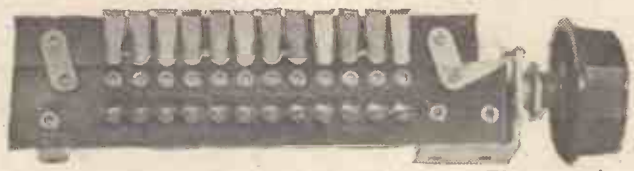


Fig. 1.—A flat switch of the type referred to. The particular component illustrated is a 3-pole change-over switch.

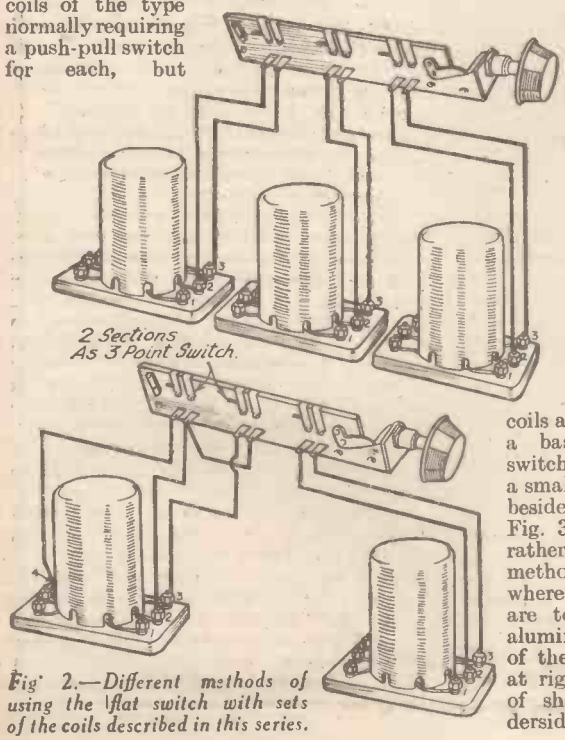


Fig. 2.—Different methods of using the flat switch with sets of the coils described in this series.

Ganged Coils and Switching

A practical detail we have not yet considered is in connection with the method of mounting the flat switch. If all the coils are screwed directly on to a baseboard or chassis, the switch can easily be attached to a small component bracket fixed beside the coils, as shown in Fig. 3. Another and perhaps rather more "professional" method is illustrated in Fig. 4, where the coils and the switch are together mounted on an aluminium baseplate; the edges of the baseplate are bent over at right-angles to form a kind of shallow chassis on the underside of which the switch can be mounted very neatly by means of a small aluminium bracket. The sketch will be self-explanatory, and it need only be added that the switch should always be mounted so that the connections to it from terminals on the coils are as short and direct as possible.

All-Wave Tuning

Coils for short waves, as well as for the broadcast bands, have been fully dealt with, but no information has yet been given in regard to employing a combination of broadcast and short-wave coils in an all-wave receiver. This is certainly a combination that is rapidly becoming more popular, and which has been proved (by the "All-Wave Two" and the "All-Wave Unipen," both described in PRACTICAL WIRELESS) to be thoroughly satisfactory and efficient. The circuit of a two-valve detector and low-frequency receiver is given in Fig. 5, where the two coils employed are the second to be described (illustrated on page 684, in Fig. 3) and the short-wave coil described on page 731. A flat switch of the type above referred to is used for shorting out a section of each coil, a separate three-point push-pull switch being employed for cutting out the broadcast coil entirely. This is a very convenient system of wavechanging, since the lower and higher band on either the short or broadcast ranges can be obtained by means of the ganged flat switch, whilst to change from broadcasting to short waves it is only necessary to pull out the knob of the three-point switch.

The circuit is so arranged that the

(Continued on page 800)

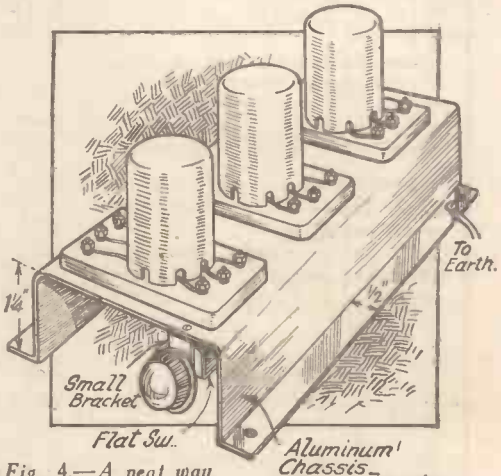


Fig. 4.—A neat way of building up a complete coil and switch assembly.

MAKING YOUR OWN SCREENED COILS

(Continued from previous page)

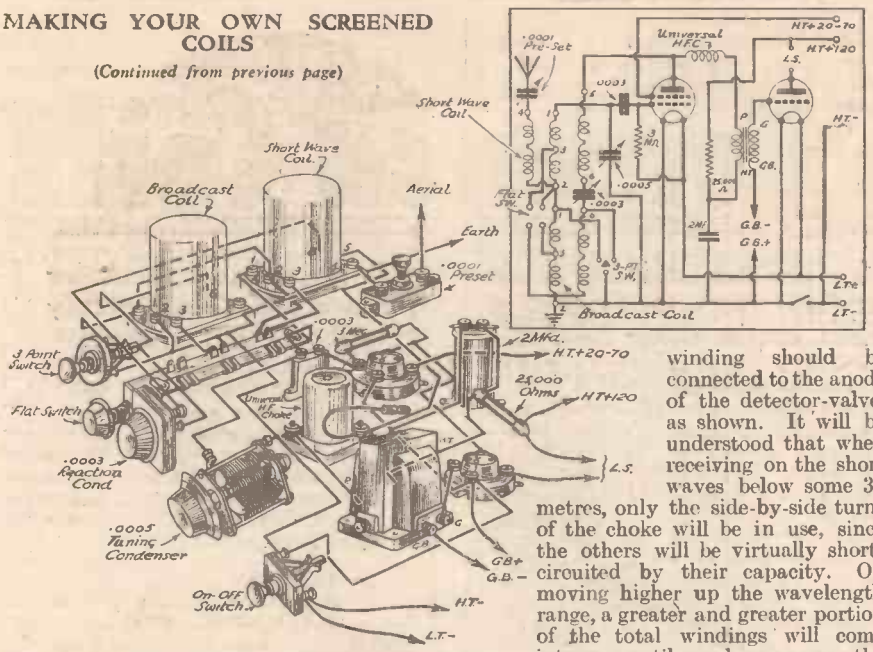


Fig. 5.—A useful all-wave two-valve circuit using two of the coils described.

reaction condenser comes between the two reaction windings, and because of this the moving vanes (which are connected to the spindle, of course) are at earth potential; in consequence, hand-capacity effects are not likely to be troublesome. A .0005 mfd. variable condenser is shown for tuning purposes, and this capacity is admittedly rather high for short-wave reception, although it is essential for covering the full band of wavelengths on the broadcasting ranges. So that tuning shall not be too critical a process, it is practically essential that the condenser should be provided with a reliable slow-motion drive. The reaction condenser is .0003 mfd., and although this is on the high side it is not likely that any great difficulty will be experienced in operating it; if it should seem rather "fierce," a smaller capacity can be tried. As a matter of fact, even a .0002 mfd. condenser will give reaction over the full range of wavelengths when a screen-grid valve is used for detection, as shown, but with medium-impedance triodes, such a capacity will be found rather too low to produce oscillation at the higher condenser readings.

A "Universal" Choke

A "universal," or all-wave high-frequency choke is shown, and most of the components sold under one or other of these names can successfully be used in this position. As an alternative, a short-wave and broadcast choke can be wired in series, connecting the short-wave component to the anode of the detector valve. Yet another method, and one which will be favoured by keen constructors, is to make the choke from similar materials to those employed for the coils. Constructional details of such a choke are given at Fig. 6, and it will be seen from this sketch that a small portion of the windings are arranged as side-by-side turns (for short-waves), the other portion being placed in slots formed by means of the dividing washers supplied with the coil former. There are 900 turns in all of 34-gauge d.c.c. or enamelled wire, and of these 25 are wound side by side, 50 are placed in the first slot, 105 in the second, and 180 in each of the remaining four. The "top" end of the winding should be connected to the anode of the detector-valve, as shown. It will be understood that when receiving on the short waves below some 30 metres, only the side-by-side turns of the choke will be in use, since the others will be virtually short-circuited by their capacity. On moving higher up the wavelength range, a greater and greater portion of the total windings will come into use until, on long waves, the whole choke will be in action.

Points of Interest.

There are a few other practical points which should be dealt with before concluding this series. A reader wrote some days ago from Aberystwyth asking if it would not be better to use silk-covered wire in place of the d.c.c. specified in the previous articles. As reason for this question the reader said that he had been informed that cotton

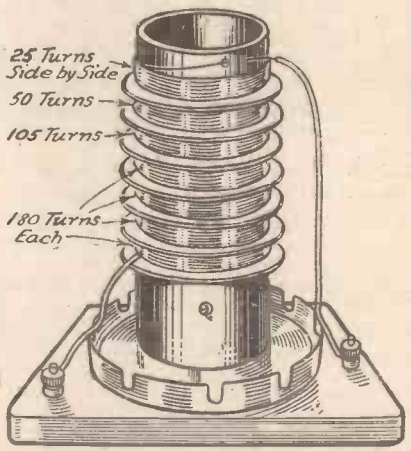


Fig. 6.—Details of an excellent all-wave or universal H.F. choke.

possesses some property which makes it unsuitable for coil winding. This is not quite true, although the reader had probably seen it stated at some time that cotton absorbs moisture rather easily, and when it becomes damp it is liable to act as a kind of high resistance short between adjacent turns. In practice, however, it is scarcely likely that the finished coil will be situated in a damp place where the moisture could produce an effect such as that mentioned. Should there be any danger of the coil being attacked by damp, it would be best to apply a thin coat of shellac varnish or melted paraffin wax to the windings. Here again we come up against a question that is often disputed—whether or not shellac and cotton produce a compound which attacks and corrodes the copper wire. There might be something in the suggestion that copper is attacked in this way, but I have never found any proof of it. In any case, whether using shellac or wax, make quite sure that only the thinnest possible layer is applied, because it will increase the self-capacity of the finished coil and thereby reduce its efficiency to some extent.

The difficulty just referred to would, of course, be non-existent if enamelled or silk-covered wire were used for the windings. Enamelled wire was given as an alternative in the specifications in respect to all the coils described, and this is eminently suitable provided that care is taken in winding it to prevent adjacent turns rubbing each other and scraping away the enamel. If enamelled wire is used, the number of turns should, theoretically, be modified slightly, due to the fact that the inductance and self-capacity are changed. In practice, however, the difference is generally so slight that the correction factor need not be taken into consideration. The only point that should be considered is that the distance between the ends of windings should be the same as those mentioned and shown in the various drawings. And as enamelled and silk-covered wires are thinner than those with cotton covering, the medium-wave turns occupy a shorter space on the former. The same remarks apply to silk-covered wire as to enamelled, except that in this case there is no danger of the insulation being scratched.

There is a little point in regard to soldered connections that ought to be dealt with. Under no circumstances should acid or chloride be used as a flux in soldering fine wires, since if it is, the joints are almost sure to corrode sooner or later, when trouble will naturally be experienced. Perhaps the best flux of all is resin, because this is not only non-corrosive, but it leaves a protective layer over the joint and is not "messy" in use. Additionally, it is an insulator, so that if any should "splutter" when the hot soldering iron is applied, no harm can be done.

CHOOSING & USING RESISTANCES

(Continued from page 798)

R.10 is an L.F. volume control, and varies the amount of L.F. signal current passed from the transformer secondary to the grid of the output pentode. Its function is comparable to that of R.1, although low-frequency, instead of high-frequency, current is being handled. The maximum resistance should be considerably higher than the impedance of the transformer, or else there will be some loss in the way of high-note response. A good value for general use is 250,000 ohms, and the component may be either wire-wound or otherwise; the former type is liable to be a bit "noisy" when the control is in use, but the latter might—if not of very sound construction—be productive of crackling noises. As in the case of R.5, it is an advantage to have this resistance of the "graded" type so that the resistance variation near the "full-volume" (grid) end of the element is less than at the other end.

R.12 is for decoupling the priming grid of the pentode, and it also cuts down the voltage to a suitable figure; the method of deciding upon its value is similar to that employed for R.9. It should be added, however, that an average value is about 2,000 ohms, which serves to prevent the passage of low-frequency alternating currents without "dropping" the voltage.

FROM THE FLASH LAMP

"MICRO-MICRO-FARADS"

By "Photon"

THE capacity of a conducting sphere in infinite space is, in electrostatic units, defined as equal to its radius in centimetres. To avoid the use of the term "infinite" it is easy to interpret this by saying that *well in the open* the capacity of a conducting sphere is somewhat greater than its radius expressed in cm. This enables us in many cases to assess the capacity of a component or part of a component by mere inspection with sufficient accuracy to decide whether it is important, and to compute what its effect will be on the

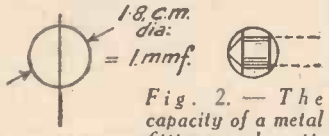


Fig. 1.—A sphere whose capacity is 1 micro-micro-farad.

Fig. 2.—The capacity of a metal fitting can be estimated from the size of a sphere which will contain it.

circuit of which it forms a part, but the result being in *centimetres* means nothing to the ordinary man used to dealing with microfarads. The conversion factor fortunately is simple and easy to remember thus:—

One micro-micro-farad = 0.9 of an electrostatic unit, that is to say 0.9 of a centimetre. For ordinary purposes, especially if the equivalent sphere has to be guessed, it is sufficient to say that a capacity

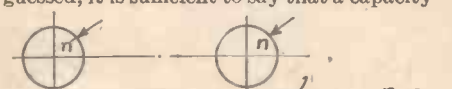


Fig. 3.—Two equal spheres at a distance l apart.

of 1 cm. is equal to 1 m.m.f. As an amusing example of this it may be remarked that the radius of the earth is a matter of 640 by 10^6 centimetres, and therefore on this approximate basis its electrostatic capacity is 640 microfarads only! What a paltry thing is our earth! More accurately the figure is 700 microfarads. As a practical application of this rule, the following examples are interesting. We can always make an *outside estimate* of the capacity of any metal fitting such as a grid-leak clip, or cap, or a terminal by describing around it the smallest sphere that will contain it, then the radius of that sphere in centimetres gives the capacity in m.m.f. Again, if we have to deal with an H.F. choke, we can approximate the end portions by imaginary spheres, and so assess the capacity. There is, however, one thing to guard against, capacities assessed in this manner are capacities between the part, or its equivalent sphere, and the surrounding earthed metal work, as for example, the screening or other metal panel. This means that the capacity may be greater than given by the estimate, but unless the space is exceptionally cramped the error will not be substantial. The method is capable of refinement without much complication. For example, if there are two equal spheres at opposite potential widely separated the capacity between them (one + and the other —) is half that of a single sphere, or if separated by a distance l (centres) the capacity of one to the other is :— $\frac{l}{l-r} \times \frac{r}{2}$ cm.

Some Examples

In conclusion a few examples are given in Figs. 1, 2, 3, 4 and 5. Fig. 1 represents a sphere whose capacity in the open = 1 mmf. Fig. 2 is the simple case of a metal fitting supposed to be far removed from earthed surroundings, a limiting figure being given by the radius of the containing sphere, as drawn. Fig. 3 is the case of two equal spheres distance l apart, Fig. 4 is the case of a single sphere at a distance = $l/2$ from an earthed boundary wall. Fig. 5 shows the manner in which it is possible to estimate the capacity of a choke coil; here, however, if the dielectric is in part solid, such as ebonite, the capacity will be greater than for a naked winding. This may be assessed knowing the value of the specific inductive capacity K. For ebonite K=2.8 to 2.9; there appears to be no suitable material available with a lower value.

It often happens that in putting up or remodelling a set one or more condensers of small capacity are found to be required, it is far easier to make such condensers than to buy them, and it costs less. If C_{11} stand for the capacity in mmf.

$$C_{11} = \frac{KA}{11.3\,b} \text{ mmf. or } A = \frac{C \times 11.3\,b}{K} \text{ cm.}^2$$

where A is area in cm.^{2}; b is thickness of dielectric in cm. and K is the specific inductive capacity. In air K = unity.

Two examples will suffice. If the dielectric is *air*, and the thickness $b = \frac{1}{2}$ mm.=.05 cm. Then *one mmf.* will require an area :—

$A = 11.3 \times .05 = .565$ cm.^{2}

It should be noted that $\frac{1}{2}$ mm. is about the usual air gap in a variable tuning condenser, hence for a condenser of .0005 m.f. (=500 mmf.) about 280 cm.^{2} is required. A sample measured was found to have vanes of 14 cm.^{2} area and 20 dielectric

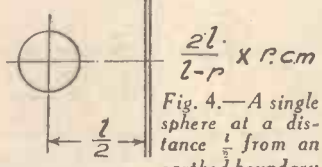


Fig. 4.—A single sphere at a distance $\frac{l}{2}$ from an earthed boundary wall.

spaces which is in perfect agreement.

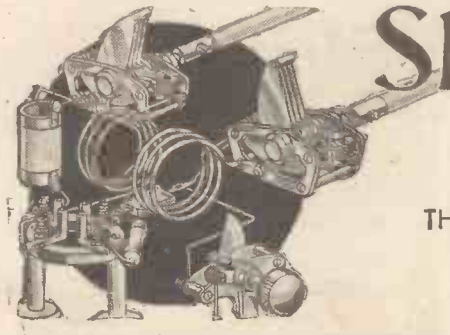
If the dielectric be mica the value of K may be taken = 5. A usual thickness of mica is $2\frac{3}{4}$/1000 inch or .008 cm. Hence area required for one mmf.

$$A = \frac{11.3 \times .008}{5}$$

$=0.18$ cm.^{2}

In building up small mica condensers it is convenient to use copper foil rather than tin foil. The copper foil should be as thin as procurable.

Fig. 5.—Illustrating the method of estimating the capacity of a choke.



Short Wave Section

THE LESSER LOGGED SHORT WAVERS

By E. THURWAY

CONDITIONS are now proving very favourable for the capture of distant transmissions on short waves, and daily reports are being received of the logging of stations of which signals had not been tuned-in for several months. Generally speaking, most of the short-wave transmitters can be classed under two separate headings in our lists, namely, those we can pick up at almost any period of the year, and those for which only a useful search can be made during certain months. As a rule, amongst the former may be found most Europeans, a number of North Americans and, to a certain extent, Australians, such as Sydney VK2ME; in addition, we can also look forward to hearing such stations at Nairobi, Bandoeng, and a few others from the East. In January especially the following guide will be found useful, as it gives the various times at which we may expect to hear broadcasts from the different quarters of the globe.

From midnight onwards to roughly 6 a.m. is the favourable period for East Coast and mid-west North Americans, and for stations situated in the Argentine, Brazil, Mexico, and so on, in the 30–50 metre band; from 6 to 9 a.m. you may expect to log Australian calls, as well as broadcasts from the American Pacific coast. Starting again towards midday, the 16 to 25-metre band should be searched, such broadcasters as W3XAL, Bound Brook, and the Dutch stations at Bandoeng usually coming in at that time; also Europeans working on channels between 19 and 32 metres. Again, from 5 to 8 p.m. we can try for India, South Africa, Kenya Colony (all included in 30–50 metres), or in the immediate lower band for North America, then until midnight in the wave-lengths ranging from, say, 35–70 metres and above.

If, as I assume, this is not your first attempt at listening to short-wave transmissions, you will have already secured the dial readings of some of the more better known or more powerful broadcasters, possibly in different sections of the wave band; if such is the case, it will help you greatly to narrow down your search for other wanted transmitters, as the loggings will give you a landmark for the various dial degrees at which to start. Casual twirling of the condensers is usually very disappointing, as tuning on the short waves must be very accurate, and consequently it is an easy matter to pass over a number of signals which very careful and slow moving of the dial would have caught.

European Wavelength Alterations

Before giving you details of a number of new stations, now being heard, let me mention a few alterations in some of the regular Europeans. Poznan (Poland), which had closed down temporarily when my last notes were published, is again on the air on Tuesdays and Thursdays at G.M.T. 17.30. The wavelength at present is slightly higher than hitherto, namely, 31.63 metres (9,485 kc/s). Jelöy, which relays the Oslo broadcasts, is now working on 42.92 metres (6,990 kc/s), on which channel it is providing both excellent quality and exceedingly loud signals. You will hear on this wavelength the usual musical-box signal usually associated with the Oslo entertainments in the higher broadcasting wave-band. Vienna (UOR2) on 49.41 metres (6,075 kc/s) has also resumed its tests on Tuesdays and Thursdays, and may be picked up at odd hours between G.M.T. 13.30 and 21.00. There is no change to report in the time schedules or frequencies of the British, French, and German transmitters.

The station used by the Technical College of the University of Bucarest, which had not been logged for some months, has been overhauled and now operates on 45.5 metres (6,593 kc/s) at slightly increased power. The best time to make the search is on Sundays from G.M.T. 15.00. It may be identified by the fact that the studio possesses a woman announcer and that the call frequently given out is *Radio Romania*.

OXY, Skamlebaek, after trying out a few channels around 49 metres, seems to have settled down again on 49.4 metres (6,075 kc/s); through this station you may get an excellent reception of the Copenhagen programmes.

In the 49-metre Band

Now for the lesser logged foreigners. In the 49-metre band we find several, but it will repay you to devote some time to the capture of La Paz (CP5), Bolivia, on 49.3 metres (6,085 kc/s), which is a daily transmitter between G.M.T. 00.30 and 04.30; the station also uses an alternative channel for its daylight broadcasts, namely, 19.61 metres (15,295 kc/s), which should be picked up between G.M.T. 16.30 and 17.30.

Barely two or three kilocycles above the former wavelength between midnight and 01.30, you may come across a Canadian call: VE9BJ, St. John, New Brunswick, a privately owned station which does not fail to mention its owners (C. and A. Munro); gramophone records are broadcast as well as a news bulletin.

Working up higher, if you hear Spanish and English announcements, you should stand by to secure identification, as CMCI, Marianao (Cuba) is on the ether daily from about 22.00; it is a powerful station on 49.5 metres (6,060 kc/s), of which the signals have already been logged in the British Isles. W4XB, on 49.67 metres (6,040 kc/s), the short-wave relay of WIOD, Miami Beach (Fla.) is also a possible and equally deserves a careful search.

Exploration of the 50–75 metre band, beginning with the powerful Moscow station, on most nights will bring good results; it is a mistake to believe that all the broadcasters work on the lower channels. A few evenings spent in this direction will amply repay your trouble. HJ4ABE, Medellin (Colombia) on 52.17 metres (5,750 kc/s) works from 00.30–04.00 on Tuesdays, and from 23.30–01.00 on Thursdays and Saturdays; also on other days from 16.00–05.00. Another South American, HCJB, Quito (Ecuador), I am informed, has changed his wavelength to 73 metres (4,110 kc/s) and operates every night from 01.15–02.45; the calls are in Spanish and English and the interval signal a two-tone chime.

Transatlantic and Other Distant Stations

A few metres above this channel you will find a welter of Dutch, French, and other amateur transmitters (75–85.7 metres), which at times provide items of interest. Working down, you will pass through the channels used by the International Service of Criminal Police, *e.g.*, HAP2, Budapest, on 72.09 metres, and by the transatlantic and other liners (71.82 metres). There are many degrees of the condenser dials on which you will wish to spend a little time, as most of them represent busy commercial or other channels.

Landmarks, as already stated, in the form of detailed logged condenser readings, are indispensable to the short-wave enthusiast. In every instance they will provide a quick jumping-off point and save considerable delay and worry. They also permit, by comparison, if a wavelength is not available, a fairly good estimate of the wavelength on which a transmission has been tuned in. Should you have found W8XK, East Pittsburgh, one of the KDKA pioneers, on 48.86 metres—it is on the air nightly—work up very slowly, degree by degree—when you will probably capture YV3BC, Caracas, on 48.92 metres (6,132 kc/s), the relay of the medium-wave broadcasting station in that city. From G.M.T. 21.00–02.00 on week-days is the most favourable period; on Sundays at that time the transmissions are carried out on 31.56 metres (9,510 kc/s). In the call you will hear a reference made to the *Radiodifusora Venezolana*. A further Venezuelan station, namely, YV11BMO, situated at Maracay, operates on 48.95 metres (6,127 kc/s). You may distinguish it from the previous one by the fact that it announces itself as the *Broadcasting Company of Caracas*; a man presides at the microphone.

Finally, reports have been received respecting two new Russian 500-watt transmitters, RNZ and RTL, respectively, on 62 metres (4,839 kc/s) and 54.74 metres (5,480 kc/s). They are situated in Kamschatka.

Exploring the ether with a good short-wave receiver to-day provides a fresh interest in radio; moreover, it permits its owner to hear transmissions which are not vouchsafed to him in the ordinary broadcast band.

RADIO RAMBLINGS

By IACE

Jottings from my Notebook

Loosely-Fitting Coil Covers

THERE is a point regarding tuning coils which is worth mentioning. I refer to the fitting of the covers of the "canned" type. Sometimes these do not fit at all tightly. This may not at first appear to be a very serious fault until we remember that the position of the cover affects the tuning range. This means that, in the case of ganged circuits, any movement of one of the coil covers is liable to upset the ganging. Of course, some coils have the covers held firmly in place by means of a nut on top. A simple safeguard of this nature is really all that is necessary.

Sometimes the covers fit fairly well, but tend to move when operating the wave-change switch incorporated in the base of the coils. I came across an example of this in a set of three coils mounted on one base with the switches linked by a rod in the popular manner. Every time the switch knob was turned the three covers wobbled from side to side!

"Intermittent" Rating of Accumulators

I SHOULD also like to give two suggestions concerning accessories. The first concerns the rating of accumulators. Could not the out-of-date and misleading "intermittent" rating be discontinued? It was based on the purely arbitrary assumption that an accumulator used to work a trembler coil, as for motor ignition or similar purposes, would last twice as long as when on continuous discharge. Under this system an accumulator capable of delivering 10 ampère-hours of electricity would be marked "20 amp.hrs.int." or "20 a.h.i." Often, however, the "int." is omitted and the purchaser is led to believe that he has a 20 amp.hrs. battery whereas, in reality, it is only of 10 amp.hrs. capacity. Of course, if it is stamped "20 amp.hrs. actual" there can be no mistake, but, as it is, a rating of 20 ampère-hours without any other qualification may mean either of two figures. If the intermittent system were abolished there would be no possibility of ambiguity.

Battery Cords

THE other suggestion I should like to make is that portable and such like receivers could be considerably cleaned up and at the same time made more fool-proof by eliminating most of the battery cords. Instead of using wander plugs, the H.T. and G.B. batteries would be fitted with brass contacts or clips somewhat similar to pocket-lamp batteries. All that would be needed when renewing a battery would be to slide the old one out and slip a new one in. The brass contacts would automatically connect with corresponding ones inside the case. This arrangement would make battery changing easier besides eliminating the possibility of plugging-in to the wrong sockets.

The batteries would have to be standardized as regards shape and size and would be fitted with a number of brass clips in place of the sockets used at present. The contacts inside the set would be in the form of spring-loaded plungers and placed so as to register with the clips on the battery which gave the appropriate voltages. Of course, each battery clip would be provided with a socket as well so that the battery could still be used in the orthodox manner with sets employing wander plugs.

Whistling in the Dark

I WAS privileged recently to witness a performance of *Whistling in the Dark*, a gangster play on American lines produced at the Comedy Theatre. The plot in brief is this: A dope and bootlegger gang are anxious to "bump off" an undesirable official who is in their way. An unsuspecting novelist, looking out for quiet retreat, happens upon them and asks to be allowed to look over the house. Amusing incidents result in his being held prisoner by the gang until he has produced a plan, on thriller lines, of the perfect crime which said gangsters can apply to aforesaid official. As a writer of crime stories the novelist here applies his imagination and produces a workable scheme. The play continues through amusing efforts on his part to warn the victims of his plot. Eventually he converts the radio set into a two-way system of communication with the telephone exchange, the gang having disconnected and removed the telephone. This part of the play was well done, and it is the first time, so far as I am aware, that radio has been used as a theatrical property in this way. The play is well acted, and I particularly liked Miss Billie Riccardo's acting as the eloping bride-to-be of the novelist. I had seen this actress only once before in the revival of *The Belle of New York*, in which she daintily played the part of Fifi with grace and distinction.

Siemen's Full o' Power Batteries

IT is always interesting to learn something about the construction of the apparatus or accessories which we use in conjunction with our radio sets and generally accept as a matter of course.

I have just been given some very interesting information concerning the Full o' Power Radio Battery which is claimed to be entirely distinct in construction to other types of dry batteries. Most of us visualize a dry battery as consisting of the type with a "dolly" wrapped with fabric surrounded with a moist paste or jelly electrolyte in an outer zinc container with soldered seams. In the Full o' Power Battery, however, the made-up "dolly" is dispensed with, a special manganese mix being compressed directly into the zinc container which, in this case, consists of a one-piece seamless cup pressed out from zinc sheet of heavy gauge. The zinc cup is thus perfectly leak-proof. It is most important to observe, however, that the manganese mix is not permitted to come into direct contact with the zinc, an insulated lining of very thin but tough paper being inserted into the zinc cup before the manganese mix is compressed into it. By this method it is possible to compress approximately 20 per cent. more active materials into the Full o' Power cell with a consequent increase in its life.

OLD COMPONENTS IN NEW CIRCUITS

(*Continued from page 780*)

Many amateurs whose experiments were commenced several years ago will have a 400-ohm potentiometer lying about. This was probably used to vary the potential applied to the detector grid through the grid-leak, but it can now be employed as an automatic grid-bias resistance in the L.F. circuit. The method of connection is perfectly simple, as can be seen from the sketch given at Fig. 5. The lead which was previously connected to the negative H.T. wander plug is now joined to one side of the potentiometer, whilst the other side is taken to the G.B. negative terminal and to the negative wander plug on the high-tension battery. In order to prevent instability a fixed condenser is connected in parallel with the potentiometer. The condenser shown is a 25 mfd. electrolytic one, this being most suitable, but if such a condenser is not readily available, an ordinary 1 or 2 mfd. one will make a good substitute. A correct value of bias for some types of valves can be obtained by varying the slider of the potentiometer, but the maximum resistance available will be too low for valves of other types, and in such cases it will be necessary to include a fixed resistance in the lead between the potentiometer and H.T. negative; this is shown by broken lines in Fig. 5. In any case the actual resistance value required can be found by dividing the grid-bias voltage required by the valve at maximum anode voltage by the anode current taken under the same conditions, and multiplying by a thousand. All the figures required for the calculation can be obtained from the makers' instruction sheet. An example will remove any difficulty in following the above statement; for the moment consider the Cossor 220 P.T. which requires 9 volts G.B. and takes 23 milliamps high-tension current. The bias resistance required is 9 divided by 23 and multiplied by 1,000, or 391 ohms. Suppose the valve in use had been a Cossor 215P, which requires a G.B. voltage of 7.5 and consumes 10 milliamps anode current, the bias resistance necessary would be 750 ohms, and therefore a fixed resistance of about 500 ohms could be wired in series with the potentiometer and the optimum setting of the potentiometer slider found under working conditions.

Scratch Filters

It frequently happens when using a pick-up that needle scratch is troublesome and some kind of filter is desirable in order to eliminate it. Scratch filters can be bought, but those who are still in possession of a set of plug-in coils will be pleased to know that one of these—having between 1,000 and 2,000 turns—may be used in conjunction with a small pre-set condenser as an excellent filter. The connections are shown in Fig. 6, and these are self-explanatory. It need only be pointed out that the pre-set condenser should be adjusted until needle scratch becomes inaudible or is reduced to its lowest volume level.

FACTS & FIGURES

Components tested in our Laboratories

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

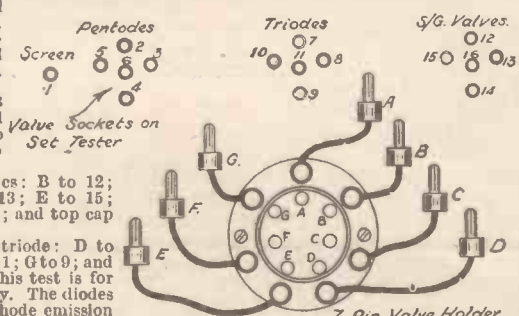
BRITISH RADIOPHONE PERFECTION SEVEN

BRITISH RADIOPHONE, LIMITED, announce that they are shortly releasing a free blue print of an ingenious seven valve superhet receiver in which their well-known Radiopak is employed. The circuit arrangement employed is of the single H.F. separate, oscillator type, and a metal rectifier (or cold valve) is employed for second detection and a separate similar rectifier for delayed automatic volume control purposes. An output stage of the pentode type is used to deliver an output of slightly over 1 watt. The blue print gives full constructional details and a list of recommended accessories, and we hope to have an opportunity of testing a complete receiver built to the specification in the near future. A point of interest for the more technical-minded reader is the choice of a frequency of 117.5 kc/s as an intermediate frequency in place of the more orthodox 110 or 126 kc/s. The chart may be obtained free from British Radiophone, Ltd., Aldwych House, Aldwych, London, W.C.2, or from your local dealer.

TESTING MULTI-PIN VALVES

USERS of the Six-Sixty valve and set testers will have probably found that it is a rather difficult matter to test the new multi-pin valves in these testers. The same point applies to all users of testers in which the standard type of holder for a valve is fitted. The Six-Sixty Valve Company have now issued an interesting pamphlet which gives the following useful information for using the testers with the latest type of valve. They advocate the mounting of a 7-pin valveholder of standard type on a suitable small baseboard and suggest that a flexible lead should be joined to each of the terminals. A plug should terminate the leads, and this should be of a type suitable for plugging into the existing valve sockets on the tester. The valve to be tested is then inserted in the 7-pin holder and the appropriate leads are plugged into the socket of the valveholders on the test panel as indicated below.

The Equilode Speaker which was reported on in these columns on December 16th last. The new matching dial on the rear is clearly shown by this illustration.



The connection for an additional valve-holder for testing Multi-pin valves on the Six-Sixty and similar test sets.

Battery H.F. pentodes are tested as normal S.G. valves.

Battery Class B (each half tested separately): B to 7; C to 9; D to 8; and E to 10.

Mains H.F. pentodes: B to 12; C to 11; D to 13; E to 15; F to 16; G to 15; and top cap to 17.

Mains duo diode triode: D to 8; E to 10; F to 11; G to 9; and top cap to 7. This test is for triode section only. The diodes will fail when cathode emission fails, a fact which will be revealed by the triode test above.

Mains single diode tetrode: B to 12; C to 14; D to 13; E to 15; F to 16; and top cap to 17.

Mains duo diode pentode: B to 12; D to 13; E to 15; F to 16; and top cap to 17.

Mains output pentode: B to 2; C to 1; D to 3; E to 5; F to 6; and G to 4.

DUBILIER SMALL ELECTROLYTIC CONDENSERS

A FURTHER consignment of the new small electrolytic condensers manufactured by the Dubilier Condenser Company has been received. These are of the type primarily designed for grid bias smoothing, and vary from a 10 volt working rating to 250 volt. The condensers are extremely compact, and are fitted at one end with a nut which, in contradistinction to the usual large electrolytic condenser, is connected to the negative pole. It will be recalled, of course, that in the ordinary type the case is negative, and this makes contact with the metal chassis. The positive pole is then found below the chassis, projecting in the centre of the hole through an insulated disc. In these small condensers, however, the case is provided with the fixing bolt, and the positive lead is provided in the form of a long flexible projecting from the upper end of the case. It is sufficiently long to enable the condenser to be wired into practically any circuit, and it will be found exceedingly useful for biasing purposes in mains receivers, with a consequent reduction in the risk of hum troubles. We have thoroughly tested these condensers, subjecting some to as much as 50 per cent. overload with no apparent trouble. They are roughly 1in. in diameter by about 2½in. long, and thus may conveniently be fixed into most receivers in place of the standard type which may at present be fitted. The capacities range from 2 mfds. to 50 mfds., and the price from 2s. 6d.

NEW PETO-SCOTT LOUD-SPEAKER

A NEW moving-coil loud-speaker of sound design is now offered by Messrs. Peto-Scott. It will be recalled that this firm previously had a remarkable model which sold at 15s., and the demand has resulted in the stock of this speaker being completely disposed of. The new model is slightly dearer, and is of more robust design. The magnet system is of the orthodox claw type, and is larger than the previous model, whilst the cone itself is of a prepared paper material. The chassis is also continued so that the back of the diaphragm is practically enclosed, with the result that the complete unit is slightly heavier than the previous model. The sensitivity of this speaker is quite as good as the original model, satisfactory results being obtained with a good two-valve receiver. It appears to handle slightly more volume than the old type, and a 5-watt amplifier was coupled to it without any undue chatter. The response curve is sensibly straight over the normal frequency band, bass being reproduced with a clean tone, and the upper notes coming out in a crisp manner without squeakiness. At 10s. 6d., complete with dust-bag, this is a line which no reader should pass by. A Class B model is available at 22s. 6d.

MAGNUM COMPONENTS

AMONG recent new Magnum components are the H.F. choke and the two-gang condenser. The former is wound with high-grade copper wire on a slotted ebonite former. A high inductance with a low self-capacity is obtained, and the choke is suitable for use in the anode circuit of a S.G. valve, or for simple reaction purposes. The component is designed for one-hole fixing, and terminals are provided for ease of connection. The price is 2s. 6d. The two-gang condenser incorporates two of the .0005 mfd. magnadensers, together with a Magnum slow-motion drive, and an independent drive is provided for trimming purposes. Both drives are positive and non-slipping, and the dial is calibrated 0 to 100, or, if desired, in wavelengths for use with Magnum coils. The price of this unit is 10s. 6d., and, if desired, a grey cellulose cover may be obtained for an additional 1s.

BUILDING THE NUCLEON 4

(*Continued from page 786*)

of the small fixed condensers having to be accommodated near to their respective associated components instead of being disposed below the surface. However, it is not possible to have things both ways, and, therefore, the difficulty of wiring and other drawbacks of the "one-side layout" must be contended with.

Construction

Before commencing construction the various components should be placed on the baseboard exactly as shown in the Wiring Diagram, Fig. 6, and not until every part has been found to be exactly in place should the fixing screws be driven home. It will be found most convenient to leave the tuning condenser until last, and to fit only the valveholders and the fixed condensers at the outset, the various interconnecting wires being put in as the assembly progresses. If the whole of the components are mounted first, it may be found by some constructors that the wires to the filament terminals of the valveholders, for instance, are impossible to connect. When the valveholders have been wired the transformers may be mounted and then the terminal strip at the rear. The leads to the terminals should be fitted, and then the three coils mounted in the space provided. Care must be exercised to get these in the correct positions, as it will be noticed that two of these are for the band-pass tuner and the third has entirely different connections. If they are reversed on the baseboard the receiver will not function. Coil TG is nearest the panel, and coil BP2 is the centre one.

The Panel

Now drill the panel, using the dimensions in Fig. 2 as a guide, and marking out the window from the template supplied with the drive. To cut this out a fretsaw may be used, or a number of small holes may be drilled all round the edge of the opening and the central piece of ebonite then broken out. It will not be necessary to file the opening smooth if the hole is made slightly larger than that recommended on the template. Mount the escutcheon and the other panel components, and then attach the leads to the reaction condenser, potentiometer, and switch. Place the panel in position and fix the retaining screws, after which the remaining wires may be fitted into position. It will be seen that in many cases soldering has been resorted to in order to make quite certain of good connection, but there is no reason why the task of building should be shirked on this account, as soldering is a really simple job, and, as has already been mentioned many times in these pages, the principal point to bear in mind is cleanliness. If the iron is used when it is really hot and the work is clean the solder will run quite freely, and a really sound connection will result.

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).

A Very Useful Little Set

SIR,—I received the PRACTICAL WIRELESS Kit of Tools safely, with which I am delighted. They are a very useful little set, and are well worth the money. I am a regular reader of your valuable paper, so I also have the set of spanners and drill gauge. Every success to PRACTICAL WIRELESS.—F. HANDS (Burton-on-Trent).

"Time Constant"

SIR,—In the December 2nd issue the term "time factor" is mentioned in Photon's article, "The Subdivision of Copper." I would be grateful if you would tell me in plain words:

1. Where the question of time comes in?
2. The importance of the "time factor."
3. And physical explanation of the term.

In reading an article on electric instruments I came across "Maximum time factor." What does this mean?—M. NEIDLE (London, S.E.).

[*Firstly it would appear that when you mention "time factor" you are misquoting from the article in which the term used is "time constant." The time constant is a term used in electrical engineering to denote the relation between L the inductance, and R the ohmic resistance of a circuit, but it is also applied to circuits having a capacity and resistance in which the time constant is:* $C \times R$

More generally it applies to any physical change, whether electrical or otherwise, which follows the logarithmic law. For example, when an E.M.F. is applied to a circuit that comprises a resistance only the current rises immediately to a value = V/R. If there is an inductance also in circuit the current rises logarithmically, ultimately reaching thes ame value V/R, but the initial rate of rise is determined by the inductance only and the time constant is the time which would elapse if this initial rate of rise were to continue till the value V/R is reached. The actual current flowing after that period of time is approximately two-thirds of the full value V/R.—ED.]

A Wonderful Kit.

SIR,—I wish to take this opportunity of thanking you for your wonderful Pocket Tool Kit. One look at these tools is enough to convince anyone that they are made to stand the test of time. PRACTICAL WIRELESS will also stand this test, because it is always kept up to a high standard.—G. BAILEY (London, N.).

"Proud To Own Such a Set"

SIR,—Thanks very much for the Tool Kit just received. Such a kit was, you may be sure, scrutinized severely, and as a practical man I have not the slightest hesitation in stating it is (in my opinion) a kit of the essential tools every amateur constructor should possess. I am proud to own such a kit, and urgently urge others to write you for one.—F. O'C. COOPER (Dover).

"Remarkable Value for the Money"

SIR,—I beg to acknowledge receipt of my Tool Kit, and I must say that it exceeded all of my expectations. The gift is like PRACTICAL WIRELESS, remarkable value for the money.—R. TAYLOR (Churt).

"A Wonderful Volume"

SIR,—I have been a regular reader of PRACTICAL WIRELESS since the first edition, and I think it is a very good wireless magazine for beginners and experts alike. I also wish to thank you for your "Popular Mechanics Encyclopædia," which I have just received. It is a wonderful volume, and will be most useful to me.—G. ALLAN (Forest Gate).

"Exactly What Is Required"

SIR,—I should like to take this opportunity in wishing your paper every success. I consider that it is about the best weekly wireless periodical that I have read since about 1922. No, I have not been a reader since No. 1 issue, but that I regret. However, I consider that your gift Tool Kit is exactly what is required by a person who spends nearly all his time at the experimental bench.—G. BARTHOLOMEW (Bulford).

"The Ideal Tool Kit"

SIR,—I must write and thank you for the really first-class Tool Kit which arrived O.K. It is the ideal kit for the wireless enthusiast.—J. E. BISHOP (London, W.C.).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT whilst indirectly-heated valves are warming up, the primary of an L.F. transformer is unloaded.
—THAT the above point explains the cause of hum when first switching on a mains receiver.
—THAT it is not possible to convert an inductive condenser into a non-inductive condenser by external means.
—THAT, generally speaking, it is not possible to use A.V.C. in a D.C. mains receiver unless a simple inefficient circuit is employed.
—THAT a whistle which accompanies loudspeaker reproduction, and which stops when the grid of the output valve is touched, denotes L.F. instability.
—THAT the simplest cure for the above is to reverse the connections to one of the L.F transformer windings.
—THAT instability can be caused by the vibration of the vanes of a tuning condenser.
—THAT an H.F. choke may be wound on a tapered former to improve its characteristics.
—THAT a sectional-wound choke, with small sections at either end, acts in a similar manner to the above type.

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.

MULLARD H.F. PENTODES

CONSTRUCTORS contemplating the use of screened (H.F.) pentodes in their next receiver should obtain a copy of a new Mullard leaflet on these valves which has just been issued. The special properties of the screened pentode are fully described, and are followed by full operating data and characteristics, with curves of the two Mullard types—V.P.4 and S.P.4—and practical operating hints for using these valves in modern circuits.

EELEX SHORT-WAVE CONVERTERS

THE problem of getting a short-wave superhet type converter to work with superhet receivers has been effectively solved by J. J. Eastick and Sons, who have produced a range of compact converters of single and two-valve types, the two-valve models having an extra stage of amplification. The converters are suitable for all types of broadcast receivers which are designed for reception above 1,000 metres. The wavelength range of the converter with the standard coil supplied is 15-60 metres, although this range can be increased to 120 metres by means of an additional coil. Booklets containing full particulars can be obtained from the above-mentioned firm at 118, Bunhill Row, London, E.C.1.

"THE ALL-METAL WAY, 1934."

THIS is the title of an attractive handbook dealing with the construction of H.T. battery eliminators and battery chargers embodying Westinghouse metal rectifiers. The book, which is primarily of interest to home constructors who prefer to build their own apparatus, deals fully with rectification, battery eliminator problems, mains conversion, and battery charging. 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.

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 CROYDON RADIO SOCIETY

A popular comparison of members' gramophone pick-ups took place on December 12th at St. Peter's Hall, S. Croydon. A motor was fixed to a special test board, around which was screwed each pick-up on arrival. Switching enabled any two to be compared at a time, and all of them fed into a high-class receiver, using an A.C. H.L. and an L.S.6a at 350 volts for output. A discussion revealing some inherent difficulties in records and their reproduction first took place. Correct tracking was vital, and the needle must remain at right angles to the radius. There was also the difficulty of side pull on the groove, methods of minimizing this being indicated. In any case needle scratch limited top response at 3,500 cycles, while impracticability of a wide groove limited the bass. Tests were performed on a special musical frequency test record, and various needles were tried in turn. The Society is preparing for its New Year campaign for members, and PRACTICAL WIRELESS readers can gain ready admittance on application to the hon. secretary, E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

SLADE RADIO

It was a "Members' Night" at a meeting held recently, and the opportunity was taken to deal with the following:—

1. Questions on subjects relating to lectures during the past quarter.
2. General questions.
3. Interference, mains, etc.

A large number of questions were raised and dealt with in a very satisfactory manner by Messrs. A. Freeman and G. T. Peck, the joint technical advisers. During the evening an oscillator of the latest type was exhibited and inspected by the members with great interest.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

BATTERSEA AND DISTRICT RADIO SOCIETY

On Friday evening, December 15th, the Battersea and District Radio Society held its last meeting for 1933, when Mr. D. Ashby, of the Westinghouse Brake and Saxby Signal Co., Ltd., gave a lantern lecture on the "Westector and its Associated Circuits." Various circuits for detection, automatic volume control, and H.T. current economizing by means of the Westector were shown by means of slides, and ably explained by the lecturer. The next meeting will be on January 9th, when it is hoped that the finishing touches will be given to the new D.C. mains receiver which the members have been building.—L. W. Smith, Hon. Sec., 8, Emu Road, Battersea, S.W.8.

INTERNATIONAL SHORT-WAVE CLUB (LONDON CHAPTER)

At the meeting of the London Chapter held at R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, December 15th, Mr. P. J. L. Macfarlane, G5MK, gave an illustrated talk on the layout and construction of short-wave receivers. He also gave some details of a new method he has discovered of obtaining reaction. A discussion then followed, dealing with the propagation of ultra-short waves. Various theories being put forward by the members, who showed great interest in this subject. Our new series of meetings commenced on January 5th at 8.0 p.m.—A. E. Bear, Sec., 10, St. Mary's Place, Rotherhithe, London, S.E.16.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

A large number of short-wave listeners attended the inauguration of the Manchester Chapter of the International Short Wave Club, held on Tuesday, December 12th, at 75, Long Street, Middleton, nr. Manchester. Mr. F. Fielding, of Allied Newspapers, Ltd., and Mr. F. Sharpe were present. Mr. H. Wild, chairman, in opening the meeting spoke of the many advantages of being a member of this world-wide organization. Mr. Fielding then gave a talk on short-wave receivers, and mentioned the thrills to be obtained by hearing Australia for the first time. Mr. H. B. Shields, technical adviser, then described and demonstrated several short-wave receivers. All present agreed that they had enjoyed a most interesting evening. Many exclusive features have been arranged for future meetings, and all PRACTICAL WIRELESS readers in the district who are interested in short-wave work are invited to attend. The next meeting will be held at 75, Long Street, Middleton, nr. Manchester, at 8.0 p.m. on Tuesday, January 9.—R. Lawton, Secretary, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, Nr. Manchester.

REPLIES TO BROADCAST QUERIES

MAC (London, N.10): We can trace the following call signs: (2) G6VK, A. R. Dellbridge, "Normanhurst," High Road, Laindon, Essex; (4) G2WS, W. A. Scarr, B.A., 4, Ridge Mount, Cliff Road, Hyde Park, Leeds, Yorks; (5) G5VT, A. E. J. Cooper, "Halfacres," Bishops Stortford, Hertfordshire; (6) G5VL, R. W. Leader and H. J. Powditch, Porth House, Porth, St. Colomb Minor, Cornwall; (9) G5CV, P. D. Walters, 45, Fairfax Road, Bedford Park, W.4; (11) G2SK, K. G. Styles, 19, Southampton Buildings, Chancery Lane, W.C.2; (12) G5UK, M. B. Buckwell, 114, Tankerville Drive, Leigh-on-Sea, Southend, Essex; (13) G6VI, W. MacCallum, 21, Park Place, Stirling, Scotland; (16) G5VB, A. F. Elton Bott, "Francisca," Barlow Road, Hampton, Middlesex; (17) G5SB, S. Berry, 143, Cheltenham Road, Bristol, 6; (18) G5RB, A. R. V. Garrett, Swinley House, South Ascot, Berkshire; (20) HAF4A, Denes Bibo, 50, Marvany Utca, Budapest, 1, Hungary; (21) PAOAG, R. H. Brouwer, 14, Grootestrasse, Rijssen, Holland; (23) PAOHB, W. M. F. J. Otten, Havermarkt, Breda, Holland; (25) PAORO, J. R. Letitre, 111, Scheveningenschelaan, The Hague, Holland; (27) PAORP, M. E. A. Bemelmans, 24, Bezuidenhout, The Hague, Holland; (28) PAOMF, J. H. Van Dijk, 331, Hoofdweg, Amsterdam, Holland; (30) F8VG, Georget, Rue de l'Eglise, St.-Laurent près Epinal (Vosges), France; (31) F3BI, Marc Tonna, 134, Boulevard Dauphinot, Rheims, France; (33) F3CP, Louis Regnier, 9, Rue de Mazenay, Le Creuzot, France; (34) F8PU, Bassus, 2, Rue Saint Vincent-de-Paul, Bordeaux (Gironde), France; (36) F8QS, Eugène Dartevelle, 21, Rue de Douzies, Sous-le-Bois, Maubeuge, (Nord), France; (37) F3AM, P. Munch, 1, Rue du Hugstein, Guebwiller (Haut Rhin), France; (38) F8KI (K ?), M. Yvonnet, 8, Rue Desnouettes, Paris (15), France; (39) F8VV, Marcel Dudouet, Chalet D.9, Colombelles (Calvados), France; (40) F8AC-Lagien, 12, Rue Edmond Rostond, Marseilles, Bouches, du-Rhône, France; (41) F8CL, De Commines de Marsilly, Villa Saint Georges, Saint-Lô (Manche), France; (42) F8JE, Leon Cozic, 8, Rue Victor Hugo, Brest (Finistère), France; (43) F3BN, Marcel Mathias, 36, Rue Marchais, Orleans (Loiret), France; (44) F8ZB, Bouchard, Les Erables, Route de Corcelles, Dijon (Côte d'Or), France; (45) F8VL, Caradec, 177, Rue Croix-Nivert, Paris (15), France; (46) F8YR, Beaujeau, 85, Rue Sadi-Carnot, Armentières (Nord), France; (47) EAR155, Ignacio Guitian, 44, General Lacy, Madrid, Spain; (49) HB9K, Philip Recordon, Grand Champ, Lausanne, Switzerland; (50) HB9AA, Hans Buechler, 77, Scheuchzerstrasse, Zurich 6, Switzerland; (51) ON4BL (A ?), H. de Thier, 115, Avenue du Chêne, Heusy, Verviers, Belgium; (52) F8MI (L ?), Lieutenant Paqueron, Chef de Transmissions du Territoire, 22, Rue du Commandant Mellier, Fez (Morocco); (53) CT1FU, Mario de Vasconcelos, 461, Rua das Valas, Oporto, Portugal. AUSSI (Kent); SILVANUS HAYWOOD (Tipton): VK2ME, Sydney (Australia) received direct on 31.28 m. The interval signal is the call of the Kookaburra (Laughing Jackass). The address is: Amalgamated Wireless, Ltd., 17, York Street, Sydney, N.S.W., Australia.

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.

THERMAL DELAY SWITCH

"As a new reader of your interesting periodical I have just seen reference to what is called a thermal delay switch. I realize from the name that this operates on a temperature basis, but regret that I cannot see its application in a normal receiver. Please could you let me know just what it is, and its general application?"—G. H. (Kettering).

The switch is employed on the mains side of a receiver, which uses a rectifying valve of the indirectly-heated type. The heater of such a valve is fed from a secondary winding on the mains transformer, and the centre tap of this winding is employed as the H.T. positive lead. Obviously, therefore, when the mans are switched on the H.T. positive connection is completed to the receiver, but the heater takes thirty seconds or so to obtain maximum emission, and thus there is a risk of condensers and other components breaking down due to the excessive load caused by the fact that no anode current can flow until the valve is giving emission. Where the valves in the receiver are of similar type the danger is increased. The delay switch is wired in series in the H.T. lead, and it is fed from the same heater winding. Thus, whilst the heater is attaining maximum temperature the switch is also warming up and only closes when a certain temperature is obtained. This is designed to take approximately the same time as the normal I.H. valve. The switch may, of course, be employed in a D.C. mains receiver for the same reason.

WAVE-CHANGE SWITCH FAULTY

"My receiver has been working for quite a long time without any trouble, but find I cannot now get Daventry or other long-wave stations. When I switch over to the long waves there is a sort of rustling noise, but there are no signals and reaction also seems dead. Can you give me any idea what is wrong?"—R. B., (Pimlico).

It is most probable that the wave-change switch has become faulty, due either to corrosion or a bad contact caused by a weakened spring. There is, however, the remote possibility that one of the long-wave windings (if more than one coil is used) has broken, although with the majority of commercial coils this should not happen. Examine the switch carefully and we think you will find that this is the real cause of the trouble. Whenever a set works well on one wave-band and fails on another it may be taken that the fault can only arise in the part of the circuit which is changed, and with the majority of broadcast receivers one part of the coil is simply shorted out for medium waves, thus localising the fault as being in the switch or that portion of the coil which is brought into circuit.

FUSE SHORTING TO CHASSIS

"I have finished the Orbit but am rather puzzled by a peculiar fault which is occurring on it. When I finished and screwed the fuse bulb in it glowed fairly brightly. The switch was 'off,' and so I pulled it into the 'on' position, and was surprised to see the fuse go out and the valves then lit up and the set worked. Results are really splendid, and I could not wish for a better set, but I cannot understand whether I have made a mistake in the wiring, or whether the fuse should work as it does. It is definitely alight when the switch is off and goes out when the set is on. Is this normal?"—W. D. C. (Bromsgrove).

The fault is due to the fact that you have screwed the fuse bulb too hard into its holder, and this has forced the lower contact down on to the metallized chassis. If you give the bulb one or two turns upward you will find that it will go out and will then function in the ordinary way. A number of readers seem to have experienced this peculiarity, and it would, therefore, appear to be a good plan to fit a disc of paper or thin card below the fuse holder when mounting this in order to avoid the risk.

DATA SHEET No. 68.

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

SHUNT RESISTANCES FOR CONVERTING A 100-OHM METER.

Required Shunt (Ohms)	Multiplying factor	Required Shunt (Ohms)	Multiplying Factor
0.100	1,000	2.04	50
0.125	800	2.56	40
0.200	500	3.45	30
0.251	400	5.26	20
0.334	300	11.11	10
0.503	200	14.29	8
1.010	100	20	6
1.266	80	25	5
1.695	60	33.33	4
		50	3
		100	2

From the above table it will be seen that if a meter having a resistance of 100 ohms and reading 5 milliamps is required to read 50 milliamps (that is 10 times) a shunt of 11.11 ohms will be required. Knowing the resistance of the meter, any resistance can be ascertained from the above table.

FURY FOUR PROBLEM

"I have finished the Fury Four and can only get very weak signals. I have tried everything to bring up the strength but without avail. I finally borrowed a meter and find that the total H.T. across the terminals are only 30 volts I have checked all the resistances by replacing them with others and can still get no results. Can you give any clue to the trouble?"—T. Y. D. (Gloucester).

There is undoubtedly a short-circuit across your H.T. supply in some part of the receiver, and the only way to find it is to connect a meter across H.T. positive and negative and then to go right through the circuit disconnecting various components one at a time until you find that the voltage rises to normal. This may seem tedious, but it is infallible, and it will most likely be found that there is a short-circuit on to the chassis.

MEASURING OUTPUT VOLUME

"I am getting really interested in the performance of my set since I have taken up "Practical Wireless," and I have a problem to put to you. I know nothing of mathematics, or the technical side of wireless, but I am immensely keen to be able to measure the actual volume given off by my set as I wish to carry out experiments with various ideas and to compare them with what I get now. I can, of course, judge the quality by my ear, but I cannot judge actual power and I should like to measure this, as I read that an increase of 50 per cent. is not detectable by the ear alone."—F. L. P. A. (Holloway).

If a circuit is made up by you and you cannot detect an increase in volume, there is hardly any necessity to measure it. However, from an interest point of view you probably wish to carry out some experiments, and therefore the easiest arrangement is to fix up the following apparatus. Obtain a small disc of polished aluminium, say, about as large as a penny. Have a really high polish on one side, similar to a mirror. Stick this, mirror side outwards, on a length of very thin silk, and stretch the silk between two firmly fixed arms. The entire structure should be really rigid, and the length of silk should be adjusted so that the mirror can rotate, or at least vibrate freely. This piece of apparatus should be stood directly in front of your loudspeaker (the actual optimum distance being found by experiment), and a small lamp focused on the mirror with no signals coming through. When the set is switched on it will be found that the sound waves will cause the mirror to move about, and you can then arrange the lamp and mirror so that the spot light cast by the latter is directed on to the wall. The maximum movement will be obtained by the loudest signal, and you should be able to arrange matters so that you get only a small movement with the present set and thus be able easily to see the circuit which produces maximum volume. Of course, the lamp and mirror must always be placed exactly in the same position.

ADDITIONAL LOUD-SPEAKER

"I was very interested in the recent article on connecting an extra loud-speaker, but I find that all through that article the author did not deal with the push-pull circuit. As I am at present using this arrangement, and should like to use an extra speaker, I should be glad of directions for connecting it to my circuit."—H. A. S. (Gainsborough).

The conditions of a push-pull circuit are generally similar to a triode employing an output choke. That is, the two anodes of the push-pull valves are joined together through a choke or the primary of an output transformer. The centre tap of this winding is joined to H.T. positive. Therefore, an extra speaker may be joined to the two anodes, either direct, or through a fixed condenser of 2 mfds. There is no D.C. flowing in the normal push-pull stage so that the condensers are not essential, and they need only be used when the extra speaker is supplied at some distance from the apparatus. If the present speaker is joined to the anodes, then it will be preferable (as in the other cases mentioned in the article) to obtain a speaker with an output transformer, or a separate transformer, and to use this for supplying one speaker and the primary to be used as a choke.

STATICS

"I am rather puzzled by the phenomenon which I receive regularly on my set. If I set the tuning dials to a spot slightly below London there is practically dead quiet. As I turn the dials towards London, however, there comes in a lot of cracklings and noises which are strongest when I am tuned to London, and if there is no music on there is a most horrible noise. —G. T. (Edgware).

The fault is quite beyond your control, and is due to the high efficiency of your H.F. stage, or stages. The carrier-wave of the local station acts as a conveyor for all kinds of static and other noises and these are in themselves untuned but accompany the carrier wave. Thus, when tuned to a point where there is no broadcast station the noises are not so clearly audible as when you tune in a powerful carrier with its accompanying "mush." Obviously the noises (as well as the general signal) will be reduced if you lower the amount of H.F. amplification.

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PRACTICAL WIRELESS, 6/1/34.

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PREMIER Supply Stores, 20, High Street, Clapham, S.W.4. See our advt. on Page 748 of December 23rd issue.

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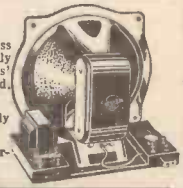

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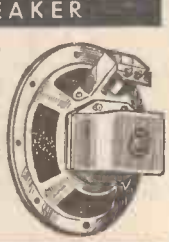

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TWO FREE GIFTS NEXT WEEK! SEE INSIDE!

Practical Wireless

3D

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EDITED BY F. J. CAMM.

The ICONOSCOPE

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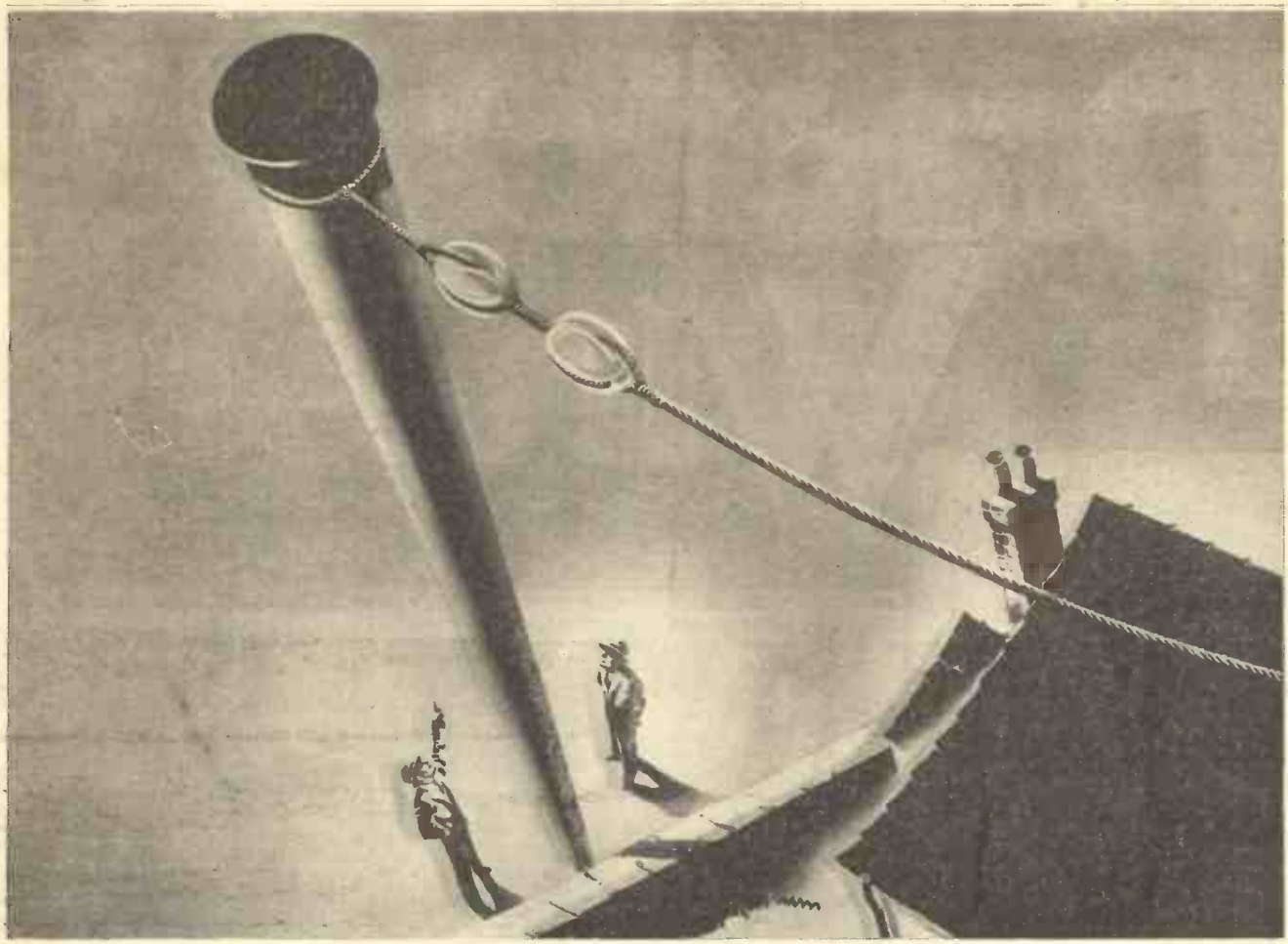

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ROUND *the* WORLD *of* WIRELESS

What of Television?

THERE are distinct signs that television is at last coming into its own, and the public is realising that, although present-day television transmissions are not perfect, they are at least capable of providing excellent entertainment. Until lately the degree of perfection to which wireless telephone reception has attained has been offered as an excuse for the statement that radio is rapidly approaching finality. Such a statement is obviously far from the truth, since no sound can be really "complete" without the associated "vision." It is a very short time since moving-pictures were considered to have become well-nigh perfect, but immediately it was found possible to synchronize sound and music with the pictures, ideas underwent a rapid change. To-day "silent" films would be scoffed at, and in precisely the same way it is safe to predict that "visionless" radio will very soon be a thing of the past.

The change-over to televised wireless transmissions as common sources of entertainment will probably come "in a night," and it behoves every interested amateur to make himself acquainted with the principles of television at the earliest possible opportunity. It is very largely with this idea in mind that we commenced to present to readers of PRACTICAL WIRELESS a short time ago our "Television Supplement," the popularity of which has already become very apparent to us. PRACTICAL WIRELESS has, since its inception, gained a wonderful reputation for presenting a vast number of facts and a maximum amount of information in concise and interesting form, and readers may rest assured that the self-same principles will apply to the many articles on television which will be given.

Perhaps there are some readers who consider television beyond their comprehension, or who think that the necessary apparatus is either complicated or costly. To any such persons we would suggest that they carefully peruse some of the television articles, after which we are convinced that their views will completely be modified. To other readers who have already assimilated the fundamentals, or who have commenced to experiment with television apparatus, we would say that they will find all the additional information and constructional details which they require contained in our regular feature, the "Television Supplement."

A Secret Out

FOR some time the Editor of PRACTICAL WIRELESS has been hard at work on what motor car manufacturers delight to refer to as a "hush-hush" task. The nature of this has been kept secret until just recently, when it has become known in the office that Mr. Camm has been designing another new receiver for his readers. Mr. Camm described his "Fury Four" in January, 1933, and this remarkably efficient set was easily the most popular home-constructor set of the year. The latest 1934 receiver is even better than the 1933 one, so you can rest assured that it is something really good. Although very easy to make, it embodies all the latest developments and is sure to meet with the warm approval of every amateur who delights in set construction. The writer is forbidden from giving any further details at the moment, but the complete specification will shortly be available for publication. Look out for the set which will ensure perfect reception during 1934!

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(1) The PRACTICAL WIRELESS "1934 Wavelength Guide and Station Log"—A hang-up chart containing all of the important stations and their new wavelengths, as laid down under the Lucerne Plan.

(2) A valuable Booklet entitled "MAKING YOUR SET SELECTIVE." The problem of selectivity has become acute, and this specially-prepared booklet will show you how to modify your receiver to cope with modern broadcasting conditions.

F. J. CAMM'S 1934 FURY SUPER.

Next week's issue will also contain details of Mr. F. J. Camm's 1934 Fury Super. Every reader will be interested in his latest receiver, and readers who built the "Fury Four" (described in January and February last year) will be enabled for a few shillings to bring their receivers entirely up to date. The demand for the next issue, in spite of a greatly increased printing order, will be colossal! Reserve your copy now!

Practical Mechanics for January

THE January issue of NEWNES' PRACTICAL MECHANICS (6d. from all newsagents, or 7½d. post free from George Newnes, Ltd., 8-11, Southampton St., Strand, W.C.2) contains many interesting articles on fascinating scientific and mechanical subjects. There are well illustrated articles on "Making Mains Transformers for all Purposes," "The Iris Diaphragm," "Astronomy," "Model Boats," "Making a Small Precision Lathe," "Home Cinematography," "Television Synchronizing Gear," "Piccard Gondola," "Experiments in Chemistry," "Microscopy," "Home Recording," "Practical Conjuring," "Lathe Work for Amateurs," "Model Railways," "Gramophone Upkeep, Overhaul and Repair," "Making an Ingenious Combination Lock," "Practical Hints and Tips," "Building Model Aeroplanes," "Making a Twin Solenoid Electric Motor," "The Polariscope," whilst special features deal with "New Tools, Gadgets, and Accessories," "Money Making Ideas," "Trade News," "Club Reports," "Free Patent Advice to Inventors," "Replies to Readers' Queries," "The Latest Novelties," "Notes, News and Views," etc., etc.

This modern and practical monthly magazine is lavishly illustrated and has an attractive new three-colour cover each month. Get a copy to-day.

Mr. W. O. Twells

IT is with deepest regret that "His Master's Voice" announce the death of a valued member of their Advertising Department; Mr. W. O. Twells. He died on December 16th at the age of forty-five years, after a week's illness, culminating in double pneumonia.

Mr. Twells joined "His Master's Voice" in May last, after having been in charge of the radio section of Columbia advertising for four years. He was previously with Celebritone, Ltd. He leaves a widow and two young children. The funeral took place on Tuesday, December 19th, at which prominent members of both "His Master's Voice" and Columbia staffs were present.

ENSURE YOUR FREE GIFTS BY ORDERING NEXT WEEK'S ISSUE NOW!

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

Wireless for Diamond Mines

AN interesting example of the use of wireless in industry is the regular communication service maintained by the Consolidated Diamond Mines of South-West Africa, Limited, between their station at Luderitzbucht (South-West Africa) and their mining camp at Oranjemund, 160 miles distant. Equipment capable of operation on either telegraphy or telephony, as desired, was supplied by the Marconi Company some eighteen months ago, and has since been regularly used for the exchange of messages at fixed hours every morning and afternoon, on wavelengths of about 1,100 metres. Despite the severity of the atmospheric disturbances prevalent in South-West Africa, the service is very reliable. An interesting feature of the Luderitzbucht station is that, its site being on solid granite with sand pockets, the use of counterpoise is required instead of the usual buried earths. The installations at both stations are identical. The transmitters are the Marconi "U" type of 1½ kilowatts power, and derive their energy from paraffin engine generator sets. This type of transmitter comprises two rectifying valves and one oscillator in the telegraph unit, with a modulator and submodulating valve added for telephony. The wave range is from 600 to 3,000 metres.

Short Plays from Midland Regional

ON January 22nd Midland Regional listeners will hear three short plays—Maurice Baring's *The Drawback; The Monkey's Paw*, by W. W. Jacobs, which has been given from London, and Gertrude Jennings' clever comedy of a lift, *Five Birds in a Cage*. Then, on the 27th, there is a pantomime burlesque, *Snowdrop and the Seven Dwarfs* (Hollywood Version), with music and lyrics by Ronald Hill. As the result of nearly two hundred auditions, Martyn Webster has found some new acting talent in the region, and some new players will be in the casts.

New "Points of View" Talks

THE first Scottish Regional discussion in the new "Points of View" series will take place on January 15th. This series will bring to the microphone, on some half-dozen occasions, distinguished Scots to discuss some of the great world problems of the present day. "Is Democracy Doomed" is first on an interesting list, and it will be debated by Mr. Tom Johnston, who was Parliamentary Under-Secretary for Scotland in 1929-31, and Lord Privy Seal in 1931, and Professor F. A. E. Crew, the distinguished biologist and author. It will be interesting to discover whether there is a typically Scottish view-point on great world problems.

Prague's Alternative Programmes

THE old Prague-Strasnice station, which was closed down when the new Liblice transmitter was brought into operation, has been completely overhauled and brought up to date. It is now carrying out tests in the early morning hours on 249.2 metres with a view to the broadcast of an alternative programme for radio listeners.

INTERESTING and TOPICAL PARAGRAPHS

RECORDING THE KING'S CHRISTMAS MESSAGE

By special permission of The King, an H.M.V. gramophone record of his Christmas Day speech was made in the "His Master's Voice" recording laboratories at St. John's Wood. The half-recorded wax blank, which is made chiefly of soap, can be seen, whilst one of the engineers adjusts the volume and the other examines the track of the King's voice under a magnifying glass. The width of the track of His Majesty's voice in the record is only three thousandths of an inch.

Opera House Relay

IN future Radio Budapest will restrict its relays of performances from the Royal Hungarian Opera House to excerpts consisting of one act, as it has been found that when this course is adopted the appetite of listeners is whetted and the opera house bookings proportionately increase as a consequence of the broadcast.

Neutral Broadcaster for Holland

SO far the two Dutch transmitters, Hilversum and Huizen, have been run by a number of political and religious bodies, who in the course of their programmes have introduced a considerable amount of propaganda for their respective associations. In view of the friction existing between these various programme organizers an attempt is to be made to establish a high-power station with a view to a regular service of strictly neutral broadcasts.

Some Music Case!

THE National Broadcasting Company of America, when removing its belongings to the new headquarters at Radio City, was called upon to transfer the largest collection of music in the world. It consists of more than 500,000 scores valued at well over half a million dollars. In many instances they bear the actual signature of the composer, an embellishment which greatly enhances their value.

Radio in the Sahara Desert

THE French Authorities have decided to establish a comprehensive network of small wireless telephony and telegraphy stations in the Sahara desert with a view to linking up the different military posts. The first three stations will be installed at Wahatel Faragia, Wahatel Karigia and on the Sinai promontory.

Will the Poste-Parisien Take Over Other Duties?

ACCORDING to a report from Paris the Poste-Parisien station may suspend its entertainment broadcasts in the near future, as there is a possibility of the transmitter being taken over by the French Admiralty. It would be used for ensuring communications between the capital, the naval seaports, and warships at sea.

Verbal or Gong Time Signals

CONTRARY to the custom adopted in this country by which the exact time is automatically supplied by the Greenwich Observatory, many Continental stations still broadcast at odd hours, and take their signals from an electric clock in the studio. In Germany, except at fixed periods of the day, the listener is verbally told the time when the announcer strikes a gong and informs his hearers the number of minutes or seconds past the hour. A similar method has been the custom in most French studios, but it is gradually being replaced by clock carillons at the opening or end of the programmes.

Value of Super-Power Valve's Emission

IN 1,000 hours a good two-volt battery super-power valve would emit electrons the total weight of which would be of the order of 300 times the weight of the complete filament.

SOLVE THIS!

Problem No. 69

Jackson made up a battery-receiver in which an R.C.C. stage was incorporated. He found that both on local stations and gramophone the output valve was overloaded, so he substituted a potentiometer for the grid leak in the R.C.C. stage. He found, however, that as the control was adjusted, very little alteration in volume was experienced for part of the travel, and then suddenly the volume fell away rapidly, so that it was very difficult to obtain smooth control of the volume. He had the potentiometer tested and it was found to be quite in order. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, 8–11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 69 and posted to reach here not later than January 15th.

SOLUTION TO PROBLEM No. 68

The bias resistance which was joined in the cathode lead of the H.F. valve in Jenkinson's receiver was broken, thus isolating the cathode.

The following three readers succeeded in correctly solving Problem No. 67, and books have, therefore, been forwarded to them:—

M. W. Bowden, 3, St. Michaels Gardens, N. Kensington, London, W.10. G. B. Ashford, 221, Rookery Road, Handsworth, Birmingham. R. Handford Banner, Nether Farm, Shuttlewood, Chesterfield.

THE ICONOSCOPE—

THE MODERN ELECTRIC EYE

The Marvellous Invention of an American Scientist. With the Iconoscope Objects can be "Seen" in Their Entirety and Retained in an Electronic "Memory."

By "LAMBDA"

IN studying the problem of flight, designers have taken as their pattern or model the bird, and so we have arrived at the present state of perfection in the art of flying. So it is with television. The eye and its operation have been the object of considerable attention by scientists who have been endeavouring to reproduce by artificial means what Nature provides.

Now Dr. Zworykin of America, who is well known for his researches into the problems of television, has produced by electrical means an "Electric Eye," which functions in several respects in a manner similar to that of the human eye. In perfecting the Iconoscope, as this new invention is called, the cathode-ray tube and the photo-electric cell have been utilized. Both have already been employed in television, and it seems only natural that further developments should be associated with them.

The Cathode-ray Tube

Fundamentally the cathode-ray tube is somewhat analogous to the ordinary radio valve. It possesses a hot cathode, or filament, and an anode. Fig. 2 illustrates diagrammatically the various elements comprising it. First of all there is the cathode C, which is surrounded by a circular shield S. Mounted above it is the circular anode or "gun" as it is called. Arranged above are two pairs of plates, D, mounted at right angles to each other: these are known as the deflecting plates. The glass tube is filled with a quantity of inert gas, such as argon.

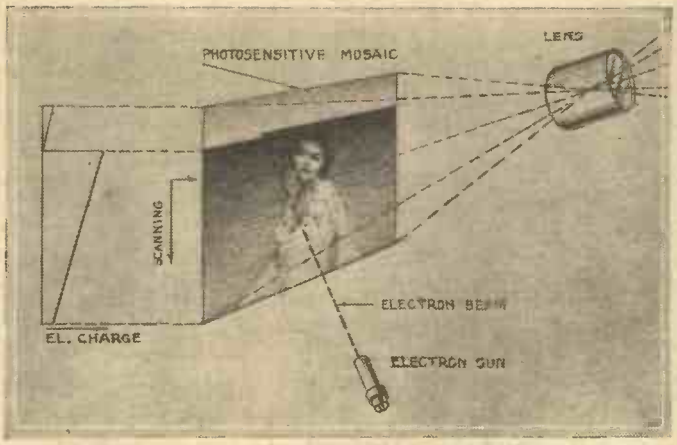

Fig. 1.—Showing how the scenes projected on to the mosaic are scanned.

A positive potential of from 300 to 3,000 volts is applied to the anode, which has a small hole in the centre. Electrons are attracted to the anode and race through the hole at high speed, impinging upon the flourescent screen at the end of the tube. On striking the fluorescent screen a luminous greenish glow appears. In order to focus the stream of electrons into a beam the shield is given a negative bias and the inert gas also assists in focusing. They are therefore emitted from the cathode in a stream similar to the stream of water which emerges from the nozzle of a fireman's hose pipe.

After leaving the anode they pass through the two pairs of deflecting plates. It is a unique property of this electron stream that it can be diverted or bent, by placing a bar magnet close to the tube, when they will be attracted towards it. This stream can also be bent by electrical means.

A positive potential is applied to each pair of deflecting plates, whose function is to alter the direction of flow of the electron stream, one pair of plates causing it to adopt a vertical movement and the other plates causing it to move horizontally. This is how we reproduce, by electrical means, the principle of scanning as employed with the Nipkow Disc or Mirror Drum in the mechanical television systems.

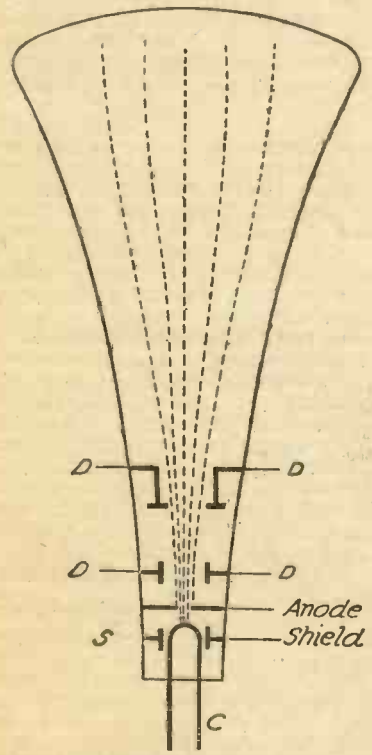

Fig. 2.—Theoretical diagram of a cathode ray tube.

The Photo-electric Cell

Here again we have a device which operates fundamentally on the same principles as that of the radio valve and the cathode-ray tube; that is, an emission of electrons from a cathode is attracted to the anode, this being at a positive potential with respect to the cathode. The great difference lies in the method adopted to attract the electrons from the cathode to the anode. In the photo-electric cell the cathode usually consists of a coating of nickel or silver sprayed on the inside of an evacuated glass bulb. This sprayed surface is then coated with a light-sensitive metal. The anode may be a small disc of nickel, or may take the form of a small sheet of wire gauze.

Now when light is allowed to fall upon the light-sensitive cathode electrons are emitted; they are attracted to the anode and an electric current flows. This current, as can well be imagined, is extremely small, and is therefore amplified by means of a suitable valve amplifier. Its particular value in television is that the amount of current flowing varies with the intensity of the light which is focused upon it; therefore the fluctuations in light intensity can be converted into a fluctuating electric current which is directly proportional to the light value. Having considered these two devices we are now able to appreciate the importance of the Iconoscope and the remarkable advance which has been made towards the perfection of television.

The Problem

With existing television systems all scenes to be televised have to be scanned, line by line, and the picture rebuilt at the receiving end, dependence being placed upon the persistence of vision of the human eye to perfect the illusion. The scene is therefore composed of a number of elements; consequently the light falls on the photo-

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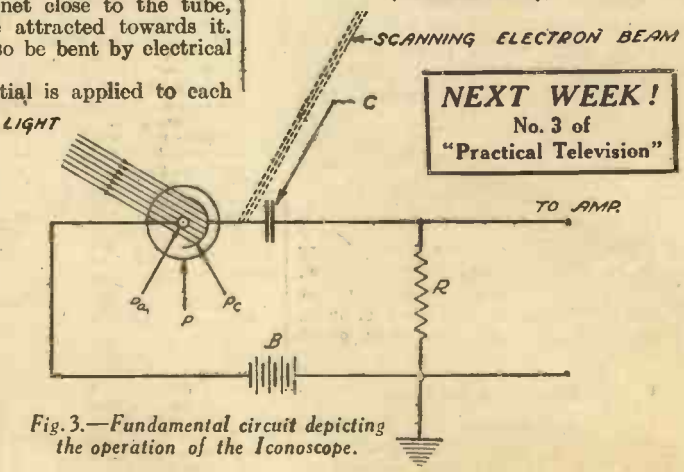

Fig. 3.—Fundamental circuit depicting the operation of the Iconoscope.

(Continued from previous page)

electric cell for only a fraction of a second and corresponds to the illumination of one picture element. Supposing we desire to obtain a scene composed of, say, 70,000 picture elements, the time of transmission of one element will be quite infinitesimal.

We have already seen that the current from a photo-electric cell is proportional to the amount of light falling upon it and also to the time during which it is acting on the cell, so that in this example the amount of light is very small indeed, and consequently the amount of amplification needed to obtain a satisfactory result would be very great.

Now the inventor of the Iconoscope reasoned that if a television system could be devised which would function in the same manner as the human eye, comprehending the whole of the scene at once, all points of the picture would affect the photo-sensitive cells at the same time. If the picture contained 70,000 elements we should, theoretically, secure 70,000 times the amount of photo-electric output.

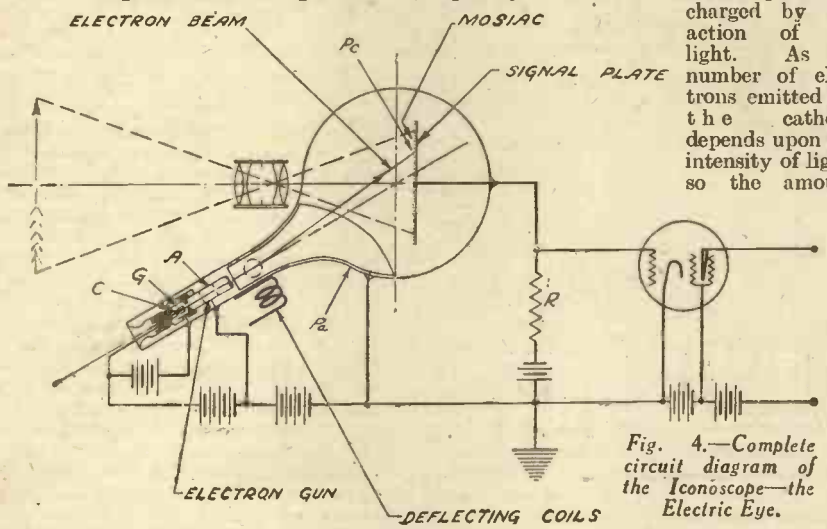

Fig. 4.—Complete circuit diagram of the Iconoscope—the Electric Eye.

Having "seen" the whole of the picture it would of course still be necessary to scan it, so that it would also be essential to devise some method whereby the scene could be retained; some sort of electronic "memory" would have to be arranged. This was the problem.

The Solution

In order to solve this problem a special form of cathode-ray tube was constructed in which a rectangular plate is used in place of the fluorescent screen (see cover illustration). This plate consists of a sheet of a very thin mica, mounted upon a sheet of metal known as the signal plate. Upon the other side of the mica sheet is sprayed a solution of light sensitive material which settles upon it in the form of globules. Each of these globules constitutes a separate photo-electric cell, the plate behind the mica sheet representing the anode which, of course, is common to all the cells.

The picture is projected upon the mosaic, which results in a continuous emission of electrons according to the distribution of the light in the picture. This device also acts as a number of small condensers, the mica sheet being the dielectric. The charges acquired by each element of the mosaic are released by the cathode-ray beam each time the picture is completely scanned. The impulses are amplified and used to modulate the intensity of the cathode-ray beam in the receiving tube, in which the picture is reproduced upon a fluorescent screen.

An Elementary Example

To appreciate how this system functions we will consider the circuit of Fig. 3, which shows only one of the many photo-electric cells which constitute the mosaic. This single cell is represented by P, and C represents its capacitance to a plate—the signal plate—common to all the elements. The complete electrical circuit is quite straightforward and can be followed from the cathode Pc to C, then through the resistance R to the negative terminal of the high-tension battery, the anode Pa being connected to the positive terminal. You will notice the straight parallel lines representing the light source being projected on to the photo-electric cell. In actual practice this would, of course, be the reflected light from the scene to be televised. Immediately the light falls upon this cell the cathode Pc emits electrons and consequently the condenser C becomes positively charged by the action of the light. As the number of electrons emitted by the cathode depends upon the intensity of light, so the amount by which the condenser is charged also depends upon the intensity of the light.

Now when the electron beam strikes this particular element Pc C it receives electrons from the beam and consequently becomes discharged. For the reasons already given it will be apparent that the discharge current is proportional to the amount of light falling upon the cell. This discharge current is now converted into a signal voltage across the resistance R which is connected to a suitable valve amplifier.

The Iconoscope

We now arrive at the complete circuit of the Iconoscope and this is shown in Fig. 4. The photograph (Fig. 1) should be examined in conjunction with the theoretical diagram. Here we are dealing with the complete unit and the figure shown focused on the mosaic is ready to be scanned.

When discussing cathode-ray tubes it was mentioned that the beam could be bent by magnetic or electrical means. In the Iconoscope this deflection of the beam is carried out magnetically by means of two pairs of coils so arranged that they slip on the neck of the tube. A complete television transmitter along these lines is illustrated on the cover.

The writer is indebted to Dr. V. Zworykin for his courtesy in supplying the diagrams and photographs of the Iconoscope reproduced in this article.

THE ADVANTAGES OF R.C. COUPLING

RESISTANCE-CAPACITY coupling between low-frequency stages has fallen very much into disfavour of late. This is doubtless due to the excellent performance given by the modern transformer, which can generally show a straight response from 50—5,000 cycles at least. The comparatively large stage gain is also an important point in its favour. Offset against this is the undeniable fact that resistance-capacity coupling still has a much wider frequency response than the transformer. The low-stage gain is not a very formidable objection in these days of high amplification mains valves. Perhaps, however, the most important fact to be borne in mind is that R.C. coupling scores heavily in the reproduction of transients.

Let us examine these points individually. Providing a good transformer is parallel fed, there is probably little to choose between the two coupling methods as far as bass response goes. Look at the response curve of any transformer, however, and we shall see that above 5,000 cycles the curve falls rapidly. This is due to the inherent self-capacity of the windings; with R.C. coupling the self-capacity of the components is negligible, and providing correct coupling values are chosen, an even response up to at least 10,000 cycles may be assured.

Now we come to transients. In passing, we may as well remark that the musician usually terms this "attack," which is self-explanatory. Any sudden or staccato sound comes under this heading; hand-clapping, and pistol shots are good examples, as also are the explosive consonants in speech, *e.g.*, "p" and "b." Most receivers fail dismally in handling transients when transformer coupling is employed. The reason for this is that all transformers tend to oppose any change in current; in point of fact they have electrical inertia. A sudden surge of current occasioned by a transient will meet with a sluggish response by the transformer; it will not "jump to it."

Furthermore, when the sound ceases the transformer is loth to leave go, as it were. Our original transient, therefore, emerges from the fray as a blurred and poor imitation of the original. No such effect is apparent with R.C. coupling. Reproduction has far more "attack." The rendering of the piano and stringed instruments, which are rich in transients, is far more pleasing and life-like.

A few words with regard to details. Do not make the coupling condenser too large, and do not use too high a value of grid-leak, otherwise trouble will arise with grid blocking. This phenomenon is caused by a heavy charge on the condenser being unable to leak away quickly enough. If, on the other hand, the leak is made too small, amplification will suffer; too small a grid condenser will tend to weaken the bass. A useful compromise between the two evils is a .01 mfd. condenser and a .5 meg. leak.

It must not be thought from the foregoing that a receiver using transformer coupling is incapable of good reproduction. Far from it. So much depends on the rest of the set, in particular, perhaps, the loud-speaker. After all, what is the use of striving for a receiver response up to 10,000 cycles when the speaker cuts off at 5,000?

POWER AMPLIFIERS

AND ALL ABOUT THEIR CONSTRUCTION.

In this Practical Article the Author Gives Some Useful Information in Regard to the Choice of Circuits for Power and Public Address Amplifiers.

By FRANK PRESTON.

MANY requests are received by the Advice Bureau of PRACTICAL WIRELESS for designs and circuits in respect to amplifiers for public address and demonstration purposes. It is obviously outside the scope of that Department to supply complete designs for individual requirements, and it is thought that a few notes on the subject might be helpful. The notes will be of a general nature, since it would be quite impossible to give a single design that would be suitable for all requirements. There are many points to consider in deciding upon the basic essentials of the circuit to be used, as will be seen when reading the following paragraphs, but sufficient information will be given to permit of the average experimenter working out the final details for himself.

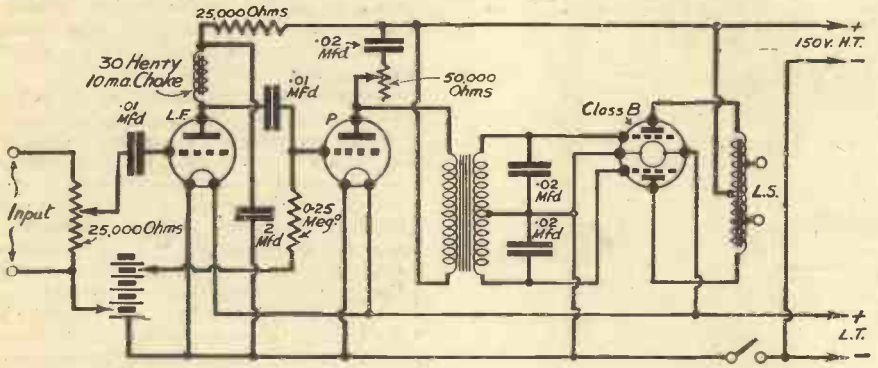

Fig. 1.—The above circuit represents an excellent arrangement for a battery-operated 2 watt amplifier.

Power Supply and Signal Output

The very first item which must be considered is that of the power supply which is to be used. If A.C. mains are available any desired amount of signal output can be obtained with little difficulty; with D.C. mains the output is more limited, whilst when the only available power is that to be derived from batteries it is impossible to obtain a greater output than 5 watts unless economy can entirely be ignored. When dry batteries (as opposed to accumulators) have to be employed for high tension supply the greatest economical output is restricted to about 2 watts.

Having settled the power-supply question, that of the signal output required must be taken into consideration. No very definite ruling can be given, but it will generally be found that an output of at least 1 watt should be allowed for every 6,000 cubic feet of space when the speakers are placed indoors, or to cover a circle of some 15ft. radius when the speakers are out-of-doors. These figures must, naturally, be modified according to the general "noises" which occur at the same time as the speakers are in use, and also according to the acoustic properties of the room, or situation in which they are operated.

By way of example, let us suppose that an amplifier is required to enable gramophone records or wireless programmes to be comfortably heard in a small hall measuring 50ft. by 25ft. by 10ft. high. The volume of such a room is 12,500 cubic feet, and therefore a signal output of just over 2 watts is about the minimum required. This could be supplied by a battery-operated receiver having a good Class B valve in the output stage, and if three or four speakers were available, so that the sound could be more uniformly distributed, the output would probably be adequate.

A Battery-Operated Amplifier

A circuit for a suitable amplifier is given in Fig. 1, where it can be seen that two valves precede the Class B one. It might be possible fully to load the Class B with only a single (driver) stage, but it is always found better to operate valves at somewhat less than their maximum capacity when quality of reproduction is an essential feature. The first valve is of the L.F. type, having an anode impedance of about 10,000 ohms, and the input to this (from the detector valve of a receiver, pick-up or microphone transformer) is supplied through a .25 megohm volume control potentiometer. Choke-capacity coupling is employed between the first and second valve, whilst ample decoupling is provided in the first anode circuit. The second valve, which acts as a driver, is of the small power type, having an impedance of about 4,000 ohms and a mutual conductance of some 2.5 milliamps. per volt. It feeds into a driver transformer of 1:1 ratio, which has a resistance-capacity tone control in parallel with its primary winding. There is also a .02 mfd. condenser across each half of the secondary to prevent the possibility of "Class B rattle," and undue high-note response. The output valve feeds into a centre-tapped Class B choke to which the speakers are connected. When only two speakers are employed it will generally be found best to wire them in parallel, but when several are to be connected up a series-parallel arrangement is to be preferred, and it is better to employ speakers

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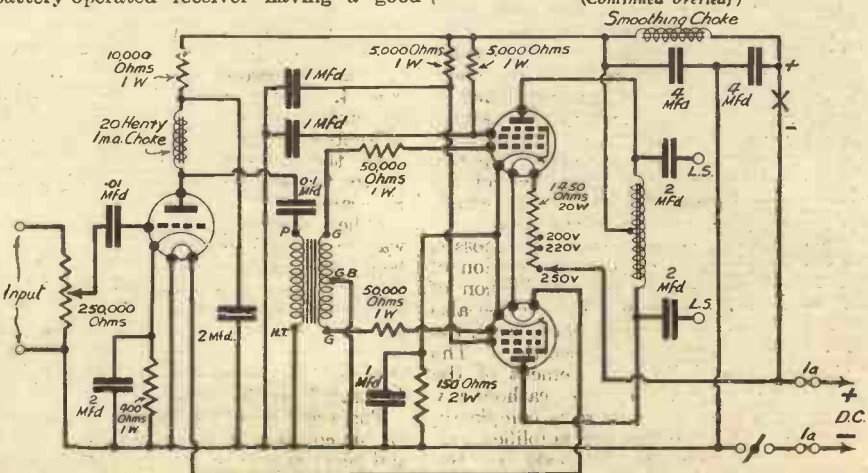

Fig. 2.—In this circuit indirectly-heated D.C. valves are employed, their heaters being wired in series.

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of the type now sold for "extension" purposes, having transformers with tapped primaries and a switching device for choosing the most suitable ratio under working conditions. In the particular circuit illustrated, grid bias is obtained from batteries, but there is no reason why automatic biassing should not be employed if desired.

On D.C. Mains

When D.C. mains are to be used for supplying the necessary power, the best circuit arrangement is probably that shown in Fig. 2. Indirectly-heated D.C. valves are used, and there are three in all; the first is of the high-amplification power valve type having an impedance of about 2,500 ohms, a mutual conductance of 4.5 milliamps. per volt and an undistorted output of some 600 milliwatts. This feeds into a pair of indirectly-heated D.C. pentodes connected in push-pull through a 5 : 1 input transformer which is parallel-fed through a choke-capacity circuit. The two pentodes are each capable of delivering 2,300 milliwatts output when supplied with an anode voltage of 250, or of just under 2 watts when 200 volts is fed to the anodes. Thus a total output of about 3½ watts (3,500 milliwatts) can be expected under normal working conditions. All the valves are of the type requiring a heater current of .1 amp. at 35 volts, and the heaters are wired in series, a tapped "ballast" resistance of 1,450 ohms being included in circuit to cut down the mains voltage to the required figure of 105. Automatic bias is provided for every valve, and the values of resistances shown are correct for most valves of the types referred to. Smoothing is by means of a 500-ohm choke and electrolytic condensers. The total H.T. current will be between 60 and 70 milliamps., and the smoothing choke must therefore be capable of handling this. Rather more than 50 milliamps. will be passed through the centre-tapped output choke, which component should have an overall inductance of about 50 henries when carrying the maximum current. So far as is known, there is no standard component on the market which complies with these requirements, although there are several firms who will make one to special order. The difficulty can easily be overcome, however, by employing two smaller chokes connected in series, and there are many examples of this type of component on sale. As regards the choke used for feeding the input push-pull transformer, this need have an inductance of no more than 15-20 henries at 15 milliamps. and so no difficulty occurs in this respect.

A.C. Operation

When A.C. mains are being used any signal output up to some 15 watts can be obtained without great difficulty and without the need for a special H.T. generator. In fact, an amplifier of that nature can be made by using standard components throughout. The general arrangement of a simple circuit, which is extremely efficient, is shown in Fig. 3, from which it can be seen that four valves are employed altogether. The first is an ordinary indirectly-heated A.C. valve of the L.F. or small power type, and is resistance-capacity coupled to the second valve, a large power valve having a maximum undistorted output of about two watts. This valve is choke-capacity coupled to the input push-pull transformer which feeds into a matched pair of directly-heated super-power pentodes. The latter should be of a type having an undistorted output of 10 watts, a mutual conductance of 4 milliamps. per volt and a maximum anode-voltage rating of 500. The suppressor grids require a maximum voltage of 200, and this is obtained by the insertion of suitable decoupling (and voltage-dropping) resistances in the high tension supply circuit. Rectification is by means of a full-wave valve rectifier which gives an output of 500 volts at 120 milliamps. There are three low tension windings on the mains transformer, of which one supplies 4 volts at 4 amps. for the filaments of the directly-heated output pentodes, another gives 4 volts at 2 amps. for the heaters of the first two valves, and the third supplies 7.5 volts at 2 amps. for the rectifier filament. Automatic grid bias is provided for all the valves by means of suitable resistances in the cathode and H.T. negative leads, whilst an adequate degree of decoupling is provided to ensure stability under all conditions.

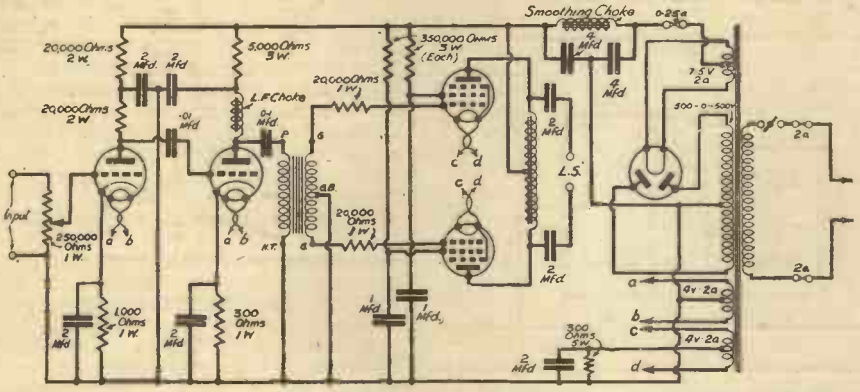


Fig. 3.—The circuit for a really powerful A.C. mains-operated amplifier. Indirectly heated valves are employed in the first two stages with a pair of directly heated pentodes in the push-pull output stage.

Suitable Components

The smoothing choke must be an exceptionally good component having an inductance of not less than 15 henries when carrying the maximum high tension current (120 milliamps.). All the smoothing and coupling condensers must be of a type having a rated working voltage of not less than 1,250, and it is wise to insert fuses in the positions indicated on the circuit diagram. It is scarcely necessary to detail all the components employed, since the values of all important ones are clearly marked on the drawing. Notice particularly the wattage ratings of the various resistances and bear in mind the fact that the values shown are minimum ones which there is no harm in exceeding. It would appear that the maximum output of this amplifier should be about 20 watts, since the two valves in push-pull have each an undistorted output rating of 10 watts. Actually, however, the full output cannot be obtained, due to the fact that the total anode current consumption of the four valves under "maximum anode voltage" conditions is slightly over 160 milliamps. As the rectifier is of a type supplying only 120 milliamps. the full voltage will not be obtained under working conditions, with a result that none of the valves will be fully loaded. This is not really a disadvantage, and makes for longer valve life whilst permitting the use of perfectly standard and easily-obtained components. To obtain a full 20-watts signal output it would be necessary to connect two rectifiers in parallel or to use a rectifier of the mercury-vapour type; neither method is worth the expense entailed unless the full output is an essential feature.

In making A.C. amplifiers to give greater outputs, up to, say, 100 watts it becomes necessary to employ a pair of valves of the transmitting pattern in the output stage, when specially large rectifiers are called for. Nevertheless, the circuit arrangement given at Fig. 3 is generally applicable to any type of amplifier regardless of its signal output.

A "Universal" Amplifier

It is frequently desirable to have an amplifier of the "universal" pattern which can be operated from either A.C. or D.C. at will and in such a case the circuit of Fig. 3 is applicable provided that a half-wave metal rectifier (or two such rectifiers joined in parallel) is inserted at the point marked "X." The rectifier should give an output of no less than 80 milliamps. at 200 volts. When working on D.C. the rectifier merely acts as a "passenger" since it does no useful work, but when the amplifier is connected to A.C. mains it fulfils its normal function.

High Tension from a Low-tension Accumulator

WILL the author of the article entitled High Tension from a Low-tension Accumulator, appearing in our issue dated December 23rd, 1933, please send his full name and address so that payment can be made?

Television—Be Prepared!

I HOPE all readers are mentally preparing themselves for the advent of television by carefully studying the frequent articles we publish on that subject. Television is inevitable, and radio cannot be considered complete until it arrives. As with radio telephony, the home constructor will undoubtedly be the first to enjoy real television.

The Search for the Ideal

A FRIEND of mine who has purchased quite a number of receivers is still searching for his ideal. I tried to elicit from him what that ideal was, and found that he wanted to receive almost every British and European station at equal strength, free from interference and of equal quality. Such an individual expects too much from one instrument. You cannot have it all ways. If you want multitudes of stations, you must be prepared for a fair amount of headphone work and a sacrifice of a certain amount of quality.

Some causes & Cures for L.F. INSTABILITY

By BERNARD DUNN

Numerous Simple Methods of Dealing With Distortion and Other Troubles Arising from Unstable L.F. Amplification are Here Described

IN a previous article I dealt at some length with instability of the kind which is often present in high-frequency amplifying stages, and now it is proposed to consider the low-frequency portion of the receiver. It is somewhat difficult to draw a distinct line between the two kinds of instability which have been referred to as L.F. and H.F., since quite often the two are inter-dependent to such an extent that, for example, high-frequency currents are the cause of low-frequency instability and *vice versa*. In order to make this point more readily appreciated, it might be mentioned that in some receivers L.F. instability of a violent nature can easily be produced merely by running the loud-speaker leads near to the aerial-earth leads, or even to the terminals to which the latter are connected. In the same way, the proximity of speaker and pick-up leads can often be the cause of serious instability, whilst in a console type of receiver the same kind of trouble might be introduced by running the loud-speaker wires close to the tuning coils, or to the detector or S.G. valve.

The causes of L.F. instability above referred to are perhaps fairly obvious ones, but they should always be looked for as a preliminary to the further tests that might be applied to a set which is behaving unsatisfactorily.

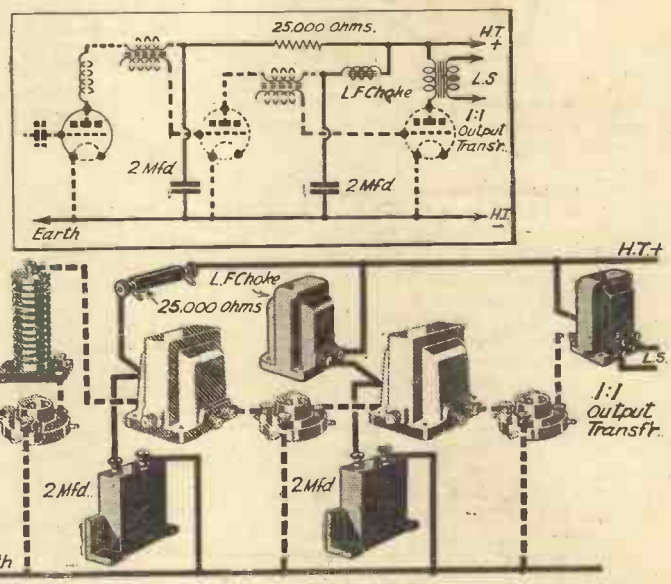


Fig. 1.—These theoretical and pictorial diagrams show how the detector and consequent L.F. valves can most easily be decoupled. The decoupling components and wiring are shown by full lines, the remainder of the circuit being in broken lines.

Detecting L.F. Instability

Before going any farther into the subject it might be best to decide just what we mean by L.F. instability, and also how it can be detected. As a matter of fact, this is often the most difficult part of our task, since the fault can manifest itself in so very many different ways. It might be noticed that reproduction is simply distorted; perhaps it sounds "screechy" or high-pitched; there might be a constant whistle accompanying all reproduction; a whistle or "groan" might be noticed on notes of certain frequencies or on loud passages; the noise which has been given the name of "motor-boating," due to its similarity to the sound made by the exhaust of a motor boat, might make good reception impossible. Instability can make itself known in other ways, too, but one of the symptoms referred to is in most cases noticeable.

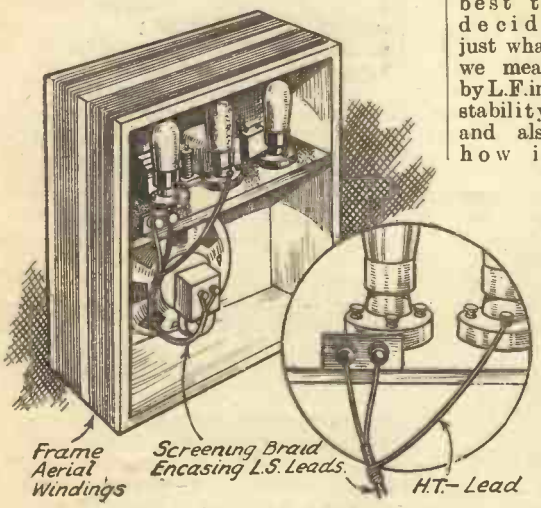


Fig. 2.—L.F. instability in portable sets can often be cured by screening the loud-speaker leads with metal braiding.

Next we should consider what is the prime cause of the trouble, so that we may be in a better position to localize the fault and to say exactly which component or connection is responsible for it. Broadly speaking, L.F. instability, like H.F. instability, is due to a feed-back or uncontrollable oscillation effect. But instead of the feed-back being one of high-frequency currents, it is low-frequency ones which are concerned, and because of this it invariably gives rise to effects which can be detected by the ear.

High Resistance H.T. Supplies

A very common source of the trouble is the high-tension supply. If this is of high resistance and the anodes of the detector and low-frequency valves are connected directly to H.T. positive, through the usual coupling components but without the insertion of decoupling resistances, etc., it is a perfectly easy matter for the low-frequency currents appearing in the anode circuit of one valve to pass back to the anode of a previous valve, thus producing a definite and obvious feed-back or reaction effect. If the high-tension supply were of low resistance those currents would pass

(Continued overleaf)

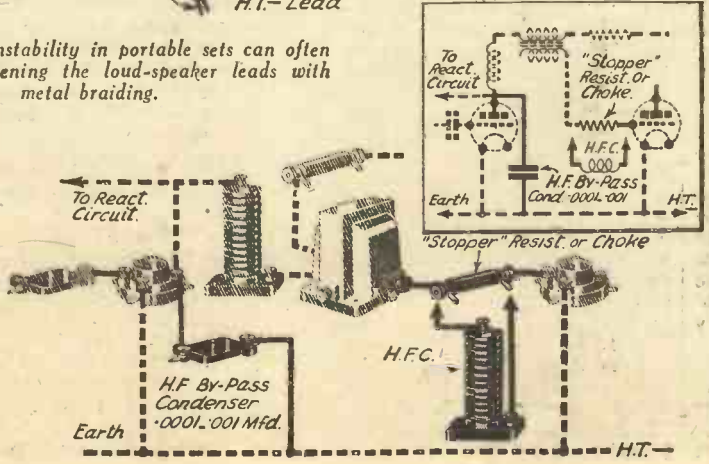


Fig. 3.—Different methods of preventing the passage of H.F. currents into the L.F. amplifier are shown here. New components and connections are indicated by heavy lines.

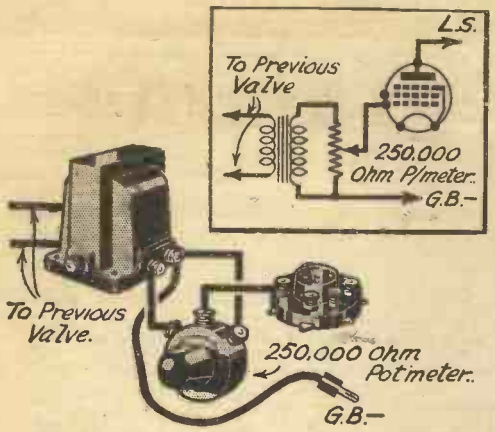


Fig. 4.—When instability is due to fitting a new high-amplification valve a volume control should be connected between the L.F. transformer and the grid of the valve.

(Continued from previous page)

through it to earth and cause no trouble whatever. High-tension batteries, when in good condition, have a comparatively low internal resistance to L.F. currents and therefore do not tend to produce instability. But when the battery runs down, its internal resistance increases and there is a definite opposition to the easy flow of signal current through it. The very old, though obvious, idea of connecting a large capacity (2 mfds. upwards) condenser across the positive and negative high-tension terminals is a good one, since the condenser provides an easy by-pass to the L.F. currents.

When an eliminator is employed instability is liable to be much more pronounced, due to the fact that it has, of necessity, a much higher resistance. This resistance is introduced by the chokes and resistances which are essential for smoothing purposes. Even with an eliminator, however, it is often quite sufficient to connect a 2 mfd. condenser between the output terminals in order to reduce its L.F. resistance to a reasonably low figure.

Decoupling the L.F. Stages

In every case where the H.T. supply is responsible for the trouble it is considerably better to tackle the problem by decoupling the detector valve, at least. This is done by inserting a fixed resistance of some 25,000 ohms between the coupling component (resistance, choke, or transformer primary) and high-tension positive, and joining a 2 mfd. fixed condenser between the " set " side of the resistance and earth. The method just mentioned is very well known, but does not, by itself, always give the desired effect, especially when two or more low-frequency stages are included in the set. It is then a good plan to decouple the first L.F. valve also, and this could be done by following the same method, but that would not prove very satisfactory, because the resistance would so cut down the anode voltage that the valve could not operate under efficient conditions. But if a small L.F. choke were used in place of the resistance the voltage-drop would be inappreciable and efficiency would not be impaired. The output valve in any fairly modern set is adequately decoupled by means of the output transformer fitted to the loud-speaker, but where a speaker of the older balanced-armature type is still in use, the last valve can be decoupled satisfactorily by interposing a 1 : 1 transformer between the set and the speaker. All the methods of decoupling which have just been described are illustrated collectively in Fig. 1, the decoupling components and wires being shown in full lines, and the others by broken ones.

L.F. Feed-back

A prevalent source of L.F. instability in portable sets is feed-back between the frame aerial and loud-speaker leads. The two are bound to be placed fairly near together, so that the difficulty is not quite so easy of solution. One way of overcoming it is to screen the speaker leads by means of a length of the special metal braiding sold for the purpose. This is slipped over the wires, making sure that it does not make contact with them, and connected to H.T. negative (which corresponds to the normal earth connection of a "fixed" receiver) by means of a length of thin wire (See Fig. 2). Whilst on this subject, it should be mentioned that the lengths of wire made up in the form of coil springs and intended for curtain runners are *not suitable* for screening purposes unless all the turns are soldered together. This is because the wire forms a small inductance coil, and thus, instead of preventing H.F. pick-up, it actually assists in that direction. The point is mentioned because it has come to our notice that a number of readers have made use of this apparently simple and inexpensive method of screening, with unsatisfactory results.

H.F. By-pass

With some portables it is not enough simply to screen the speaker leads, because there is a certain amount of H.F. current leakage into the last valve. In that case, a cure can generally be effected by connecting a small by-pass condenser between the anode terminal and H.T. negative; when a Class B output stage is employed, the condenser should be joined between the two anodes, or alternatively, a condenser may be connected from each anode. The capacity of the condenser depends upon the severity of the trouble, but a value from .001 to .005 mfd. will nearly always prove suitable. It should be remembered that if the capacity is too high there will be some slight loss of the higher notes.

H.F. " Stoppers "

Although the method of by-passing H.F. currents which reach the power-valve is fairly effective, it is generally better to prevent them from passing into the L.F. amplifier at all. High-frequency currents should really be entirely dispensed with in the anode circuit of the detector valve, but they do sometimes find their way farther into the set. The H.F. choke *should* prevent their passage into the amplifier stages, but it cannot be fully effective unless a by-pass condenser is connected from the anode of the detector-valve to earth. This is a point which is too frequently overlooked, although it only calls for a fixed condenser wired as shown in Fig. 3. The condenser may have a value between .0001 and .001 mfd., but in every case the smallest value which gives the desired result should be employed, since the higher values by-pass a small percentage of the higher audio-frequencies as well and so tend to make reproduction rather low-pitched.

Another method of preventing H.F. currents from passing into the L.F. amplifier is to insert a " stopper " in series with the lead from the transformer or R.C.C. unit to the grid of the first L.F. valve. The " stopper " may be either a fixed, *non-inductive* resistance of between 50,000 and 100,000 ohms, or a second H.F. choke. This method is of particular value in the case of short-wave receivers, although it is by no means useless with normal broadcast receivers, especially portables. Connections for the " stopper " are given in Fig. 3.

New Valves

It was mentioned in the previous article on H.F. instability that the trouble could be due to the fact that new and more efficient valves had been used to replace older ones with which the set worked quite satisfactorily. The very same thing applies in respect to L.F. instability, and it is very often found that reproduction becomes almost unbearably poor when a pentode is fitted in place of a previous small power valve, for instance. Pentodes *do* give a certain amount of emphasis to the higher notes, but they should not cause reproduction to become distorted to the extent that it is accompanied by a constant " whine." Many amateurs tolerate this, in the idea that the pentode naturally does not produce such good quality, although it increases the output volume. The idea is entirely fallacious, and if the effect mentioned above is noticed when changing over to a pentode, it is a sure sign that instability has been introduced. In the majority of cases it can be removed merely by reversing the connections to the secondary terminals of the L.F. transformer. Sometimes, a " stopper " is required before the difficulty can be overcome, whilst in extreme cases it is practically essential to reduce the amount of amplification by replacing the L.F. transformer by one of lower ratio. Before going to the expense of such a modification, however, it is a good plan to try the effect of fitting an L.F. volume control, as shown in Fig. 4, or of reducing the step-up effect of the transformer in the way illustrated at Fig. 5. In the latter method, two fixed resistances are connected between the secondary terminals of the transformer, and the grid of the output valve connected to the junction between them. In some instances the quality will be improved by shunting one of the resistances by a .01 mfd. fixed condenser.

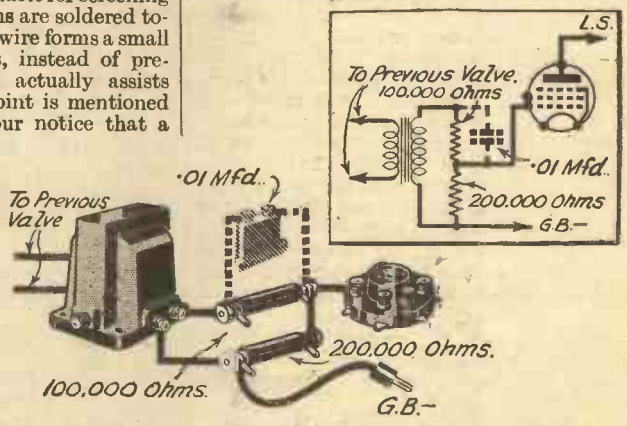
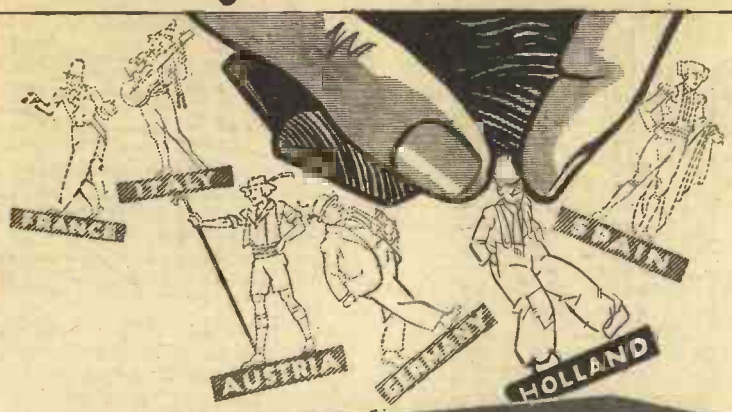


Fig. 5.—The amplification of an L.F. stage can easily be reduced by using the connections shown above and explained in the text.

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.*

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

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Prices do not include batteries or accumulator.

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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.

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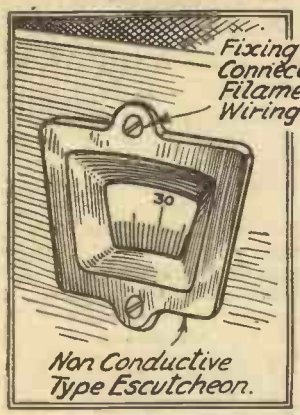
READERS' WRINKLES

THE HALF-GUINEA PAGE

Rapid Accumulator Testing

IN many sets the accumulator is often put inside or in a cupboard, out of the way. This keeps it out of sight, but, unfortunately, it is not very convenient for testing purposes. If the set is fitted with a moulded escutcheon held in place

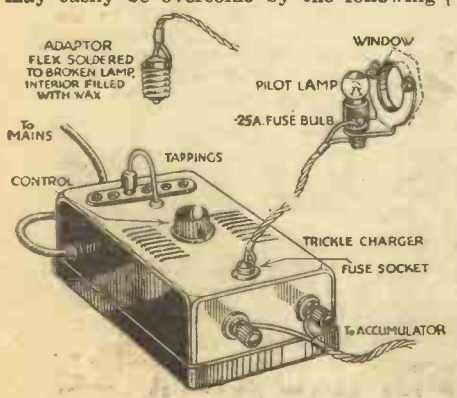


A useful dodge for quickly testing an accumulator.

with two or more nuts and bolts, two of these can be wired to the filament circuit. The voltmeter can then be applied to the heads of the screws, which are, of course, on the front of the panel, and the correct voltage ascertained in a very short time. This method has the advantage that no reading can be taken unless the set is switched on.—P. W. (Windsor).

Combined Fuse and Pilot Light for Small L.T. Trickle Charge Unit

THE majority of low-tension charging sets are designed with a separate 4-volt secondary pilot lamp winding; this, however, besides being a rather heavy additional load upon a small set, does not give a true indication. It tells us that the mains switch is "over," but we do not know whether the "charging" secondary is functioning correctly or not; also should the pilot lamp circuit be broken we get an extra heavy load transferred to the charging secondary, and this may cause some damage if not under strict supervision. This serious disadvantage, I have found, may easily be overcome by the following

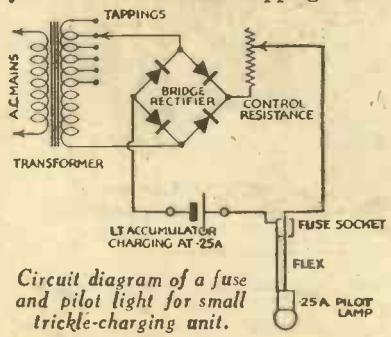


A combined fuse and pilot light.

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.

modification to the usual circuit; the fuse in the circuit is replaced by a 2-volt lamp rated at the required charging current (*e.g.*, .25 amp.). A suitable adaptor (see diagram) is constructed to enable the circuit to be extended to a socket placed at the rear of the control panel. The .25 amp. lamp will, therefore, act as a combined fuse and pilot light, and, because it is in series with the charging circuit, we can adjust the transformer tapping and re-

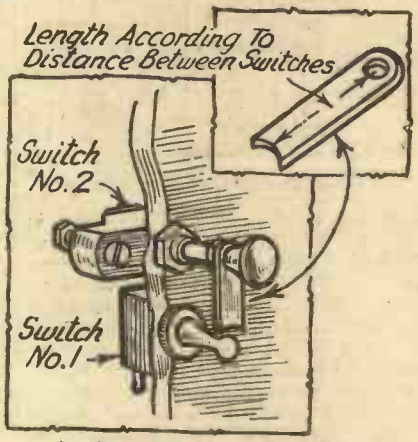


Circuit diagram of a fuse and pilot light for small trickle-charging unit.

sistance setting to cause the pilot lamp to just glow, and, having set this, we know that we are charging at the required rate, *i.e.*, approximately .25 amp.—C. McLEOD (Liverpool).

Substitute for a Thermal Delay Switch

THE following device is a useful alternative to a thermal delay switch in certain cases of home-constructed all-mains sets, where the owner does not mind an extra control. Two separate switches are used, one for switching the A.C. supply from the mains, and the other for switching the rectifier. The switches are mechanically interlocked so that the A.C. supply must be switched on and the filaments begin to warm up before voltage is put on the plate of any of the valves. The switches are arranged as shown herewith, switch No. 1 being an ordinary panel mounting tumbler, fixed in the usual way, and used for switching the A.C. supply from the mains. Switch No. 2 is a plain push-pull switch mounted on the panel just above No. 1 as depicted. No. 2 switch, however, must be of the type in which the control shaft does not revolve. Also the distance between the switches should be as short as possible. When the switches are mounted a piece of stout metal of the shape shown is fixed on the shaft of the push-pull switch, and held securely by the screw cap or knob of the switch. It will be seen that switch No. 2 cannot be pulled on until switch No. 1 has first been put in the "on" position. Again, switch No. 1

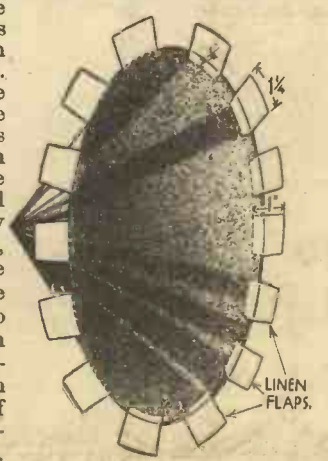


An alternative to a thermal delay.

cannot be put off until No. 2 has first been pushed off. Switch No. 2 can, with advantage, be in the secondary circuit of the transformer which is feeding the rectifier. —P. D. RICHARDS (Norwich).

Mounting a Floating Cone

WHEN adopting the floating cone arrangement, where the cone is attached to a baffle by means of a linen ring, it is often difficult to centre the cone accurately, and at the same time obtain an even tension all round the linen. A better method is as follows: Cut a strip of linen into twelve pieces, each measuring 1¼in. by 1in. Glue these twelve pieces to the cone, ¼in. from the edge, at equal distances round its periphery, and in such a way that the side measuring 1¼in. lies along the cone, as shown in the sketch. The free ends of the linen flaps are then glued to the baffle, and it is an easy matter, having once centred the cone, to obtain an equal tension on each piece of linen.—T. M. ALLAN (Troon).



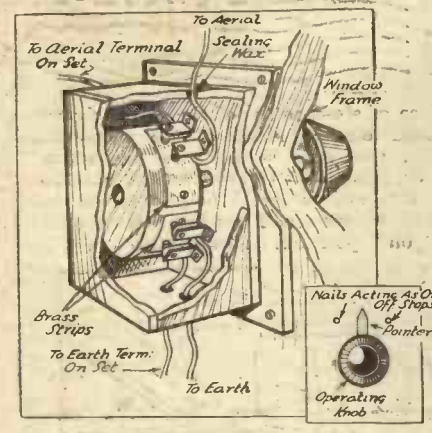
A method of mounting a floating cone.

READERS' WRINKLES

(Continued from previous page)

A Novel Rotary Switch

THIS novel aerial-earthing switch, which is made from odds and ends, is of simple construction and has self-cleaning contacts. No measurements are included, as these will vary with the thickness of

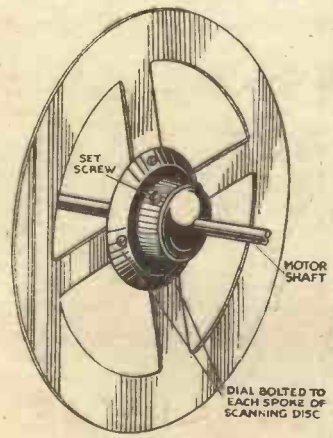


A novel aerial-earthing switch.

window frame, etc. The switch rotor is part of a cotton reel, and the four spring contacts were obtained from two old electric lamp sockets, the springs forming excellent contact with the rotor and also providing an easy means of mounting and connecting leads. The holes in the sides of the box through which the leads are connected to the four brackets can be made weatherproof by wax from an old H.T. battery, whilst the lid keeps rain from the contacts. The whole can be painted to match the woodwork of the window. Only a quarter of a turn is necessary to switch on and off, hence two nails and a pointer operate inside the window as stops and indicating device respectively. The nail acting as "off" stop is positioned so that the gap between the long and short brass contact strips comes between the two earth leads. The diagram shows the switch in the "on" position. The pressure of the spring contacts is adjusted by altering the distance of the brackets from the "contact-strips." —WM. A. SCANES (Bexley Heath).

Fitting a Scanning Disc to a Motor Shaft

I FOUND the following method of fitting a scanning disc to a motor shaft very satisfactory. An old tuning dial was drilled through the blank end, and the disc centre drilled to the size of motor shaft.

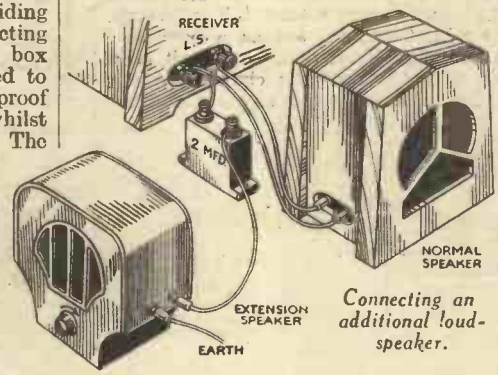


A method of mounting a scanning disc on a motor shaft.

The disc was then attached to the dial by four bolts, one at the centre of each spoke. If the tuning dial centre is too small for the motor shaft, it can be drilled out, care being taken to keep the drill straight. If the dial centre is too large thin metal packings can be used, leaving a hole for the screw. The accompanying sketch clearly shows the arrangement.—JOHN FORMAN (Leicester).

Connecting An Extra Loud-speaker

IT is often required to connect an additional loud-speaker to the set for use in another room, and although this can be done by wiring it in parallel with the existing one, the method is not ideal because it often introduces distortion besides making it necessary to employ a long length of twin flex. The capacity of the flex might be so high as to cause a serious drop in volume and at the same time cutting off the high-note response. The difficulty can be overcome very simply as shown in the accompanying sketch; the normal speaker is left exactly as before, a lead being taken from the negative L.S. terminal on the set (the one joined to the anode terminal of the output valve) to one side of a 2-mfd. fixed condenser. A single lead is then taken from the other side of the 2 mfd. condenser to one terminal on the extra speaker, whilst the second terminal on that speaker is connected to

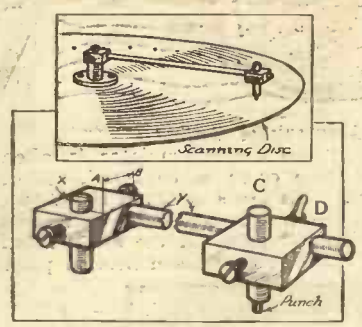


Connecting an additional loud-speaker.

any convenient earthing point, such as a water or gas pipe. It will be seen that this idea is applicable to any type of speaker —moving-coil or balanced armature—and that the normal speaker is used as an efficient output choke for feeding the extra one.—O. (London).

Television Disc Punch Holder

HOWEVER careful one may be in marking out a television scanning disc, it is very easy to make quite an appreciable error in lining up the punch at each hole. The tool shown in the accompanying sketch, which is self explanatory, will definitely avoid one error and greatly simplify the whole process. Care should be taken to see that the distances A—B and C—D are equal, and that the moving parts are push fits. The spindle X should be the same diameter as the motor spindle, and the screws holding this and the rod Y should be screwed up tight to avoid any risk of movement. The rod Y should preferably be of square cross section to ensure that the punch is held vertical for each hole. The disc is divided into the requisite 30 sections and the position for hole No. 1 carefully marked. To ensure of no radial error occurring, the boss to fit the motor shaft is next fitted to the disc, and the spindle X allowed to turn in same. The punch is then lowered to just press on the disc and, after being set exactly square with any radial line, the grub screw is tightened up, thus ensuring that the side of each hole punched will be exactly parallel with the radius at any position. The

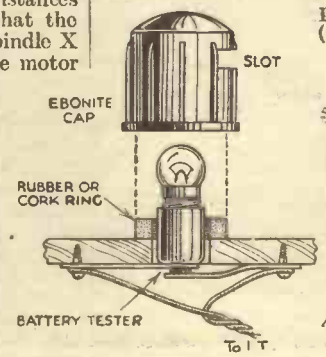


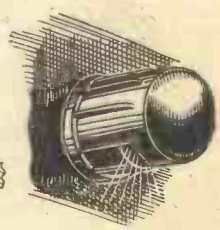
A device for punching holes in a scanning disc.

punch holder is then pushed along the rod to the position for hole No. 1, the thumb screw tightened up, and the hole punched. The thumbscrew loosened again, the holder pushed slightly towards the centre until the outside edge of the punch falls exactly over the inside edge of the hole just made, the screw tightened again and the punch is in the correct position for the next hole, the process being repeated for each hole. No dimensions are given, as these will naturally vary with individual requirements, but if the rod Y is made from 3/16" square section brass there will be sufficient whip on a length of 9" or 10" to allow for the slight downward movement of the punch when struck.—E. L. NIMMO (Wimbledon).

A Novel Panel Lighting Device

THE accompanying illustration on this page shows a panel illuminating device which has a very pleasing appearance. The cover for the bulb consists of an ebonite cap taken from a scent bottle. The slot is formed by making two saw cuts near the top of the cap and prizing out the unwanted strip, leaving an edge which can be filed smooth. For the bulb holder, a compass type battery-tester suits the purpose admirably. The legs are cut down to an inch in length, one being bent to the same level as the other, and a hole large enough to take a small screw is drilled in the end of each. A hole slightly greater in diameter than the body of the tester is bored in the front panel of the set just above the tuning dial. Through this the tester is placed, and two screws, with connecting wires clamped beneath, are utilized to hold it in position. A cork, or preferably a rubber ring, that fits into the ebonite cap tightly, is glued to the panel round the bulb, and, after the cap has been screwed on, the fitment is complete.—J. E. DAVEY (Selhurst).





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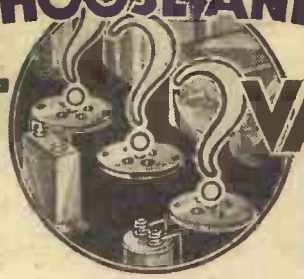
HOW TO CHOOSE AND USE THE BEST VALVES



In this Series of Articles the Author Explains the Function of the Various Types of Valves Employed in Modern Receivers

TO begin with, it should be explained that the three prime functions of the valve in radio reception are (1) amplification of the comparatively weak signals developed in the aerial circuit (high-frequency amplification), (2) separation of the audio-frequency component (the "programme") from the radio-frequency component (the carrier)—this process is known as "detection"—and (3) the amplification of the audio-frequency signal so that it may operate a loud-speaker (low frequency amplification).

High-frequency Amplification

In modern receivers this function is always performed by some variant of the screen-grid valve. The ordinary screen-grid valve, which is available in both battery and mains types, is a tetrode, *i.e.*, a four electrode valve. The filament, or cathode, the anode, and the control grid perform their normal functions, but the fourth electrode, the screening grid, which is connected to an H.T. positive voltage of about half the anode voltage, acts as an electrostatic screen to prevent feed-back within the valve from anode to grid, which would otherwise occur and cause instability and howling.

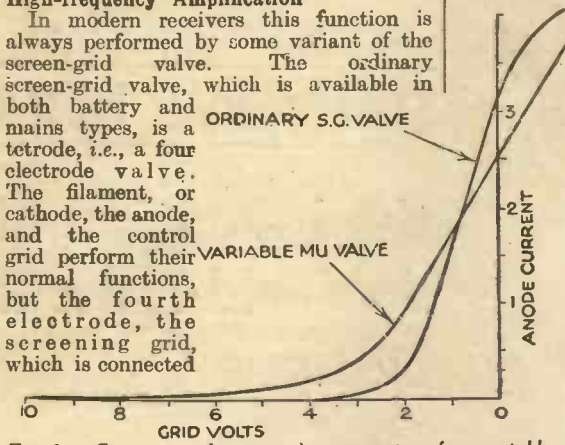


Fig. 1.—Comparison between characteristics of a variable-mu valve and an ordinary S.G. valve.

The relative efficiency of screen-grid valves of various types can be gauged roughly from the value of their mutual conductance, this being a sort of "factor of goodness" published by the valve maker. For battery-operated types the conductance may range from about 1.0 to about 1.5, while in mains types the figure ranges up to 3.5, or even more.

For the average receiver, having only one high-frequency stage the more sensitive valves, *i.e.*, those having a high mutual conductance, are preferable. If, however, two high-frequency stages are employed, it may be difficult to control two high gain stages, and valves of lower mutual conductance are often recommended.

H.F. Overloading and Distortion

Another point to bear in mind is that normal screen-grid valves are designed to handle without distortion only comparatively weak input signals.

The distortion point, that is to say, the value of grid voltage at which grid current commences to flow, varies with valves of different makes. Some valves, therefore, require a small amount of negative grid bias, while others work better without bias. Care should be taken, therefore, to read the instruction sheet issued by the valve-maker, and to carry out his recommendations in this regard.

The liability of ordinary screen-grid valves to overloading by strong signals has led to the introduction of a modified form known as the variable-mu screen-grid valve. It differs from the ordinary screen-grid valve in that, due to the special design of the grid, the grid base of the valve is greatly extended. The form of the characteristic curve of a variable-mu valve, compared with that of an ordinary screen-grid valve, is shown in Fig. 1.

Variable-Mu Valves

The value of the variable-mu valve is that, by applying a very small grid bias, or no bias at all, the valve is in a condition of maximum sensitivity, and will give full and undistorted amplification of small signals; but by applying an increasing amount of grid bias, the mutual conductance of the valve is decreased so that the effective amplification is less. At the same time, when operating at low sensitivity, the valve will handle quite powerful inputs without distortion. Thus, for weak signals, which are not likely to overload the valve, full amplification can be used while for strong signals, which would overload an ordinary screen-grid valve, and which usually do not need much amplification, more grid bias may be applied, thus cutting down the amplification, but at the same time avoiding distortion.

In the case of battery variable-mu valves, bias is best applied by a potentiometer R of say 20,000 to 50,000 ohms connected across a grid-bias battery which may also supply grid bias to the low-frequency valves of the set. This arrangement is shown in Fig. 2, where the slider is connected back to the grid circuit of the high-frequency stage.

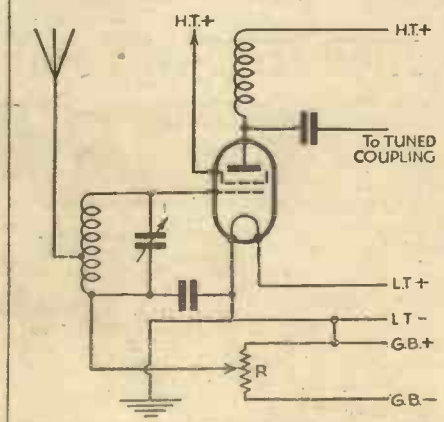


Fig. 2.—Variable bias to a battery variable-mu valve.

The several types of battery variable-mu valves on the market can be divided roughly into "long-grid base" and "short-grid base" types. The former requires a grid-bias range of about 15 or more volts for full gain control, but the short grid base type uses a much smaller maximum grid-bias voltage. The short grid-base valve owes its development in part to the popularity of Class "B" output, regarding which some details will be given in a subsequent article. In Class "B" no bias is usually required for the output stage, although the previous low-frequency valve, or "driver" needs a small negative bias. Valve makers have therefore sought to produce new variable-mu valves which can be controlled by a 9 volt, or even 4½ volt grid-bias battery.

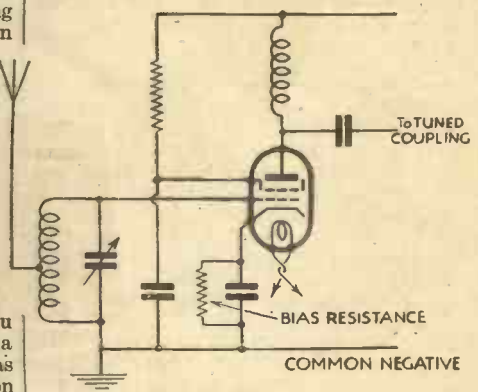


Fig. 3.—Method of auto-bias for mains S.G. valve.

"A.V.C."

Another development which has had a great influence on the design of the latest variable-mu valves is "automatic volume control," a device in which the adjustable bias to the variable-mu stages is applied automatically by the increase or decrease of strength of the incoming signal. One of the difficulties in applying automatic volume control is to obtain a large controlling bias voltage, and, although there are methods of amplifying the control voltage, a short grid-base variable valve is very desirable for most simple circuits employing A.V.C.

Some of the most recent valves of this type in the battery range give full control with a grid-bias variation of as little as 4½ volts, but generally speaking, a valve of this type should be so designed that its mutual conductance is reduced to about 1.0 per cent. of the maximum by applying from 7 to 9 volts negative bias.

Mains operated variable-mu valves usually have a much longer grid base, of the order of 40 volts, but in most types, by reducing the screen voltage, the grid base can be decreased by about half, although this advantage is only obtained at some small sacrifice of maximum sensitivity.

Bias Application

Practically all mains screen-grid valves, of both ordinary and variable-mu types, required a small permanent negative bias, and this is best applied by includ-

(Continued on page 824)

ADAPTORS OR CONVERTERS

In This Article the Author Describes the Relative Merits of Both Types of Apparatus

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

SHORT-WAVE work is really a class on its own, and for the best results special receivers should be designed incorporating all the features and avoiding all the pitfalls associated with this class of reception. For financial reasons this course is not always possible and, in consequence, recourse must be made to ways and means for adapting or converting the existing home radio set, so that it can tune *down* to the wavelengths desired, that is from about 15 to 80 metres for the short waves and from 5 to 8 metres for the ultra-short waves.

The Converter

Unfortunately, a great deal of confusion seems to exist as to the respective merits of an adaptor and a converter, as well as the distinction between their respective functions. The two terms are often interchanged, whereas each carries out its own particular work in a separate and distinct fashion, and it is therefore advisable right at the outset to clarify matters. The term converter should only be applied to those devices which actually convert one frequency into another. That is to say, the superheterodyne principle is involved, the converter being used often as the combined first detector and oscillator which, when coupled to the ordinary radio receiver, changes the short or ultra-short waves into long or medium waves, so that they can be handled in an efficient and normal manner by the receiver.

In effect, the broadcast receiver under these circumstances functions as the intermediate frequency amplifier and detector of the superheterodyne. For the best results, therefore, this intermediate frequency amplifier should give a fair measure of amplification, and, in consequence, one of the requirements when using a converter is to employ it in conjunction with a set having one or more screened-grid or high-frequency pentode H.F. stages.

The Adaptor

Although it may be argued that in functioning in this way the converter "adapts" the broadcast band receiver so that it can receive short waves, it is preferable to look upon the adaptor as working in a different way. An adaptor in its simplest form consists of a short-wave detector unit designed to be sensitive to short wavelengths, no change of frequency taking place while it functions. It works in conjunction only on the audio or low-frequency side of the broadcast receiver, and ignores the radio-frequency stages, whereas the converter requires them.

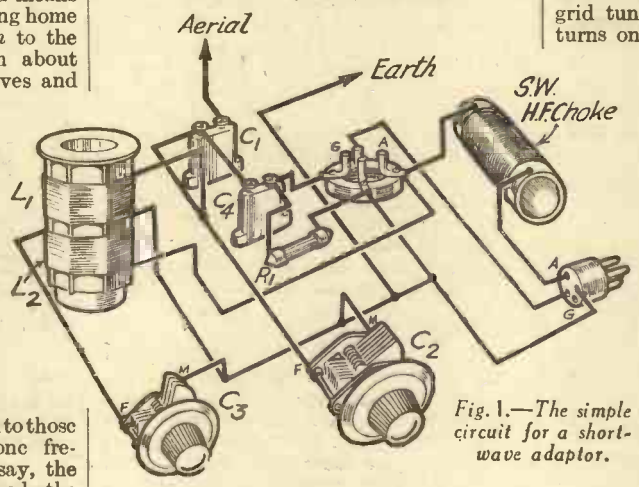


Fig. 1.—The simple circuit for a short-wave adaptor.

Owing to the fact that in some broadcast receivers the high-frequency side is inefficient, and the consequent amplification of a relative low order, one can obtain equal results with an adaptor or converter, and the final choice as to which is used by the individual, therefore, depends upon the merits and nature of the broadcast set, for the cost of each unit is of about the same order of magnitude.

In practice, the method employed for using an adaptor is to remove the detector valve from the set and use it in the unit, coupling the unit to the set by a plug fitting into the vacant valve-holder socket. No external or extra high-tension or low-tension supplies are required, for the unit uses those of the normal set, and as the grid terminal of the set's detector valve-holder is not used, the tuning arrangements are isolated and replaced with those of the adaptor.

Some Circuits

Let us now deal with some practical suggestions for using one of these arrangements. Taking the adaptor first, a reference to Fig. 1 will indicate a typical circuit for the unit, the connection to the receiver being made with the four-prong base shown, which may very easily be made from an old valve base if desired.

The circuit is almost self-explanatory. First of all we have a very small capacity series aerial condenser C_1 passing to the grid tuning circuit L_1 C_2, the number of turns on L_1 depending on the wavelength range it is desired to cover, while C_2 can have a maximum capacity of .00015 mfd. Leaky grid rectification is employed, the condenser and resistance values being about .0003 mfd. and 3 megohms respectively. In the anode circuit we find a short-wave high-frequency choke. As a rule, these can be made up very readily by the amateur himself by taking a length of wire one quarter of the average wavelength of the range to be covered and winding this as a single layer solenoidal coil. For example, if the average wavelength is in the ultra-short range, say 8 metres, then 2 metres of wire (about 6½ft.) wound on an inch former will do nicely.

Adjustment

The reaction circuit is quite normal with a capacity variation feed, the value of the condenser C_3 being of the order of .00025 mfd. Note that the moving vanes of both variable condensers are on the earth side. Both filament leads and the lead from the high-frequency choke pass to the filament and anode prongs of a four-pin valve-holder plug, the grid pin being free, as mentioned earlier.

It is quite usual to find that when the adaptor is connected to the broadcast receiver, the regeneration or reaction is not very smooth. This reduces the sensitivity

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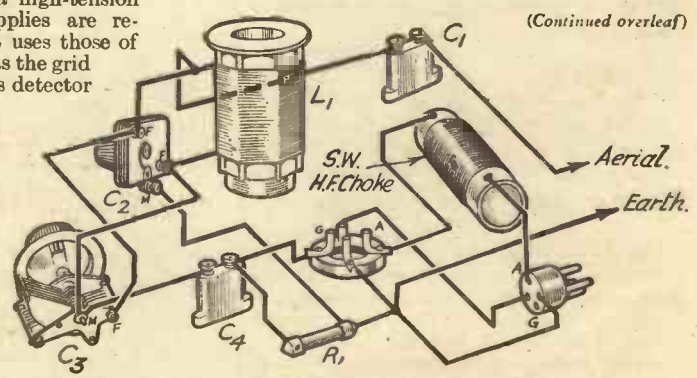

Fig. 2.—Another form of short-wave adaptor of somewhat novel character.

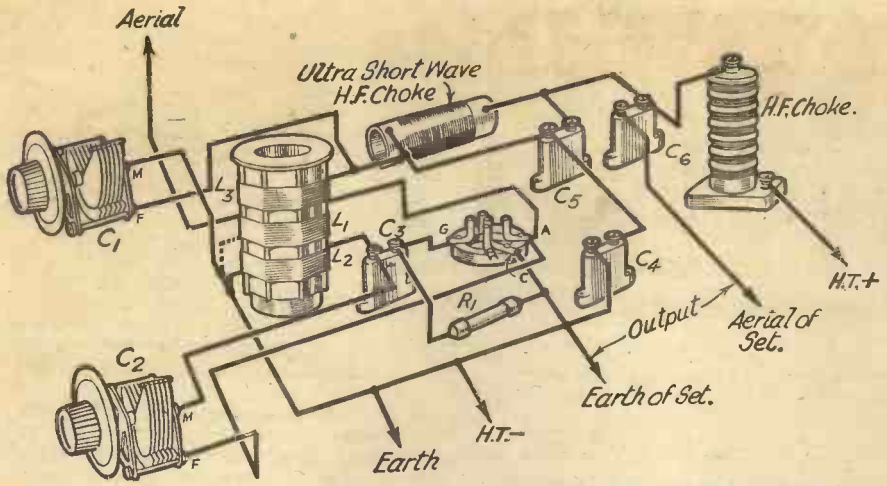

Fig. 3.—An interesting converter circuit showing in this case a mains-fed valve.

ADAPTORS OR CONVERTERS

(Continued from previous page)

unless rectified, and the best way to smooth out the reaction control is to adjust very carefully the anode voltages applied to the adaptor valve. Another method is to try various values of grid-leak, but, as a general rule, the anode voltage adjustment will suffice.

Another Adaptor

For those readers desirous of trying something a little different from the normal or ordinary arrangement, the circuit shown in Fig. 2 will have an especial appeal. The aerial feed is effected through a small series condenser C_2 as before, but the tuned circuit L_1 C_3 is now located across the anode and grid of the valve. As before, the ratings of inductance and capacity are dependent upon the wave-length range the adaptor is expected to cover. For example, for ultra-short wave working C_3 would be .0001 mfd. capacity, and L_1 three or four turns of No. 12 s.w.g. spaced ¼in. on a 1in. former. Coming now to the grid leak R_1 and the grid condenser C_4, these could be ½-megohm resistance and .0001 mfd. capacity respectively.

An ultra-short-wave high-frequency choke is located in the anode circuit, but notice that reaction is introduced *via* a differential condenser C_2. This has its two fixed plates joined one at each end of the tuned coil L_1, while the moving vanes connect to earth. To use the unit, just plug into the detector position of the broadcast receiver with the plug provided and follow out the operations detailed for Fig. 1, being careful to adjust the anode voltage of the adaptor valve.

A Converter

The points which have just been dealt with in no way exhaust the adaptor question, but enough has been said to indicate the broad outlines of the work and principles involved. It is necessary now to look into matters appertaining to converters. A unit of this character has already been built and will be published shortly in PRACTICAL WIRELESS, so at this juncture I shall content myself by dealing with an ultra-short-wave converter which differs somewhat from that already constructed. The circuit is shown in Fig. 3, and a comparison with Figs. 1 and 2 will indicate where lie the main differences.

First of all, the two separate coils L_2 and L_3, consisting of say three turns on a 1in. former, are tuned by a condenser C_1 of .0002 mfd. maximum capacity. The aerial is magnetically coupled to this circuit by coil L_1, which can consist conveniently of a single turn of wire. The bottom end of this coil is, in the diagram, linked to earth by a dotted line, this being to indicate that it must be tried on site to see whether the earth connection to the coil L_1 is desirable or not. Condenser C_2 is variable and has a capacity of .00005 mfd., and located in the position shown makes the valve act as a combined oscillator and first detector—the main criterion of difference between an adaptor and a converter which has been pointed out earlier.

Other Points

The grid-leak R_1 and the grid condenser C_3 can have values of 3 megohms and .0001 mfd. respectively, while the bypass condenser C_4 can be made equal to C_3, that is .0001 mfd. In the positive anode feed to the valve there is an ultra-short-wave high-frequency choke shunted by a .0001 mfd. fixed condenser C_5, and after this we have a standard broadcast band H.F.C. This latter choke must be of the fieldless type, and the signals are fed through C_4 (.002 mfd.) to an output terminal which is connected to the aerial terminal of the broadcast receiver.

Note here that if the broadcast set has a series aerial condenser of the pre-set type this must be either short-circuited or turned to its maximum value, preferably the former. The second output terminal is joined to the earth terminal of the set, while H.T.+ and H.T.— link to the set's high-tension source or a separate one, whichever is more convenient. As to valve choice, a good general purpose mains type valve, such as the 41MHF, MH4, 354V or AC/HL is suitable, and the working of both the converter and set together follows the usual lines of superhet practice with the proviso that tuning is much more critical.

HOW TO CHOOSE AND USE THE BEST VALVES.

(Continued from page 822)

ing a small resistance between the H.T. negative and the cathode. This has the effect of making the cathode slightly positive with respect to the grid, and amounts to the same thing as making the grid slightly negative. Fig. 3 shows the method of biasing a "straight" screen-grid valve in this way. The value of the resistance depends upon the amount of bias required and the anode current of the valve, and is always quoted by the maker. The capacity of the by-pass condenser is not critical, and may be from .1 to 1.0 mfds.

In the case of a variable-mu mains valve, the variable bias should also be applied automatically by a variable resistance in series with the small permanent bias resistance. The connections for this arrangement are shown in Fig. 4, where R4 is the permanent bias resistance and R3 the variable control bias resistance. Here again appropriate values must be

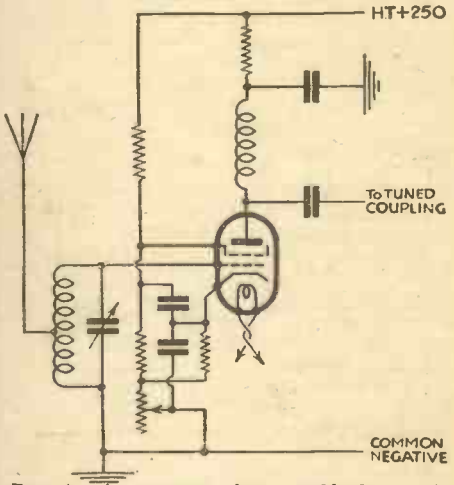

Fig. 4—Arrangement for variable bias and constant screen voltage for mains variable-mu valves.

taken from the valve-maker's catalogue or instruction sheet.

Screened H.F. Pentodes

A word must now be said concerning the most recent type of H.F. amplifier, namely the screened pentode, which in many cases is supplanting the screen-grid tetrode entirely. These valves are similar in design to screened tetrodes, but have a third grid situated between the screen and the anode and connected to the cathode as in an output pentode. The effect of this earthed grid is to render the valve capable of operation satisfactorily under conditions involving large anode voltage swings, and at the same time to greatly increase the amplification factor of the valve. In general it may be said that in any standard circuit a screened pentode will give a higher degree of amplification than an ordinary screen-grid valve, although owing to the bigger internal impedance of the high-frequency pentode, it shows to maximum advantage only when used in conjunction with well-designed coils.

Screened pentodes for mains sets are available in most British makes, and both "straight" and "V.-M." types are available. Screened pentodes are connected in exactly the same way as ordinary screen-grid valves, and no alteration to the circuit is necessary when substituting them for existing tetrodes.

CHOOSING A CIRCUIT

Points on the Choice of Circuits for Various Requirements, Explained by P. J. WATTS

THE question of choosing a circuit is not quite the simple one which it might at first appear. For instance, how many H.F. stages should be employed for good long-distance results? How many L.F. stages for really high-quality loud-speaker results? Is A.V.C. to be incorporated? Shall the circuit be mains- or battery-operated? These are probably only a few of the points which arise in the minds of the listener who desires to construct for himself a new receiver, and the following notes will enable the choice to be narrowed down to such limits that the final selection should be made without any difficulty whatsoever.

Locals or Foreign?

First of all, it is necessary to have a detector valve, no matter what type of circuit is built. It is, of course, possible to use a crystal detector, or one of the metal-oxide rectifiers, but these may be dealt with later under the heading of refinements. The detector valve alone will not operate a loud-speaker, although the signals may be sufficiently powerful to furnish quite good headphone strength. Thus we come to the first point in our selection—one valve is required for detection, and if only headphone signals are required no further valves will require to be added after this stage, whilst if a loud-speaker is to be operated some successive amplification will have to be included. The degree of such amplification will depend both on the amount of amplification which precedes the detector valve, and upon the volume which is required from the speaker. For instance, if the detector valve is joined direct to the aerial input (with reaction included) the signals from a local station will be sufficiently loud to furnish quite good loud-speaker volume with only one L.F. stage. Similarly, two L.F. stages will probably bring in a fair number of distant stations at moderate volume. The final point in the volume selection will be "How loud?" It may be stated that for normal room strength 2 watts will prove adequate. This means that in a normally furnished room, say 10ft. square, a fully loaded 2-watt output will provide signals sufficiently powerful to be heard with comfort in every part of the room, and the faintest broadcast sound will not be lost. If, however, it is desired to radiate dance music sufficiently loud to enable dancing to be carried out and not have the music masked by the sound of talking, laughter, moving feet, etc., 5 watts will be found the very minimum, although my personal preference is for a 5-watts output stage, to which the signal fed is only of moderate volume, so that all risk of overloading is removed on even the loudest climax. This arrangement also permits of a very "full" tone being obtained without any of the customary harshness which occasionally arises when a 2-watt stage is worked "full out."

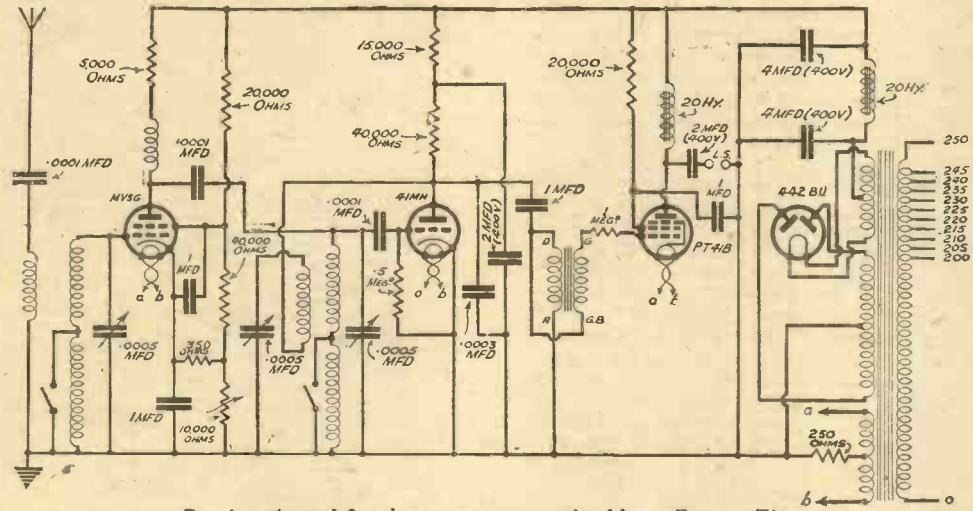

Fig. 1.—A good 3-valve mains circuit, the Mains Express Three.

Class B or Pentode

For the battery user, Class B will be necessary to obtain this volume of sound, and this, in turn, necessitates a driver valve. Thus, for Class B working we have found that three valves are essential. A pentode valve will deliver an output of the order of 1 watt, so that for cases where this volume will suffice a pentode may be used and this will enable the driver stage to be dispensed with. The small power valve will prove adequate where a very small room is in use, or where the ordinary small loud-speaker is employed, as it must be appreciated that a moving-coil type of speaker is necessary in order to do justice to an output of 2 watts or more. The H.F. stages must be chosen according to the range which the receiver has to cover. In other words, if it is desired to hear the small powered Continental stations, or probably American medium-wave broadcast stations, then two H.F. stages will be the minimum which can safely be employed. If these are of the variable-mu type it will be possible to fit a volume control to reduce the signal passed on to the detector when receiving stations nearer at home. One H.F. stage, feeding a detector valve which has a good reaction control, will, however, prove capable of splendid range, and if a variable-mu valve is used in this case no other form of volume control should be necessary. Thus, for general all-round results it may be said that the single variable-mu H.F. stage (or simple S.G. valve if the extra complication of the control is not thought necessary) will prove adequate, whilst for consistent long-distance reception two H.F. stages should be employed.

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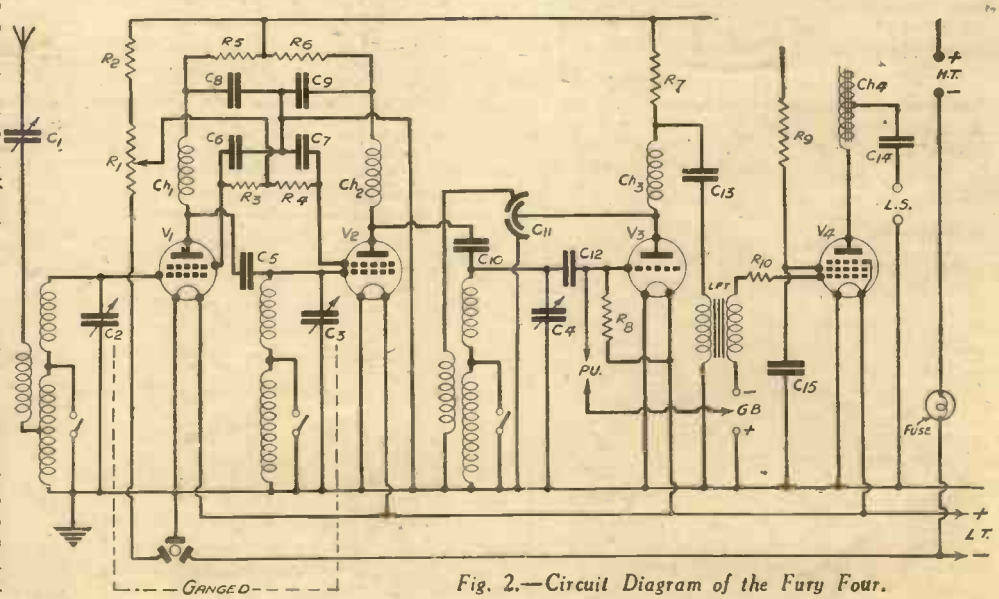

Fig. 2.—Circuit Diagram of the Fury Four.

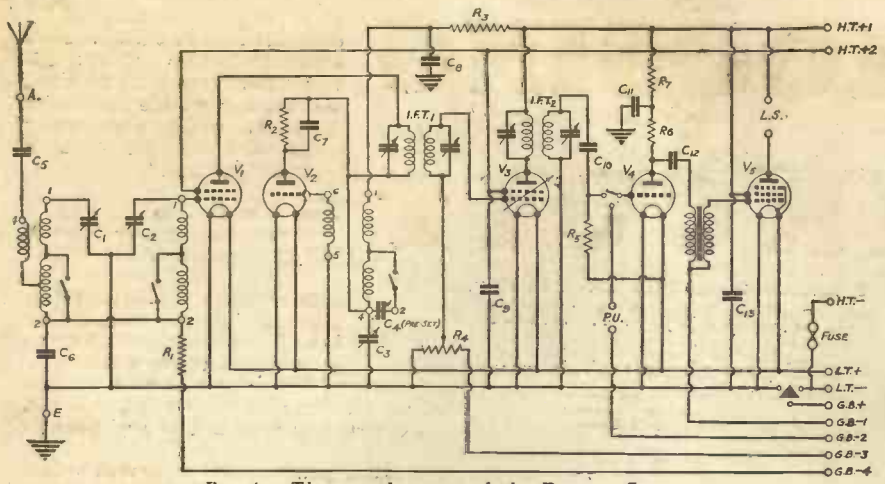

Fig. 4.—Theoretical circuit of the Premier Super.

(*Continued from previous page*)

The Superheterodyne

On the other side of the picture we have the superheterodyne circuit which will have a range sufficient to enable practically every worth-while European station to be received anywhere in England, and, provided the circuit can be accurately adjusted, this will prove one of the most useful of circuits.

Modifying the Detector Stage

The detector valve may be replaced by a cold valve, in which case the amplification normally obtained in this stage will be lost. It would be possible, of course, to use the detector valve, in the case of a replacement, as a subsequent L.F. stage, but where the cold valve is being used on economy grounds this cannot be done. No reaction can be employed with this type of detector, and therefore some further loss of volume is obtained. On the other hand, a diode valve, or a diode portion of a multi-electrode valve may be employed, in which case automatic volume control may be incorporated for keeping constant the strength of signals received in the H.F. stages. Reaction is, however, still precluded. A reaction circuit, properly handled, will prove in many cases equal to a good H.F. stage, so that it is not always advisable to dispense with this unless it is found possible to use two H.F. stages, when the use of reaction becomes almost unnecessary.

Mains Receivers

Practically all of the above considerations apply alike to mains or battery-operated receivers, with the exception that the output from the pentode which is operated from the mains may reach the order of 3 watts. Summing up the above points, therefore, it may be stated that an S.G., detector, and pentode circuit will provide a number of stations with a good output, capable of feeding a moving-coil loud-speaker, and this arrangement may be said to be one of the best all-round receivers. Fig. 1 is the circuit of our Mains Express Three which incorporates this arrangement, and it is also obtainable in battery form under the title of the Long Range Express Three.

Where longer range is required two H.F. stages should be employed, and the Fury Four, shown in Fig. 2, is typical of this type of circuit. For the larger output afforded by the Class B arrangement the Beta Class B Four shown in Fig. 3 employs a single H.F. stage with the added L.F. amplification. The superheterodyne circuit is shown in Fig. 4, which is the arrangement employed in The Premier Super.

Tuning Coils

The choice of the tuning circuit, that is, whether band-pass, iron-core, etc., is to be used, will depend upon the amount which is to be expended on the receiver as well as on the proximity of the nearest station. For instance, at five miles from a main B.B.C. station it would be found impossible to use a simple H.F. stage without losing a large number of distant stations working on wavelengths fairly close to the local. The band-pass circuit would restrict the local to a few degrees and thus enable a number of other stations to be heard. With two H.F. stages, however, the selectivity should be adequate for all normal requirements, although the use of a band-pass input circuit, or a band-pass coupling stage between the first and second valves, would increase selectivity. For the same reason, the iron-cored coils give an increase in selectivity, and thus the choice of this part of the circuit will depend upon local conditions. The above notes should enable the choice of a receiver to be narrowed down to very small limits, and no difficulty should now be experienced by any reader in ascertaining just what particular type of set will best meet his particular requirements.

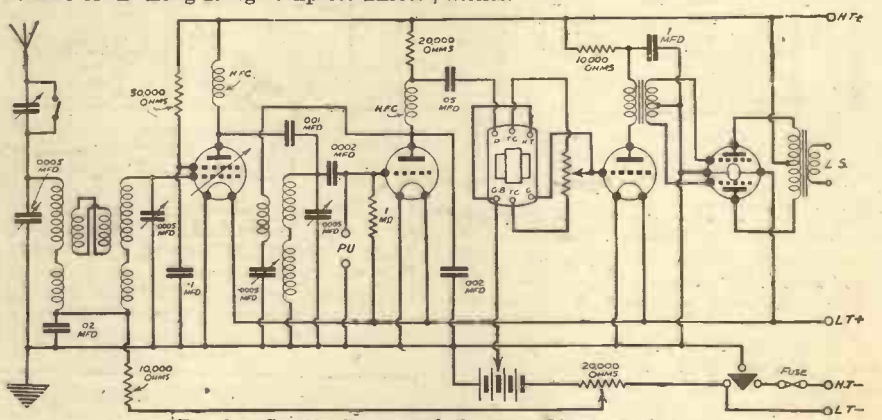

Fig. 3.—Circuit diagram of the Beta Universal Four.

BOOK RECEIVED

The Broadcaster Annual, 1934.

THERE is no better method of reviewing the 1934 edition of the Broadcaster Radio and Gramophone Trade Annual which has just been published by the Broadcaster and Wireless Retailer, of 29, Bedford Street, Strand, W.C.2, than by suggesting, by mention of a few of its contents, the wide scope covered by this publication.

The constitution and the year's work of every one of the trade's important associations, including the R.M.A., the B.V.A., the R.W.F., the W.R.A., the Gramophone Dealers Association, the Component Manufacturers Federation and the Cabinet Manufacturers Association, forms part of the publication.

The Service Section of the Annual (probably of greater interest to the retail reader of this reference work than any other of its valuable sections) has been extended.

No less than twelve pages are devoted to tabular information upon the supply voltages applying to nearly five thousand districts in the United Kingdom, while to make this type of information even more valuable some five pages are devoted to an examination of the relative markets for mains and battery receivers.

The Broadcaster Annual Directory this year occupies over eighty pages, divided into four sections. Every important manufacturer, together with his address, telephone number, the addresses of his branches, is listed in section one. Similarly every important wholesaler is dealt with in section two.

Section three consists of an alphabetical list of trade names, and finally there is the Products Supplied section occupying nearly half the total space devoted to the Broadcaster Directory.

In addition the Annual gives figures for twelve months for the exports and imports of radio apparatus, data governing postal regulations, how to register a company, information upon factory acts and shop regulations, upon the procedure to be adopted in taking out a patent, registering a design or trademark, the latest form of licence issued by the British Licensing Pool and by the Philips-Mullard group.

It gives monthly licence figures for every county of the British Isles, a directory of important new radio companies formed during the year, and a chart giving the characteristics of practically every valve on the market.

It is published at 5s., with a special privilege price of 2s. 6d. to *Broadcaster* subscribers.

PETO-SCOTT

EVERYTHING RADIO—CASH C.O.D. or EASY TERMS

Peto-Scott are pioneers in Radio and Television. Our service to the British public was introduced in 1919, and during fourteen years of solid Service and Satisfaction we have established a reputation for fair dealing that defies competition. Customers in all parts of the globe come to us regularly for all their radio requirements—Sets, Kits of all descriptions, Part Kits, Miscellaneous Components, Speakers, Eliminators, and Accessories. Purchases can be made for cash, C.O.D., or on Easy Payments. WE DEAL WITH YOU DIRECT. Peto-Scott's Easy Way System, with its strict privacy and no third-party collections, will bring radio to your home by convenient monthly payments. Send list for quotation: no obligation. Easy Terms on miscellaneous components over £2.

BRITISH RADIOPHONE MATCHED PERFECTION SEVEN

KIT "A" Author's Kit of first specified parts including METAPLEX baseboard, less Valves, Westectors, Cabinet and Speaker. Cash or C.O.D., Carriage Paid, £8/5/0. Balance in 11 monthly payments of 15/3. Send only **15/3**

Send for **FREE BLUE PRINT** of the **MATCHED PERFECTION SEVEN**, together with detailed list of parts.

BARGAIN KIT

GUARDIAN Q P P 4-VALVE RECEIVER, formerly £3/19/6. **KIT "A"** Complete Kit of Parts in sealed carton with full instructions, less valves and cabinet. Cash or C.O.D. Carriage Paid, 59/6. Send only **5/6** Balance in 11 monthly payments of 5/6

SHORT-WAVE KIT

DISCOVER S.G. THREE

The finest S.G. 3 valve receiver ever designed exclusively for short-wave reception.

KIT "A." Author's Kit of Specified Parts in sealed carton, less valves and Cabinet. Cash or C.O.D. Carriage Paid, £4/10/0. Send only **8/3** Balance in 11 monthly payments of 8/3

Send for "How to Build 4 SHORT-WAVE SETS," ALSO FREE BLUE PRINT OF THE GUARDIAN Q.P.P. 4.

W.B. EQUILODE EXTENSION SPEAKER with adjustable Switch, Chassis and Equilode Unit for perfect matching. Cash or C.O.D. Carriage Paid, £1/13/6. Balance in 7 monthly payments of 4/6. Send only **4/6**

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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 only **6/-**

GARRARD AUTOMATIC RECORD CHANGER for A.C. mains. Mounted on unit plate, complete, ready for fitting in position, including Garrard Pick-up and Tone-arm. Cash Price, £10/10/0. Carriage Paid. Balance in 11 monthly payments of 18/6. Send only **18/6**

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NEW W.B. P.M.4A. 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 only **5/9**

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

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 only **4/-**

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

NEW ATLAS C.A.25, for Mains, Class-B and Q.P.P., four tappings: 60/80, 50/90, 120, 150, 25 m.a. Cash or C.O.D. Carriage Paid, £2/19/6. Balance in 10 monthly payments of 6/-. Send only **6/-**

HOME BROADCASTER

Broadcast through your own set with the G.E.C. Microphone. Works off your set with only a 3-volt Dry Battery. Complete with 25 feet of Flex. Cash or C.O.D. Carriage Paid, £1/1/0. Balance in 6 monthly payments of 3/6. Send only **2/6**

PILOT AUTHOR KITS

NUCLEON CLASS "B" FOUR

KIT "A" Author's Kit of first specified parts including Peto-Scott Ready-drilled Panel and METAPLEX Baseboard less Valves and Cabinet. Cash or C.O.D., Carriage Paid, £8/8/0. Balance in 11 monthly Payments of 15/3. Send only **15/3**

KIT "B" As for Kit "A" but with set of Specified Valves only. CASH OR C.O.D. Carriage Paid, £10/13/3. Send only **19/6**; Balance in 11 monthly payments of 19/6.

KIT "C" As for Kit "A" but with set of Specified Valves and Peto-Scott Nucleon Four Cabinet. CASH OR C.O.D. Carriage Paid, £11/14/3. Balance in 11 monthly payments of 21/6. Send only **21/6**

F. J. CAMM'S BOOM SET

Described in "Practical Wireless," Nov. 4th, 1933.

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** YOURS FOR **9/6**

Balance in 11 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 Walnut Consolette Cabinet, but less speaker. C.O.D. Carriage Paid £8/5/0. SEND ONLY **15/3** *Balance in 11 monthly payments of 15/3.*

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

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 only **4/3**

	£	s.	d.
1 Set Specified Valves	1	2	9
PETO-SCOTT KOMPACT Cabinet (Post and Packing 2/6 extra)		15	0
PETO-SCOTT P.M.M.C. speaker, as specified		19	6

A.C. QUADPAK

KIT 'A' Author's Kit of First Specified parts, including Peto-Scott "Metaplex" chassis (less valves, cabinet and speaker) Cash or C.O.D. Carriage Paid, **£8.10.0** YOURS FOR **15/6**

Balance in 12 payments of 15/6.

KIT "B." As Kit "A" but with set of specified Valves only. Cash or C.O.D. Carriage Paid, £12/9/6. SEND ONLY **22/9** *Balance in 11 monthly payments of 22/9.*

KIT "C." As Kit "A" but including Valves and Peto-Scott Universal Walnut Consolette Cabinet with baffle baseboard assembly, less speaker. Cash or C.O.D. Carriage Paid, £13/14/0. SEND ONLY **25/-** *Balance in 11 monthly payments of 25/-.*

KIT-BITS

You pay the Postman. We pay post charges on orders over 10/-

	£	s.	d.
1 Peto-Scott Metaplex Chassis 16" x 10", with runners	0	2	9
1 Set of 5 specified Valves, including rectifier	3	19	6
1 Peto-Scott Universal Walnut Consolette Cabinet with Baffle and Baseboard Assembly	1	4	6

Exact to Specification

SPECIAL NOTICE. When ordering Panels of special size, or PLAIN Chassis instead of DRILLED, add 33⅓ per cent. to Cash Price.

CONVERT YOUR PRESENT SET TO A MAGNIFICENT RADIOGRAM

1934 WALNUT ADAPTAGRAM

THIS amazingly popular Peto-Scott Cabinet has brought the joys of the Radiogram to thousands of British Homes. Built by master craftsmen of the piano trade. Real inlaid walnut, mortised, tenoned, French polished. With motor-board, ready to take your set, speaker, and power equipment. Comes to you with plain front, or vignetted to take panels, 14 in. by 7 in., 16 in. by 7 in., 18 in. by 8 in. Baseboard depth, 14 in. Baffle board 3/6 extra.

YOURS FOR **8/3**

MODEL "A" Cash or C.O.D., £3/-. Carriage and packing 2/6 extra. Yours for 8/3. Balance in 11 monthly payments of 8/6 (Carriage Paid).

Special drillings or other special cut-out designs, add 3/- extra to Cash Price or 3d. to each monthly payment.

MODEL "B." Standard 1934 Adaptagram with Double Spring Motor, 12-in. Plush-covered Turntable, Automatic Stop, B.R.G. Tone-arm with Pick-up and Volume Control Complete—Automatic needle cup. Cash or C.O.D. Carriage Paid £6 GNS. Or 12 monthly payments of 12/-. Carriage Paid.

MODEL "C." A.C. Mains only. Standard 1934 Adaptagram Cabinet—Collaro Induction Electric Motor with Tone-arm, Pick-up, Volume and Control in one Unit, 12-in. Plush-covered Turntable, Automatic stop—Automatic Needle Cup. Cash or C.O.D. Carriage Paid. £7 GNS. Or 12 monthly payments of 13/9. Carriage Paid.

Oak or Mahogany no extra. D.C. Model Prices on application.

SEND FOR 1934 CABINET CATALOGUE.

CELESTION CLASS "B" UNIT, "B" Stage 9. Combined Class "B" Unit and P.P.M.9 Moving-coil Speaker. Excluding "Class B" Valve. Cash or C.O.D. Carriage Paid, £2/15/0. Balance in 11 monthly payments of 5/-. Send only **5/-**

NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL, complete kit comprises 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 only **10/3**

PETO-SCOTT PERMANENT MAGNET MOVING-COIL SPEAKER

FOR POWER OR PENTODE. Complete with input transformer. Send only 2/6; balance in 5 monthly payments of 4/0. CASH or C.O.D. **19/6** Carriage Paid. **2/6** DOWN.

Class "B" Model Cash or C.O.D. Carriage Paid £1/2/6 or 2/6 down and 6 monthly payments of 4/-.

IMPORTANT—Parts, Kits, Miscellaneous components Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our own 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.** Irish orders executed for Cash only.

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Dear Sirs:

(a) Please send me.....

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NAME .....

ADDRESS .....

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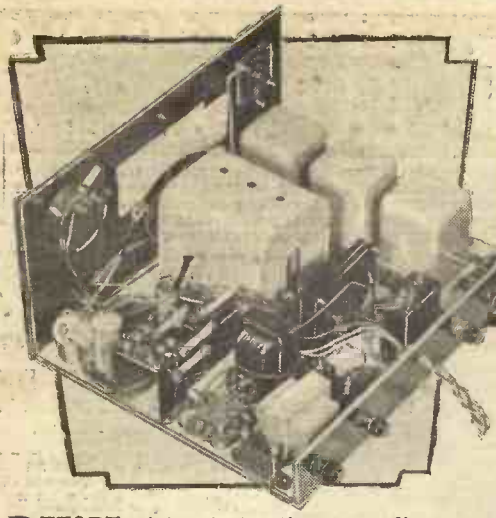
ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID



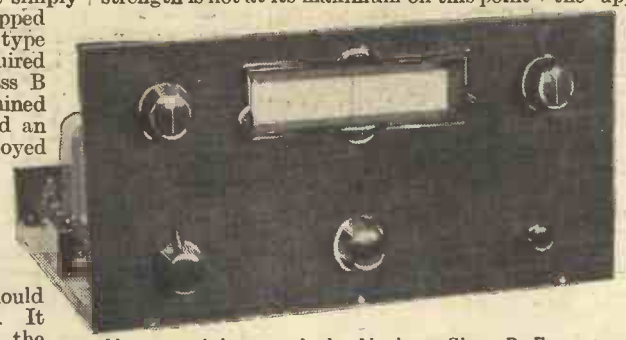
ADJUSTING AND OPERATING THE— NUCLEON 4

How to Trim this Fine New Receiver which Employs the Most Modern Coils and Valves

BEFORE giving instructions regarding the trimming of this powerful little receiver it is necessary to draw attention to the loud-speaker which is used with the apparatus, and also to the method in which it is joined to the receiver. The speaker itself is fitted with a special input transformer, which, unlike the usual type of Class B transformer, is not simply a standard transformer having a tapped primary which will "match" any type of valve. The characteristics required for ideal reproduction with a Class B valve have been very fully examined by the makers of the speaker, and an ingenious form of winding is employed in the transformer in order to get the best from this particular method of amplification, and it is therefore essential that the correct model is ordered. It should be noted that this is the FR6-PM-22 Class B, and when putting your order you should be very clear about this reference. It will be noted, of course, that in the list of components which was published last week the reference was abbreviated and the figure 4 was quoted instead of 6. The wiring diagram on page 786 illustrated a Class B choke connected to the output valve, but with the speaker which is specified this will not be required. The terminals of valveholder V4, therefore, which are at present joined to the two terminals on the choke, marked "P," must be connected to the two terminals marked L.S., whilst the lead going to the choke terminal marked H.T.+ must be joined to the terminal on the speaker, which is similarly identified. In this way the very highest quality will be obtained and the output choke will not be required.

Trimming

Having joined the speaker as above mentioned, the battery plugs should be connected to the appropriate tapping points, the high-tension plugs being inserted in the positive and negative ends of the battery, whilst the G.B.2 plug is inserted in the 16-volt tapping on the grid bias battery. G.B.—1 is then plugged into the 3.5 volt socket temporarily, and the accumulator is joined to the L.T. spades. Connect the aerial lead to terminal A2, and switch on. Rotate the wave-change control so that the pointer is towards the right, when the coils are set for the normal wave-band, and upon rotating the tuning control to the approximate wave-length of your local station, this should be heard. Rotate the upper right-hand control until signal strength is very weak, and then with a long screwdriver made from a strip of wood carefully adjust the trimming screws which are visible through the top of the ganged condenser. You will find that not only are the three screws interdependent, but that the actual setting of the tuning scale will also be modified when they are adjusted. You should, therefore, endeavour to obtain your local station with the pointer upon the correct wave-length figure on the scale, although if you find that the signal strength is not at its maximum on this point the indicating wire on the condenser scale may be slightly bent in order to give the correct indication. When once the correct setting has been obtained it should be possible to select any station within range by simply turning the indicator to the correct wave-length.



Neat panel layout of the Nucleon Class B Four.

The Aerial Condenser

The aerial lead should then be transferred to terminal A1 and a search made for weak distant stations in order that you may more accurately gauge your particular local conditions. Carry out the trimming adjustment also with this aerial connection and see if it is necessary to use this condenser in your locality. Your aerial characteristics may be such that you obtain best results when the aerial is joined direct to the coil from terminal A2, but no matter which connection you employ, the trimming will have to be carried out for that particular connection and then not touched again. When receiving the powerful local station the upper right-hand control will be set to provide ample undistorted volume, and in many cases this will be at practically its zero position. For a weak or long-distance station, the control will have to be turned to its maximum position, and it may also be necessary to introduce some reaction through the medium of the upper left-hand control. A compromise between signal strength and selectivity may be obtained by reducing volume slightly on the right-hand control, and then using the reaction control to bring up the volume to the required level.

The G.B.—1 plug may be adjusted to provide the best quality, and this is best carried out on the local station, where the maximum signal strength is obtained. It will not be found unduly critical, but the maximum voltage without distortion should be employed.

It should be unnecessary to remove the screening cans from the tuning coils, as no adjustments are available on these particular parts. If for any reason the cans are removed, on no account should the coils themselves be touched as it is possible to upset the ganging or even to damage these components by unnecessary handling.

LIST OF COMPONENTS FOR THE NUCLEON CLASS B FOUR

One set Wearite Iron-Core Coils (Types B.P. 1, BP. 2 and T.G.). (Wright and Weaire.)
One Polar Star Minor Three Gang Condenser with Horizontal Drive. (Wingrove and Rogers.)
One Polar Pre-set Condenser (.0003 mfd.). (Wingrove and Rogers.)
One 50,000 ohm Megite Potentiometer. (Graham Farish.)
One .00015 Differential Reaction Condenser. (Graham Farish.)
Three 4-pin valveholders and one 7-pin. (Graham Farish.)
One .03 mfd. Non-inductive condenser } T.C.C.
Three .1 mfd. Type 81 ditto
One .0002 mfd. Type 34 ditto
One .00015 mfd. Type 34 ditto
One 1 mfd. Type 50 ditto
Two .01 mfd. Type 34 ditto
One 2 mfd. Type 50 ditto
One 250,000 ohm 1 watt resistance } Dubilier
Three 100,000 ohm. ditto
One 30,000 ohm. ditto
One 10,000 ohm. ditto
One 1 megohm ditto
One 3-point On/Off Switch Type S.39. (Bulgin.)
One Type H.F.P.A. Screened H.F. Choke. (Wearite.)
One Midget Screened H.F. Choke. (Bulgin.)
One A.F.3 L.F. Transformer. (Ferranti.)
One Hypernik Class B Driver Transformer. (Lissen.)
One Metaplex Baseboard (14in. by 11in.). (Peto-Scott.)
One Panel (14in. by 7in.). (Peto-Scott.)
One Terminal Strip (14in. by 1½in.). (Peto-Scott.)
One 7-way Battery Cord. (Belling and Lee.)
Five Type B Terminals (Aerial, Aerial, Earth, L.S.— and L.S.+). (Belling and Lee.)
Two Coils Connecting Wire, Length of Screening Braid, Screws, etc. (Peto-Scott.)
One 220 VSG valve } Cossor
One 210 DET valve
One P.215 valve ..
One 240B valve ..
One 120-volt Lion Battery } Vinces
One 16-volt Lion Grid Bias Battery.....
One 2-volt 40 amp. Accumulator. (Lissen.)
One Rola FR6-PM-22 Class B Loud-speaker. (Rola.)

Now, more than ever before, **range** is of first importance to listeners.

Wavelengths are changing; you will be unaccustomed to the new tuning, and only if your set will pick up distant difficult foreigners with ease and precision will you avoid irritation and disappointment.

The new Dario Valves will give your set the best chance. Their **range** is something new to wireless reception. They will pick out each station from the next as if no other existed; and, with it, their accuracy is perfect. Sturdy, too, like all Dario Valves in the past, these new models mean a big economy. Study the list of prices and types below and write to-day on the coupon attached for our new complete list of types, prices and specifications.

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

DARIO VALVES

Every new type and improvement.

PR.W.2

POST THIS COUPON TO US

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

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

Retrospect and Prospect

The Author of this Interesting Survey Looks Ahead, and Discusses Probable Developments During 1934. Will Television Arrive, and Will Receivers Take the Form He Suggests? By LAMBDA

WHAT progress has been accomplished in 1933? What developments? What achievements? New valves! New coils! New circuits! All tending to improve reception; all helping to provide greater selectivity, greater sensitivity, and better quality.

Look at the new valves provided for us in 1933. Class B, double diode triodes, H.F. pentodes, and the pentagrid or heptode. These are not all.

Tuning circuits have been revolutionized by the introduction of Ferrocart and other iron-cored coils. Automatic volume-control is the order of the day even for battery receivers employing only one high-frequency stage. The pace has been set, and are we, in 1934, to see this rate of progress maintained?

Are we to witness anything startling or revolutionary in components or circuit design?

Now for 1934

Not being gifted with second sight, I do not propose to suggest that anything remarkable will occur in this remarkable age. Nothing surprises us, and we radio enthusiasts would probably only raise our eyebrows if it were announced that communication had been established with one of the planets. What would interest us would be that legislation had been introduced for the protection of wireless listeners against that very annoying form of interference—man-made static. Let us hope that during the present year this form of interference will definitely be laid by the heel, either by the prevention at the source of the interference or by the introduction of some means of preventing it, in every instance where it causes interference with reception. Considerable progress has been made, so let us hope that we shall soon see the end of this very troublesome form of interference.

Quality of Reproduction

There is going to be a demand for real quality reception this year. Whilst the complete set with self-contained loud-speaker will still be popular, those seeking real quality will favour the receiver which does not include a loud-speaker, the selection of the latter being left to their own individual choice. Perhaps the wish in this instance is father to the thought—but I do like my loud-speaker separate from the receiving set itself. A large baffle board about two feet square is my choice; real quality can then be obtained, providing, of course, that the set and loud-speaker are capable of faithful reproduction. A large baffle provides a better balance between high- and low-note response.

Television

There has been television, and rumours of television. We have grown accustomed to

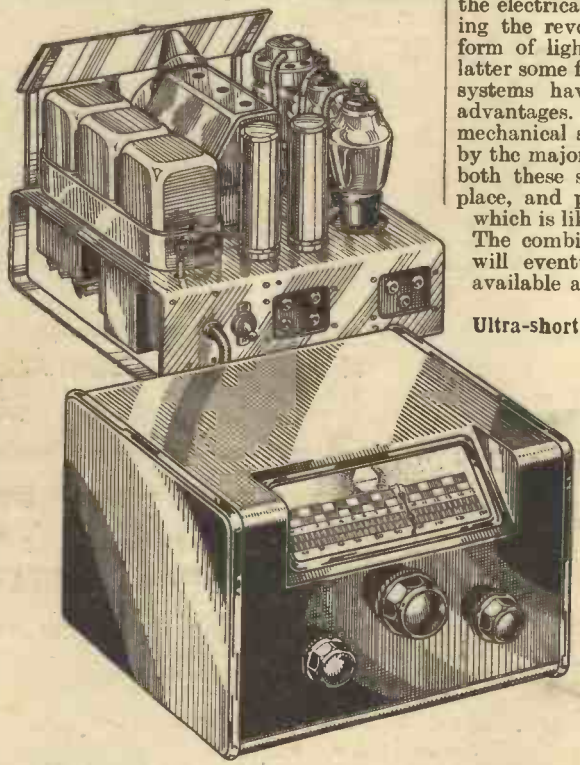


Fig. 1.—A set of the future? Note the dial divided into channels.

them. But during the present year television will definitely arrive. Not perfect! Receivers were not by any means comparable with present-day apparatus ten years ago, but broadcasting had arrived.

This year we shall see pictures with apparatus which will be comparable with those early wireless receivers.

At the present time two television systems appear to be emerging from the results of the years of research into the problems associated with the development of television. There is the mechanical and the electrical system. The former employing the revolving mirror drum and some form of light modulating device, and the latter some form of cathode-ray tube. Both systems have their advantages and disadvantages. At the present time the mechanical system appears to be favoured by the majority. Further developments of both these systems will undoubtedly take place, and practical tests will then prove which is likely to be the superior method. The combined vision and sound receiver will eventually become popular, and be available at reasonable prices.

Ultra-short Waves

A considerable amount of research work has been conducted on the transmission and reception of wavelengths below 7 metres—the quasi-optical waves. Experiments are being conducted on wavelengths as low as 9 centimetres.

These quasi-optical waves travel only in straight lines, their range being essentially limited by the curvature of the earth. They can be efficiently projected in narrow beams, are not affected by atmospheric noise, and only require very low power. For television they appear particularly suitable, as they

(Continued overleaf)

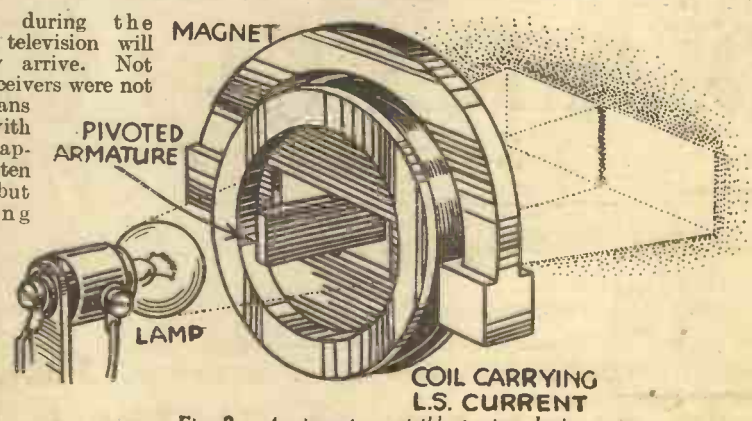


Fig. 2.—An ingenious visible tuning device.

(*Continued from previous page*)

can easily be modulated by frequencies of several hundred kilocycles. Already experiments in television transmissions on these wavelengths are being conducted, and there is no doubt that there are great possibilities for the future of television on these extremely short-wave lengths. Owing to the wide frequency channels available, 120-line scanning will be practicable, thus providing greater picture definition, which is a great step towards making television of real entertainment value. Maybe that this year we shall witness great advances in this direction.

The superhet receiver has come to stay. It is rapidly superseding the tuned radio-frequency circuit. It is certainly more selective, and it cannot now be accused of being responsible for poor quality of reproduction.

Tone-correction devices can be applied very successfully to a superhet receiver, as only one frequency, the intermediate frequency, is being dealt with. Consequently, the amount of attenuation of the higher frequencies can be calculated, and tone-correction circuits easily designed. In all probability three-valve superhets will become available. PRACTICAL WIRELESS foresaw the four-valve superhet with A.V.C. as far back as May 27th, 1933, when the hexode valve was described. This is now an accomplished fact, made possible by the use of the hexode or pentagrid frequency changer.

Considerable improvements are being made in tuning dials; they are now easier to read, and the horizontal type of dial is rapidly coming into favour. Shall we also see a further development, and have our dials engraved with frequency channels instead of wave-lengths or frequencies?

Stations in Europe are spaced 9 kc/s apart, so that this method cannot be adopted. The alternative would be to allow each station a channel number. If our dials were then calibrated accordingly, what a simple matter it would be to refer to the channel number in the list of stations. Another advantage of this system would be the facility with which stations could be identified, for it would only be necessary to refer to the corresponding channel number in the list of stations to ascertain the name of the station being received. What an advantage this system would be.

Fig. 3.—The small cathode-ray tuning device developed by Standard Telephones

Visual tuning indicators, in some shape or form, will be universal in new receivers. They will be very much in evidence at the next radio exhibition at Olympia. In view of the almost universal application of automatic volume-control they will become essential.

The valve manufacturers during the past year have displayed amazing ingenuity and resourcefulness in their ability to provide new types of valves. Will this rate of progress be maintained in 1934? At the present moment there does not seem to be any very urgent need for new types of valves, but rather a standardization of the existing types. There is, of course, always room for improvement. No doubt the battery pentagrid valve will be produced in due course. Battery-set users will then be in the same position as the owner of a mains superhet receiver.

In 1933 the battery set was well catered for in the new types of valves produced, particularly output valves. However, the triple twin valve may be produced in this country this year. It would be welcomed by owners of mains receivers with only a limited anode voltage available. At present, to obtain an undistorted output of five watts or over, it is necessary to provide an anode voltage of at least 400 volts for the output valve. In some cases this may necessitate the re-designing of the mains portion of the receiver.

With the triple-twin valve this can be achieved, and an output of about four watts obtained with an anode voltage of about 250 volts. This valve would therefore be an advantage in small mains sets with limited anode voltage. The triple-twin valve is somewhat analogous to the Class B valve for battery sets.

This is my forecast for 1934. You see, there is still plenty of scope and room for improvement. Time will tell whether these predictions are correct. In any case, we can be sure that stagnation will not set in. New components will be designed, and further advances made in all directions.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

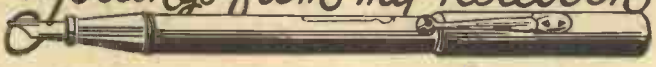


Photo-cells in Commerce

PROBABLY every wireless enthusiast is interested in photo-electric cells and their applications from a technical and scientific point of view, but probably few realise to what extent these light-sensitive devices are employed commercially. It will, therefore, perhaps surprise many readers to learn that a number of dog, horse and motor race-courses employ what are called ray-timing devices. In these cases a ray of light (generally ultra-violet or infra-red, which is invisible to the naked eye) is directed across the finishing line on to a photo-electric cell connected to an amplifier and stop-watch. Immediately the ray of light is broken, due to a horse, dog or motor-car passing the line, the cell actuates the amplifier which, in turn, stops the watch and so gives an exact record of the time of finishing. At the starting end of the track a similar arrangement is also employed for starting the stop-watch.

Another use for photo-cells is that of counting the number of finished objects passing along an endless belt in factories where mass production methods are employed. In that case the cell "feeds" into an amplifier in the output circuit of which is included an electric counter. Any mistake in counting the number of articles passing along the belt is thus impossible, and the counting process is perfectly simple and rapid. At least one firm of biscuit makers in this country employ photo-cell counters, whilst in America the system is employed in many engineering shops and in flour mills.

Photo-cells are also extremely useful in connection with street lamps, for they can be arranged to switch on the lights immediately the normal daylight falls below some pre-determined intensity. As a matter of fact, photo-cells are used for this purpose (only experimentally at present, it is admitted) in Liverpool, Hull, York, Erith and Beckenham. It is by no means unlikely that still wider and permanent use will be made of this system of automatic illumination in the future.

A High-output Multiple Valve

MULTIPLE valves, in which a single filament is used in conjunction with two or more grids and anodes to provide two stages of amplification by means of a single valve, have been made in the past and sold in fair numbers on the continent. Some of these valves have been reasonably efficient and have been used in the construction of compact receivers of the low-power type, but the valves have only been capable of providing a comparatively small signal output. A new valve of the "multiple" type has now been developed in America which, in addition to providing two stages of low-frequency amplification, is able to deliver an output of some 5 watts. The valve is, in fact, intended principally for use in public-address amplifiers. It is of the indirectly-heated type and is distinctly unusual in that the output load for the first set of electrodes is connected in the cathode, instead of in the anode, lead. An advantage of this system is that, by correctly choosing the output component, it can be used to provide the necessary bias without the use of the normal bias resistance.

Leaking Condensers

MODERN condensers and resistances are usually very reliable, and remain constant in value for long periods. But even so it does not do to overlook the possibility of a slight change in value or reduction in efficiency after constant use, and in some instances only a slight divergence from their original characteristics will cause noticeable distortion. I was thinking particularly of coupling condensers used in R.C.C. coupling. A slight insulation leakage will result in a positive charge leaking on to the grid of the following valve. If the value of the associated grid leak is rather high this charge will accumulate, and so neutralize the grid bias which is applied through the grid leak. In other words, the valve will be under-biased, although apparently the correct bias is applied. A milliammeter connected in the plate circuit of the valve will show a higher reading than it should do. This is, of course, an indication of under-biasing, so that if on checking up the value of the bias tapping or resistance the voltage is found to be correct, then strong suspicion rests on the coupling condenser.

Distortion and Ageing Components

A POINT which it is always useful to know when attempting to diagnose the cause of distortion is whether the distortion has always been present or whether it has gradually developed. If the receiver originally gave perfectly good quality, but has since begun to distort, then a number of causes immediately suggest themselves. Apart from the obvious ones, such as worn-out batteries and old valves, there are others, such as the accumulation of dust and damp, the partial breaking down of resistances and condensers, etc.

Dust is, of course, a great enemy of good quality, since it is usually hygroscopic in nature, and by attracting moisture from the air, forms a thin, conducting medium over the surface of the various components in the receiver. In this way many terminals become connected together by what amounts to a high resistance.

Phase Difference

ONE of my correspondents asks me to explain to him what phase difference is. This is probably a question which is difficult to understand by many radio fans who are now using the electric mains as a driving force for their receivers. I quite appreciate it is difficult for the uninitiated to understand how, if there is only one voltage, there can be any difference. If the voltage is alternating there may be a difference in the time when any selected value of voltage is reached, even though the voltage is the same, because alternating current is governed by a time factor, that of frequency per second. This time factor is usually stated on the house meters as so many cycles, such as 40, 50, 60 and so on. In some districts, such as parts of the Midlands and Cornwall, it is as low as 25 cycles per second. With direct current there is no alternation, and so no phase difference. When direct current is pulsating, an introduced alternating current is converted into changing values of direct current, and here phase enters also.

Revision of Wavelengths

THE unique Philips calibration system with the micrometer dial which is incorporated in Philips models 630A. and C., 634A. and C., and 636A., has a great advantage with regard to the wavelengths shuffling, because the dial itself needs no change. All that is necessary to keep the system up to date after January 15th is a new calibration chart which they are supplying.

New charts will be ready for all Philips owners of any of the above-mentioned types free of charge. New charts for the 634A. and C., and 636A. are now ready. These will be sent upon receipt of the necessary particulars, which are—type number of set, registration number and number of the old chart. This consists of two figures, for instance 24.

New charts are also available for dealers for any of the above-mentioned types they may have in stock, and will be sent without delay upon receipt of the application form which is being sent to them.

Home-constructors' "Difficulties"

IT is becoming very obvious that many of the so-called difficulties which are encountered by the home-constructor are actually of his own making. The majority of the receivers which are received by us for examination owing to their failure to come up to the guaranteed standard are full of small points which go a long way to prevent good results. One of the most common faults lies in the method of tightening nuts. It is absolutely unnecessary to lock these up with a spanner, or to use a screw-driver on those which have slotted heads. Where the connecting screw passes through bakelite or similar material the action of using a spanner on the nut does not always result in increased tightness, but rotates the actual screw when the locking faces are firmly in contact, and further rotation unscrews the screw or bolt beneath the bakelite surface. In many components this results in the internal connecting wire or lug coming loose and noises, or even complete disconnection results. In other cases we have found that even thick connecting wire has been sheared practically right through, and the slightest touch results in the wire snapping off. The fingers are sufficient to enable a really good connection to be made, and "finger tightness" should be the rule with all connections.

REVIEWS OF THE LATEST RECORDS

By T. Onearm

All Sorts

There is a very good comic record by Ike Freedman (the Scottish Hebrew Gentleman). He sings (on *Regal MR*1095) *King of Palestine* and *Romeo*. They are both excellent tunes as well. If you dare risk one of those airs, which will probably result in your murder (by those who will catch it from you !) *The Man on the Flying Trapeze* (*Decca F*3682) will be most suitable. The thing is well sung by a good vocalist with the Jolly Rollickers. You have now been warned. The most interesting novelty for a long time is the record of an Electronde performance of *Le Cygne* and *Schubert's Serenade* by Martin Taubmann (*H.M.V. B*8020). Every radio lover should get this record : it is not only extremely interesting from a technical standpoint, but it is very delightful to listen to this "musical oscillator" as Mr. Taubmann "plays" it. It sounds like a disembodied 'cello—a 'cello without any wood, that is. I believe this is a discovery with big possibilities, if it isn't too difficult to manipulate. I shall certainly try it.

For Dancing

If you have never heard Chalmers Wood and his Scottish Dance Orchestra, do so at once. Try *Scotch Broth* (foxtrot) and *Scottish Memories* (waltz). A first-rate dance record of the "straight" sort. One of the really big hits of many months is the record of two high-lights from the "Gay Divorce." They are played by Leo Rersman's Orchestra and are *Night and Day* and *I've Got You on My Mind* (*H.M.V. B*6398). Fred Astaire sings both vocals, which gives the record an enormous *cachet*.

Songs of all Kinds

"Beloved Ben Davies," the announcement of his new record begins, and nobody will disagree. At seventy-six, this veteran sings *Tom Bowling* and *Come Into The Garden, Maud* (*Columbia DB*1205). I wish we could have had "Tom" on both sides, so as to have a new side when the other was worn out ! It is clear that "Maud" is a strain on him, but it is delightful to hear him again. Now Heddle Nash, one of our best English tenors of to-day. He sings *Your tiny Hand is Frozen* and *The Serenade from The Fair Maid of Perth* (*Columbia DX*540). The first is very good indeed both from the vocal and histrionic view-point. Tauber has a perfectly enchanting song in *I Greet You, My Beautiful Sorrento* on *Parlophone RO*20228. You will travel far before you hear a lovelier melody. Two songs of the rural school—*When the Harvest's In* and *The Merry-Go-Round* are on *Columbia DB*1204, sung by Harold Williams. Easthope Martin lovers, please note : these are in the tradition.

Now two records introducing well-known airs with vocal settings. The first is our old friend *Stephanie Gavotte*, and Emmy Bettendorf sings the simple words exquisitely—on *Parlophone R*1633. Then Anona Winn does two on *Columbia DB*1203. Czibulka is again chosen with *Hearts and Flowers* and the famous *Rendez Vous*. The words are ballad-ish, of course, but by no means unsuitable. Both are nicely sung to these very good tunes.

Josef Schmidt has two magnificently sung arias from La Tosca— *E Lucevan le Stelle* and *Recondita Aimonia* on *Parlophone R*1619. This singer is definitely from the top shelf. Few of us are proof against such songs as *Mary* (Kind, Kind, etc.), and *Eileen Alannah*. You will enjoy their singing by the Victorian Quartette on *Regal-Zono MR*1039. An uncommonly attractive bit of harmony, with orchestra.

High Spirits

There are many laughs abroad from the latest records, and one of the best of those quiet, subtle monologues I have ever heard is John Tilley's *Company Promoter* on *Columbia DX*537. As the chairman of a company of decidedly shaky character he addresses the shareholders. In his address are some gems of highly polished humour, every one of which is too good to quote. A great record ! Then Norman Long, breezy and cockney as ever, gives us *We Can't Let you Broadcast That* and *'Oles* (*Columbia DB*1216). The poor B.B.C. stop quite a number of hefty blows in the first, and the second is the philosophy of the gent with the road-drill. *Taking Possession* (*H.M.V. B*8003), proves that Claude Hulbert is not such a fool as he seems—as the other three of Those Four Chaps discover.

A musical novelty of very great merit is *A Gypsy Sing-Song* (*Regal-Zono MR*1048). Sidor Barman's Gypsy musicians give real support to the title, and those who yearn for the gypsies to sing to them (as the song demands) will get all they want here. There are two band performances which must not be missed. The first is the musical staging of the Tidworth Tattoo on *H.M.V. C*2593–4. Definitely better than the Aldershot one, and the massed band playing *Sanctuary of the Heart* is unforgettably striking. The other is one of the best the Grenadiers have ever done—*Columbia DB*1207. They play *Unter den Linden* and *Phantom Brigade*, both marches clear of the usual uninspired blare. Clean-cut bright tunes —so splendidly played.

Two very good "at the piano" artists, Fred and Leslie Douglas, sing exceedingly well *Carry Me Back to Green Pastures* and *I've Found The Right Girl* (*Sterno* 1245).

Peter Dawson has done some of Stanford's songs of the sea. Quite the best is *Outward Bound* (*H.M.V. B*4482). I don't know a better performance of his. A very good chorus is with him.

FACTS & FIGURES

Components tested in our Laboratories

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

COLVERN TUNING UNITS

THE provision of high-efficiency tuning coils, together with a ganged condenser having a wavelength-calibrated scale enables the home-constructor to assemble a highly-efficient receiver with a minimum of trouble. Messrs. Colvern have now turned their attentions to the production of a unit of this type, and that illustrated below employs the Ferrocart iron-core coils, together with combined switching. As may be seen, the coils are of the "G" pattern, which are slightly more compact than the original "F" type of Ferrocart coil. The coils, together with the screened

The neat Colpak manufactured by Colvern Ltd. Note the two switches.

condenser, are mounted on an aluminium base-plate, and, in addition to the coil wave-change switch incorporated in the coil bases, a radio-gramophone switch, and also a battery switch is mounted on the plate to be operated through the wave-change switch rod. The switch nearest the control knob is for radio-gramophone change-over, and is a clean-acting, substantial switch which will not be liable to give rise to troubles through faulty contacts. At the opposite end of the switch rod is a Q.M.B. type of switch designed to operate by a cam action on the end of the rod. This may be used for breaking the low-tension circuit, and, if required, the switch may be supplied in the high-voltage type suitable for switching off a mains receiver. The complete Colpak, as it is called, may be obtained for simple receivers, or superheterodynes. In the former case the coils provided are of the band-pass and intervalve type, with reaction coil fitted to the latter coil. In the superheterodyne pack, the combination consists of band-pass and oscillator coil which is suitable for use with a circuit employing a separate oscillator valve, or one of the new pentagrid or heptode valves. The price for either type is 57s. 6d. (without dial).

MULLARD HIGH-EFFICIENCY PENTODE

THE Mullard Pen.4VA is now generally released, and where the maximum output from a single stage is desired no listener should hesitate to obtain one of these valves for feeding the loud-speaker. As we have previously mentioned, this delivers nearly 3 watts undistorted output. In addition to this factor it will handle a larger signal than the Pen 4V, and thus, whilst giving the user the advantage of more volume, it at the same time reduces the possibility of distortion due to overloading. It is an A.C. valve having a 4 volt 1.5 amp heater, and taking up to 250 volts anode and auxiliary grid voltages. The bias required at this figure is 22 volts and a 500-ohm resistor will be found correct if inserted in the cathode lead. The correct load impedance is 6,000 ohms, and the price is 18s. 6d.

NEW FERRANTI RECEIVERS

THE latest list received from Messrs. Ferranti gives complete details of the whole range of Ferranti receivers and extension loud-speakers. Four new models have only just been introduced, namely, the Lancastria Radiogram; the Arcadia Magna Consolette; the Arcadia Console and the Arcadia Radiogram. The Lancastria Radiogram is built on very sound and modern lines, having a sloping baffle to assist in maintaining constant high quality at any volume level, and is fitted with a high-grade electric motor and pick-up. The price is twenty-six guineas. The Arcadia models are superheterodyne receivers designed as table models or radiograms, and also represent extremely efficient and up-to-date instruments. The list may be obtained by any reader upon application to Messrs. Ferranti, at Hollinwood, Lancashire.

THE FILTERMATIC OCTAVE TONE CONTROL

SOMETHING new in tone controls has been received from the Rothermel Corporation, and, although of American origin, it represents a new idea in such controls, as, so far as we can trace, there is no similar type of apparatus made in this country. The complete apparatus resembles a variable resistance, having a diameter of 1¼in. and a total depth of only about half an inch. The case is of bakelite with a metal end, and connections are of the soldered type. So far, therefore, the appearance of the device is not out of the ordinary. Internally, however, there are some interesting details. A number of circular thin metal plates are arranged with mica sheets to form a condenser having a total capacity of approximately .006 mfd. At various portions of the complete assembly lugs are brought out and these are bent back to form a seven-stepped contact disc, across which rotates a broad metal arm. Thus, as the control knob is rotated, the arm (which is joined to one of the external contacts) taps off sections of the condenser, enabling a variation from 50 m-mfds. up to the maximum value of .006 mfds. to be obtained. There is a very definite maximum and minimum position, and the device will be found most useful where a variable condenser effect is required. The makers state that the condenser has been designed primarily for use in the grid circuit of a valve. The price is 5s.

NOVEL EXIDE INDICATOR

SEVERAL ingenious methods have been used in the past to enable the non-technical user to ascertain the condition of a low-tension accumulator. Thus we have had coloured balls which floated either singly or in combination according to the condition of the acid. A single ball which floated on the surface, or sunk to the bottom with varying gravity, and so on. The Exide factory are now producing an ingenious device which removes all worry from the user's mind, and as may be seen in the illustration, one side of the accumulator is furnished with a full-size indicator bearing very clearly the words, "Full," "Half," and "Empty." A large hand is pivoted at the opposite side of this scale, and as the accumulator discharges the hand slowly travels across the scale. There is thus no possibility of any misunderstanding arising and the indication may be read even when the cell is standing inside a cabinet or other dimly-lighted place.

This illustration shows the new indicating device for accumulator condition, developed by the well-known Exide people.

UTILITY COMBINED CONTROL

A MOST ingenious combination control has been submitted for test by Messrs. Wilkins and Wright. It consists of a small bakelite dielectric reaction condenser and a potentiometer mounted on a common control spindle. As probably many experimenters have found when endeavouring to combine

A new combined control manufactured by Messrs. Wilkins and Wright.

two devices of this nature, it is exceedingly difficult to make the two controls operate at the correct moment. The potentiometer is, of course, used to vary the bias on a variable-mu H.F. valve and thus control volume, whilst the condenser is employed in the usual way for reaction purposes. The idea underlying the combination, therefore, is that as the signal input is increased, reaction is increased. Obviously, the H.F. control must be adjusted to a certain value before the reaction control commences to operate and this is difficult to accomplish with the standard components. In the new Utility device the plates of the reaction condenser are of unusual shape and thus it is possible for the control to be turned through a fair movement (actually 180 deg.) before the plates of the condenser commence to interleave and this will, in the majority of cases, enable the H.F. input to be modified to the required degree before the reaction control commences to function. The arrangement was tried out on three different receivers in which the separate controls had previously been fitted, and it was found to provide a very smooth control without any necessity for drastic voltage, or circuit alterations. The price of this control is 7s. 6d., with a reaction condenser of the differential or the ordinary type as required.

EASTICK'S RADIO BULLETIN

THE December, 1933, issue of this interesting little booklet is filled chiefly with lighter fare, including seasonal greetings from various radio manufacturers. Among the other contents are particulars of meetings, etc., of the W.R.A. during November and December; short-wave notes, and specifications of components for various sets described in different periodicals during December. Details of the new Eelex Short-Wave Converters are also given. The Duplex model has been redesigned, in order that it may be used in conjunction with superhets. This model is now fitted with a universal plug-adaptor for connecting the low-tension supply from the main set, whereas in the old models the plug-adaptor was used for A.C. mains sets, and spade terminals for battery sets.

The M2 Super model is a complete all mains (A.C.) super-het. converter, employing a screen-grid pentode H.F. stage preceding the oscillator valve. A special short-wave two-speed slow-motion dial is fitted, with illuminated escutcheon. This converter is built into a very attractive oak cabinet, with panel to match. Copies of the booklet can be obtained from J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1.

TRIOTRON VALVES

THE popular Triotron valves need little introduction to our readers, but to those who have not yet tried them in their receivers we would recommend a very useful booklet, the Triotron Valve Guide for 1934, which has recently been issued. In addition to giving complete information regarding each type of valve in the very comprehensive range which is now available, it also includes several popular types of circuits to enable you to obtain the best results from the valves. A technical appendix gives some useful information explaining in simple terms the working of auto-grid bias, decoupling, etc., and a selection of hints and tips on better reception. The Triotron Technical Service Department is always ready to assist in solving radio problems. All interested readers are advised to write for a copy of this useful booklet to Triotron Radio Co., Ltd., Triotron House, Bloomsbury Street, London, W.C.1.

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).

F. J. C's. Latest: Excellent Results

SIR,—With reference to my query regarding your latest set, I have carried out your instructions for locating the fault, and find that the trouble was caused by two loose connections on coil F.10, the terminal screws being loose and making bad contact. After correcting this I find that the receiver is all you claim it to be—and more. The selectivity permits of all the separation necessary in this district, and the sensitivity enabled me to log a remarkable number of stations. In a locality such as Brighton, where fading after dark is troublesome, even on the nearest Regional and National (London), the A.F.C. control is especially appreciated. The absence of fading and really "true to life" quality of reproduction make the set a perfect source of entertainment. Thank you for a fine set.—H. STENNING (Brighton).

"Simply A 1"

SIR,—I have just received my Pocket Tool Kit, and may I add one more "Thank you" to those which have preceded mine. Every Wednesday I look forward to receiving my copy of PRACTICAL WIRELESS. I think it is the *only* paper, book, or encyclopædia that is of use to anyone with a wireless set, from a crystal upwards, and especially to home constructors. The Tool Kit is simply A 1, and I hope to make fuller use of it very shortly as I am contemplating the construction of a new set.—C. B. HILL (Ringwood).

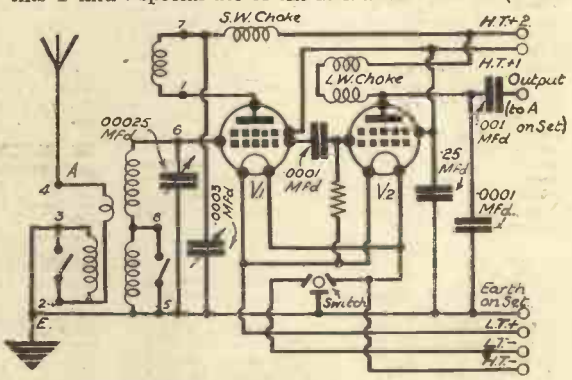
Two S.G. Short-wave Converter with Special Low-Loss Features

SIR,—The accompanying circuit diagram is of a short-wave superheterodyne converter which utilizes two screened-grid valves (metallized), one as oscillator, the other as detector. Combined with the R.I. antinodal short-wave coil, and used in conjunction with a five-valve (2-v-2) mains broadcast set, this gives efficient operation from 12 metres up to 80 metres *entirely on the loud-speaker*. On a 100-degree slow-motion dial fitted to the converter, oscillations come in continuously from 6 to 100 degrees on the lower of the two short-wave bands, and from 0 to 91 degrees on the upper.

I attribute this remarkable result to the following combination:—

1. Absence of "Miller Effect," due to use of two screen-grids.
2. Absence of dead spots and excessive damping due to use of antinodal coil.
3. Connection of S.W. H.F. choke to reaction coil (terminal 7 of antinodal coil), rather than as ordinarily connected, *i.e.*, to anode of valve.
4. Use of 5-megohm grid-leak, instead of the 2 megohms usually specified.
5. Lack of stray capacities owing to ease with which short connections can be arranged in this combination.

A long study of English and American short-wave periodicals has failed to disclose to me any circuit which has used this combination of two screen-grids, and I think I can claim originality for this, plus the special use of the R.I. antinodal coil (which



Circuit diagram of S.G. Short-wave Converter.

(*Continued on page 838*)

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.

UXBRIDGE RADIO CLUB

The third meeting of the Uxbridge Branch of the Anglo-American Radio and Television Society was held at 11, Hawthorn Drive, Willowbank, Uxbridge, on December 21st. An enjoyable time was spent by all present, and records of America were once again played over—by request. A number of short-wave stations were tuned in upon the club receiver. A discussion upon one- *versus* multi-valve receivers for short-wave work was the topic of the evening. A Ruislip member contended that the increase in unwanted noises which was caused by the adding of an amplifier to a single-valve receiver was such as to render the tuning in of faint stations an extremely difficult procedure. Mr. Leslie W. Orton agreed that such was the case in a great number of instances. However, if the receiver was well designed the extra amplification was worth having, because, in suppressing static and similar noises by placing a .0015 mfd. condenser across the secondary of the transformer, the extra amplification could be obtained without a large increase in unwanted noises. The club two-valve all-mains receiver was demonstrated and all agreed that it was extremely silent in operation.

There is no charge for attendance to meetings of the Uxbridge Branch, and everyone is welcome. The club is not a technical one although technically minded listeners will find much to interest them. Particulars may be obtained from Mr. Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge. Radio Normandy broadcast a special message regarding this branch between 5 and 6 p.m. on Christmas day.

SLADE RADIO

A talk on "Oscillators and their applications" was given by Mr. F. J. Singleton at a meeting held recently. After a few words on testing and servicing modern radio receivers he went on to give a full description of the all-mains oscillator and the various uses to which it can be put. The Philco 16B all-wave model was then described by Mr. G. T. Peck. This has 11 valves, covers 10-600 metres without a break, and is provided with shadow tuning, tone compensation at all volumes, and twin class C output giving 11 watts undistorted. The demonstration showed that the receiver was remarkably selective and very powerful. Those interested are invited to write to the Hon. Sec. for details of the Society. Address, 110, Hillarics Road, Gravelly Hill, Birmingham.

INTERNATIONAL DX'ERS ALLIANCE

The special broadcast list of the I.D.A. is given below for the benefit of readers who are members of this organization.

Jan. 14 4—6 a.m. PAOASD, Amsterdam 3,770 79.57 m.
Jan. 21 2—4 a.m. *CR7AA, Mozambique, Africa 3,543 84.67 m.
Jan. 21 4—6 a.m. PAOASD, Amsterdam 3,770 79.57 m.
Jan. 27 6.30—7.30 a.m. CP5, La Paz, Bolivia 6,060 49.5 m.
Jan. 28 4—6 a.m. PAOASD, Amsterdam 3,770 79.57 m.
Jan. 28 7.30—9 a.m. VE9CS, Vancouver, Canada 6,070 49.43 m.
Feb. 4 2—4 a.m. *CR7AA, Mozambique, Africa 3,543 84.67 m.

Reports to stations and to I.D.A. *CR7AA, Box 183, Laurenço Marques. Mozambique, Africa. WABC is the *KEY* station of the Columbia System. Confirmed personally by Director of Public Events, etc.

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.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

Records of American stations were again heard at the fourth meeting of the Uxbridge Branch, held at 11, Hawthorn Drive, Willowbank, Uxbridge, on December 28th. The records, made during last week, were of CKAC, CKGW, WSB, WSM, WEAF, WABC, WTIC, WCAU, WHAS, KYW, KMOX, WOC-WHO, LR4, LR3, WLW, WOR, WEEI, WNAC, WKAQ, etc. They were all loud and clear. A very interesting time was spent by all, and short waves were the topic of the evening. A number of S.W. stations were tuned in upon the club receiver. One member reports having heard the B.B.C .7-metre (approx.) transmitter and the Crystal Palace transmitter regularly. He used a three turn (one inch diameter) coil for grid and the same for reaction. The receiver was his ordinary short-wave set. He resides some eighteen miles from London. There is no charge for attendance to the Uxbridge Branch, or for joining the society. Everyone is welcome. Meetings are held each Wednesday. Full particulars from Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge.

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.

BROADCAST TALKS

THE full B.B.C. programme of talks for the period January to March inclusive is given in a booklet just published, entitled "B.B.C. Talks, 1934." The series that provides the most imposing list of speakers is at 8.30 p.m. on Tuesdays. It is designed as a summary of the group of talks which have been planned for the autumn and spring by the Central Council for Broadcast Adult Education, under the general title of "Taking Stock." Among the speakers in this series will be: Mr. H. G. Wells, Mr. Winston Churchill, Mr. David Lloyd George, Mr. Ernest Bevin, Mr. Israel Sieff, Mr. Bernard Shaw, Mr. Walter Elliot, and Mr. Quintin Hogg. In this same "Taking Stock" group comes the "National Character" series at 7.30 p.m. on Mondays. Hitherto the subject has been approached mostly from within. In the spring listeners are to hear some views from abroad—from such men as Professor Moritz Bonn, Professor Felix Frankfurter, and Dr. Karel Capek. Among the other well-known speakers who will also be heard during the season are Professor John Hilton, Sir Oliver Lodge, Professor C. G. Seligman, Mr. Vernon Bartlett, Mr. A. P. Herbert, Mr. James Agate, and Sir Walford Davies. The talks booklet may be obtained free on personal application to the B.B.C. Bookshop, Broadcasting House, Portland Place, London, W.1, or for one penny by post, from any B.B.C. offices.

LISSEN RECEIVERS

A VERY attractive range of receivers, including the famous "Skyscraper" series, is displayed in the latest folder issued by the Lissen people. Here are models to suit varying tastes and purses, and from which the most discriminating listener should have no difficulty in choosing a receiver to suit his requirements. There is model 8005, a two-valve battery set with a "pentode" performance, and its price is only £3 19s. 6d., complete with batteries and valves. At the other end of the range there is model 8060, a fine six-valve all-mains superhet. Equipped with A.V.C., band-pass tuning, and an electro-dynamic loud-speaker, this high-class instrument is priced at £14 14s. Other models include A.C. and D.C. models with moving-coil speakers, and battery-operated portable and table sets, all housed in handsome cabinets of modern design, and at prices ranging from £4 4s. to £12 12s. Full particulars of all the receivers are given in the folder, copies of which can be obtained on application to Lissen Limited, Lissenium Works, Worple Road, Isleworth, Middlesex.

REPLIES TO BROADCAST QUERIES

HARDY (Newbury): (1) 7th harmonic of *Poste Parisien*, Paris; (2) possibly 6,976 kilocycles, ON4TM, Experimental station, Radio Wallonia, Villiereil-le-lez-Brayeux near Binche, Belgium; (3) 56.475 m., 4th harmonic of *Radio Normandie*, Fécamp would tally with this transmission; (4) 11,760 kc/s, DJD, Königs Wusterhausen; (5) cannot trace; (6) GBB, Rugby on 13,585 kc/s and other frequencies, works with Canada and with liners; (7) G6RX, Experimental transmitter, Rugby (4,320 kc/s); (8) GSA, Daventry (6,050 kc/s), usually closes down at G.M.T. 01.10; you may have heard a broadcast from VE9HX, relaying CHNS, Halifax on 6,048 kc/s at that time; (9) possibly FIU2, Tananarive (Madagascar) on 5,692 kc/s; works between G.M.T. 15.00 and 16.30; (10) GBC, Rugby (4,975 kc/s); works with liners; (11) cannot trace call-signs; (12) French amateur experimental transmitter; the word "Tokio" was given to indicate the letter *T* in call sign. FITZGERALD (Greystones): Probably amateur experimental transmitter, but cannot identify unless you give call-letters. SMITH (E.5): We can trace G2JG as K.T. Jago, 189, Newport Road Leyton, E.10; G51V is not in published list. SCASE (Bristol): (1) CKY, Winnipeg; (2) CUD is apparently a Portuguese call, possibly Lisbon (3) EAX, Barcelona 31.8 m. (9,434 kc/s); (4) JNA, Nagoya 33.41 m. (8,980 kc/s); (5) JNB, Nagoya on 24.59 m. (12,200 kc/s); (6) LCP, Jeløy (Norway) 20.62 m. (14,550 kc/s); (7) PDQ, 27.28 m. (10,995 kc/s) and 27.30 m. (10,990 kc/s), PDS, 27.94 m (10,735 kc/s); PGA, 38.314 m. (7,830 kc/s), 38.29 m. (7,835 kc/s), 38.265 m. (7,840 kc/s); PGC, 32 m. (9,375 kc/s), 32.02 m. (9,370 kc/s). These are all transmitters at Kootwijk, Holland; (7) WIW, Sayville (N.Y.) 27.75 m. (10,810 kc/s); WKS, Sayville, 18.422 m. (16,285 kc/s); (8) WQS, Rocky Point (N.Y.) 21.56 m. (13,920 kc/s) and 21.631 m. (13,915 kc/s) BARX (W.9): We can trace the following call signs (1) G2CT, R. W. Peel, 24, Temple Grove, Golders Green, N.W.11; (2) G6VI, W. MacCallum, 21, Park Place, Stirling, Scotland; (3) G5RD, A. R. Gardner, "Ashleigh," Abbots Langley, Watford, Herts; (5) G5NW, E. J. Allan, 8, Westfield Place, Dundee, Angus, Scotland; (7) G5KH, H. D. Cohen, 144, West Hill, Putney, S.W.15; (8) G5SA, D. Price Jones, Western Electric Co., Ltd., Bush House, Aldwych, W.C.2; (9) G6VK, A. E. Brooks, 19, Alexandra Road, Uplands, Bedminster, Bristol, Glos.; (10) G2JU, E. J. Pearcey, "Colinwood," 126, Pinner View, Harrow, Middlesex; (11) CT1FZ, Jose C. Correia da Silva, Elvas, Portugal. NIGHTRAKE (Peterborough): W1BI, Willard H. Northrop, 71, East Brown Street, West Haven, Conn.; W1ACK, F. P. Webber, Jnr., 602, Humphrey Street, Swampscott, Mass.; W1AWC, Reuben R. Townroe, Church Street, Yalesville, Conn.; W2CIM, Richard Rauch, 130, Mortimer Avenue, Rutherford, New Jersey, U.S.A.; W2CIF, Henry J. Abrew, Balmville, Newburgh, New York, U.S.A.; W5AW, J. S. Tucker, 1011, S. Tyler Street, Amarillo, Texas; W8CL, K. Mengle, 723, Parkside Avenue, Buffalo, New York, U.S.A.; W9HOY, H. M. Flora, 10,815, Prairie Avenue, Chicago, Ill.; W2COJ, T. Laird, 1,006, Sanford Avenue, Irvington, New York, U.S.A.; W8CI, Wm. H. Marshall, Jnr., 2,712 North Avenue, Parma, Ohio; The last four call signs you give belong to Dutch amateur transmitters, but we regret we are unable to trace them in the latest lists. We advise you to write to: N.V.I.R., Post Box 400, Rotterdam, Holland, for further information.

THE CROYDON RADIO SOCIETY

The last meeting of 1933 was spent in discussing members' radio problems at St. Peter's Hall, South Croydon. Mr. Nightingale presided. Many topics required elucidation, ranging from the design of smoothing circuits for mains units to acoustics in large halls. At the end of the meeting the chairman remarked on the flourishing condition of the society, inasmuch as every member present had had something to add to the discussion. The New Year fixture cards are now ready, and the syllabus is a very full one up to April, when the session ends. One feature is the number of evenings devoted to different aspects of quality reproduction, and, of course, the President, Mr. H. R. Rivers-Moore, is giving another popular lecture. Dr. Hughes will also lecture on "Acoustics in Radio." PRACTICAL WIRELESS readers are urged to write for a fixture card, and so avail themselves of the many good things the society has arranged for the amateur's interest and advancement. Hon. Secretary, E. L. Cumbers, Maycourt, Campden Road, South Croydon.

PRACTICAL LETTERS

(*Continued from page 836*)

the makers originally did not advise as suitable for superhet converters), and the method of joining S.W. choke through reaction coil to anode of S.G. I have received Sydney direct (confirmed) on loud-speaker with witnesses present. I had Schenectady at R.9 for one full hour on the occasion of the relay of Chicago arrival of General Balbo. All the G.S. stations, all the Germans, Russians, and the Italian and Portuguese are alternative locals to me, with the volume control at 50 per cent., and the summer atmospherics of the broadcast band never one evening stop me from getting a good alternative programme—European or extra-European.

The cost of the necessary components works out at two guineas.—H. W. AUBURN (Hampstead).

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.

LOUD-SPEAKER POLARITY

"I have a rather old type of reed loud-speaker and I wish to bring this into use again. I have cleaned it up and reassembled it, but find that during the cleaning process the positive and negative markings have become removed. I should like to know, therefore, if there is any simple way of finding out which is positive and which is negative in order that I may connect this to my receiver in the correct way."—R. L. S. (Teignmouth).

There is no necessity to know which is positive or which is negative so long as you connect the windings to your receiver in the right sense. Of course, if a filter-output circuit is used it will not matter which way round the speaker is connected. However, if it is joined direct to the anode circuit you should connect it to the terminals and then carefully adjust the tensioning screw until the reed flies down on to the pole pieces. Now, slowly unscrew the adjustment until the reed comes away, and then reverse the connections to the receiver. If in the new position the reed flies to the magnet then that is the correct way round for the speaker and the terminals should be suitably marked. If, however, in this second position, you find that the tensioning screw requires to be given a few more turns before the reed is attracted to the pole pieces, then the first method of connection was correct.

REDUCING THE LOCAL

"I have a commercial receiver which employs two variable-mu H.F. stages and delivers nearly three watts output. I find that even when the volume control is turned to its very minimum position (just before it cuts right out) the local station is much too loud. Is there any way in which I can reduce the strength of this station? Generally, I find that it is good enough to undo the aerial lead, and then turn the valves full on, in which case the local comes through fair, but not quite loud enough. I do not, of course, want to interfere with the inside of the set."—W. S. C. (Glasgow).

The simplest method of reducing the sensitivity of your receiver when the aerial is connected is to join a resistance across aerial and earth terminals. The actual value will depend upon the tuning arrangements, and generally a value up to about 150 ohms proves most suitable. You can probably find room at the back of the cabinet, for instance, to fit a variable resistance having a maximum value of, say, 400 ohms, and you should join the arm of this resistance to earth, and the end of the winding to one side of an ordinary short-circuiting (on/off) switch. The other side of the switch should be joined to the aerial, and then when the switch is open, the receiver will be in the normal condition, but when closed the resistance will be included across your aerial-earth circuit and it may then be adjusted to give you the volume required. When the receiver is then required for foreign or distant stations, the switch should be opened. The control will require no further adjustment after the preliminary setting has been made.

DATA SHEET No. 69.

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

SERIES RESISTANCES TO CONVERT 100-OHM MILLIAMMETER INTO VOLTMETER.

Voltage Range Required	Resistance required for 1mA Range	5mA Range	10 mA Range
2 Volts	1,900	300	100
5 ,,	4,900	500	400
10 ,,	9,900	1,900	900
15 ,,	15,000	2,900	1,400
20 ,,	20,000	3,900	1,900
50 ,,	50,000	9,900	4,900
100 ,,	100,000	20,000	9,900
200 ,,	200,000	40,000	20,000
300 ,,	300,000	60,000	30,000
500 ,,	500,000	100,000	50,000

From the above table any intermediate values may be obtained.

WAVE-BAND IDENTIFICATION

"I have finished the Orbit receiver and am more than delighted. It works in a most satisfactory way, and I wish to include it in a large radio-gram cabinet, but have one small grouse. The knob on the coils is not clearly marked with the wave-band, and I should like to fit some indication on the dial-light so that I can see (and others in the home also) when the set is turned to the long or the medium waves. Can you suggest any simple arrangement which will not cost a lot to fit up?"—Y. S. (Birmingham).

A very simple arrangement can be fitted up if you are using the dial light. Obtain a separate bulb-holder similar to that fitted behind the dial and mount it close to the present holder. Join one contact on each holder together and to the L.T. negative bus-bar, and take a separate flexible lead from each of the other contacts. Solder or otherwise fix a piece of metal on the rod of the wave-change switch, with an insulated connection taken from the end of this piece of metal to L.T. positive. Two small pieces of brass should be arranged on either side of the switch rod so that they make contact with the piece of metal as the switch is placed in its medium and its long-wave position. By wiring one of these pieces to each holder, and using a red bulb in one holder and a green in the other, it will be possible to tell, by the colour of the dial light to which band the receiver is adjusted.

TESTING A FAULTY SET

"I have rigged up a circuit of my own design, taken from various points I have seen in your book. When tested out it was absolutely dumb. What is the easiest way to test through the circuit for the most likely fault. I have only got a voltmeter and no other testing instruments."—G. H. (Hatfield).

You do not state the type of circuit, but if you have a pair of headphones it should be a fairly simple matter to have these connected in the anode circuits of the detector and L.F. stages in turn. If any H.F. stages are fitted, they should be cut out, and the aerial taken direct to the tuned circuit feeding the detector stage. By joining the 'phones in this anode circuit you should hear something, and you can then include the H.F. stage (or stages, one at a time) until you fail to hear signals, when you will know that the fault has been localized in that part of the apparatus. If with all the H.F. stages signals are obtained, you will know that the fault arises in the L.F. side and can add these stage by stage. The actual fault should not be difficult to locate once its position in the circuit is found, but a milliammeter will be found extremely useful.

AUTOMATIC CALLING DEVICE

"I wonder if it is asking too much to give me details of a scheme which will switch my set on when the tuning note is sent out. I should like to make up a device like this purely for a novelty, and I wondered if you had any ideas or knew of any scheme which makes this possible."—F. H. (Wylam-on-Tyne).

Such a scheme is possible, but it is rather too complicated and expensive for you to build up. To operate on the tuning note only, you would have to fit a small receiver (continually switched on) with a low-frequency circuit adjusted so that the continued reception of a note having the frequency of the tuning note would cause a relay to come into operation and so switch on your receiver. If the constant-note circuit was not included, it might be possible for the set to be switched on by a powerful static or even a B.B.C. test transmission. It would be possible to fit a simpler device to operate when a carrier-wave was received, and a more or less simple tuned circuit, with a powerful relay designed to operate from the carrier would switch on the set. The idea is not worth the trouble of fitting in our opinion.

SHORT-WAVE RECEIVERS

"In view of the popularity of the short waves I should like to make up a set for the purpose of hearing what is doing down there. Do you advocate separate coils for small wave-bands, and to adopt the old plug-in idea, or is it possible to use switching without much loss? I am not so keen on long-distance work as to hear some sort of results for purely entertainment value."—K. W. (Exeter).

The plug-in arrangement has much to be said for it, especially if a large range of wavelengths is to be covered. On the other hand, switching will simplify operation, with slight losses, and as you do not want extreme long-distance work, this should prove no handicap. However, we think that for general short-wave experiment, the plug-in arrangement will prove most useful, as you can then find the band which offers you most signals (or most powerful transmissions) and can then leave that particular coil in circuit until you desire again to carry out experiments. Furthermore, the coils will be easier to make up and you will find the resultant circuit more straightforward.

FREE ADVICE BUREAU COUPON

This coupon is available until January 20th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 13/1/34.

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, 12 volts 20 milliamps, 20/-; Trickle Charger 8/- extra; 150 volts 30 milliamps with 4 volts 2–4 amps. centre tapped L.T., 25/-; Trickle Charger 6/6 extra; 250 volts 60 milliamps with 4 volts 3–5 amps. centre tapped L.T., 30/-; 300 volts 60 milliamps with 4 volts 3–5 amps. centre tapped L.T., 37/6; 150 volts 50 milliamps, 27/6. Other outputs to order at pro rata prices.

AMERICAN Triple Gang .0005 Condensers, with Trimmers, 4/11.

PREMIER Chokes, 40 milliamps, 25 henries, 4/-; 65 milliamps, 30 henries, 6/-; 150 milliamps, 30 henries, 10/-; 60 milliamps, 80 henries, 2,500 ohms, 5/6.

POLAR 3-gang, totally screened .0005 with complete disc drive, split end vanes, 5/-; ditto with Trimmers, 8/6; Polar 2-gang with complete disc drive, padding Condenser and Trimmer .0005, 6/6.

ORMOND Condensers, .0005 2-gang semi-shielded, 2/6; brass vanes with trimmers, 3/6.

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

COLLARO Electric Gramophone Motor, complete with all fittings, Turntable and Automatic Stop, 100-250 volts A.C., 35/-, listed £3.

GARRARD Radio-Gramophone Unit, listed 10 guineas, a few only at £6/10/0.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 milliamps, 0-1, 0-5 amps, all at 6/-.

SPECIAL Offer Microphones by prominent Manufacturers, high sensitivity, uniform response, complete with stand, Transformer and Battery, listed £3/15/0, our price, 8/6.

HOME Radio Microphone, complete, 5/-. Simply plug into pick-up terminals.

WESTERN Electric Condensers, 250 volts working 1 microfarad, 6d; 2 microfarad, 1/-.

T.C.C. Condensers, 250 volts working 1 microfarad, 1/3; 3 microfarad, 1/9; 4 microfarad, 450 volts working, 4/-; 750 volts working, 2 microfarad, 3/-; 4 microfarad, 6/-.

T.C.C. Electrolytic Condensers, 440 volts working 4 microfarad or 8 microfarad, 3/-; 15 microfarad, 100 volts working, 1/3; 6 microfarads or 15 microfarads, 50 volts working and 50 microfarads, 12 volts working, 1/-.

T.C.C. Block Condensers, 250 volts working, 4 x 4 x 1 x 1 x .5, 3/6; 2 x 2 x 2 x .1, 2/-; 2 x 2 x 2 x 1, 2/3; 2 x 2 x 1 x 1 x 1 x 1 x 1.1 x .1, 3/-. The above three Condensers are same price in Dubilier, 300 volts working.

H.M.V. Block Condensers, 400 volts working, 4 x 4 x 1 x 1 x .5, 5/6; 4 x 2 x 1 x 1 x 1 x .5, 4/6.

DUBILIER Condensers, 4 x 4 x 2, 300 volts working 3/-; 8 microfarad dry electrolytic, 450 volts working, 3/-.

SPECIAL Offer of Mains Transformers, manufactured by Phillips, input 100-120 volts, or 200-250 volts; output 180-0-180 volts, 40 milliamps, 4 volts 1 amp, 4 volts 3 amps, 4/6; 200-0-200 volts, 4 volts 1 amp, 4 volts 3 amps, 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, 250 volts 60 milliamps rectified, with 4 volts 3-5 amps. centre tapped L.T., screen primary, 15/-; with Westinghouse Rectifier, 25/-.

4 VOLTS, 3 amps centre tapped, 6 volts, 2 amps, centre tapped, 9 volts, 1 amp., 12 volts, 1 amp, 7/6; 4 volts, 3-5 amps, 22 volts, 1 amp, 8/6; 10 volts, 3 amps, 14 volts, 4 amps, 10/-.

PREMIER H.T.9. Transformer, 300 volts, 100 milliamps Rectifier, with 4 volts, 3-5 amps centre tapped L.T., and screened primary, 15/-; with Westinghouse Rectifier, 26/-.

PREMIER H.T.10 Transformer, 200 volts, 100 milliamps Rectifier, with 4 volts, 3-5 amps centre tapped L.T., and screened primary, 15/-; with Westinghouse Rectifier, 26/-.

PREMIER Mains Transformers, output 135 volts, 80 milliamps for voltage doubling, 8/6; 4 volts, 3-4 amps, centre tapped L.T., 2/- extra; Westinghouse Rectifier for above, giving 200 volts, 30 milliamps, 8/6.

PREMIER Mains Transformers, output 250-0-250 volts, 60 milliamps, 4 volts, 3-5 amps, 4 volts, 2-3 amps, 4 volts, 1-2 amps (all centre tapped), with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350 volts, 90 milliamps, 4 volts, 3-5 amps, 4 volts, 2-3 amps, 4 volts, 1-2 amps (all centre tapped), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400 volts, 100 milliamps, 4 volts, 4-5 amps, 4 volts, 2-3 amps, with screened primary, 15/-.

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

SPECIAL Offer Manufacturers Type Transformers, 350-0-350 100 milliamps, 4 volts, 1 amp, 4 volts, 2 amps, 4 volts 3-5 amps, 10/-; input 200-250 A.C., 350-0-350 120 milliamps, 4 volts, 2-3 amps, 4 volts, 2-4 amps, 100-120 volts input, only 5/-. H.T.8. Transformer with 4 volts, 3-5 amps, centre tapped L.T., 8/6; with Rectifier, 18/6.

WESTERN Electric Mains Transformers, 300-0-300 volts, 65 milliamps, 4 volts, 1-2 amps, 4 volts, 2-3 amps, 8/6; 500-0-500 volts, 150 milliamps, 4 volts, 3-5 amps, 4 volts, 2-3 amps, 4 volts, 2-3 amps, 4 volts, 1 amp, centre tapped, 4 volts, 1 amp, centre tapped, 19/6.

BRITISH Radiophone wire wound potentiometers, with Mains Switch incorporated, 10,000, 50,000, 25,000 ohms, any value, 3/6.

CENTRALAB Potentiometers, 50,000, 250,000, half meg. and 1 meg., any value, 2/-; 200 and 400 ohms, wire wound, 1/-.

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 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6; 50 watts, any value up to 50,000 ohms, 3/6.

1000 ohms 150 milliamps wire wound variable Resistances, 2/-. Burndept 2 watts Resistances, all values from .5 to 50 ohms, 3d. each. Holders, 2d. each.

WIRE wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms, 2/-; 500,000 ohms, 3/-.

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Practical Wireless, January 20th, 1934.

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Practical Wireless

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AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

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These 2 FREE GIFTS *Inside!*

PRESENTED WITH "PRACTICAL WIRELESS" Dated Jan. 20th 1934.

MAKING YOUR SET SELECTIVE

PRACTICAL WIRELESS 1934 WAVELENGTH GUIDE & STATION LOG

FIRST DETAILS *of the* FURY SUPER

The Screened Pentode—and Your Aerial

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FIRST DETAILS OF THE 1934 FURY SUPER ARE ON PAGE 850

Practical Wireless

EDITOR:
Vol. III. No. 70 || F. J. CAMM || Jan. 20th, 1934.
Technical Staff:
W. J. Delaney,
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.,
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ROUND *the* WORLD *of* WIRELESS

Qualify To-day for Our Great New Presentation Volume!

EVERY reader of PRACTICAL WIRELESS should take a pen and qualify *at once* for the Editor's latest volume "NEWNES' EVERYMAN'S WIRELESS BOOK." This is our third Presentation volume, the two preceding volumes being "THE WIRELESS CONSTRUCTOR'S ENCYCLOPÆDIA" and "THE ENCYCLOPÆDIA OF POPULAR MECHANICS." The demand for both of those books (similar in style and size) was, as everyone now knows, truly colossal, and no other technical volumes have such a phenomenally large public. Mr. F. J. Camm's latest, "NEWNES' EVERYMAN'S WIRELESS BOOK," uniform in size and binding, will make the third of the PRACTICAL WIRELESS volumes, which place valuable technical information before the reader in delightfully easy language and which, easily understood by the amateur, does not offend even the most expert. Mr. Camm is an indefatigable worker, and is one of the busiest journalists in Fleet Street. The amount of work he manages to get through is really enormous; but notwithstanding this he has managed during the past months to write *this entirely new work!* It might be described as "The Wireless Doctor," for it deals in an amazingly complete manner with faults, noises, operation, adjustment, etc., etc., of battery and mains receivers. It has hundreds of easily-understood illustrations and is a worthy successor to our two previous volumes—an ideal volume for the listener as well as the constructor. Note that only nine coupons are required! Turn to pages 859 to 861 and order yours NOW!

The Fury Super—This Year's Outstanding Receiver!

ELSEWHERE in this issue appears the preliminary announcement of The Fury Super—an up-to-the-second successor to the famous Fury Four, which was last year's most successful receiver for the constructor. If you built the original Fury Four you will be able to modify this one for a modest sum—and if you did not, you should certainly build the Fury Super. It is *not* a superhet, but it *is* super selective, super powerful, and of super quality, and it is GUARANTEED! Now turn to page 850 and read the preliminary details.

An Injustice to Radio Toulouse

IN French wireless circles it is considered that a grave injustice has been done to Radio Toulouse in allocating to the new transmitter a channel (335.2 metres) which has to be shared with Helsinki (Finland), as this assignment prevents the French station from using its full power if interference is to be avoided. In the same way it is hardly expected that Radio Normandie will be satisfied to broadcast on 200 metres—an international common wave—which would compel the power to be reduced to a few hundred watts. Moreover, it is openly averred that few listeners to this programme possess receivers which can tune into so low a channel.

Penalising the French Private Broadcasters

ALTHOUGH definite channels were allocated by the Lucerne Plan to French P.T.T. stations, with the exception of Poste Parisien (Paris) and Radio Toulouse, the privately-owned transmitters were left entirely to the mercies of French State officials. The result has been that most of them have been put on common or international wavelengths. Nice, Juan-les-Pins and Radio Vitus (Paris) are ordered to work on 222.6 metres (1,348 kilocycles); Radio Lyons on 215.4 metres (1,393 kilocycles); Radio LL (Paris and Beziers) on 209.9 metres (1,429 kilocycles); Bordeaux Sud-Ouest and Nimes on 201.1 metres (1,492 kilocycles), and Agen, Radio Normandie (Fécamp) on 200 metres (1,500 kilocycles). Poste Parisien (Paris) on 312.8 metres would appear to have been particularly favoured, and numerous supporters of Radio Toulouse cannot see why this exception should have been made.

Russia's Plans for 1934

WITH a view to the development of broadcasting in Russia the Soviet authorities have decided to expend during 1934 some forty million roubles (roughly £2,000,000). According to a recent census there are now over two million wireless receivers in the country, but State assistance is to be granted towards an increased output; during the year it is hoped that one million sets will be distributed, as it is deemed judicious to keep small country districts in close touch with activities in the capital. A scheme has been drawn up whereby some five hundred thousand receivers will be placed in villages and small centres situated at some distance from provincial broadcasting stations. The sets will remain in the possession of the local authorities.

Possible Dutch State Broadcasting Monopoly

AS the three broadcasting stations in Holland, namely Kootwijk, Huizen and Hilversum, belong respectively to the State and to two private concerns, a proposal has been put forward to amalgamate the various interests of the programme organisers and work the service through a neutral association, if possible, entirely State controlled.

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

Tunis-Kasbah

ALTHOUGH the name of the Tunis broadcasting station still appears in some lists, it has been closed down for some considerable time. A new transmitter to feed the Tunis area is to be built by the French authorities during 1934, and, according to the Lucerne Wave Plan, will work on 514.6 metres (583 kilocycles). The question of power has not yet been definitely decided, but it will be in the neighbourhood of 20 kilowatts.

New Portuguese Transmitter

ACCORDING to a report from a French listener, tests have been heard from a station in Portugal on about 350 metres. Announcements are given out in four languages to the effect that the broadcast is that of a new 5-kilowatt station erected by the Portuguese Radio Club in the neighbourhood of the capital. Has any reader picked up these signals?

Italy's Duplicate Programmes

THE policy of providing alternative programmes for Italian listeners is now well on the way to fulfilment. Both Milan 2 and Turin 2 have been brought into operation for the broadcast of the Rome-Naples wireless entertainments to the two northern cities. A further station is now being erected in the capital to re-transmit the programmes of the northern group of studios. It will be known as Rome 3; Rome 2 is the Santa Palomba short-wave station, working on 25 metres. In each case the power of the broadcast will not exceed 200 to 250 watts in order not to cause interference with the reception of foreign programmes.

Better Signals from Vienna

LISTENERS will doubtless have noticed an improvement in the recent broadcasts from the new Vienna-Bisamberg station. It is due to the fact that the reflector mast now directs the transmissions towards the west, and measurements show that radiation in this manner has increased by twenty per cent. Moreover, cold and more settled weather having set in, atmospheric conditions have proved more favourable to wireless transmissions.

Norway's New Transmitters

THE new high-power station at Trondheim is fast nearing completion, and it is expected that it will start up in the early spring. The wavelength is 476.9 metres (629 kilocycles). Notwithstanding contradictory reports the power of the transmitter now under construction at Bergen will not exceed 20 kilowatts. Its position in the broadcast band will be roughly that of the old London Regional wavelength, namely, 352.9 metres (850 kilocycles).

Disturbances in the Ether

NOT only do wireless engineers to-day have to contend with the effects of a congested wave-band, but are also called upon to cope with the interference caused by harmonics of transmissions made by distant stations operating on higher channels. Recently curious noises in the background of the Heilsberg (Germany) programmes were traced to Minsk (U.S.S.R.) of which the harmonic (276.2 metres) caused a powerful heterodyne.

INTERESTING and TOPICAL PARAGRAPHS

BROADCAST FROM A COAL MINE

Mr. Idris Richards (on right), during his recent broadcast half a mile down the Bedwas Pit, Monmouthshire.

Sweden to the Fore

THE Swedish Government has voted a sum equal to about £73,000 towards defraying the expense of an overhaul and reconstruction of the Motala transmitter. The power of the station, when the work has been concluded, will be approximately 150 kilowatts.

The New and the Old

AS the recently completed 5-kilowatt station at Freiburg im Breisgau operating on 259.3 metres, in common with Frankfurt-am-Main, has caused some slight inconvenience to local listeners, the same programme is simultaneously broadcast through the older and weaker station on 569 metres. The authorities have decided to maintain this service until January 15, when the new channel is taken over. In the meantime, Freiburg is blessed with two transmitters putting out the same entertainment.

Jugoslavia Forges Ahead

SO far, in the British Isles, broadcasts from Ljubljana are the only Jugoslavian transmissions which have been fairly well heard. In 1934, however, we shall be given better opportunities of tuning in programmes from Belgrade as the present station is to make room for a 50-kilowatt transmitter. As a development of the wireless network relays are to be erected at Skoplje, Subotica, and Sarajevo. Zagreb also will be endowed with a more powerful station, and will then pass on the existing broadcasting plant to Split (Spalato).

SOLVE THIS!

PROBLEM No. 70.

Atkinson built up a Class B Amplifier for addition to his receiver, and before connecting it he checked the voltages at all the terminals. These were quite in order, so he plugged in a Class B valve and joined it to his existing receiver. The only result was a peculiar gurgling sound from the loudspeaker, no distinguishable signals being received. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and post to reach here not later than January 22nd. Envelopes must be marked Problem No. 70.

Solution to Problem No. 69.

The potentiometer that Jackson purchased was of the "graded" type, and when joining this to his receiver he had connected round the wrong way. By reversing the connections to the two outside terminals he would have found that control of volume would have been rendered perfectly smooth.

The following three readers successfully solved Problem No. 68 and books have accordingly been forwarded to them: J. Kitchener, 48, De Burght Street, Riverside, Cardiff; C. N. Green, 12, Somerton Road, Cricklewood, N.W.2; D. F. Eadie, 25, Mannering Road, Shawlands, Glasgow.

How Poland Fights Radio Pirates

STRINGENT measures are being taken against unlicensed listeners; where conviction is obtained, they may be heavily fined or condemned to three months' imprisonment. In addition, all wireless apparatus is confiscated and the Post Office authorities are also given the power to claim, as an extra punishment, a sum equal to half the amount of the annual listening tax! Apparently it works out cheaper to take out a licence.

To Bey or Not to Bey

THE municipal authorities of Alexandria (Egypt) having noticed that some of the small local broadcasting stations announced at the microphone the names of *all* their artists with the title *Bey*, the owners were informed that if further complaints were made all transmitting licences would be cancelled. Listeners in Egypt are anxiously awaiting the opening of the Abu Zabal high-power station, when all privately-owned transmitters will be closed down.

The Importance of Weather Forecasts

THE success achieved by the meteorological bulletins broadcast by the Air Ministry from Heston Airport for the benefit of aviators, has induced the authorities to consider the installation of a powerful transmitter on a more favourable site. It is thought that weather forecasts broadcast every hour throughout the day would be of interest to all wireless licence holders. Such a service would usefully supplement the weather reports now given out by the B.B.C. before the new bulletins.

(Continued on page 848)

A.V.C. AND THE GRAMOPHONE PICK-UP

Some Simple Methods of Connecting a Pick-up to the New Multi-valves. By PERCY RAY.

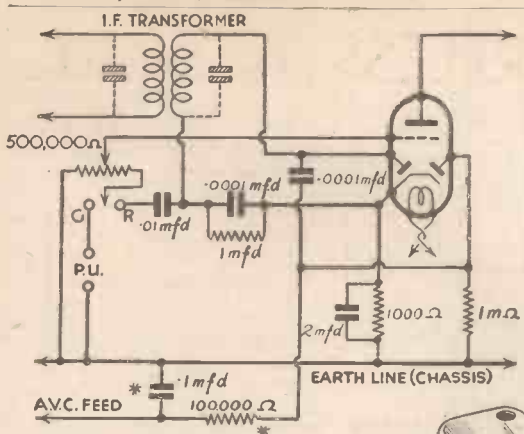
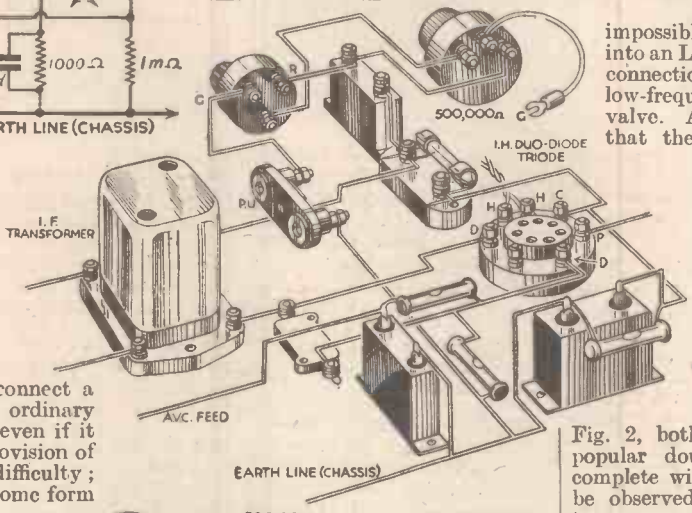
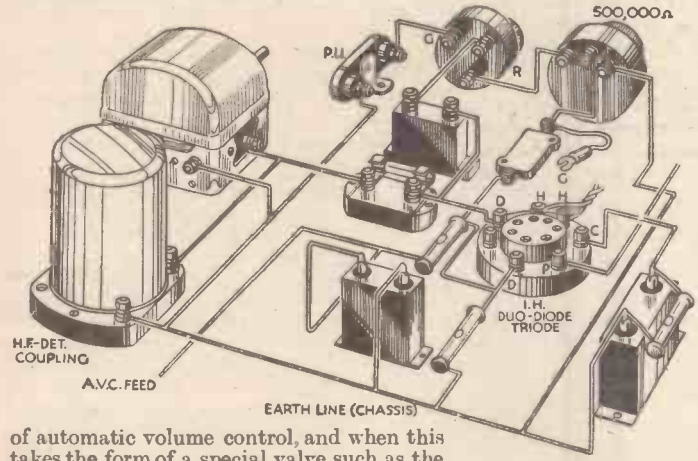


Fig. 1.—The double-diode-triode, arranged for A.V.C. with delay, with provision for gramophone pick-up. The circuit shown is that usually used for this valve in a superhet. Components marked are liable to considerable modifications.*

IT is quite a simple matter to connect a gramophone pick-up to an ordinary straight detector circuit, and even if it is an all-mains arrangement the provision of automatic grid bias presents little difficulty; many modern sets, however, use some form of automatic volume control, and when this takes the form of a special valve such as the double-diode-triode the addition of a gramophone pick-up becomes more difficult and the most experienced constructor may be excused if he finds himself hopelessly bewildered by the circuit tangle of a double-diode pentode.



All these special A.V.C. valves have one thing in common—they make use of a small diode for detection and reserve the main portion of the valve for low-frequency amplification. Quite obviously the diode cannot be fed by the pick-up as it is quite impossible to make this form of valve into an L.F amplifier, so the gramophone connection must be made direct to the low-frequency portion of the A.V.C. valve. A moment's reflection will show that there is no alternative to this arrangement, as it would not be satisfactory to tap into the grid circuit of the output valve owing to the amplification of the single stage being insufficient to raise the relatively small output from the gramophone pick-up to volume sufficient to operate a loud-speaker.



A Simple Scheme

The diagrams, Fig. 1 and Fig. 2, both show circuits for using the popular double-diode-triode and each is complete with pick-up connection; it will be observed that in these illustrations a two-way switch is used to accomplish the change-over from gramophone to radio as this is preferable to incorporating a plug and jack.

The circuits shown employ identical pick-up connections

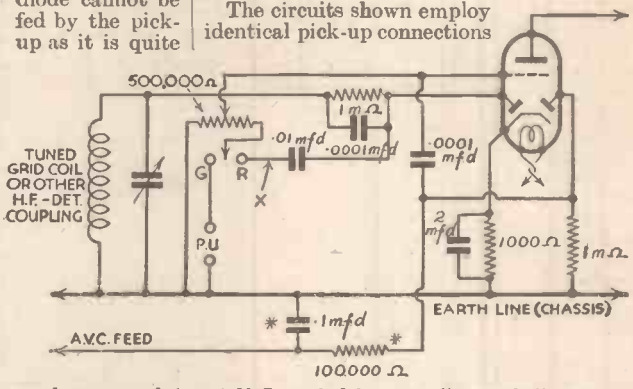
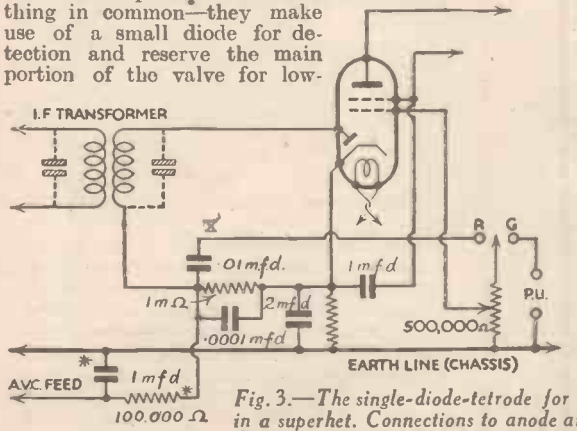


*Fig. 2.—The double-diode-triode, arranged for A.V.C. with delay in a "straight" receiver, and fitted for reproducing gramophone records. A filter may be required at "x" in sets inclined to instability. Components marked * are liable to modification.*



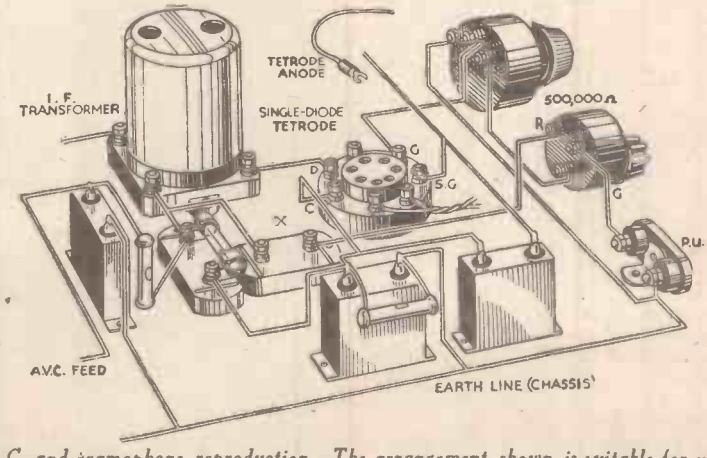
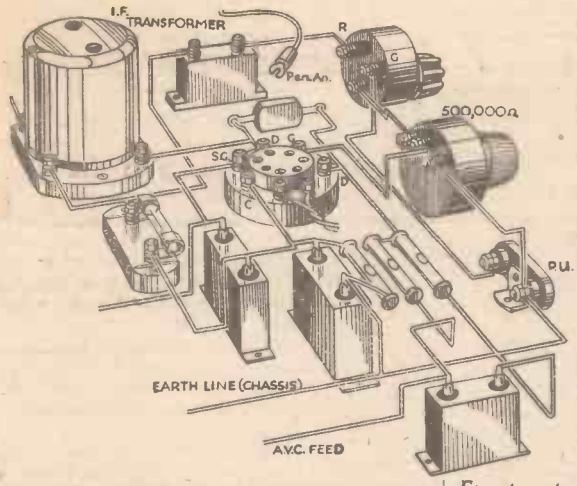


Fig. 3.—The single-diode-tetrode for A.V.C. and gramophone reproduction. The arrangement shown is suitable for use in a superhet. Connections to anode and screen are normal. An H.F. filter may be necessary at "x" in certain circuits. Components marked are liable to modification. Value of bias resistor varies widely with different makes of valve. That recommended by valve maker should be used.*



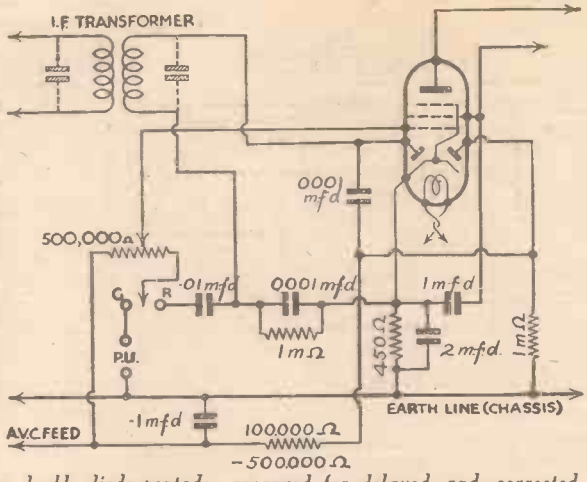


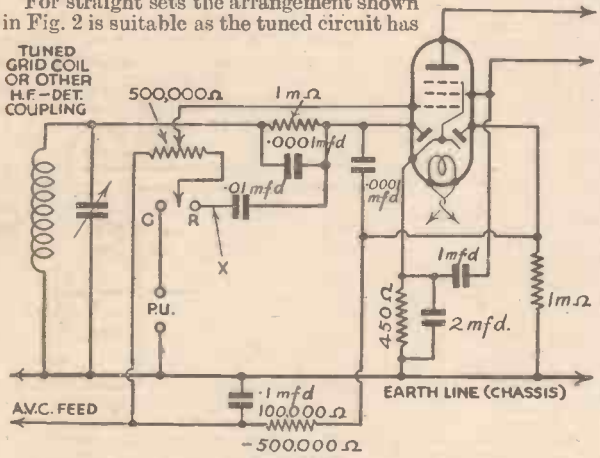
Fig. 4.—A pick-up added to the double-diode-pentode, arranged for delayed and corrected A.V.C. in a superhet. Connections to anode and extra grid are normal and not changed by the addition of the pick-up.

but differ slightly on the radio side. Both are arranged for delayed A.V.C., but the former is most suitable for use in a super-heterodyne receiver, where the detector is not preceded by a tuned circuit.

A glance at Fig. 1 will show that it would be most inconvenient for use in a straight set using the normal ganged condensers where the rotating plates are all in metallic connection with each other as neither side of the condenser is connected to earth.

For straight sets the arrangement shown in Fig. 2 is suitable as the tuned circuit has been moved to bring one side of the tuning condenser direct to earth; these two variations are explained in detail to prevent the possibility of confusion being introduced by the slight rearrangement necessary to include the pick-up, and will enable the reader to identify the circuit that should be chosen when introducing a pick-up to a set already using a double-diode-triode for automatic volume control.

In the circuits already described and also in those dealt with below, the volume control is so arranged that it functions on both radio and gramophone, a combination that is valuable and seldom described although its advantages are obvious.



The Double-diode-tetrode

The correct way of introducing a pick-up into a diode-tetrode circuit is shown at Fig. 3. As in the other circuits, the change-over is accomplished by a simple single-pole double-throw switch. The diagram is complete and, therefore, no further comments are necessary except to draw attention to the ease with which the low-frequency portion of a diode-tetrode is overloaded. Consequently, care should be taken to select a volume control with really satisfactory grading.

The Pentode

Fig. 4 shows the double-diode-pentode arranged for use in a superheterodyne to give delayed and corrected A.V.C. or reproduction of gramophone records. The circuit is, necessarily, complicated but the actual addition of the pick-up section is very simple.

Fig. 5 also shows the addition of a pick-up to a double-diode-pentode circuit which is arranged for use in a straight receiver. When using a pick-up with this type of valve it is often necessary to shield the leads as they are apt to cause mains hum in the speaker unless they are kept very short. This is due to the relatively high sensitivity of the pentode portion.

In all these circuits care has been taken to so arrange them that they are entirely free from the radio section and to ensure that one side is, in each case, sensibly at earth potential. Consequently, it is often unnecessary to shield the leads to secure stability.

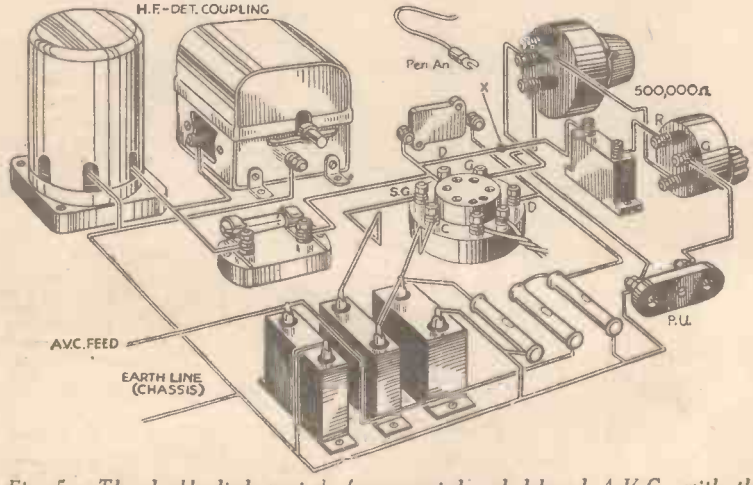


Fig. 5.—The double-diode-pentode for corrected and delayed A.V.C. with the addition of gramophone switch and terminals. Connections to anode and extra grid are normal. An H.F. filter may be desirable at "x" in some cases.

"RADIO MAGAZINE":

Newnes' New 6d. Monthly.

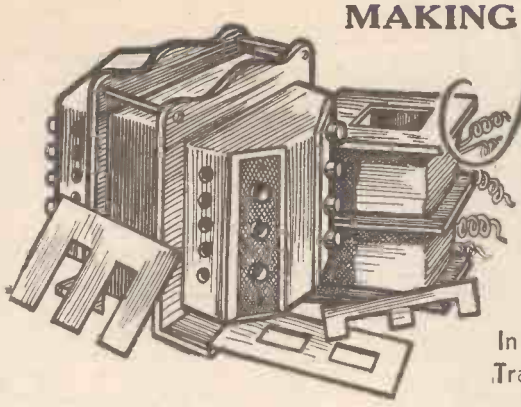
EVERY reader of PRACTICAL WIRELESS will want *Radio Magazine*, the new de-luxe all-photogravure pictorial. Just as PRACTICAL WIRELESS is a wealth of information on the technical side, *Radio Magazine* is a storehouse of interest on the entertainment side.

Each month, *Radio Magazine* will interpret the programmes and reveal the personalities behind the programmes. In the first number, for instance, Eric Maschwitz, the B.B.C. Director of Variety, outlines his plans for light entertainment; Val Gielgud, director of productions, gives an outline of the plays he has in hand; Henry Hall reviews dance band activities; Walton O'Donnell explains the operations of the military band.

Radio Magazine is the first all-gravure pictorial magazine published in the British Empire to deal with the "human interest" in broadcasting. Photographs of more than 200 radio favourites dominate its eighty pages, and on its cover is a delightful picture of "The Carlyle Cousins."

There are eight full-page art portraits of microphone favourites; articles on foreign reception, set manufacture, the Lucerne Plan, interviews with Flotsam and Jetsam and the rest of the microphone teams on "how they met"; and for women there is a unique Fashion Feature, exclusively written for *Radio Magazine* by Doris Arnold, the B.B.C. staff pianist.

Radio Magazine has been waited for by listeners for years. Edited by Garry Allighan, it is one of the finest magazines on the bookstalls.



MAKING Mains Transformers

In This Useful Article the Author Describes the Construction of Some Mains Transformers of Different Types, at Least One of Which Will Be Suitable for Practically Any Requirement. By FRANK PRESTON.

IN previous articles in PRACTICAL WIRELESS I have described in general terms the construction of mains transformers, explaining the underlying principles and giving sufficient data to enable the average experimenter to work out the details for himself. It would appear, judging by the large number of inquiries received on this subject, that there are many readers who would prefer to have more complete particulars in regard to specific components, rather than to calculate these by the methods previously described. For that reason it is proposed to deal more precisely with five different transformers of the types which are in greatest demand.

A "Universal" Transformer for Use With Metal Rectifiers

Since the correct input voltage for various types of metal rectifiers varies rather considerably, it is a distinct advantage to have a transformer with a tapped secondary which can be employed in conjunction with practically any type of rectifier. The lowest voltage required is 80 (for the style H.T.5 rectifier used in a voltage-doubler circuit), and the same style of rectifier requires 135 volts when connected in a half-wave circuit. The style H.T.8 takes 200 volts when used in a voltage-doubler circuit, whilst the H.T.7 needs an input of 250 volts for half-wave use. It will thus be seen that if a transformer is made to provide all the secondary voltages mentioned it can be employed with any of the most commonly-used models of metal rectifiers. Besides providing those voltages, however, the secondary winding must also be capable of providing the highest current which will be called for by any of the rectifiers mentioned. This is 200 milliamps, so that the exact output requirements are known. A core consisting of six dozen pairs of No. 4 stalloy stampings will be wanted, and a winding spool must be bought or made to fit these. For preference the spool should be divided into two sections, as shown at Fig. 1; it can be made exactly as described in the issue of PRACTICAL WIRELESS dated Dec. 23rd, 1933, where the subject of choke construction was fully dealt with. On the other hand, a suitable spool can be bought ready-made from a number of firms who specialize in the supply of transformer components.

For a maximum A.C. supply voltage of 250 the primary winding should consist of 2,000 turns of 30-gauge enamelled wire,

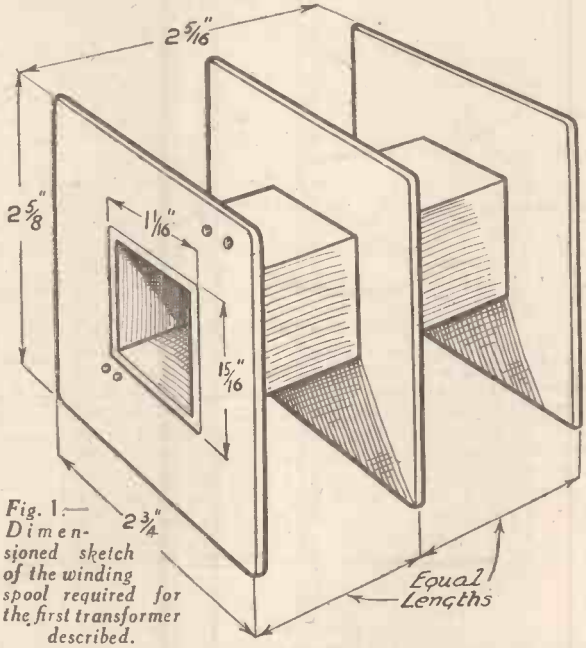


Fig. 1.—Dimensioned sketch of the winding spool required for the first transformer described.

and tappings should be taken after winding 1,600, 1,760, and 1,920 turns to accommodate supply voltages of 200, 220, and 240, respectively. Actually, these tappings will cover any mains voltage between 200 and 250, since the exact number of turns need not necessarily be employed. As an example of this, it might be said that where the mains supply is at 230 volts, either the 220-volt or 240-volt tapping might be used, the same rule applying where the mains are at 210 volts; either of the two lowest tappings could be used in that case. It might also be mentioned at this point that a slightly higher output voltage can always be obtained by connecting the mains to a tapping intended for a lower supply voltage. For instance, if the transformer gives 250 volts when the 230-volt supply mains are connected to the 240-volt tapping, the output would probably rise to about 260 volts if the 220-volt primary tapping were used instead.

The primary winding will be placed in one section of the spool and care should be taken to arrange the windings as nearly as possible in layers. After about every 500 turns it is advisable to cover the winding with a layer of oiled silk or waxed paper to prevent the possibility of breakdown. The sectional drawing at Fig. 2 will clearly illustrate this point. There will be no need to give all constructional details, since these can be obtained by making reference to the article mentioned above and also to that given on page 535 of PRACTICAL WIRELESS dated Dec. 3rd, 1932.

The secondary will have the same number of turns as the primary, the same kind of wire being used, but tappings will be taken after winding 640, 1,080 and 1,600 turns. Layers of insulation should also be arranged in the same manner as previously described. After the windings are complete they can be covered with empire tape or other insulating material. Before doing this, however, it will be well to mark the various tappings to avoid confusion later.

There is no need to mention the method of fitting the core, making clamps, etc., here, since all these items were fully dealt with in the previous articles which have already been referred to.

A Transformer for L.T.

Very often it is required to convert a battery set for all-mains working, using an H.T. eliminator which is already on hand. The other important component required is a transformer to supply the heater current for the A.C. valves. This can be made very easily by using a core consisting of six dozen No. 4A stalloy stampings, and fitting on this a winding spool having the

(*Continued overleaf*)

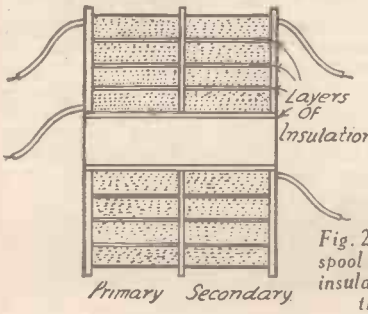


Fig. 2.—Section through the wound spool showing the arrangement of insulating layers used to "break" the windings into sections.

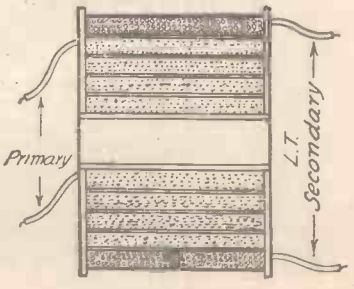


Fig. 3.—This sectionalized sketch shows the arrangement of windings in the L.T. transformer described.

MAKING MAINS TRANSFORMERS

(*Continued from previous page*)

principal dimensions given in Fig. 1, but being only 1½in. long. In this case the spool is not divided into two sections, but, instead, the secondary winding will be put on top of the primary as shown in the sectional drawing at Fig. 3. The primary is exactly the same in regard to the number of turns, gauge of wire, and tappings as for the previous component. After completing the primary, this winding should be covered with two or three layers of insulation, when the secondary can be wound over it. The latter winding, to give 4 volts at 6 amps. (maximum) will consist of thirty-two turns of 16-gauge d.c.c. wire, a tapping being taken after winding sixteen turns. The output from this transformer will be sufficient to heat the cathodes of up to six indirectly-heated A.C. valves, but at the same time it will be quite safe to use the component with only two or three valves, since the "regulation" will be quite good, due to the comparatively substantial nature of the core.

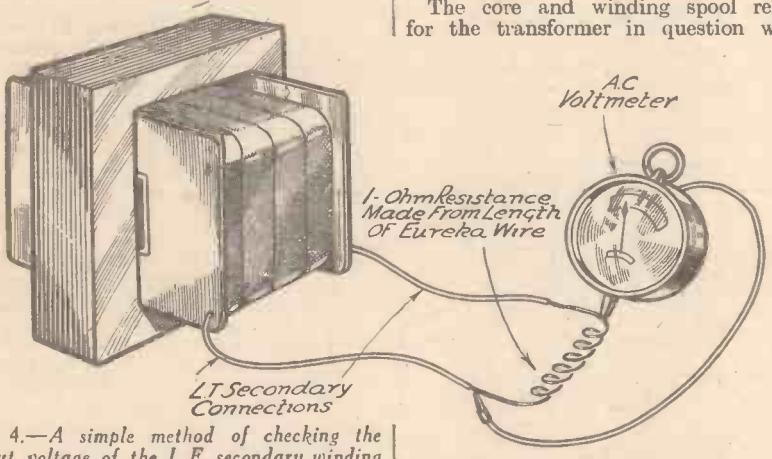


Fig. 4.—A simple method of checking the output voltage of the L.F. secondary winding conditions of "full load."

It is rather important that the heater voltage should be almost precisely 4 volts under working conditions, and for that reason it is preferable to check the transformer output before finally putting the component into use. This can be done as shown in Fig. 4, by connecting a 1-ohm resistance in parallel with the secondary winding and measuring the voltage across its ends by means of an A.C. voltmeter (a simple moving-iron instrument will serve for this purpose). Should it be found that the voltage is more than about five per cent. "out" it should be adjusted by modifying the winding, adding or removing a portion of a turn.

A Transformer for Valve Rectification

Many experimenters prefer to employ valve rectification, and a slightly different type of transformer is required for that purpose. In addition to the high-tension secondary winding, a low-tension winding is necessary to heat the cathode or filament of the rectifying valve. Should the transformer be intended for use with a full-wave valve, it will require to give 250 volts on each side of a centre-tapping, whilst if a half-wave rectifier is to be used only a single 250-volt winding will be called for. In order to cater for both these needs the transformer to be described will have a double 250-volt secondary of which either one or both halves can be used as desired. The low-tension supply needed will be either 1 or 1.2 amp. for a half-wave valve, or 2 or 2.4 amp. for a full-wave valve. (The larger and smaller currents in each case are given to apply to the indirectly and directly-heated types of valves.) If the winding is designed to give a maximum of 2.4 amps. at 4 volts, it will be suitable for practically any type of valve rectifier.

The core and winding spool required for the transformer in question will be precisely the same as for that first dealt with. The primary winding also will be just the same, and should be placed in one section of the spool. The H.T. secondary winding will consist of a total of 4,000 turns 38-gauge enamelled wire, and should be tapped at the 2,000th turn. An L.T. winding, consisting of thirty-two turns of 20-gauge d.c.c. wire will then be wound on top of the H.T. secondary, after taking care to insert an ample layer of insulation between the two.

High and Low Tension from the Same Transformer

In nearly every case where a transformer is being made for use in an entirely new mains receiver, it is most convenient to design this to supply both high-tension and low-tension for all the valves. Such a component is very similar to those already dealt with and is, in fact, a combination of the first two, or the second two, described. To make the transformer a set of six dozen pairs of No. 4 stalloy core stampings will be required as before, but the winding spool should now be divided into three sections, of which the centre one is only about 3/16in. wide. The primary winding—which should be exactly as before—should be wound in one of the end slots, and the H.T. secondary in the other end one, with the heater L.T. winding in the narrow central slot. This arrangement is particularly good, due to the fact that the L.T. winding acts as an efficient screen between the primary and H.T. secondary and prevents the passage of H.F. currents, which might be present in the mains supply, from being passed on and into the anode circuits of the valves. Thus, mains hum is reduced to a minimum. The actual form taken by the high-tension secondary winding depends chiefly upon the type of rectifier to be employed. If a metal rectifier is preferred, the secondary can be identical with that specified for the first transformer described at the beginning of this article; on the other hand, if a valve rectifier is to be employed, two secondaries, exactly like those used for the third transformer, and disposed in the same manner, will be required. The low-tension secondary should consist of thirty-two turns of 16-gauge d.c.c. wire, with a centre-tapping, placed in the narrow central section of the winding spool.

A Transformer for a Trickle Charger

If a receiver of the battery-operated type is used, and it is desired to convert this for all-mains A.C. working, the simplest method is to employ an eliminator for H.T. current supply, and use this in conjunction with an accumulator which can be kept fully charged by means of a trickle charger consisting of a suitable mains transformer and a metal rectifier. A rectifier such as the Westinghouse style L.T.2, which gives an output up to 6 volts at .5 ampere is probably as convenient as any for trickle-charger use. This requires an input of 11 volts to produce the output mentioned, but lower-voltage outputs sufficient for charging 4 and 2-volt accumulators can be obtained by using input voltages of 9 and 7.5 respectively. An excellent transformer for use in conjunction with this rectifier can be made by using the No. 31 stalloy stampings specified for the L.T. transformer in conjunction with the same kind of winding spool. The primary, again, will require a maximum of 2,000 turns of enamelled wire, which may be either 30 or 36-gauge. For the secondary, eighty-eight turns of 22-gauge d.c.c. wire can be used, and this winding should be tapped after sixty and seventy-two turns in order to obtain the two lower input voltages called for by the rectifier.

ROUND THE WORLD OF WIRELESS

(*Continued from page* 844)

Power of Danzig to Increase

SO far the Danzig station has relayed the Königsberg programmes, and its power was a modest one. The German Government has now decreed that a new 5-kilowatt transmitter shall be erected during 1934 in order that the city may provide a greater proportion of the wireless entertainments. The new wavelength is 230.2 metres (1,303 kilocycles) which, until a further Yugoslavian station has been built, is an exclusive channel.

Hamburg Now 100 Kilowatts

MANY listeners will have been surprised to hear powerful signals from Hamburg on its new wave-length of 331.9 m., approximately the position on the condenser dial where Milan was previously found. The fact is that as a result of day and night work the engineers were just able to get the new 100-kilowatt station ready in time for the change-over. This ultra-modern installation possesses a wooden mast 480ft. high, supporting a specially designed ring aerial which, led down vertically to a small hut at its base, is thus connected to the transmitter by cable.

Fifteen-minute Broadcasts

IF you have ever studied a North American radio programme you will have noticed the number of broadcasts made during the day which do not exceed fifteen minutes in length, whether they are talks, vocal or instrumental recitals or even dramatic sketches. The B.B.C. in February will also introduce a new type of short, light entertainment. In this instance it will consist of feature songs of well-known dance-music composers. Each in turn will conduct his own works, and the full programme will last for fifteen minutes.

IMPROVING REPRODUCTION

Some Interesting and Useful Hints Which Will Enable Your Loud-speaker to Give Even Better Results.

By W. J. DELANEY

ALTHOUGH you may have a perfectly good receiver, fitted with a really first-class moving-coil type of speaker it is quite possible that results are not by any means "perfect." I fully realize that there can be no such thing as "perfection" when reproducing in the confines of a drawing-room such a relayed item as the London Symphony Orchestra, but at the same time there are many little points which, if carefully attended to, will result in the covering of faults in both receiver and speaker, and in giving prominence to some particular feature which has its appeal to your individual musical sense or which adds realism to music which is reproduced in your particular acoustic surroundings. To commence with, the higher musical frequencies, commonly referred to as "top notes," *must* be reproduced if anything approaching realism is to be attained. This means that every by-pass condenser in the receiver must be chosen with care. If, therefore, you propose to follow this article, with a view to improving your reproduction by quite considerable proportions, the first point is to examine the circuit of the particular receiver and make certain that decoupling condensers are sufficiently large to prevent back-coupling, and then examine the anode by-pass condenser in the detector stage. All too often this is too large and does more than is required of it. Therefore, try the effect of smaller capacities, using the smallest which permits good rectification. This will probably be about .0001, and this value should be taken as a starting-off point.

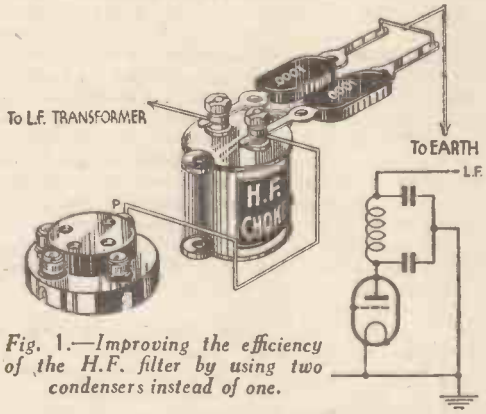


Fig. 1.—Improving the efficiency of the H.F. filter by using two condensers instead of one.

The L.F. Stages

Generally speaking, the H.F. and detector stages will not prove very important when improving is being undertaken, so that, provided the receiver is perfectly stable, and that adequate signal strength is passed to the detector (especially if operating on the power-grid principle), the principal part of the circuit to be attended to is that which deals with L.F. amplification. The anode circuit of the detector must, of course, be included in the "L.F. side," and a good H.F. filter is the first point which in most receivers may be modified with advantage. I have already stated that the by-pass condenser should be as small as possible, and the arrangement shown in Fig. 1 will prove very useful in a search for perfection. An H.F. choke of the ordinary type is employed, but instead of connecting the by-pass condenser direct from the anode to earth, a second condenser is employed, and this also is joined to earth but is on the opposite side of the choke. In wiring this arrangement into the receiver the choke should be as close as possible to the anode leg of the detector valve, and the two condensers should be joined close up to the terminals of the choke, with their opposite terminals bridged and the junction taken to the nearest earth point. In the case of mains valves, this lead should be taken direct to the cathode of the detector valve. The first L.F. valve must obviously be sufficiently biased to handle the output from the detector, and, unless a good H.F. volume control is fitted, it will be found advisable to fit a volume control to this stage to avoid all risk of overloading in subsequent stages. A potentiometer across the secondary is quite satisfactory, provided the value is chosen with care. Nothing lower than half a megohm (500,000 ohms) should be used, and it is a good plan to decouple this in case any H.F. has strayed so far. Fig. 2 shows a very good arrangement for this complete portion of the circuit, and the following stage or stages should be arranged on the usual standard lines.

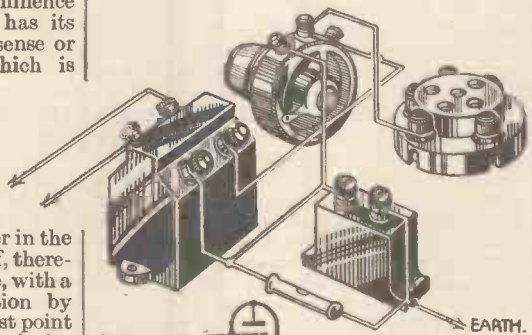


Fig. 2.—A good type of volume control with decoupling added.

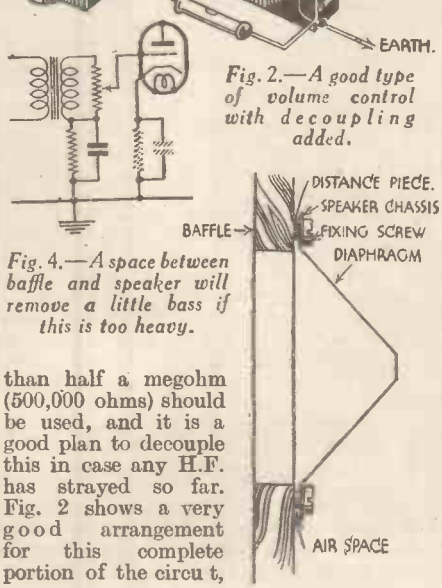


Fig. 4.—A space between baffle and speaker will remove a little bass if this is too heavy.

The Output Stage

In the output stage, the only point of importance, other than the correct grid bias voltage, is the output filter. This arrangement has been many times mentioned in these pages, and for the benefit of those who are not familiar with it, Fig. 3 gives the connections. The choke should be chosen according to the valve, and a tapped choke will be found additionally useful in obtaining correct matching. The coupling condenser should be of 2 mfds. or more, and the choke and condenser, as well as the loud-speaker leads, must on no account be arranged near the aerial portion of the receiver.

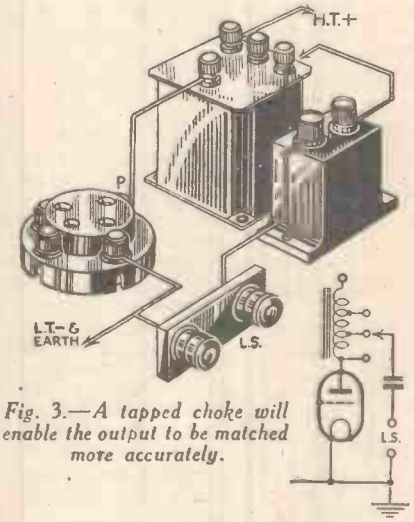


Fig. 3.—A tapped choke will enable the output to be matched more accurately.

The Loud-Speaker

The above-mentioned points are only refinements to be added to receivers not already fitted with them, or are points which might readily receive attention, and there remains only the loud-speaker and its mounting. It is probably here that many good equipments are spoiled, the mounting resulting in boom, or alternatively, in loss of high notes. The fact that a moving-coil speaker requires a baffle has been so often stressed in technical journals that many listeners have become obsessed with what might be called "baffle-itis." Thus, cabinets have been built which carry the baffle really too far, and introduce what has become known as "box resonance." Further, to utilize this baffle idea, large cabinets of the radio-gram type have been used with the loud-speaker arranged low down near the floor, introducing not only a fair measure of high note loss, but also an unnatural effect due to the illusion of the speaker being lower than ear level. From these few points it will be seen that there is indeed room for much improvement, and we will now take them one by one, and see just what should be done when either building a cabinet or mounting a speaker.

Size of Baffle

In spite of what has been repeatedly stated regarding the size of a baffle, it is unnecessary to use a larger surface than 2ft. square. I do not mean by this that no better low note response is obtainable when using a larger speaker, but that the *average* receiver, utilizing an *average* speaker,

(Continued overleaf)

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in the normal domestic surroundings will produce such an effect that any further increase in size will be unnoticeable. Obviously, if a 5 or 6 watt output stage, operating a powerful well-designed speaker in a room having good acoustical properties is in use, then the size can with advantage be increased. For the normal listener, however, 2ft. by 2ft. will be sufficient, and thus it is not necessary to build a massive cabinet out of keeping with the normal furnishings of the home. The most important point is that the sides of the cabinet should be kept rather on the narrow side in order to avoid boxiness. Thus, the front of the cabinet may be 2ft. square with sides 12in. or slightly less in depth.

Speaker Mounting

If the circuit arrangements, or the particular diaphragm characteristics, result in a rather over-emphasis of the lower notes, it is a simple matter to reduce this by mounting the speaker slightly behind the baffle, small distance pieces being inserted between the speaker edge and the baffle. Obviously, the distance separating the two will have to be selected according to the characteristics of the complete outfit. On the other hand, lack of bass may be improved by making quite certain that there is no leakage between speaker and baffle, a sheet of good substantial felt or similar material being interposed between the two, with the centre of the material cut just larger than the diaphragm diameter. Where the speaker is mounted low down, it will be found that the higher notes may be heard much better when the speaker is tipped backward so that it is directed into the room at approximately ear level. For this it will naturally be necessary to build the cabinet with a sloped front rather than to tip the entire cabinet backward. It may, in certain circumstances, be necessary to incorporate both the above ideas in one assembly, and the illustrations, Figs. 4 and 5, will make the schemes quite clear.

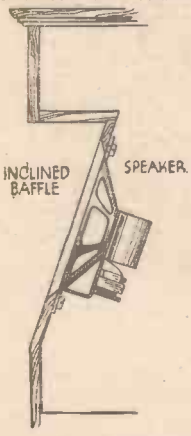

Fig. 5.—A sloping baffle will assist in the search for improved quality, and will strengthen the upper register.

Thinning and Weighting the Diaphragm

I do not propose to instruct readers how to modify the response curve of a speaker by thinning the diaphragm, or loading it up, as such modifications may result in irreparable damage if carried out by inexperienced persons, but where sufficient mechanical knowledge and ability is possessed, it will be obvious that a resonance in a diaphragm may be shifted up or down the musical scale by either thinning or weighting, and sensitivity to certain frequencies may be obtained by reducing the resistance imposed by the spider or other centralising device. Such modifications must, of course, be carried out with great care, as they are, generally speaking, impossible to correct when once made.

MR. F. J. CAMM'S 1934 FURY FOUR SUPER

Some Important Details Concerning the Latest Receiver which will be Fully Described in Next Week's Issue

IN January of last year we devoted a considerable amount of space to the description of a receiver which was destined to mark a radical advance in the technique of home-constructed receivers. The name of this popular receiver is now almost a household word, and readers may remember that for many months the Fury Four was the sole topic of conversation amongst wireless experimenters. Thousands of listeners built up this efficient receiver, and thus provided themselves with an outfit which they have not yet found it possible to improve upon. It was designed to function in the most efficient manner, and utilized one or two features which at the time were not considered, by some "experts," to be all that could be desired in a modern receiver. For instance, instead of using a three-gang condenser for tuning the three coils in the receiver, it was considered more useful to employ a two-gang condenser to tune two of the coils, and a separate condenser for the detector grid coil. In the opinion of the designer this was a preferable arrangement which, in the hands of a non-technical user, as well as in the hands of an expert, would be productive of better results, as slight faults in trimming and other unbalanced arrangements would be rendered of no importance. This course was fully justified, and the many hundreds of letters which have been received from users of the receiver have confirmed that tuning is greatly simplified, and it is possible to receive many more stations owing to the greater accuracy of tuning between the respective circuits.

Another admirable feature which was incorporated in the Fury Four was the provision of only one positive lead for the high-tension battery, the individual tapping points required throughout the receiver being furnished by means of resistances which acted in the dual capacity of decoupling and voltage-dropping resistances. Thus stability was ensured, and there was no necessity for the user to be in doubt as to which plug to insert in various parts of the high-tension battery. Furthermore, the optimum voltage was ensured at all parts of the circuit, no matter what was the condition of the high-tension battery.

However, conditions have steadily changed during the past year, and newer and more efficient parts are now at hand for the home-constructor, with the result that there have been many requests from satisfied users of the original Fury Four for an up-to-date version of the circuit, in order to make use of these newer components and also to enable the receiver to be entirely suitable for the new conditions in the ether which have come into force this month. The original circuit was, therefore, carefully examined, and each part was in turn analysed in order to decide what, if any, change could be made whilst still retaining the several advantages which were incorporated in the original model. The result has been that a new receiver has been created, departing very little from the original so far as outward appearances are concerned, but giving very much better results. The latest type of iron-core tuning coils have been used in place of the air-core coils originally employed, and these are still kept in the same position, in the centre of the chassis. Separate condensers have been retained for tuning, and in place of the ordinary S.G. valves originally employed in the H.F. stages the latest variable-mu valves have now been fitted. Obviously certain other changes in components have had to be incorporated in order to make the best use of these new parts but, so far as possible it has been endeavoured to maintain the original lay-out and thus permit those who desire to do so to convert their existing Fury Four into this 1934 model with the minimum of expense and trouble. New readers and those who did not build the original model will, no doubt, take advantage of the details which will be given next week to commence the construction of this receiver without delay.

For the technical reader, we may state that the circuit employed consists of two variable-mu S.G. stages employing a parallel-fed auto-transformer coupling, with the provision of a transfer tapping to ensure that the optimum coupling is provided on both medium and long waves. The second H.F. valve is coupled to the detector by means of a direct-fed auto-transformer, thus mixing the couplings and ensuring that the circuit will be perfectly stable under all conditions, and also provide the maximum amplification. The coils tune down well below 200 metres, thus introducing a number of stations which provide good programmes in this region, and which could not be received on the original receiver. In addition, the coil assembly incorporates an on-off switch as well as a radio-gramophone change-over switch, so that one knob will now enable the receiver to be switched on and set to any wavelength or for either radio or gramophone reproduction at will. This results in a much neater layout and avoids the necessity of certain controls on the panel. Reaction is employed in the detector stage, and this is coupled, as in the original receiver, to a high-efficiency pentode output valve, which is provided with a filter-output circuit. A further refinement consists in the utilisation of a device known as a battery economiser, which ensures that the maximum H.T. current will only be required when the maximum volume is being received, and thus the H.T. battery will last for a much longer period, besides delivering better quality throughout the listening period.

All readers, no matter whether they are interested in the construction of a new receiver or not, will find innumerable points in this latest receiver which will merit their close attention. They will find that the circuit embodies all those modern features which have been thoroughly proven, although "stunt" arrangements are rigourously avoided. The constructional work has been carefully simplified so that the "1934 Fury Four Super" can be built by either beginner or advanced experimenter with the utmost confidence.

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*220 S.G.	·2	120-150	200,000	320	1·60	15/6
*220 V.S.G.	·2	120-150	110,000	—	1·60	15/6
*220 V.S.	·2	120-150	400,000	—	1·60	15/6

Cossor A.C. Mains Screened Grid Valves

Type	Purpose	Imped.	Amp. Factor	Mutual Conductance m.a./v.	Price
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*41 MSG	Super H.F. Amp'n.	400,000	1,000	2·5	17/6
*†MSG-LA	Super H.F. Amp'n.	200,000	750	3·75	17/6
*†MVSG	Variable-Mu	200,000	—	2·5	17/6
**MS/PEN-A	H.F. Pentode	—	—	4·0	17/6
*†MS/PEN	H.F. Pentode	—	—	2·8	17/6
*†MVS/PEN	Variable-Mu H.F. Pentode	—	—	2·2	17/6

The above Valves have Indirectly Heated Cathode, 4 Volts, 1 Amp.

Cossor D.C. Mains Screened Grid Valves

*†DVSG	Variable-Mu	—	—	2·5	17/6
*†DS/PEN	H.F. Pentode	—	—	2·3	17/6
*†DVS/PEN	Variable-Mu H.F. Pentode	—	—	2·0	17/6

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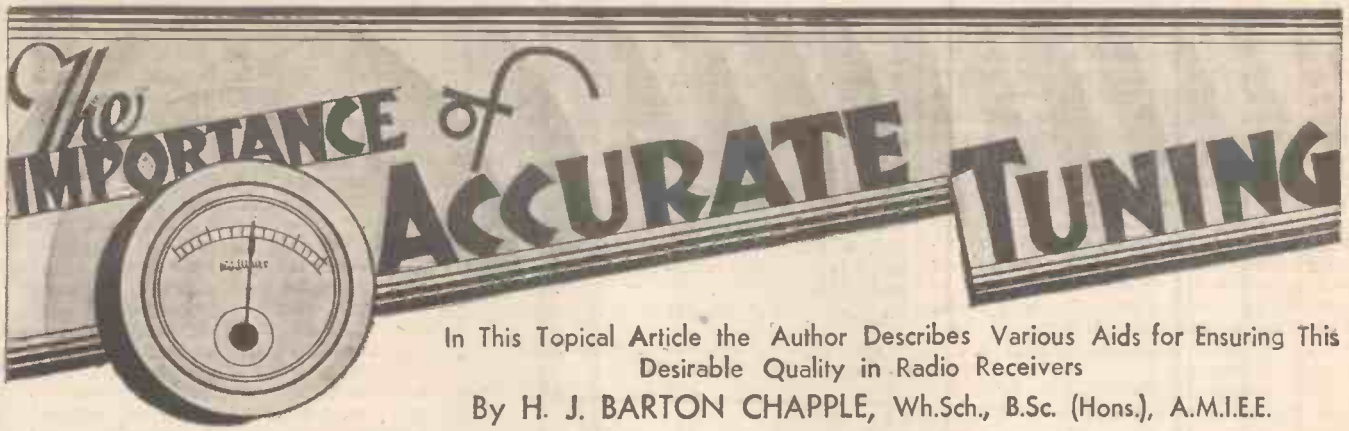

In This Topical Article the Author Describes Various Aids for Ensuring This Desirable Quality in Radio Receivers

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

THE process of tuning-in a radio set to the station it is desired to hear is so simple that one is apt to imagine that inaccurate tuning must be almost impossible. In most receivers it is only a matter of rotating a single dial until the wanted station is heard at maximum strength.

Nevertheless, it is a fact that the ear cannot always be relied upon as an accurate judge of correct tuning. Moreover, however skilful the ear, there is the possibility, with modern ganged tuned circuits, of badly adjusted matching preventing accurate tuning to be attained. It will, therefore, be of service to discuss the results of mistuning, the methods by which accurate tuning is made possible, and other kindred matters.

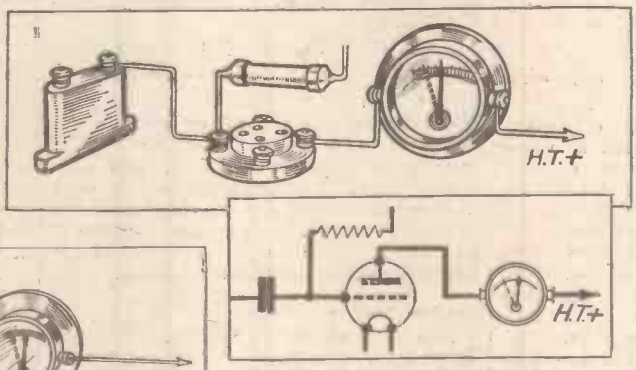

Fig. 1.—A leaky grid detector circuit milliammeter shows maximum depression of anode current when a station is accurately in tune.

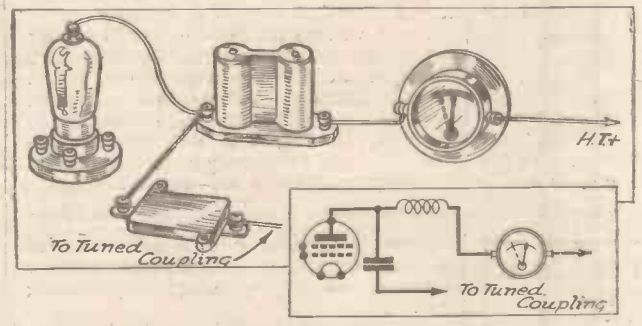

Fig. 2.—A milliammeter in the anode current of a variable-mu stage in an A.V.C. set, also shows maximum depression when a station is correctly tuned in.

Early Volume Control

First of all, most of us can remember the days of widely separated stations when receivers which were comparatively "flatly" tuned gave all the selectivity which was necessary. At that time a very favourite method of controlling volume was to detune the circuit, for a set "off" tune brought in the station less strongly than when fully tuned. With a flatly tuned circuit, little or no distortion was introduced by this method of control, which may even be employed to-day in certain circumstances.

For example, in a receiver having more than one tuned stage, the aerial circuit is often less sharply tuned than the high frequency coupling circuits owing to aerial damping. If condensers separately operated are employed for tuning it is permissible, though scarcely desirable, to detune the aerial tuning condenser slightly as a form of volume control. The same method can also be employed in a set having ganged condensers if, as often happens, a separate trimmer, accessible from the panel, is included in the aerial circuit.

Distortion from Distuning

In the case of more sharply tuned circuits, however, detuning is liable to cause very severe harmonic distortion. The reason of this is bound up with what is termed the "sideband theory." Whether sidebands actually exist or not is a matter upon which experts differ, but it is, nevertheless, a fact that a modulated carrier behaves as if it were composed of the carrier wave itself, plus a number of other waves of slightly higher and lower frequency symmetrically disposed on either side of the carrier. Any mistuning, therefore, results in certain sidebands being abnormally amplified at the expense of others, with consequent distortion. (Generally referred to as "side-band cut-off.")

Another reason why it is important to be able to tune a set accurately is that as stations are now so closely packed into the available waveband, separation between adjacent stations can only be secured by sharply tuned circuits, and if the set is mistuned, interference from stations of nearby wavelengths is almost certain to be experienced.

Tuning Problems

There are two distinct problems in connection with tuning—first, the set must be so designed as to make sharp and accurate tuning possible; second, means should be available to make it easy for the listener to ascertain whether the set is accurately tuned. Selectivity is achieved by increasing the number of tuned circuits in the receiver, due to the use of several stages of tuned amplification and/or band-pass units.

Accuracy in tuning is made possible by a careful matching or ganging of the various circuits. In most sets, the ganging is matched once and for all by initial adjustments of the small trimming condensers incorporated in the main tuning condenser assembly, and this should be very carefully and accurately done.

A description of the process of ganging adjustment is outside the scope of this article, but full instructions on this point have appeared in several issues of PRACTICAL WIRELESS.

Artificial "Flattening"

Another cause of distortion is that in sets equipped for automatic volume control, one effect of this addition is to create a kind of artificial or apparent flatness of

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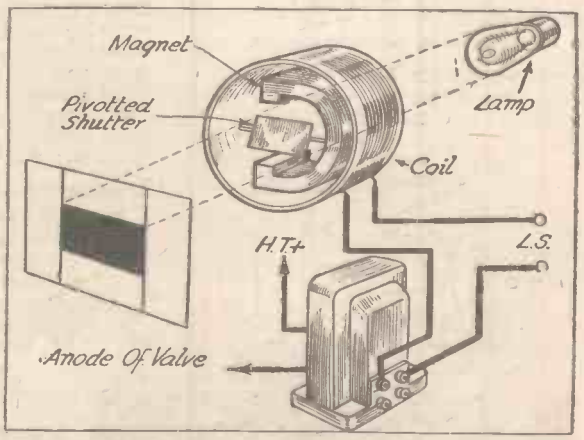


Fig. 3.—The shadow cast by a pivoted shutter, the position of which is controlled by the speech current acting in opposition to the pull of a magnet is of minimum thickness when the set is in "tune."

(Continued from previous page)

tuning. This can be explained in the following way. In normal tuning, the carrier is received at maximum strength at the point of accurate tune, and falls off in strength on either side of the optimum setting of the condenser; volume also follows the same variations. With automatic volume control, however, and particularly with the more powerful stations, perfectly accurate tuning, which gives maximum carrier strength, also produces maximum automatic control, so that for a fairly wide space on either side of the point of accurate tune the actual volume of sound is almost constant, and it is impossible to tell by ear alone when the set is, indeed, absolutely tuned.

There are several devices, now coming into use, whereby a visual indication is given to show whether the set is accurately tuned. The first, and possibly the most correct technically, is the use of a milliammeter in the anode circuit of either the detector valve or of one of the variable-mu valves controlled by the automatic volume control feature.

Visual Devices

Consider, to begin with, the use of a milliammeter in the detector-anode circuit. Most listeners know that when a leaky grid detector is actually receiving a signal the anode current is depressed, the depression depending upon the strength of the received carrier. If, therefore, a milliammeter is connected in the anode circuit of such a valve (see Fig. 1), and the set is roughly tuned to a given station, accurate adjustment of tuning can be made by rotating the condenser knob and watching the milliammeter reading, correct tune being achieved when the reading is at its lowest. On the other hand, for anode bend rectification, the needle will register its highest reading when the station is tuned in.

In the case of a milliammeter in the anode circuit of a variable-mu valve (and this method is only of service if the set has automatic volume control) a reduction in anode current is noticed as the set is brought into tune. The reason is, of course, that at perfect tune, when the carrier voltage is at its maximum, the auto-control bias is also at its maximum, and the increased bias causes a reduction in the standing current of the variable-mu valve. Here again, perfect tune is indicated by minimum reading of the milliammeter.

For this form of visual indication great accuracy in the milliammeter is not essential, and a cheap, heavily-damped instrument is definitely better than an expensive and sensitive meter. It should be mounted on the panel, if possible close to the tuning dial. In the case of an instrument in the anode circuit of a variable-mu valve, it is inadvisable to insert the meter very near the anode, as its electrical properties, such as its capacity, may introduce losses or even unwanted coupling. The best position is on the high-tension side of the high-frequency choke, as shown in Fig. 2.

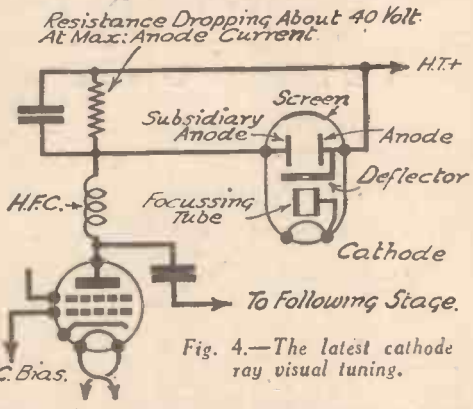


Fig. 4.—The latest cathode ray visual tuning.

Shadow Tuning

As an alternative to a milliammeter, other devices are now being introduced which, although not quite so "scientific," are very ingenious and quite effective. In one of these devices the speech current of the loud-speaker, that is, the current flowing in the *secondary* of the output transformer, or in the output circuit of a choke-filter arrangement—is made to pass through a fixed coil within which is pivoted a soft-iron armature, control being effected by a permanent magnet, as indicated in Fig. 3. As a station is brought into tune, the speech current increases with increasing volume, and the pivoted armature is deflected more and more. The armature also acts as a shutter in the path of a beam of light from a small electric lamp, and the shadow of the shutter is thrown on a semi-opaque screen on the panel. Perfect tune is thus indicated when the shadow is of minimum thickness.

Yet another luminous tuning indicator takes the form of a small cathode-ray tube (see Fig. 4). A cathode, heated from the main low-tension supply, emits electrons which are focused in the usual way, and when the set is *not* tuned to a station the stream is deflected to one side of the screen by the attraction of an anode connected to the high-tension positive terminal. There is a subsidiary anode, which is biased negatively with respect to the normal anode, by being connected to the low potential end of a resistance forming part of the anode circuit of one of the variable-mu valves, the difference of potential between the two anodes when the set is off tune being some 40 volts. As the set is tuned in, the anode current of the variable-mu valve decreases due to the application of the A.V.C. bias, the drop across the resistance also decreases, the bias of the subsidiary anode decreasing in proportion. As a result, the spot on the screen moves away from the main anode to the centre of the screen, perfect tune being indicated by the maximum deflection of the spot.

These various methods of visual tuning are, of course, a comparatively new thing to radio, but with the perfection of A.V.C. and still more stringent reception conditions, they become more and more essential to radio enjoyment, and are certainly an excellent aid to that very important feature in every good radio set—accurate tuning.

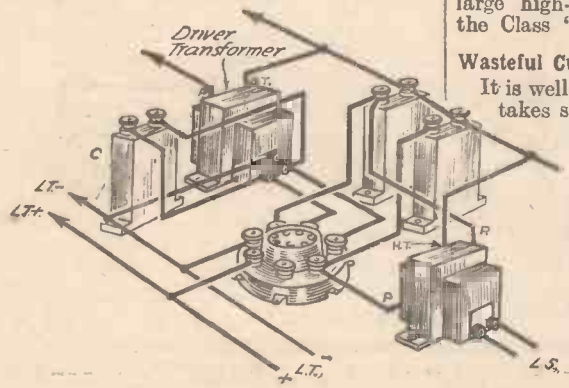
BEWARE OF THE CLASS B CURRENT THIEF

By PERCY RAY

EVERYONE knows that Class B amplification will give large undistorted output for surprisingly little high-tension current, but if certain precautions are not taken the Class B valve will often draw several times its proper current, without the owner being aware of it until the high-tension battery gives out in a week or so. This wastage is due to the omission of some form of tone control that will at least cut off the very high inaudible frequencies.

Heterodyne Whistle Filter

The two diagrams show the output section of a Class "B" receiver, and for the purpose of these notes attention should be focused on the condenser "C." This may be included for tone control in the ordinary sense, but it also serves a more subtle purpose. Without this condenser or some similar device *before the Class "B" valve* a heterodyne whistle *above* audibility can be present, often to such a degree that large high-tension currents are taken by the Class "B" valve to handle it.



Circuit and pictorial diagrams of a Class B amplifier showing condenser C referred to in the text.

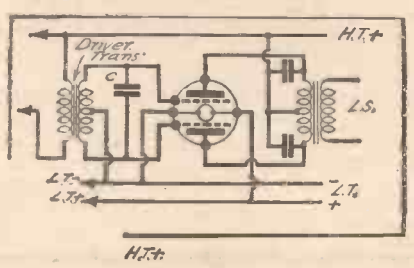
Wasteful Current

It is well known that a Class "B" valve takes sufficient current to handle the strength of signal on its grid, but it would take additional current to accommodate a heterodyne whistle which may be 30 milliamps or even more. The reason why a heterodyne whistle can take so much current is because it is steady and not widely fluctuating, with a resulting low average, as it is when reproducing speech.

As already intimated, the fixed condenser marked "C" will prevent an inaudible note being passed to the Class "B" valve, and, if large enough, it will also minimise audible whistles.

Tone Control and Class B

It is not a good thing to use tone control in the anode circuit of the Class "B" valve, as in this way valuable high-tension current is wasted to amplify the top notes which are cut off before they reach the loud-speaker. This remark is not intended to apply to the .005 or .01 condensers across the output, which are used for the entirely different purpose of preventing parasitic oscillation.



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A BRAND NEW WORD CONTEST FOR OUR READERS

"Naps" is the title of a new phrase-forming competition which is bound to make an instant appeal to all readers. It is quite simple. You form a sentence from a list of words, and compose another phrase having an apt bearing on the sentence. Now read the full details and you may win a prize with your first attempt.

HOW TO WIN

First, from the list of words choose from one to four to form an Example line. In order to give you greater scope, you may take any two, which, joined together form one, such as BUT and TON—BUTTON, or HAT and RED—HATRED. These would each be counted as one word. After you have made your Example line you compose an apt sentence consisting of not more than five words—using any five words you like.

Here is a specimen of joined words to use in the formation of an Example. The word "IN" combined with the word "TO" give "INTO." Run on the two words THE SCRAP and "INTO THE SCRAP" becomes an Example line. Compose a phrase such as "PADDY PLUNGES," and you have a "Nap" that is bound to catch the judge's eye.

The word "A" joined to "ISLE" give AISLE, which with the words "DOWN" and "THE" placed before it reads DOWN THE AISLE. An apt phrase would be "RINGED DOVES" FLUTTER.

BUT	DO	HER	WHILE
TON	IF	TO	ISLE
FREE	AS	COMES	YEAR
FOOT	PEN	WORTH	SPORTS
BRIDE	IT	MEN	MONSTER
AN	BE	FAT	THINKER
WATER	ONCE	RED	PRINTS
WHEN	IS	SCRAP	PEACE
WORK	WAS	FLOOD	PROSPERITY
PAPER	HAT	GROOM	EMERALD
TEN	LID	TORN	FRIDAY
A	PAL	MUCH	FEBRUARY
OF	AND	SHIRTS	THIRTEENTH
IN	DOWN	DRESS	FASHION
TO	THE	BLISS	WASTED

A FEW READY-MADE EXAMPLES

THE EMERALD ISLE	BE A PAL
PEACE AND THE PEN	IN THE FASHION
COMES ONCE A YEAR	PAPER SHIRTS
WATER	WHEN MEN WORK
PROSPERITY AND BLISS	AS MEN DO
PEN AND PAPER	SPORTSMEN
FATHER BECOMES A MONSTER	ONCE IN A WHILE
	THE TORN DRESS

Mr. GILBERT FRANKAU, the famous author, has agreed to examine and adjudicate upon the selection of attempts submitted to him by the Judges. He will select those attempts which appeal most to him and arrange them in order of merit.

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READERS' WRINKLES

THE HALF-GUINEA PAGE

An Excellent Dial Indicator

AN easily-made dial indicator can be made in the following way. Obtain a soldering tag and cut it to a point with a

An easily-made dial indicator.

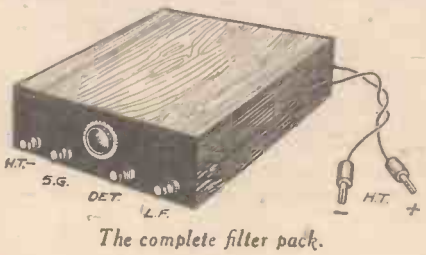
pair of scissors, as shown in the sketch, and secure it to the panel with a small nut and bolt.

Reducing Output from H.T. Eliminator

IT frequently happens that, when buying a new eliminator, it is desired to obtain one which will give a sufficiently high output for operating a more powerful receiver which may be contemplated a little later on. When this is done, however, it is very likely that the voltage applied to the present set will be a good deal too high on account of the small current consumption. This difficulty can be overcome in a very simple manner by connecting a fixed resistance between the positive and negative terminals of the eliminator to "absorb" the surplus current. The correct value for the resistance can easily be calculated by dividing the output voltage of the eliminator by the difference in current between the maximum rated output and that required by the set and multiplying by 1,000. For example, if the eliminator is rated to give 150 volts at 30 milliamps. and the present set only takes 15 milliamps. the resistance required will be found by dividing 150 by 15 and multiplying the answer by 1,000. This simple calculation gives the value as 10,000. It will generally be desirable to employ a resistance rated at not less than 2 watts.

A Useful Filter Pack

TAPPING out along the H.T. Battery is not the correct way in which to obtain the best results. The load on the battery becomes greater as the lower part is reached, with the result that this section often gives out before the top. Apart from this, there is the question of L.F. instability due to the resistance of the battery, which is common in all anode



The complete filter pack.

THAT DODGE OF YOURS!

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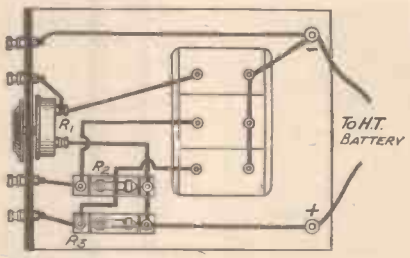
circuits. To avoid this, and to throw an even load on the battery, a filter compact is necessary. That shown in the two sketches is suitable for use on the outside of a commercial, or home-made receiver, in which there is not room to include the filter. The parts necessary are 1 variable resistance, 100,000 ohms; 1 fixed resistance, 20,000 ohms; 1 fixed resistance, 10,000 ohms; and a condenser block of three 2 mfd. condensers. R1 is variable, and suitable for the S.G. valve. R2 will answer for the detector and R3 for the first L.F. The feed from the power valve will be taken direct to the H.T. positive. The unit is interposed between the H.T. leads and the H.T. battery.



Wiring diagram for a useful filter pack.

An Ingenious Mains Tester

THE experimenter who is often called upon by friends for advice, and the service engineer, often has to pay a visit to a house where electric light mains are fitted, and it becomes necessary to ascertain whether the mains are A.C. or D.C. Whilst the meter usually gives this information, it is often simpler to make the test with the aid of the following little piece of apparatus. It may also be used for testing certain parts of a high-powered mains receiver or public-address outfit. On a wooden base mount two ordinary bayonet lamp holders and a simple on-off tumbler switch. The two lamp-holders are wired in parallel, and the on-off switch is connected across them. An iron-cored choke capable of carrying mains current is then joined in parallel with the switch, the complete circuit being shown in Fig. 2. For the choke, the primary of an unused mains transformer, a good

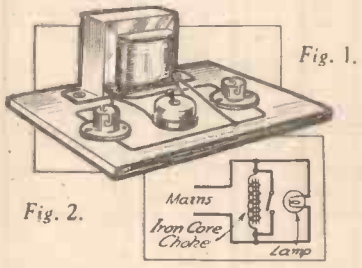


Fig. 1.

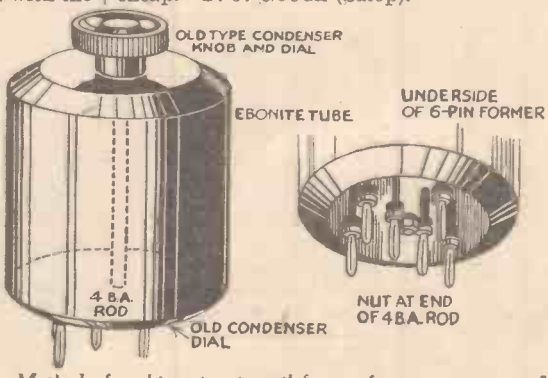
Fig. 2.

An ingenious arrangement for mains testing.

mains power smoothing choke, or, alternatively, 300 turns of 16 d.c.c. wire on a bundle of iron wires, may be used. A lead from the mains is plugged into one lamp-holder, and a low-wattage lamp in the other. When the mains switch is closed, the lamp will light up, and if the brilliancy remains unchanged whether the switch on the apparatus is open or closed, the supply is D.C. If, however, the brilliancy decreases when switch is open, the supply is A.C. The resistance of the coil to an alternating current accounts for the difference, and this may accordingly be adjusted to provide the necessary distinction in brilliancy.

Six-pin Formers from Scrap Material

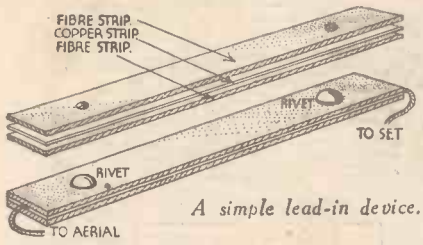
THE six-pin type of coil still remains a great favourite among experimenters, and much can be said in favour of this particular type. If a sufficient number of suitable formers are not available, the junk-box will provide the necessary material for the construction of these. The parts required are as follows: Two old-type ebonite condenser dials, 1 ebonite knob to match, a suitable length of 4 B.A. rod, 6 standard plugs, and a length of ebonite or cardboard tubing. The bottom dial is drilled to take the plugs, the rod passed through and the tubing clamped between the two dials. A nut at the bottom and the knob at the top hold the completed 6-pin former firmly together, making a thoroughly sound job. These home-made coil-formers will be found very adaptable, and their construction is both simple and cheap.—F. J. GOUGH (Salop).



Method of making six-pin coil former from scrap material.

RADIO WRINKLES

(Continued from previous page)



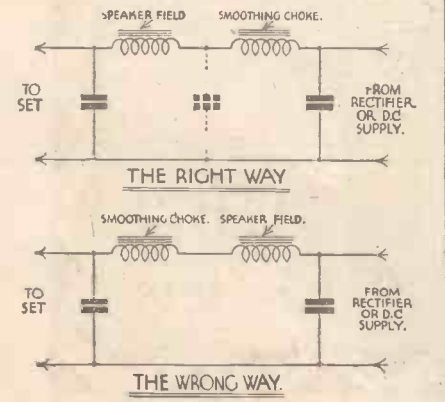
A simple lead-in device.

A Simple Lead-In Device

I WAS recently asked to install an aerial and earth system for a friend, but on arrival at the house was told that on no account would the owner consent to holes being drilled in the windows or walls. An outside aerial could be erected, but the problem was how to get the lead-in to the receiver without leaving a window always slightly open and without drilling holes. The arrangement finally used is shown above. Two strips of fibre, 1 in. wide by 18ins. long, were obtained, together with a strip of copper (18 gauge), half an inch wide. This was placed centrally on one piece of fibre and a hole drilled six inches from each end. The other piece of fibre was similarly drilled, and the three pieces were then riveted together, the copper strip being in the centre. The ends of the strip were then tinned and the lead-in attached to one end and the lead to the receiver at the other, after which the strip of fibre was tacked round the frame of the transom window above a french window. The thinness of the complete apparatus permits the window to be closed tightly when desired, a good conducting surface for the wireless is obtained, and the device can only be seen when deliberately looking for it. It has been painted to match the woodwork.

Using Field Winding as a Smoothing Choke

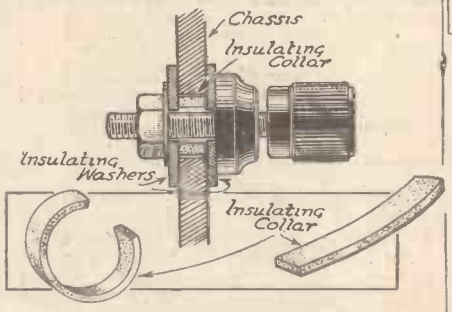
MANY users of mains sets use the field winding for a smoothing choke, this being the only choke in the circuit. If any hum is present perhaps another choke is inserted in the circuit with no apparent difference in results. In this case it is best to examine the wiring more closely and see on which side of the field winding the choke has been inserted. The reason for this is that in some cases hum is picked up directly from the field winding, and not from the valves, so that if the new choke is wired between the set and the speaker winding no change will result. The obvious way is to wire the choke between the speaker field and the H.T. supply, with perhaps a condenser in the position shown dotted. The current is then smoothed considerably before it reaches the speaker field, and consequently much less hum is picked up from this source.



Using a field winding for a smoothing choke.

Insulating Terminals

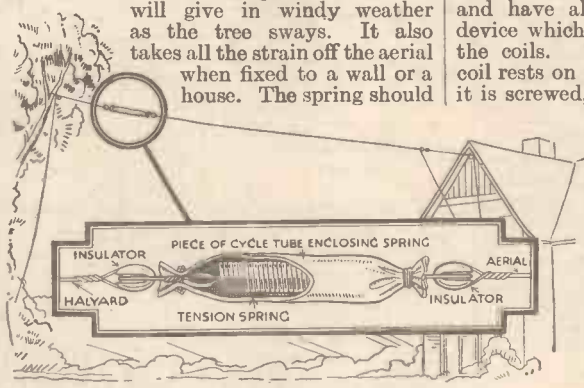
IT is sometimes necessary to fit terminals to a metal or wood chassis, and at the same time to make sure that they are adequately insulated. This can be ensured by drilling a hole somewhat larger in diameter than the screw of the terminal, and cutting a strip of insulating material—celluloid is excellent—the width being slightly less than the thickness of the chassis, and the length just sufficient to wrap round the shank of the terminal without overlapping. This is then made into a circular collar and inserted in the hole, the terminal being fitted with an insulating washer on each side.



A method of insulating terminals.

An Ingenious Shockproof Aerial

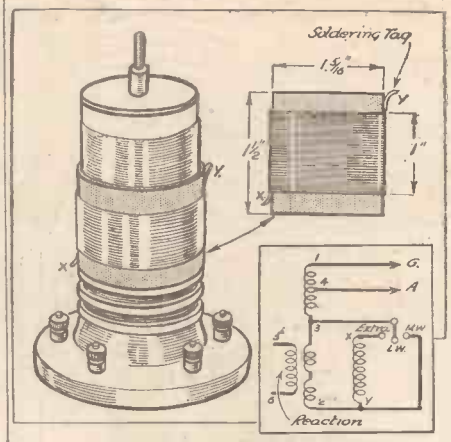
THIS aerial can be fixed to a tree, house, or wall. If fixed to a tree (very difficult without some spring device), it will give in windy weather as the tree sways. It also takes all the strain off the aerial when fixed to a wall or a house. The spring should be greased well before the rubber cover is put on. The aerial is shortened in the illustration to get all in. It will be found that the old piece of cycle tube will give with the spring.



Fitting a spring device to an outside aerial.

Extending the Tuning Range

IN most modern canned coils the medium waveband covered is from 200 to 500 metres and the long wave begins at approximately 800 metres. In my own set, which employs ready-made screened coils, the highest wavelength to which I can tune is that of Vienna. I have found an excellent way of increasing the wavelength range is by placing an additional coil over the original one. The new coil consists of approximately 100 turns of 34 S.W.G. enamelled wire, and is wired to a three-way selector switch as shown. Care must be taken to have this coil connected in series with the windings and with the turns in the same direction. This idea will make with the medium-wave coil an inductance of about 500 μH which, with the average .0005 μF tuning condenser, covers a waveband of approximately 425—925 metres. The reaction winding acts without alteration and eight or nine really good clear stations are received in addition to the usual medium-wave ones.—J. WILLIAMSON (St. Albans).



Extending the tuning range.

Simple Coil-switching Device

I HAVE made two screened coils as described by Mr. F. Preston in PRACTICAL WIRELESS No. 64, one for S.G. and a similar one for detector on my set, and have also fitted a simple switching device which may interest other makers of the coils. The ebonite baseplate of the coil rests on two wooden supports to which it is screwed, raising the coil ¾in. from the baseboard. The supports measure 3ins. by ¾in. by ¾in. Screwed to two ends of the supports is a strip of ebonite 2ins. by ¾in. by ¼in. This is fitted centrally with the three-point switch. The supports are shown at A, in Fig. 1, which shows the underside of the coil and baseplate. The strip of ebonite, B, carries the three-point switch. C is a strip of ebonite or thin, strong fibre screwed to the shanks of the switches, and serves as a connecting link. A piece of 2 B.A. threaded rod serves for operating the switches, and is screwed to the ebonite or fibre connecting link with 2 B.A. nuts. Fig. 2 is a sketch showing the two wooden supports and strip of ebonite screwed to them with a central hole for the switch.—A. TAYLOR (Knutsford).

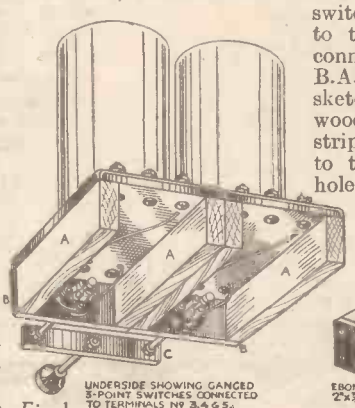


Fig. 1.

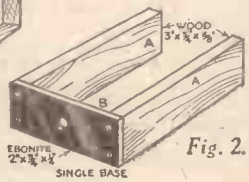


Fig. 2.

A simple coil-switching device.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HUM TRACKING

Its Causes and Method of Elimination.

By C. H. KEELING

THERE are probably very few people who have not been troubled with hum of one kind or another, and even commercial receivers are not entirely guiltless of this annoyance. The matter has become so important that attempts are being made to establish a standard test for a minimum permissible hum-to-signal ratio.

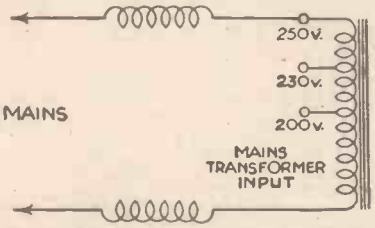

Fig. 1.—H.F. chokes (of correct design) may be advantageously included in each main lead.

The constructor who follows PRACTICAL WIRELESS designs to the letter does not have to bother about this bugbear as special measures are taken in the "lay-out" and preparation of all mains operated sets to reduce hum to negligible proportions. It is to those who have attempted their own designs, converted old sets to mains operation, or made some other modification or addition which has resulted in undue hum, that these words are addressed.

Various Kinds of Hum

The causes of hum are different, although often enough the resultant noises all sound much the same. In order to check the nuisance it is first necessary to trace the source of the trouble.

The hum may be due to any of the following:—

Speaker

(A) Lack of sufficient smoothing, if of the mains-energized type.

(B) Over-emphasis of the bass, due to design, with consequential uneven reproduction of residual hum as compared with signal output.

Mains Unit

The likely causes in this section are numerous, and are therefore dealt with separately.

Rough Mains Supply

In some districts, during certain hours of the day, old type generators are switched on in order to rest those normally employed, with the result that the hum in the set is increased.

Station or Modulation Hum

This is the description given to that type of hum, which is "tunable," *i.e.*, only appears when the station is tuned in, and of course, remains so long as the programme is audible.

Hum on one wave-band only, or which is more pronounced on one band than on the other.

On some sets the hum either increases or decreases when changing from medium to long-wave band.

Re-Radiated Hum

It sometimes happens that two or more receivers have to operate in a closely-restricted area, and hum appears on an otherwise hum-free set when one of the local sets are switched on.

The above causes and their cures will be dealt with, but it is interesting to note that some time ago the author built two almost identical receivers, one was so quiet that it was difficult to tell when the set was "on" unless a programme was coming through, the other, well it simply caused everything "rattleable" in the household to rattle, especially if they happened to have a resonance round about 50 cycles.

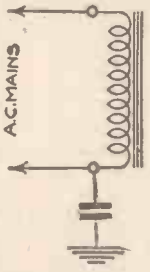

Fig. 3.—A condenser between earth and one side of the primary will prove very useful as a hum remover.

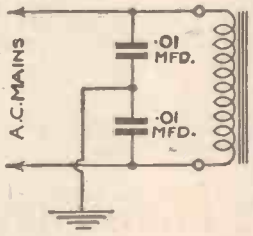

Fig. 4.—Two condensers connected across the primary winding, and the centre tap joined to earth.

It so happens that the latter case is the only one on which the writer had to employ practically every known form of "hum-stopper" before finally eliminating the trouble. Most frequently, one slight additional modification has been sufficient to ensure a silent background.

When wiring A.C. mains sets, it is usual to twist the wires to the heaters of the valves so that the "fields" surrounding these conductors are in opposition, and thus "cancel out."

Proper Screening Necessary

It is, of course, elementary knowledge that the H.F. and L.F. circuits should be kept as clear of one another as possible, and in these days of elaborate screening this is usually simple, but the writer, only recently, came across a commercial set in which the aerial band-pass coils were mounted beneath the chassis, but not separately screened; the hum on this model was terrific. The cure was fairly simple; the mains transformer, which was mounted half-way through a large aperture in the metal chassis, was brought right through to the top of the chassis.

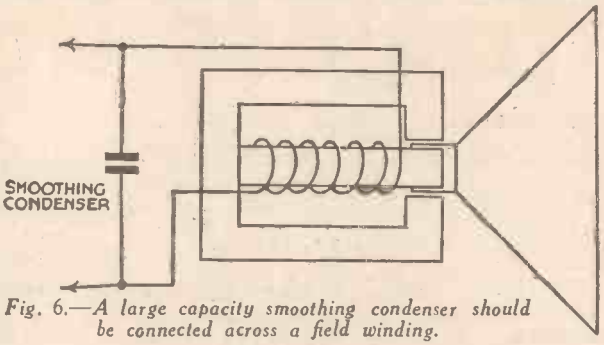

Fig. 6.—A large capacity smoothing condenser should be connected across a field winding.

It should be realized that a mains transformer is capable of radiating a fluctuating "field" of low-frequency over a relatively large area, and should, therefore, either be adequately screened or removed to a "safe" distance.

In the case referred to above, the hum was more pronounced on the long waves than on the medium; this was due to the "pick-up" on the long-wave coil being greater, owing to the larger amount of wire. Moving the latter coil only 1½in. reduced the hum 50 per cent.

A bad hum is often produced by loosely fitting laminations in the mains transformer, and especially is this the case in old types. When this is the source of the trouble the noise is quite audible with the set "dead" or the speaker "silenced." The cure is obviously indicated. (Modern types of mains-transformers rarely, if ever, suffer in this direction.) If the mains are "rough," simple H.F., *i.e.* air cored, chokes may be inserted in series with each mains lead on the mains side of the transformer (See Fig. 1).

When the hum is tunable, that is to say, only occurs while tuned to a station, usually a powerful "local," it can be cured by connecting a .01 mfd. fixed condenser on each side of the rectifying valve filament, and the secondary "outers" (See Fig. 2). An alternative method is indicated in Fig. 4.

(Continued on page 875)

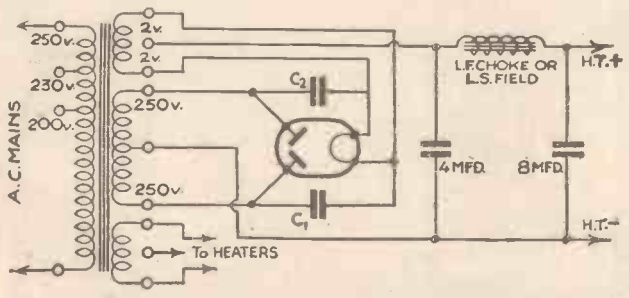

Fig. 2.—Two "buffer" condensers may be joined to the anodes of a full-wave rectifying valve to remove modulation hum.

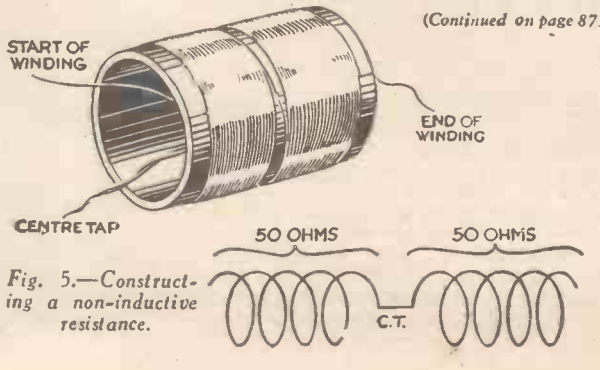

Fig. 5.—Constructing a non-inductive resistance.

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TELEVISION SCANNING DEVICES

A Complete and Interesting Description of the Various Systems of Scanning Employed in Television Practice.

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

ALTHOUGH from time to time a good deal of information has been published concerning television, it is surprising how much misconception still exists even so far as the elementary principles are concerned. This is particularly so with scanning or exploring, a process of disintegration at the transmitting end and reconstitution at the receiving end which, with our present knowledge of the system, seems inevitable in any television system.

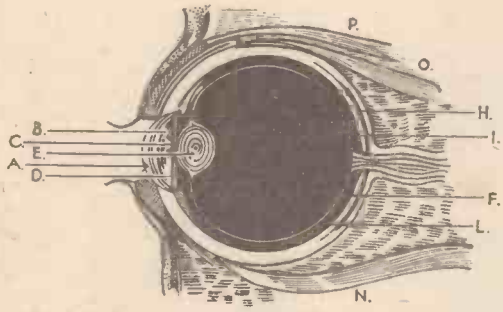

Fig. 1.—A representation of Nature's television system—the eye.

Nature's Television

Dating from the time when the German named Paul Nipkow invented the scanning disc in 1884, we have regarded it as impossible to transmit images electrically to a distance at the same instant without the aid of a scanning device. So far as the ear is concerned, such a scheme is not required in conjunction with the telephone or loud-speaker, while, of course, the camera gives an instantaneous reproduction on a photographic plate. The same is hardly true of the human eye, however, for at the back of the retina (see Fig. 1) there are millions of rods or cones, as they are called, and each of these is separately connected to a nerve. On the other hand, this television system of Nature does not conform to the process of breaking up consecutively the scene when it takes an observation, although there is an unconscious scan when we view a whole scene, as apart from gazing fixedly at one small section.

It is comforting to cherish the thought that at some future date (very distant as far as present knowledge will allow us to prognosticate) a method will be devised to eliminate scanning, but we have to face the situation as we know it to-day, so let us briefly see why we must scan.

Scanning is Necessary

Just as an example, suppose we have the head and shoulders of a subject, such as shown in Fig. 2, to transmit either directly from the human being or from a film showing this picture. In previous articles it has been shown that one or more photo-electric cells are required in order to convert the varying grades of light and shade into equivalent or relative terms of electrical current or voltage. Now if the cell or cells were "exposed" to this direct, they would merely react to give an *average* light value response, which would be transmitted as a single shade instead of showing varying light values spread over the same area.

This is useless, so we analyse or break up our subject into elemental areas which are televised in a more or less continuous motion. That is to say, an elemental spot exposes a correspondingly tiny area while the spot is made to move in a straight or slightly curved line to create a strip of light. (This effectively disposes of the fallacious dot theory which tried to prove the process was a discontinuous pulsation of dots.) Immediately this strip is scanned and the corresponding light values interpreted by the photo-electric cell, another strip takes charge, so that in one complete scan the picture is, in effect, strip-dissected like Fig. 3.

Fig. 2.—The head and shoulders of a subject for transmission.

Fig. 3.—This shows the strip scan in a normal television image.

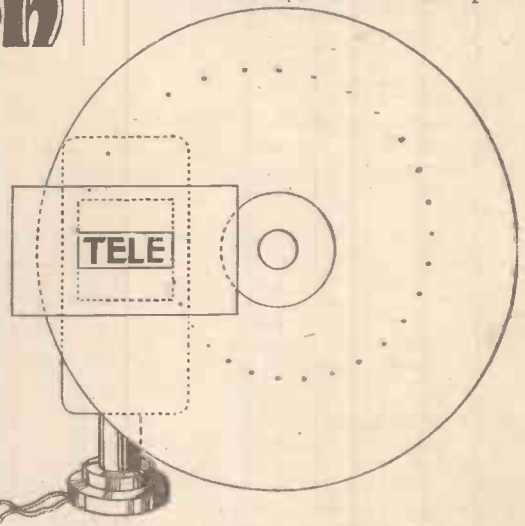

Fig. 4.—Showing how the holes are marked out at equi-angular intervals in a single turn spiral.

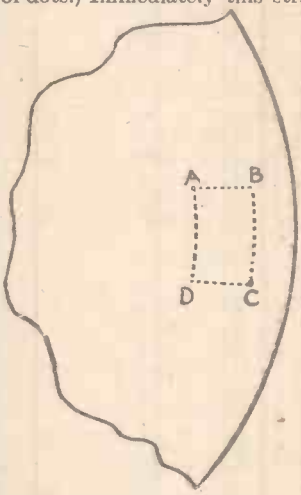

Fig. 5.—The rectangle ABCD represents the image area for this particular scanning disc.

Re-assembly

The disembodying process is carried out several times per second without a break, the resultant varying signal being electrical in character and transmitted to the receiving end by wire or by radio. Here with the aid of a suitable amplifier and another scanning device, the continuously varying signal is re-converted into terms of light. These light values are reassembled into their relative positions, and the eye is able to recognise an interpretation in light of the original subject.

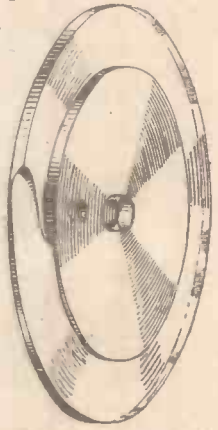

Fig. 6.—A Jenkins prismatic disc.

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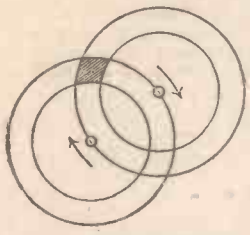

Fig. 7.—The combined action of two prismatic discs to give the required light beam motion.

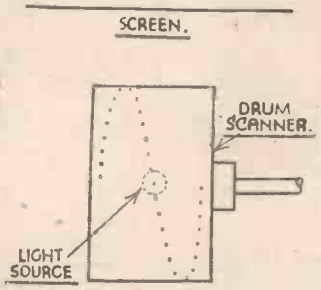

Fig. 8.—Illustrating the action of an apertured drum scanner.

A study of Fig. 3 will show that the thinner the strips (lines is the common term used) into which the subject is dissected, the greater will be the detail observed, but then we are up against the inevitable problem of the frequency sideband required for transmission, and that is a subject on its own and outside the scope of this article.

Various Devices

Realising that scanning is essential at the moment to any television system, let us now turn to the practical side and see what mechanical and electrical devices exist for carrying it to a successful conclusion. There have been inventions by the hundred, but most of them are of purely academic interest and can be ignored, while of the others only a few have emerged from the laboratory to be commercially possible. Of these perhaps the most common are :—(1) Apertured disc. (2) Lens disc. (3) Prismatic disc. (4) Apertured drum. (5) Mirror drum. (6) Mirror screw. (7) Cathode ray.

In some cases there are combinations of these and where they are of importance or show possibilities of practical development, they will be referred to.

The apertured scanning disc is perhaps the simplest of them all, and one of these was actually employed by Mr. Baird in his early and crude experiments. Essentially the correct device consists of a thin flat disc, circular in shape having a single turn spiral of holes punched at regular intervals near the periphery. This is shown in Fig. 4, and as the disc revolves about its centre concentric strips, which touch one another, are described by each hole. The disc in this form is suitable for vertical or horizontal scanning, and if we regard the area shown by ABCD in Fig. 5, it will be seen that each hole as it passes across the area describes a small arc of a circle, thus dissecting the area into the same number of strips as there are holes in the disc.

The actual scanning area is a factor of the disc diameter, hole size, number of holes, and the shape of the television picture, and simple formulæ can be derived to enable anyone to mark out a scanning disc accurately. Usually the holes are square, but when a disc is made for a large number of scanning lines, then hexagonal holes are used. When using a disc for scanning a film at the transmitting end, the exploring is carried into effect by having a circle of holes instead of a spiral of holes, and as the disc revolves the film is moved relative to it and the same effect produced as a stationary film or object with spiral exploration.

Other Discs

For certain classes of television discs it is advantageous to use small lenses mounted in each disc hole. It will be obvious that by this method focussing direct from the disc is possible, and a more intense illumination is obtained, the difference between the plain disc and the lens disc being comparable in some respects to the amounts of light admitted by a pinhole camera and one with a lens. Its scanning action is, of course, the same as that for a plain apertured disc.

Another very interesting type of scanning disc is that invented by Jenkins, of America. It is called a prismatic disc, and the novel form it takes is shown in Fig. 6. Essentially it is a disc of thick glass, the outer edge of which has been ground into the shape of a prism, the section varying gradually and continuously round the circumference, so that at one point the base of the prism is outward, while diametrically opposite this point the base is inward. If a beam of light be directed through the edge of such a disc it will be bent in a certain direction, the angle at which the beam bends depending upon the angle of the prismatic section at that point. By superimposing a second disc over the first so that their overlapping edges revolve in directions at right angles to each other (see Fig. 7), a lateral, as well as a vertical, movement can be given to the light beam.

Drum Scanning

While the lens and prismatic disc provide more intense illumination than the plain apertured disc, some form of drum scanning generally is preferable when it is desired to carry out experiments for projecting television images on to a screen. One of the simplest arrangements for this purpose is the apertured drum. An example of this is illustrated in Fig. 8, and consists of a hollow drum having a spiral of holes pierced through the side. It is possible to place the source of light inside the drum and, by revolving the drum at constant speed, each hole will pass across a definite light area and throw a beam on to a screen placed in any convenient position. Experimental drums made up on these lines are shown in the illustration, Fig. 9, one drum being placed on each end of a common shaft driven from a motor.

Fig. 13.—A very ... television is the m...

Fig. 14.—A home-made mirror drum shown for use with a crater type neon lamp.

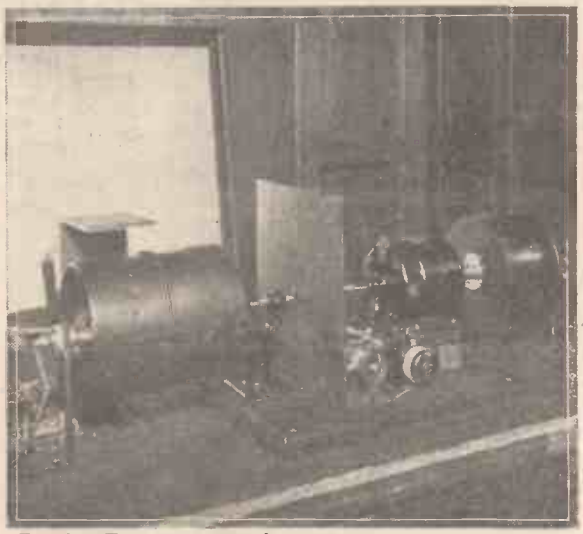

Fig. 9.—Two experimental apertured drums mounted on a common shaft drive.

Another method of using the same type of drum is indicated in Fig. 10, the scheme lending itself to the employment of a more intense light source at the transmitting end. A source of light from an arc lamp has its resultant beam condensed by a lens on to a right-angled prism conveniently mounted inside the hollow drum. The beam of light is in this way bent at right angles and made to cover a definite rectangular area, shown in this case by dotted lines inside the drum of Fig. 10. As

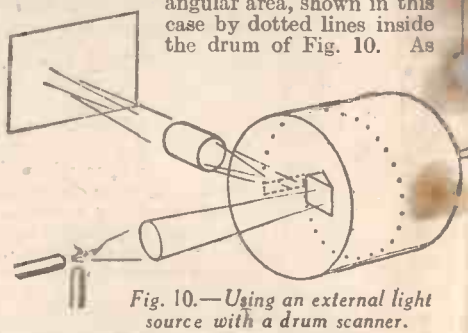

Fig. 10.—Using an external light source with a drum scanner.

the drum revolves, each aperture passes across this light field and the pencil of light emerging from the drum side can be focussed on the subject or object that has to be televised. In Fig. 11 we see an experimental arrangement which was employed for scanning lettered type on a moving tape.

If desired, lenses may be inserted in each drum aperture, and in this way the advantages mentioned for a lensed disc are secured. In any case a device of this nature can be made up quite simply in an amateur form by anyone interested, and the results compared with other scanning devices.

Belt and Mirror Drums

One development from the apertured drum is the belt scanner such as is illustrated in Fig. 12. Here we have

Popular and efficient scanning device for mirror drum shown in this illustration.

a thin strip of flexible material with holes punched in it diagonally from end to end. When the ends are joined together a belt is made, and this can be passed over two wheels or pulleys which drive the belt when they are caused to revolve through the medium of a motor coupled to one of them. The source of light is placed between the belt bands and observation made in the usual manner.

One of the most efficient methods which can be used for projecting television images on to a screen at the receiving end, or alternatively for governing light-spot movement at the transmitting end, is to employ a mirror drum. One such device of this character is shown in Fig. 13. Arranged in this way, it is adaptable for transmitting purposes. A beam of light from the arc lamp is focussed on to an inclined mirror, which in turn reflects it on to the drum. Positioned round the edge of this drum we have a number of rectangular mirrors made from optically-tested glass. Each mirror is canted at a slightly different angle with reference to the drum axis when compared with its immediate neighbour, and in consequence if the drum is revolved the beam of light is reflected from each mirror in turn and made to move upwards until it comes outside the area focussed on the drum from the bottom reflecting mirror.

In this way the drum causes the single light beam to create a number of strips of light, side by side.

The work of building a drum of this character calls for the greatest precision, but none the less is well within the scope

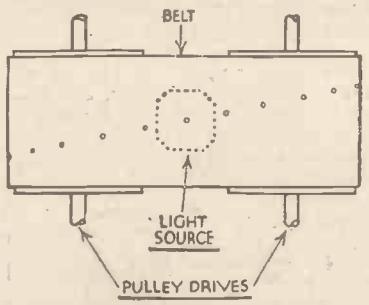

Fig. 12.—A simple scanning belt.

of the amateur. Many constructors have carried out tasks of this nature, however, and in Fig. 14 we see one with his own handiwork, this being for use in conjunction with a crater type form of neon lamp which is shown by the amateur's right hand.

(*Continued on page IV*)

Fig. 11.—Actual apparatus assembled for television transmitting using an apertured drum.

Fig. 15.—An interesting form of scanning device—the mirror screw.

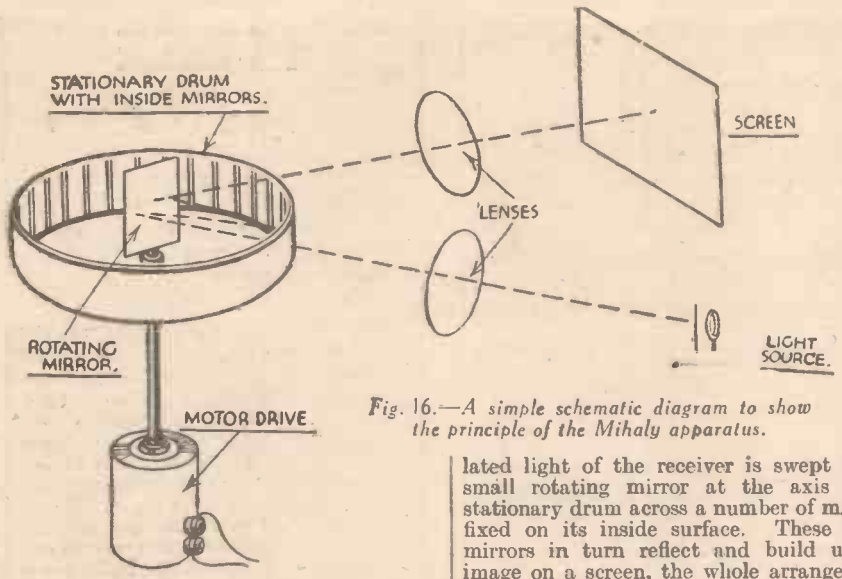

Fig. 16.—A simple schematic diagram to show the principle of the Mihaly apparatus.

Mirrow Screws

One objection which is levelled at the ordinary mirror drum is its relatively bulky nature, and in consequence one idea which has been developed on the Continent to replace the mirror drum is called the mirror screw. One of the best ways of picturing this device is to recall a spiral staircase. Arms radiate from the centre, and on the end of each one of these arms is a reflecting device such as a mirror or thin piece of stainless steel. Fig. 15 gives the reader a good impression of the apparatus.

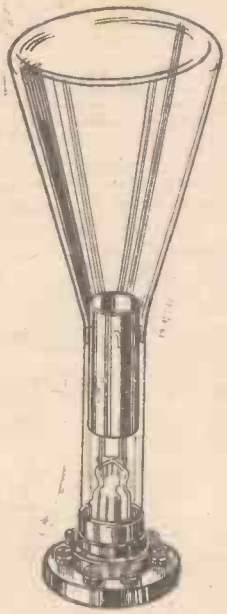

Fig. 17.—A simple illustration of a cathode ray tube.

As the "screw" revolves the reflecting surface at the end of each arm comes into any beam of light that may be focussed on it. The light, in turn, is reflected back on to any convenient screen, and it is easy to see that correctly positioned light strips are traced out as the screw is revolved. The idea is quite ingenious, but the light efficiency is of a comparatively low order.

Another Scheme

One method which may show promise has been developed by Mihaly, the Hungarian television worker, whose activities are confined primarily to Germany. His is a mechanical system by which the modulated light of the receiver is swept by a small rotating mirror at the axis of a stationary drum across a number of mirrors fixed on its inside surface. These fixed mirrors in turn reflect and build up an image on a screen, the whole arrangement being somewhat as indicated in Fig. 16. The scheme was shown for the first time at this year's Radio Exhibition in Berlin, and although the original models were rather crude, they have the advantage of being inexpensive, and that is a big factor so far as television is concerned.

Electrical Scanning

The science of television has not been wanting for supporters of wholly electrical scanning as opposed to mechanical scanning, and of recent date the use of these methods has come once more to the fore. The device most suitable for this purpose is the cathode ray tube, and the principles of action are quite simple in theory, but not so easy to realize in practice for a variety of reasons. Such things as inertia, driving motors and so on do not arise with cathode ray tubes, for here we are only concerned with harnessing the movement of electrons.

In Fig. 17 we have the bare elements of a cathode ray tube. First of all there is a cylindrical section containing the electrodes, and after this the glass container opens out in conical form to terminate in a tube end which is made to fluoresce when it is "struck" by a stream of electrons.

Fig. 18 illustrates the electrode system, a cathode being made to emit electrons by connection to a voltage source, and in front of this is a plate or anode having a pin hole towards which a stream or beam of electrons is attracted, some "escaping" through the hole to be propelled towards the fluorescent screen.

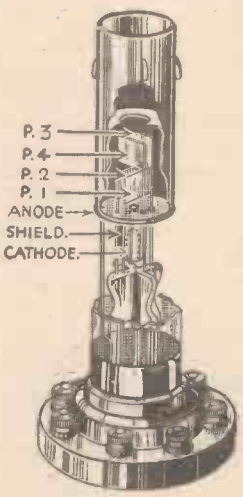

Fig. 18.—Showing the normal electrode system of a cathode ray tube.

Both vertical and horizontal motions must be given to the "spot" just the same as in our mechanical devices, and this is accomplished through the medium of the two pairs of plates P_1, P_2, and P_3, P_4 of Fig. 18. Fluctuating voltages of definite periodicity are applied to the pairs of plates to give the strip and picture frequencies, and the easiest way of doing this is to use two time base circuits containing mercury vapour-discharge tubes. The "scanning" produced electrically in this way is somewhat more difficult to understand than in the mechanical systems, and will have to form the subject of a separate article.

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RADIO RAMBLINGS

By JACE

Jottings from my Notebook

Zole Television

THERE has been a lot of talk recently about the new method of television, which is being experimented with by the B.B.C. Although this is referred to as "new" by the lay press it is not by any means of recent invention. It is a long time since the Baird Company experimented with a picture which was split up into two or more portions and each section separately analysed, and this is what is now referred to as "zone television." In the latest method the picture is divided into six separate sections; and each section is scanned by a standard method and a separate line is employed for the transmission of each section. At the receiving end the six separate "pictures" are reassembled to form one whole image, and this, naturally, enables much greater detail to be obtained. Unfortunately, however, it is not possible, at the moment, to use wireless for radiating the separate sections, owing to the fact that separate wavelengths would be required for each section. Thus it is difficult to see, at present, how this type of television could be used for broadcast entertainment. Obviously, for supplying a cinema or other place with a picture from some central source the arrangement has great possibilities, but several separate lines are essential.

Improving Television Results

IT is, of course, fully appreciated by our readers that to obtain the most from the television transmissions it is necessary to employ two receivers, one tuned to the London National programme for the reception of the vision side of the transmission, and the other tuned to the Midland Regional for the reception of the sound. The two receivers may, in most cases, be joined in series on the same aerial, and they will tune independently, although in some cases the arrangement of the aerial coil may result in the tuning of the two receivers being interdependent. The general effect of this arrangement, however, results in the actual vision apparatus standing in one part of the room and the loud-speaker in some other part, thus destroying the illusion of reality, as the voice does not appear to emanate from the speaker who is seen on the television screen. I have overcome this difficulty in my experimental apparatus by building a sound receiver on the same chassis as the television apparatus, and a loud-speaker is mounted on the opposite end of the base to the neon apparatus. This permits of a symmetrical lay-out on the cabinet front, the viewing hole being balanced by the loud-speaker fret, and the sound appears to come from the actual picture. I recommend all readers to use this arrangement.

Seven-Pin Pentodes

WHEN the Class B valve, the double-diode-triode, and similar multiple valve were introduced it became clear that there was a necessity for some particular type of valveholder (or valve base) different from that to which we were accustomed. Accordingly the now familiar seven-pin base was introduced, and although in the Class B valve, for instance, only six pins are used, the arrangement of the seven pins enabled the base to be employed for the other multiple valves which have since appeared. The indirectly-heated pentode valves which were already on the market had five-pin bases, and a side terminal for the auxiliary grid, and it occurred to the valve makers that it would be worth while to modify this arrangement and use a seven-pin base for this type of valve. Accordingly, the seven-pin base for an indirectly-heated pentode is now standardized, but we would like to point out that the Mullard Company announce that both their Pen. 4Va and the D.C. pentode type Pen. 20 may be obtained, if required, with the five-pin base and the side terminal. We understand that this firm will also shortly be able to supply the A.C. screened H.F. pentodes with seven or five-pin bases.

Dance Music

I OFTEN wonder whether the radio public is really dance mad, or whether some of those responsible for broadcast programmes (I am referring to Continental stations) really understand the requirements of their listeners. Radio dance music may not be employed for any public function without first complying with the requirements of the Copyright Act, as made clear by the recent action of the Performing Rights Society. Therefore, dance music can only be used in the home for family amusement. I hope I am correct in saying that there is very little music in modern dance tunes, and, therefore, the concoction of nigger noises and exotic rhythm is intended, I suppose, to appeal only to the terpsichorean taste. This modern disease emanates from Tin Pan Alley in New York, and it is really amusing to note on the title page of the musical score that about three people have collaborated in composing the idiotic doggerel, and at least two others have composed the music for it. The lyric writers are usually Toms, Bills, Als, etc. You know the sort of drivel. The first line ends in love, and you know that all the other lines are going to end in above, blue, you, true, and so on. I visit a fair number of houses where radio is installed, and I have never yet observed anyone dancing to radio music. Most of my hosts extract fiendish glee in switching the set off directly the tintinnabulating ululation spurts forth from the speaker. Three hundred and sixty-five nights a year there is very little else but dance music after ten o'clock at night. What an abuse of a scientific instrument, and what a misuse of perfectly good musical instruments. If nothing better can be done after ten o'clock at night, would it not be better for the stations to close down at that hour?

THE BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

MILLIAMPS WITHOUT MATHS (Part I)

Varying the Range of a Meter Without Calculations

By E. L. PARKER

IN most articles dealing with the conversion of a multi-range meter from a single range instrument it is necessary to make various calculations. Many amateurs dislike any mathematical work in connection with their radio experiments, especially so if it is necessary to find the internal resistance of a meter. In consequence of this, the multi-range milliammeter which I am about to describe may be of somewhat unusual interest, because no calculations of any kind are involved in its construction.

The first requirement is a milliammeter. This should preferably be a low reading meter, for preference reading 0-2 milliamps.

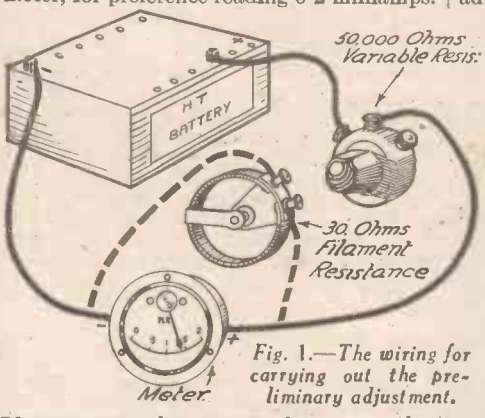


Fig. 1.—The wiring for carrying out the preliminary adjustment.

If your meter has some other range the remarks will still apply in principle.

A variable resistance with a maximum value of about 30 ohms will also be required, and one of the old dull-emitter filament resistances will do. An H.T. battery and a variable resistance in the neighbourhood of 50,000 ohms complete the components necessary for the first range.

The Circuit

The components are wired temporarily in the order shown in the pictorial sketch (Fig. 1). Approximately 50 volts high tension will be required, and the 50,000 ohms resistance is set at maximum. The meter will show a reading of about 1 milliamp, and the resistance is then reduced until this reading is increased to exactly 2 milliamps or, in the case of a meter with a different range, to full scale reading. Leaving the resistance set in this position, the filament resistance is now connected in parallel with the meter as shown by the dotted connections (Fig. 1).

You will now find that on turning the knob of this filament resistance the reading of the meter will alter. Adjust the resistance so that the meter records a little more than half of the original reading, and mark the wire-wound element of the resistance at the point where the arm is resting. The resistance will now have to be dismantled and the element removed. Unwind the part not required (that part between the marked point and what was originally the "free" end). We now have a "shunt" which, when placed in parallel with the meter, will reduce its reading by half, in other words, it has doubled the range.

Our 0-2 milliammeter will now read 0-4 milliamps with the shunt in position. As the shunt can only be approximated when tried in the assembled form, it is advisable to check the resistance in its dismantled form. Make sure that the meter records exactly 2 milliamps (or full scale reading) without the shunt, then when the shunt is applied the reading should drop to 1 milliamp (or exactly half-scale reading). If it indicates a little more than half scale, take off one turn, or less, and try again until the reading is as required. If it indicates less than half scale you have taken off too much wire.

It is not essential to use resistance wire for the shunt, as ordinary enamelled wire is just as efficient, and a former can be made from ebonite, fibre, wood, or any similar material, and the wire (preferably not thicker than 36 s.w.g. for compactness) wound on. The shunt is then tested with the meter until the number of turns is correct (Fig. 2).

Adding Further Ranges

We now have two ranges at our disposal, 0-2 and 0-4 milliamps, and further ranges can be added in the same manner. If, for instance, a reading of eight milliamps is required, the 50,000-ohm resistance is adjusted to give a reading of 2 milliamps (or full-scale reading) with *no* shunt in position, and then a new shunt is fitted by the "trial and error" method already described until the application of this shunt reduces the reading to ¼ milliamp (*i.e.*, quarter-scale reading). This means that 2 milliamps will now only move the pointer a quarter of its range, and consequently 8 milliamps will be required to make a full-scale reading. You will note that the higher the range required, the smaller the shunt will be.

In spite of the fact that this method of making a multi-range meter is so simple,

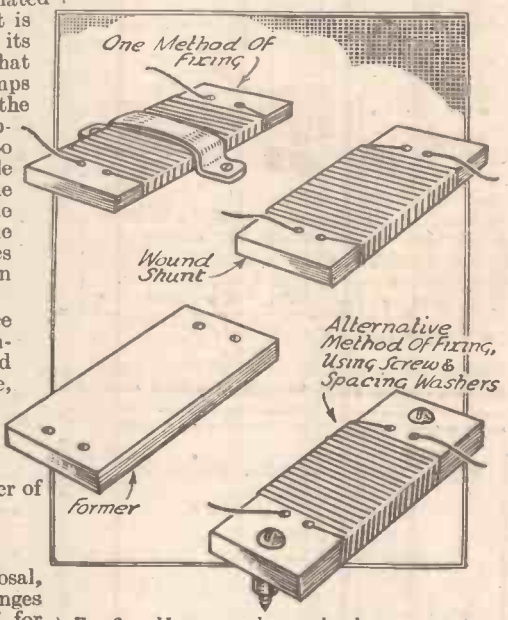


Fig. 2.—How to make up the shunt resistances.

with reasonable care an accuracy equal to that obtained by any of the other methods used by home constructors is easily obtainable, and no calculations of any kind are required.

One point should be noted; if the filament resistance when in its maximum position reduces the reading to less than the required amount, its resistance is obviously too low for the particular range required. Consequently, it will be necessary to use some other shunt.

Choosing the Ranges

When choosing the ranges that the meter is to read it is advisable to pick those that are easy multiples of the present scale reading. For example, a meter reading 0-2 milliamps could be made to read also 4, 6 and 8 milliamps. Alternatively, a new paper scale could be made, giving all the ranges, and stuck over the existing scale.

Four ranges are usually sufficient, *i.e.*, the present range and three additional ones. The remaining parts of the filament resistance should be retained, as they will be found very useful in making up a switch for the various readings.

In the next article I propose to show you how you can fit the meter and its shunts into a cabinet.

TOPICAL TECHNICALITIES

Crystal Control.

It has been frequently stated that the majority of European broadcasting stations are "crystal controlled," and this means that the wavelength (or frequency) is kept constant by means of a crystal. This crystal is not the humble material which was used in former days for rectification, but is a piece of quartz. It has the property, when subjected to electric strain of contracting or expanding, and similarly, when contracted or expanded it produces an electric strain between its faces. Obviously, therefore, by employing a piece of this crystal in the grid circuit of a valve, it is possible, by suitable adjustment, to maintain that circuit at a very constant frequency. This is done by using a very thin piece of quartz, supported between two flat plates. The actual frequency is governed by the physical dimensions of the crystal. This assembly is included (generally) between the grid and filament of a valve, and in the anode circuit of that valve is included a tuned circuit, similar to a normal tuned-anode arrangement. When this latter circuit is chosen to have the same frequency as the quartz crystal, oscillation will take place, due to the feed-back through the self-capacity of the valve. Thus the valve may be maintained at a very constant oscillation. The frequency may be modified by means of frequency doubling, and this will be dealt with next week.

STATION IDENTIFICA-

The Problem Which Always Besets the Listener, Particularly the Beginner, Owing to the Language Problem. Fortunately, it is Possible by Means Stations by Means of Interval Signals in Conjunction with the Wavelength. Interval Signals

TO the British listener who possesses none other than his mother tongue, at times the identification of European broadcasts must present a serious problem. In the course of a transmission he may or may not pick up a call put out by the studio announcer, but in the former case, if the strange words heard do not convey any information, he is compelled to fall back upon other methods.

Doubtless, it has been the realization of this difficulty experienced by the foreign listeners which has induced many of the European studios to adopt mechanical interval signals. From the earliest days of broadcasting it was felt that something was necessary to bridge a gap between items in a programme, if only to assure the listener that his receiver was working and still tuned to the transmission.

For this purpose, in most instances, the ticking of a metronome was used, but this instrument, in the long run, was adopted by so many stations for filling the interval that for the purpose of identification it defeated its own object. In the hope of securing some variety, studios sought a more distinctive signal by varying the beat, and although to-day the monotonous metronome is rapidly dying out, there still exist a certain number of stations which have not yet found a substitute.

Fortunately for the listener, however, in the majority of cases the wearying *tock-tock-tock* has given way to a number of electrical or mechanical contrivances which, in their turn, supply not only more distinctive but most certainly more melodious sounds. In the course of an hour's twirling of the condenser dials, you will hear gongs, bells, chimes, buzzers, bird calls, and even short musical phrases, which, if memorized, will tell you immediately to which studio (or group of stations) you are listening. The term "group of stations" has been advisedly included, as it must be remembered that to-day many wireless entertainments are relayed from a main station to a number of smaller local transmitters; as a consequence, the original interval signal will be tuned in on various wavelengths. Notwithstanding this slight complication, the signal provides valuable data, as a casual glance at a list of broadcasting stations will show all those operating in the same group, and in conjunction with the wavelength represented by the dial reading, the listener will easily identify the actual transmitter from which the music or speech emanates.

In the list published on this page the detailed signals have been placed against their respective transmitters in order of wavelengths, as it is thought that in this manner a two-fold object will be attained. Not only will it permit the recognition of the musical phrase heard, or, alternatively, the identification of other sounds, but it will also give some indication of the wavelength on which they are transmitted. In addition, in order to make them comprehensible to a larger number of readers, the short melodies have been translated into the tonic sol-fa notation. The stations included are those which possess clear channels; it is obvious that it would be superfluous to give those working on shared or common wavelengths, and consequently, the reader must not consider this a complete list of transmitters.

INTERVAL SIGNALS OF EUROPEAN TRANSMITTERS

METRES.	STATION.	INTERVAL SIGNAL.
203.5	Plymouth (G.B.) / Bournemouth (G.B.)	See London (261.1 m.).
208.6	Hungarian relays (Hungary)	See Budapest (1) (549.5 m.).
216.8	Warsaw 2 (Poland)	See Warsaw (1) (1,304 m.).
227.1	Budapest 2 (Hungary)	See Budapest (1) (549.5 m.).
		KEY F.
230.2	Danzig. (Germany)	:d .,d | d :s :m .,s | m :d : ‖
238.2	Riga (Latvia)	Metronome (200 beats per min.).
		KEY B♭.
243.7	Gleiwitz (Germany)	d :— | t_1 :r | d :— | —:— | s :— | f :s | m:— | —:— ‖
245.5	Trieste (Italy)	See Turin (263.2 m.).
		KEY B♭.
251	Frankfurt-am-Main (Germany).	:s_1 | m :— .m | r .,r:de.,do | r :— | — :— ‖
		KEY F♯.
256.1	Copenhagen (Denmark)	d :— :m | r :— :m | d :— :t_1 | l_1 :— :d m :— :m | m :— :d | l_1 :— :— ‖
257.1	Monte Ceneri (Switzerland)	Church Chimes.
259.1	Moravská-Ostrava (Czecho-Slovakia).	See Prague (470.2 m.).
261.1	London National (G.B.)	Metronome (60 beats per min.).
263.2	Turin (Italy)	Song of the Nightingale.
265.3	Hörby (Sweden)	See Stockholm (426.1 m.).
269.5	Kosice (Czecho-Slovakia)	Metronome (80 beats per min.).
271.1	Naples (Italy)	See Rome (420.8 m.).
276.2	Falun (Sweden) / Zagreb (Jugo-Slavia)	See Stockholm (426.1 m.). Metronome (106 beats per min.). Low pitch as hammer striking wood.
278.6	Bordeaux PTT (France)	Occasionally, stroke on gong.
283.3	Bari (Italy)	See Rome (420.8 m.).
285.7	Scottish National (G.B.)	See London (261.1 m.).
		KEY E♭.
291	Heilsberg (Germany)	d' :m . f ,l | d : ‖
296.2	North National (G.B.)	See London (261.1 m.).
		KEY C.
298.8	Bratislava (Czecho-Slovakia).	d :m | s :s ‖
301.5	Hilversum (Holland)	(V.A.R.A. broadcasts only)
		KEY C.
		:s | d' :t .r' | d' .s : ‖
304.3	Genoa (Italy)	See Turin (263.2 m.).
307.1	West Regional (G.B.)	See London (342.1 m.).
312.8	Poste Parisien (France)	Trumpet call
		KEY C.
		: .s :d' .m' | s' .,m' :l' ‖
		KEY C.
315.8	Breslau (Germany)	:s | d' :d' .,d' | d' :r' | m' .,r' :d' .,t | d' :— ‖
318.8	Algiers (North Africa) / Göteborg (Sweden)	Gong. See Stockholm (426.1 m.).
321.9	Brussels 2 (Belgium)	Small Carillon.
		KEY C.
331.9	Hamburg (Germany)	m',r' .d' :m' | — .r' :d' ‖
335.2	Radio Toulouse (France)	Gong (50 beats per min.).
338.6	Graz (Austria)	See Vienna (506.7 m.).
342.1	London Regional (G.B.)	Metronome (60 beats per min.).
349.2	Strasbourg PTT (France)	Buzzer. Deep note (5 secs. int.).
		KEY F.
356.7	Berlin (Germany)	d' :— | m :-.l | s :— | —:— | m:— | m:-.m | l :— | —:— ‖
368.6	Milan (Italy)	See Turin (263.2 m.).
373.1	Scottish Regional (G.B.)	See London (342.1 m.).
382.2	Leipzig (Germany)	Metronome (240 beats per min.) and four notes
		KEY B♭.
		d :t_1 | r :de | d :t_1 | r :de ‖
391.1	Midland Regional (G.B.)	See London (342.1 m.).
395.8	Katowice (Poland)	Sound of a hammer striking anvil.
		KEY E♭.
400.5	Marseilles PTT (France) / Viipuri (Finland)	m :d :r ‖ See Lahti (1,145 m.).

TION SIGNALS

is that of Identifying Foreign Stations. This Difficulty is Accentuated of Music, which is an International Means of Expression, to Locate the The Table Below is the First Classified and Tabulated List of Modern Generally in Use.

METRES.	STATION.	INTERVAL SIGNAL.
		KEY C.
405.4	Munich (Germany) ..	{|d¹ :s |l :m | : | : |d¹ :s |l :m ||
420.8	Rome (Italy)	Short melody (repeated in 3 keys).
		KEY F.
		{|d¹,d¹,d¹:t |d¹,d¹,d¹:l |d¹.d¹:t |d¹.t :— }
		{|d¹.l :— | : ||
426.1	Stockholm (Sweden) ..	Gong (occasionally).
		KEY E.
437.3	Belgrade (Jugo-Slavia)	{|d¹ :r¹ .r¹ |d¹ :l |t .d¹ :l ||
443.1	Sottens (Switzerland) ..	Musical box (Lausanne only.)
		KEY C.
		{|l :f :s |l :— :d¹ |s : : | : : ||
449.1	North Regional (G.B.) ..	See London (342.1 m.).
		KEY B.
455.9	Langenberg (Germany) ..	{|m :m :m |m :— :s |s :f :f |m :— :— ||
463	Lyons PTT (France) ..	Two strokes on a bell.
		KEY E♭.
470.2	Prague (Czecho-Slovakia)	{|s :d¹ : .t |s : : ||
483.9	Brussels 1 (Belgium) ..	Carillon.
491.8	Florence (Italy) ..	See Turin (263.2 m.).
499.2	Rabat (Morocco) ..	Metronome (60 beats per min.).
	Sundsvall (Sweden) ..	See Stockholm (426.1 m.).
506.7	Vienna (Austria) ..	Metronome (270 beats per min.).
514.6	Madona (Latvia) ..	See Riga (238.2 m.).
522.6	Mühlacker (Germany) ..	3 notes.
		KEY C.
		{|l¹ :t¹ :m¹ |l¹ :t¹ :m¹ |l¹ :t¹ :m¹ ||
539.6	Beromünster* (Switzerland.	Different melodies when relaying Basle, Berne, or Zürich.
		KEY E.
549.5	Budapest (Hungary) ..	{|m :s |f :s |m :s |f :s |m :— |— :— ||
559.7	Wilno (Poland) ..	Cuckoo call.
569.3	Ljubljana (Jugo-Slavia)..	Cuckoo call.
	Tampere (Finland) ..	See Lahti (1,145 m.).
578	Innsbruck (Austria) ..	See Vienna (506.7 m.).
726	Boden (Sweden) ..	See Stockholm (426.1 m.).
765	Östersund (Sweden) ..	See Stockholm (426.1 m.).

LONG WAVES

METRES.	STATION.	INTERVAL SIGNAL.
		KEY E.
1,145	Lahti (Finland)	{|s¹ :f¹.m¹ |r¹ :s |s¹ :f¹.m¹ |r¹ : |s¹ : ||
		KEY E.
1,186	Oslo (Norway)	{|s :m,d,m |s :— |m :— | : ||
1,261	Kalundborg (Denmark)	See Copenhagen (255.1 m.).
		KEY A.
1,304	Warsaw (Poland) ..	{|d .,s,:s, .,s, :l,,t,.d ,r |m., d :d : ||
1,354	Motala (Sweden) ..	See Stockholm (426.1 m.).
1,570.7	Königs Wusterhausen (Germany).	Carillon.
		KEY G.
		{:s, |d :d |r :r |m :—.s |r.d :— ||

* Beromünster on 539.6 metres (see above) when relaying Basle, Berne or Zürich varies its interval signal according to the notation shown to the right.

KEY C. Basle

{\|l :s :f \|d : : \|f :l :s \|d : : \|f :s :l \|f : : }

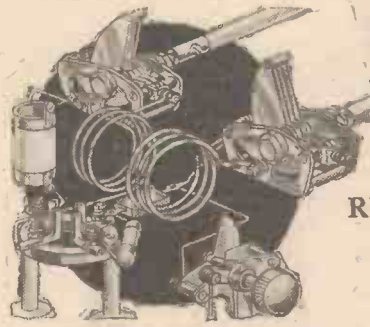
{\|l :f :s \|d : : \|d :s :l \|f : : \|\|

KEY D. Berne

{\|s .s :m \|s .s :m \|r .r,m:f .r \|m .d¹ :s \|\|

KEY E. Zürich

{\|m¹ :— :— \|m¹.f¹ :f¹ : \| : : .m¹ \|m¹.s :s¹ : \|\|



Short Wave Section

RECEPTION BELOW 10 METRES
(Part I)
AN EXPERIMENTAL RECEIVER

By B. PEDDER

EXPERIMENTERS looking for fresh fields to explore are taking increasing interest in short-wave reception on the wavelengths below 10 metres. Preliminary trials have shown that receiver technique on wavelengths from 10 metres down to 5 metres is decidedly different from that generally followed for reception between 13 and 80 metres, the main difference being a decided reduction in inductance, and capacities for tuning, etc. Stray capacities have to be guarded against and very careful layout of the components is necessary, and these should be of good make. The receiver described here is quite simple to construct, and the cost compares favourably with that of any single valve arrangement for use on the medium- and long-wave bands.

Tuning Coils

The components have not been enclosed in a metal case as constructors may wish to get at the parts frequently for trying different coils, varying the spacing between coils, trying different valves, grid leaks, etc. It was used well away from anything likely to cause instability, such as electric light wires, tools on the work bench, or any other set, in use or not, which might cause interaction and pick up. During a spell of fine weather the set was tested out in the garden with various conditions of aerial, earth and counterpoise systems. Many short-wave workers regard a .0001 mfd. variable tuning condenser as the smallest capacity they need use, while many use .00025 mfds. to save frequent coil changing if plug-in coils are used (and they are still very much in favour and give excellent results, although considered old-fashioned by others). Taking two examples of short-wave plug-in coils from makers' lists at random, we find that :—

Sample No. 1—2 turn coil, approx.: wavelength with .00005 mfd. condenser, 15 metres, or 25 metres with a .00015 mfd. condenser.

Sample No. 2—3 turns, coil, 3in. diameter, 12 to 25 metres with a .00015 condenser.

As we wish to tune to about 10 metres at the most and down to 5 metres or less we can only reduce our inductance coils to at least one turn, or for experimenting, we can use a set of 3 coils all of the same size wire, and keeping the spacing between turns the same, and the overall diameter the same, use a one turn, two turn, and three turn coil. Experimenters will soon find that several variations are possible and they can gain quite a lot of useful experience and data by trying out these changes for themselves. A few possible arrangements are :—

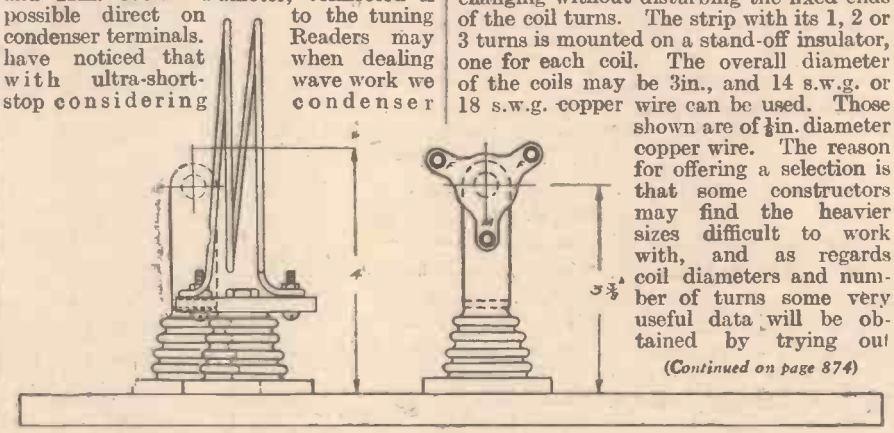
Aerial Coupling Coil,	1 turn.	Grid Coil,	1 turn.	Reaction Coil,	1 turn.
" " "	1 "	" " "	2 "	" " "	2 "
" " "	1 "	" " "	3 "	" " "	2 "
" " "	1 or 2 "	" " "	3 "	" " "	3 "

Diameter and spacing the same in each case.

Single Loop Inductances

As an alternative, single loop inductances of ⅛in. diameter copper wire or tube may be used, retaining the same size condensers. Use a set of three such loops, say 5in., 8in. and 12in. overall diameter, connected if possible direct on to the tuning condenser terminals. Readers may have noticed that when dealing with ultra-short-wave work we stop considering capacity in microfarads such as .0001 mfd. and use smaller capacity ratings in micro-microfarads, thus .0001 mfd. is 100 micro-mfds. and for tuning our ultra short-wave coils we only require a capacity of about a quarter of this or 25 micro-mfds. (m. mfd.). As a guide it may be mentioned that a single turn loop of ¼in. diameter copper tube (or pipe as used on motor-cycles) 5in. overall diameter will cover a range of about 4.5 metres to 6.5 metres with a variable condenser of 25 m.mfd. max. capacity. With a 12in. overall diameter loop the wavelength range will be from 6.5 metres to 10.5 metres. In order to avoid coil plug and mount capacity the small inductances have been mounted on flat strips of good grade ebonite and the ends secured under small brass screws and nuts, the screws being left long enough to take the connecting wire and to allow for changing without disturbing the fixed ends of the coil turns. The strip with its 1, 2 or 3 turns is mounted on a stand-off insulator, one for each coil. The overall diameter of the coils may be 3in., and 14 s.w.g. or 18 s.w.g. copper wire can be used. Those shown are of ⅛in. diameter copper wire. The reason for offering a selection is that some constructors may find the heavier sizes difficult to work with, and as regards coil diameters and number of turns some very useful data will be obtained by trying out

(Continued on page 874)



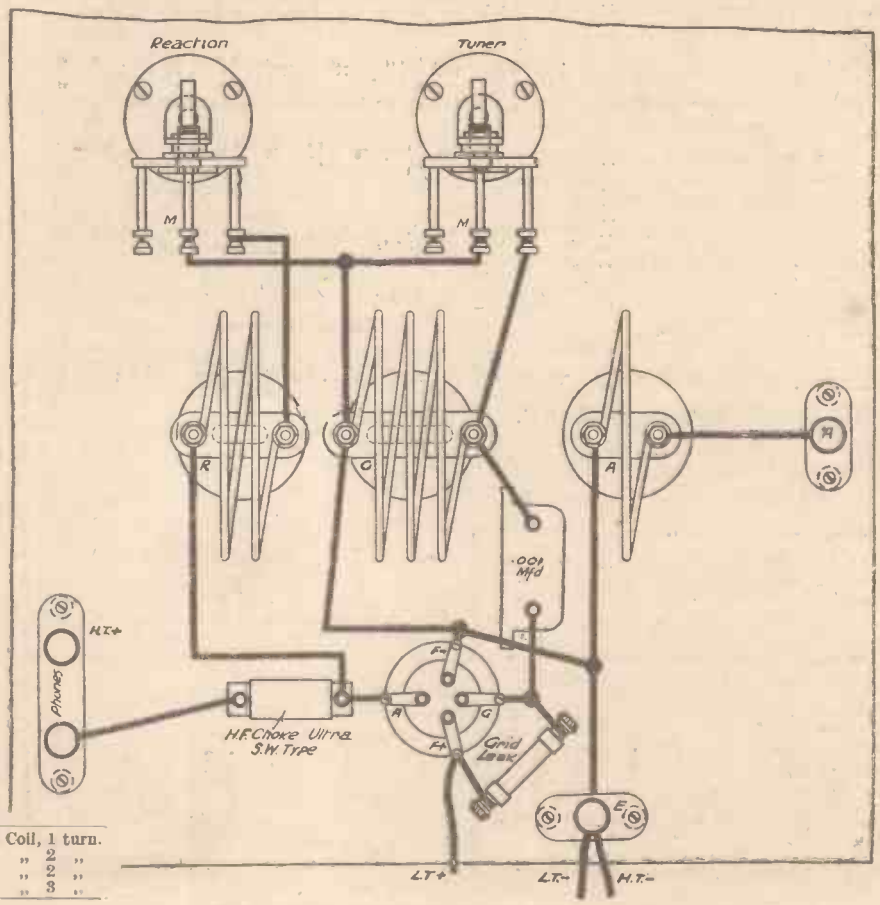


Fig. 1.—The lay-out of wiring of the experimental receiver.

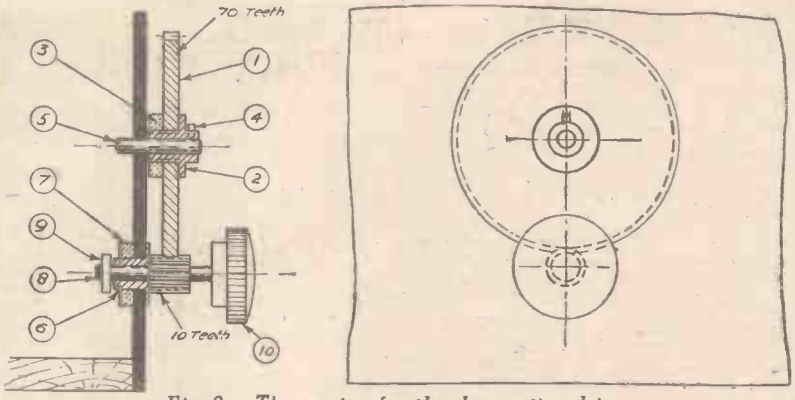


Fig. 2.—The gearing for the slow motion drive.

SHORT WAVE SECTION

(*Continued from page 872*)

variations. Variable condensers for this work should have small linear dimensions in order to keep down stray fields which cause losses, and also to keep the inductance of the plates themselves low. The type selected has a capacity of 25 m.mfd. and the same design is available in five other capacities, viz., 15, 35, 50, 75 and 100 m.mfds. Supporting brackets and extension rods 3in. or 6in. long are also available. In the receiver layout, Fig. 1, the condensers are mounted on ⅛in. thick brass L-shaped pieces mounted on the same type of stand-off insulators as used for the coils. Other ways of supporting will suggest themselves, the layout being given more as a guide than a hard-and-fast arrangement which must be followed. Baseboard space to the front edge has allowed for 6in. long extension rods passing through a plywood panel on which to fix the slow motion gearing. As this 5- to 10-metre band is not yet in extensive use except for the B.B.C. 7-metre tests, and various amateur transmitting stations on 5 metres, a slow motion dial for tuning seems a needless and expensive refinement at present.

H.F. Choke

For the high-frequency choke, one of the commercial ultra-short wave type for 5- to 10-metre work is suitable or one can be made by winding twenty-four turns of No. 20 s.w.g. insulated wire, in a single layer with turns touching, on an ebonite former 1in. diameter.

The same type of choke is also suitable for inserting in L.T. and 'phone leads if found necessary. A standard short-wave type valve-holder having the minimum of solid material and bare sockets has been used as there is no need to de-cap the valve, a job often advised but not easily carried out with modern valves.

Final Details

With regard to the inductance coils, it is quite a practical idea to include the loops as part of the connections so that only the one length of unbroken wire is used from one point to another, but unless the whole piece is duplicated with one more or one less turns, and the existing piece removed each time, coil changing is not possible. This method has been tried in the construction of an ultra-short-wave oscillator with coupling coil and Lecher wires for calibrating wavemeters for 5- to 10-metre work. With the aid of this apparatus receivers can be calibrated and wavelength range checked. It is proposed to make it the subject of a later article. The slow motion gear consists of a fibre wheel having seventy teeth cut with a standard 20 diametral pitch cutter, and clamped on a central bush or sleeve of brass, the whole being fixed by a small grub screw to the metal end of the condenser extension rod, where it passes through the front panel. A thin pointer can be fixed between the nut and fibre wheel. For seventy teeth the overall diameter of the wheel is 3.6in. and a 100-tooth wheel would be about 5in. in diameter. The smaller piece has ten teeth cut on a piece of brass, the central spindle being pressed through and having both ends threaded, one to secure the end behind the panel and the other to take the moulded knob.

Fig. 2 shows the gear arrangement and parts, which are enumerated as follows:—(1) 70-tooth fibre wheel, ¼in. thick, (2) Brass sleeve or bush to fit end of extension rod, (3) Brass nut for sleeve, (4) Small grub screw fixing gear to spindle 5, (5) End of extension rod, (6) Brass sleeve or bush for small gear or pinion, (7) Brass nut for sleeve, (8) End of gear spindle forced through 10-tooth pinion, (9) Nut for above at back, (10) Moulded knob.

LIST OF COMPONENTS USED IN THE ULTRA-SHORT-WAVE RECEIVER

- **Tuning Condenser.** 25 m.mfd. Microdenser. (Eddystone.)
- **Reaction Condenser.** 25 m.mfd. Microdenser. (Eddystone.)
- **5-10 metre H.F. Choke.** (Eddystone.)
- **4-Pin Short-wave Valve-holder.** (Eddystone.)
- **Grid Condenser.** .001 mfd. (or .0001 mfd.). (Lissen.)
- **Grid Leak.** 1 Meg. (or 3 to 5 meg.). (Lissen.)
- **Stand-off Insulators.** (Eddystone.)

(Continued from page 862)

Mains Transformers

A frequent cause of hum is an incorrect electrical centre tap on the heater winding of the mains transformer. The reason for this occurrence is fairly easy to understand, since the wire employed in this section is of reasonably large diameter. This tap is usually connected to earth or, where automatic bias is applied to a directly heated output valve, it is taken through a suitable resistance and then to earth. In order to ensure a correct electrical centre, obtain a variable resistance of approximately 100 ohms, connect the two outer ends to either side of the heater-winding, and the slider to the centre tap. The slider should be varied until the right position is found, and this will be indicated when the hum is at its lowest value. A simple, home-made resistance can be fashioned by winding a length of "Eureka" resistance wire on a small former. About 21ft. of .0076 in. or 36-gauge silk-covered "Eureka" wire will give the required resistance. This wire is obtainable from most electrical stores. An easy method of deciding the correct centre, and at the same time ensuring a non-inductive resistance winding is to "double" the wire. Having fixed the "U" shaped end on the middle of the former proceed to wind the two halves outwards and in opposite directions to each other (See Fig. 5). For mains smoothing, it is usual to employ an L.F. choke or the field winding of the moving-coil speaker, with fairly large capacity condensers on either side; the former is connected in series, and the latter across the rectified output. A typical circuit is shown in Fig. 2.

With mains energized speakers, it is possible to switch on the speaker field energy, and test the hum with the set "dead." If the result of this test is speaker hum, an electrolytic condenser of 2,000 or 3,000 mfd. is recommended for a low voltage winding, and 4 mfd. for a high voltage winding, and this should be connected across the field winding. (See Fig. 6.)

While on the subject of speaker hum, in the exceptional case mentioned previously it was found that the front of the very large cabinet had a resonance in the neighbourhood of 50 cycles, and this had to be damped by means of asbestos packing.

Common Cause of Hum

Another common cause of hum is the relationship between the mains and the L.F. transformer. To cure this, first connect the transformer to its respective neighbours with reasonably long flexible leads, and with the set switched on rotate the transformer, and move it about, carefully noting the effect on the hum level; in this way the most effective position, or angle, will be found.

Re-radiated Hum

"Re-radiated" hum is caused by a badly humming local set feeding L.F. mains hum into the aerial side of the set and to pick this up the aerials have to be fairly close to each other. The cure is in the hands of your neighbour.

If hum occurs in a previously "hum-free set" look to the earthing system; a good earth is essential to keep hum down, and where separate mains units are used the metal screening case is usually provided with a special earthing terminal which should either be separately earthed, or connected to the earth terminal on the receiver.

FACTS & FIGURES

Components tested in our Laboratories

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

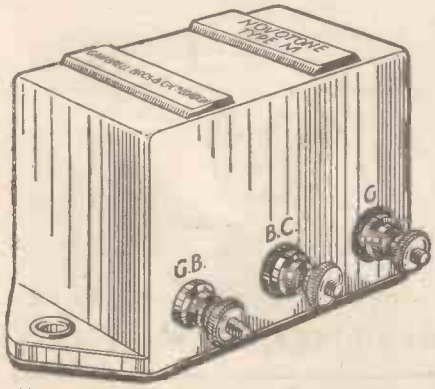
T.C.C. ANTI-INTERFERENCE UNIT

FOR the suppression of interference from electric motors and similar apparatus, the method of connecting two large-capacity condensers across the brushes with the centre point earthed is well known. This method of employing two condensers may also usefully be turned to account for removing other forms of interference which are received via the mains, and the new T.C.C. unit incorporates two such condensers in a single moulded case, with the addition of two 1 amp. fuses as a safety device. The case is provided with a substantial earthing terminal, and the connections from the mains or the apparatus have to be taken through two small holes in the end of the small fuse-box, thus effectively enclosing all bare leads and preventing the possibility of shocks. The condensers are each of 2 mfds. and are tested to 1,500 volts D.C., and are thus suitable for working up to 450 volts D.C. or 250 volts A.C. Owing to the completely enclosed method of assembly the device fully conforms to the I. E. E. regulations. It is interesting to point out, for the benefit of those readers who may be under the impression that the connection of a device of this nature across the mains will result in a higher consumption of current, that the actual current taken by the device is wattless and is not, therefore, recorded on the meter. On D.C. mains, of course, no current is consumed. The price of the unit is 10s. 6d., and the makers supply an interesting instruction sheet showing various methods of incorporating the device. We tested the unit on a small electric motor standing on the bench close to a fairly powerful receiver, and operated from the same mains plug. Without the unit the background from the brushes was very heavy indeed, but reception was free from interference when the unit was connected in circuit.

The T.C.C. anti-interference unit, showing the two fuses which are incorporated.

GAMBRELL NOVOTONE

ENTHUSIASTS who specialize in reproduction from gramophone records will have found out that the record as it stands leaves quite a lot to be desired. The bass response has to be reduced in order to accommodate the sound vibrations in the standard groove width. Furthermore, the higher frequencies are also cut to a certain extent. Consequently, if a really straight-line amplifier plus a good pick-up and speaker equipment are being employed the reproduction cannot be called perfect. Messrs. Gambrell Bros. produced some time ago a device known as the Novotone, the invention of Dr. McLachlan, whose researches into quality reproduction are very well known. This Novotone is designed so that whilst the middle frequencies are simply passed through the circuit without amplification, the lower notes are given extra amplification, the actual curve having a rising characteristic towards the lower end. In addition, the upper frequencies are similarly strengthened, and the device works in a very efficient manner. The device has now been produced in a much more compact form, known as Type M. This measures only approximately three inches long by two inches broad and high, and thus is a much neater component than the original, which was about six inches by four. Six terminals are provided and it is recommended that a resistance be used with the Novotone in order to reduce the amplification of the upper frequencies if scratch is rendered too prominent. The new model was tested in comparison with an ordinary Type J, and it certainly was productive of wonderful results. The bass seemed just as clear as on the original model, and naturally was very much more prominent than without this device. The scratch did not need so much curtailing as on Type J, and the result is to give a really fine richness to record reproduction, bringing it quite up to the level of broadcast music. Certain special sounds seemed to be immensely improved, and we may particularly mention such items as gongs, cymbals, and similar sounds which have a richness not before experienced on a gramophone record played without the aid of this device. The choice of a pick-up should be carefully made, as certain pick-ups have a very marked bass resonance and this will, of course, give rise to over-emphasis. A resistance of .5 megohms connected between two terminals on the Novotone will enable this to be modified slightly, but the maker's recommendations regarding the choice of pick-up should be followed. The price of this new model Novotone is £1 7s. 6d.



The new Model M Gambrell Novotone for improving gramophone-record reproduction.

SIEMENS FULL O'POWER BATTERY REDUCTIONS

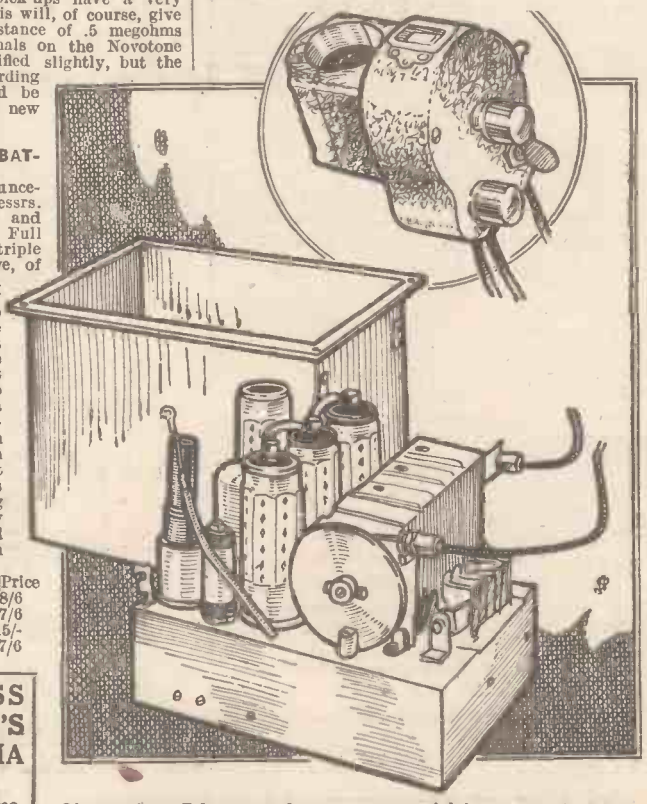
A VERY interesting announcement is made by Messrs. Siemens Electric Lamps, and concerns their well-known Full O'Power "Power" Type triple capacity batteries. We have, of course, repeatedly urged listeners to use a large capacity battery of this type owing to the improved results which are obtained, both from the output point of view and also from the point of view of cost. It must be remembered that a cheap battery will last only for a short time, and one large-capacity battery, although costing perhaps twice as much as a cheap battery, will last three times as long, thus effecting a considerable saving over the total period. The new prices of the batteries, compared with the old ones, are given below :—

Battery	Old Price	New Price
V.4 60 volts	12/-	8/6
V.5 45 ,,	9/-	7/6
V.7 108 ,,	20/-	15/-
V.8 120 ,,	24/-	17/6

NEW WEARITE TUNING COIL

MESSRS. WRIGHT & WEAIRE have seriously considered the conditions which will arise when the new wavelength scheme is adopted and have decided that a new tuning range will prove of great value when building a receiver for these new conditions. They have accordingly designed an air-cored coil which is of the completely screened type and is designed to cover a slightly different range from that previously employed. With a .0005 mfd. tuning condenser the two wave-bands covered are 150 to 550 metres and 750 to 1,950 metres, from which it will be seen that the minimum on both ranges is slightly lower than we have hitherto been accustomed to. The coil itself is wound on a paxolin former and is of rather unusual design. A portion of the long-wave winding and also of the primary winding is of the "dnolateral" type, and is waxed into position at the lower end of the former, whilst the medium-wave secondary and the medium-wave portion of the primary are carried at the other end of the former, the grid winding being wound solenoid fashion, and the primary spaced into bobbins of very low-loss material. This arrangement enables the primary winding to be designed to cover both wave-bands and also permits of the coil being used as a plain aerial coil or for H.F. purposes without the necessity of introducing switching on the primary, a practice which might introduce trouble. The reaction winding is connected to the earthed end of the secondary. The coil was tested in both a simple detector circuit and also as an H.F. coupling coil. In both positions the coil gave very good results, and reaction was found perfectly smooth throughout the range. An alternative tapping is provided on the secondary coil for connection to the grid condenser. It is obvious that the method of assembling the coil, and the values of the separate windings have been very carefully chosen, and the coil may be thoroughly recommended. The price is 5s.

This illustration shows the new Wearite "Universal" coil.



Of extremely small dimensions, this receiver is intended for operation in a car. The inset shows the small control which is fitted to the steering column. Page Car Radio are the makers of this item.

THE R.I. WREN-EASTON MICRIONISED "CLASS B" RECEIVER

Details of the Latest Kit Receiver Which Employs Some Novel Principles

THE name of Radio Instruments is well-known, and has been associated with radio for many years. To their extensive range of receivers and components they have now added a receiver of the kit type, designed to be constructed at home with the minimum of trouble and without the aid of any special tools, a screwdriver and a pair of pliers being the only necessities. The illustration Fig. 1 shows a front view of the complete receiver, from which it will be gathered that it is entirely modern in aspect, the now-popular long type of cabinet being employed with a speaker fret arranged at the side of the control panel. There are only four control knobs on this, one for tuning, one for reaction, one for wave-changing, and an on-off switch.

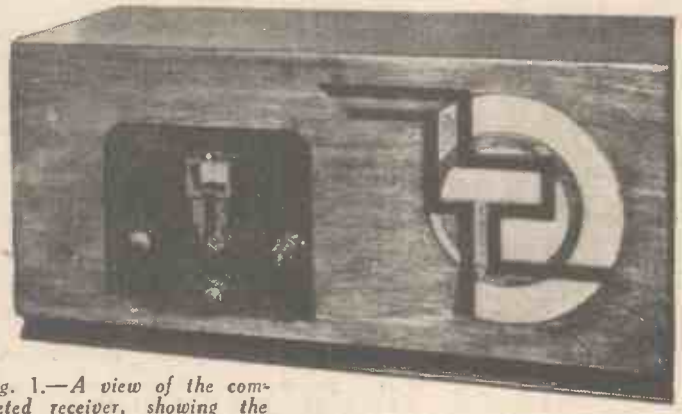


Fig. 1.—A view of the completed receiver, showing the neat panel lay-out and the loud-speaker fret arranged on the same level.

The Circuit

The circuit employed in this interesting receiver will at first sight appear to be rather out of date, owing to the fact that no high-frequency amplification is provided and a single-tuned circuit affords the only tuning facilities. When we come to examine the individual components, however, we find that this tuned circuit is provided by means of the R.I. Micrion coil, one of the new powdered-iron components which have been introduced to the market during the past year. This particular coil is of unusual design, having adjustable permeability, besides providing a winding which gives the utmost selectivity combined with signal strength. Thus it is now possible to employ a single-tuned circuit, with the addition of a reaction winding to give adequate separation of stations, and at the same time to provide an adequate signal for subsequent amplification. This is carried out by the popular Class B method, giving a powerful output with a minimum of expense in high-tension current.

The Layout

The construction of the receiver, as has already been mentioned, calls for no skill, the flat baseboard arrangement being employed, and the various components being simply attached to this by means of ordinary screws. There is no sub-baseboard wiring, and thus there are no holes to be drilled. As may be seen from Fig. 3, the parts are well disposed on the baseboard, and there should be no difficulty in getting to any of the terminals or connecting points. The aerial and earth terminals are carried on a small bracket, and to facilitate connection to these an extended bracket arrangement is provided with an ordinary screw connection, making the attachment of the wires very simple indeed. An extremely attractive walnut-faced plywood panel carries the single tuning condenser and the reaction condenser, together with the change-over switches. To accommodate the receiver one of the Peto-Scott cabinets has been chosen, and this permits of the loud-speaker (which is an Ormond product) being fitted at the side of the receiver with ample space for the batteries at the rear, as may be seen from Fig. 2. The loud-speaker is of the moving-coil type, fitted with a Class B transformer to ensure accurate matching.

Our Test

The receiver was tested in our laboratories on the standard aerial, and certainly justified all the claims which are made for it. The selectivity was of a type not previously experienced with a single circuit tuner and no H.F. amplification. The local station was confined to only just over two degrees, and when the reaction control was employed this was still further reduced, thus permitting of the reception of stations working close to the local without interference. The volume was ample, and with our particular aerial did not permit of the employment of reaction on any but the weakest stations. The small variable condenser in the aerial lead was therefore adjusted to sharpen up the tuning to see just what loss was caused thereby. The local could be confined to one degree, with ample signal strength for the room, and yet many distant stations were received in daylight. With the pre-set condenser in its setting for poorest selectivity the local occupied a greater space on the dial, but it still did not result in the loss of any worth-while stations. It is certainly a remarkably selective set, and will be found to provide adequate selectivity on practically any aerial without the necessity for reducing this to an inefficient length in order to avoid swamping difficulties. Fécamp at the lower end of the dial could be tuned in without the necessity of setting the condenser dial to its minimum position, and only the slightest trace of reaction was needed in order to bring this station to full room strength, a feat which is not easy in this particular locality on a simple detector circuit. There was no background from London on this particular station. A very handy feature is the inclusion of a dial calibrated in wavelengths arranged for the new conditions, and marked off down to 190 metres. No matter with what aerial the set is employed, the small adjusting screw on the Micrion coil may be rotated to bring the tuning point exactly on to the station and thus provide a properly-calibrated receiver. This also enables the apparatus to be taken to a friend's house or to some other listening point, and for the coil to be adjusted so that the dial readings will hold good. This is a valuable feature.

Quality

The tone is very good and forward for such a type of receiver, bass and treble being well produced and speech having a distinctness and brilliance which renders it very pleasing. The Class B circuit is, of course, already well known for its good tone-producing properties, and in this circuit the Class B driver transformer, which is an R.I. product, combined with the R.I. transformer coupling the detector and first L.F. stage, goes a long way to the production of this good quality output, whilst the Ormond speaker completes the chain in high-quality signals. There is none of the "boxiness" or undue bass resonance which might be expected from

(Continued on page 881)

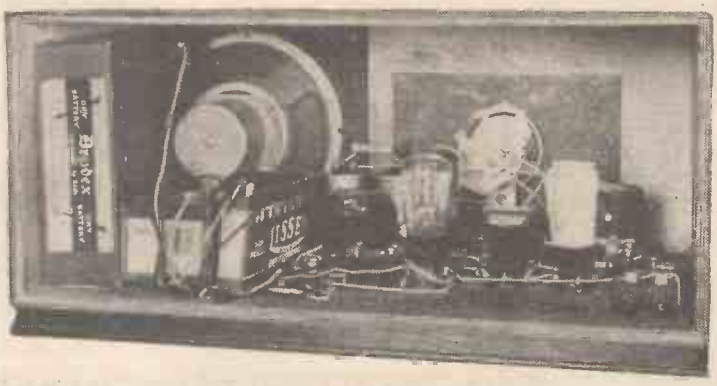


Fig. 2.—This view of the interior of the new R.I. receiver shows how the batteries are accommodated behind the loud-speaker.

OF COURSE—R.I. CHOSE THE PILOT AUTHOR KIT!

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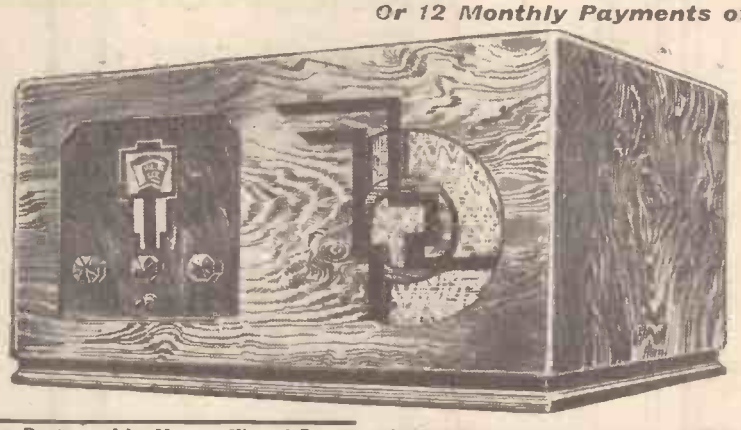

- Contains parts only as chosen and first specified by Messrs. Wren and Easton.
- Officially approved, therefore, by Authorities you can trust implicitly.
- Complete down to the last screw and piece of wire.
- The ONLY Kit of Parts officially approved by Messrs. R.I., and therefore guarantees strict adherence to Messrs. Wren and Easton's first specified components and enables their published set to be duplicated in every way.
- All panels and terminal strips accurately drilled to specification.

WREN-EASTON THREE STRUCTAKIT

Comprising PETO-SCOTT Walnut-faced Ply Panel READY-DRILLED and PETO-SCOTT METAPLEX baseboard 14in. x 10in. as specified by the Designers.

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1. Peto-Scott Walnut Faced Ply Panel READY DRILLED		2	0
1. " " Metaplex Baseboard 14 x 10		1	9
1. R.I. Micrion Coil		12	6
1. R.I. D.Y. 20 Hypermite Transformer		12	6
1. R. I. D.Y.41 "Drivermu" Class B. Transformer Including Royalties		12	6
1. R.I. F.Y. 2 Quad Astatic Choke		3	6
1. R.I. .0003 Varicap		2	6
1. Ormond .0005 Var. Condenser No. 4, R.423		4	0
1. " Dial R.365		2	6
1. " .0003 Diff. Condenser R.190		3	0
1. British Radiogram Push Pull S.P. Switch No.49		1	0
1. " " " " D.P. " No. 50/1		1	6
1. Dubilier .0001 Grid Condenser & Clips type 620		1	3
2. " .01 Mfd. Condenser type 620		6	0
2. " 2 Mfd. Type B.B.		7	0
2. " 2 Meg. 1 Watt Resistances		2	0
1. " 100,000 Ohms 1 Watt Resistance		1	0
1. " 30,000 " 1 " "		1	0
1. " 10,000 " 1 " "		1	0
1. " 1,000 " 1 " "		1	0
1. W.B. 7-pin Valve Holder		1	6
2. " 4-pin "		1	0
2. B/Lee Terminal Blocks		1	0
4. " Terminals, A.E. P.U. and P.U. Type B		1	0
1. British Radiogram Fuse Lamp & Holder			6
2. L.T. Spade Terminals			4
5. Wander Plugs			10
Peto-Scott Connecting Wire, 12 yards, Rubber covered Flex Screws & 5 Cable Clips		4	6
KIT "A" Cash or C.O.D.	£4	10	0
Specified Valves 1. Masda L.2.		7	0
" " 1. " H.L.2.		7	0
" " 1. " P.D.220		14	0
	£1	8	0
Peto-Scott Walnut Cabinet, Special Wren-Easton Consolette Model		19	6
Ormond Specified Speaker M/C type	£1	5	0

COMPLETE KIT PRICES

KIT "A" For the WREN-EASTON 3-Valve Set including all components with Ready Drilled Panel, METAPLEX Baseboard — Less Valves and Cabinet Cash or C.O.D. Carriage Paid **£4.10.0** or 12 monthly payments of 8s. 3d.

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KIT "C" As Kit "A" but with 3 Specified Valves and Peto-Scott Walnut Cabinet .. **£6.17.6** or 12 monthly payments of 12/6.

If Specified Speaker required add 25/- to Cash price or 2/3 to deposit and each monthly payment.

IMPORTANT Miscellaneous Components. *Parts, Kits, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our own system of Easy Payments on orders over £2. 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. OVERSEAS CUSTOMERS CAN SEND TO US WITH CONFIDENCE. We carry a special export staff and save all delay. We pay half carriage —packed free. Send full value plus sufficient for half carriage. Any surplus refunded immediately.* **Hire Purchase Terms are NOT available to Irish or Overseas customers.**

See our Announcement on page 867.

—MR. DEALER—PLEASE NOTE—

PILOT AUTHOR KITS for the WREN-EASTON THREE are being supplied to the trade solely through Messrs. The British Radio Gramophone Co. Ltd., Pilot House, Church Street, Stoke Newington, London, N.16 (Telephone Clissold 6287-6288), to whom all TRADE ORDERS and communications should be addressed.

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THE R.I. WREN-EASTON RECEIVER

(*Continued from page 878*)

a reasonably-priced receiver employing a moving-coil loud-speaker. The piano was very noticeable for its realistic tone—not tinny or muffled, but clean-cut and having the character "string" tone which is usually so difficult to obtain in its correct balance.

The current consumption was measured, and the average current over one hour's use was only 4 milliamps., thus providing very economical running.

The price of the complete kit, exclusive of valves and cabinet, is £4 7s. 6d., and complete with valves, cabinet and loud-speaker, £8. We have, of course, had a number of kit receivers and completely-built receivers pass through our hands, but we think that we can justly state that this latest kit will mark a new era in home-assembled commercial receivers, not only on account of its price, but because of the efficiency which has been incorporated in such a modest circuit arrangement. We were, in fact, so impressed by its performance that we arranged for an independent listener to take the set for test to his own locality, one which was known to be only of average efficiency, and which was situated ten miles from the London station. His test report is given below :—

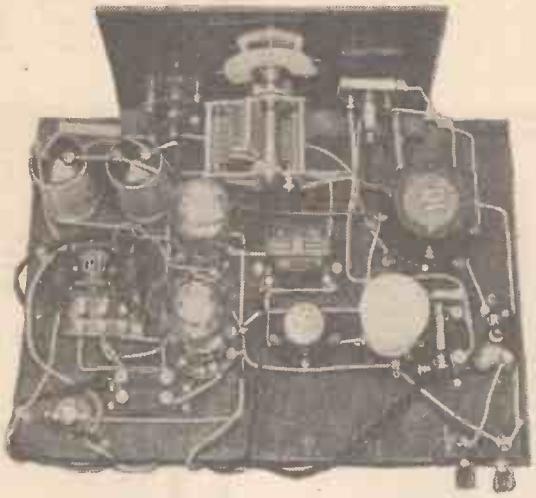


Fig. 3.—The receiver portion of the R.I. receiver, showing the single Micrion coil on the right. The simple wiring may be appreciated from this illustration.

Test of R.I. Receiver

"I took away the assembled R.I. receiver and subjected it to a thorough test in my house, which, whilst not being particularly good for reception, is nevertheless productive at times of very good results. This new R.I. receiver certainly surprised me. It was not only possible to separate the London stations, but I was successful in receiving three intermediate stations, Poste-Parisien being heard quite free from interference for the first time in my house on a detector circuit alone. Above the London Regional, the Midland provided the next comfortable signal, and Athlone was easily separated from this station. Rome was quite a good signal, and the North Regional was received at about the same strength as the Midland, the reaction control being found ideal to handle owing to the ingenious slow-motion knob which is fitted to this condenser. I had experienced the advantages of this particular Ormond condenser on a previous occasion. On the long waves there was no difficulty whatsoever in receiving five stations at good strength, Hilversum, Radio-Paris, Daventry, Eiffel Tower, and Königs Wusterhausen all providing comfortable signals during the evening of the test. I was particularly impressed by the quality and purity of reproduction, which, on the two locals, was almost too loud for the room.

A STATION LOG FOR THE NEW WAVELENGTHS

By W. MUIRHEAD

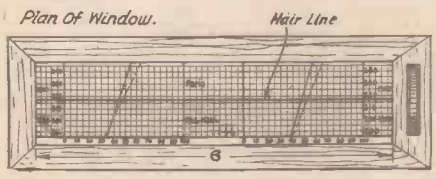
THE station log herein described has been designed to give the minimum of trouble in locating the new stations, on a set having two tuning dials.

The construction is a fairly simple matter. On a piece of squared paper 6in. by 7½in. draw vertical lines parallel to the left hand side and ½in., 2½in., 3½in. and 5½in. from it, as shown in Fig. 1. Before the change over, graphs showing dial readings against wavelengths of present stations should be drawn, as previously described in PRACTICAL WIRELESS, using a 2in. strip for each dial, and drawing the medium wave curves in black ink, and the long wave curves in red ink. On each side of the paper mark the wavelength scales used.

After the new wavelengths are definitely known, print in the centre, and opposite their correct wavelengths, the names of the principal medium-wave stations in black ink, and the long-wave stations in red ink.

The construction of the case, which is made of 3-16in. wood, should present no difficulty if the illustrations, Fig. 2, are followed.

Cut a paxolin or cardboard tube 2½in. diameter and 6½in. long and paste the squared paper round this. Mount this drum, as shown, on a ⅛in. dowel rod with an ⅛in. by 3½in. diameter thumb drive glued at the side, and make sure that when assembled it can revolve freely. The "window" is a piece of glass, or mica, with a hair line consisting of a piece of thin black thread, or a thin Indian ink line on the underside. An important point to watch is that this line is exactly parallel with the horizontal lines of the squared paper. At the bottom of the window the base scales of the graphs (dial readings) are marked in their correct positions.



The chart seen through the aperture.

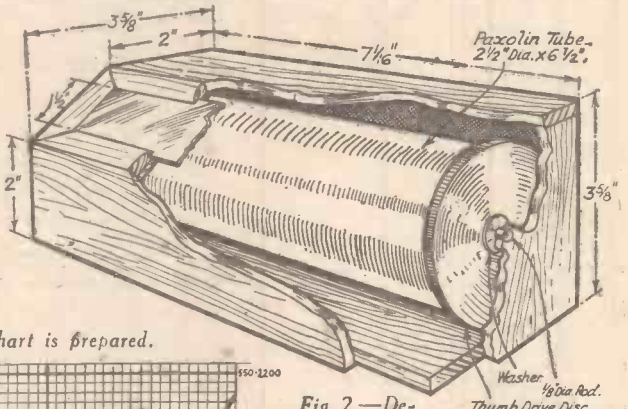
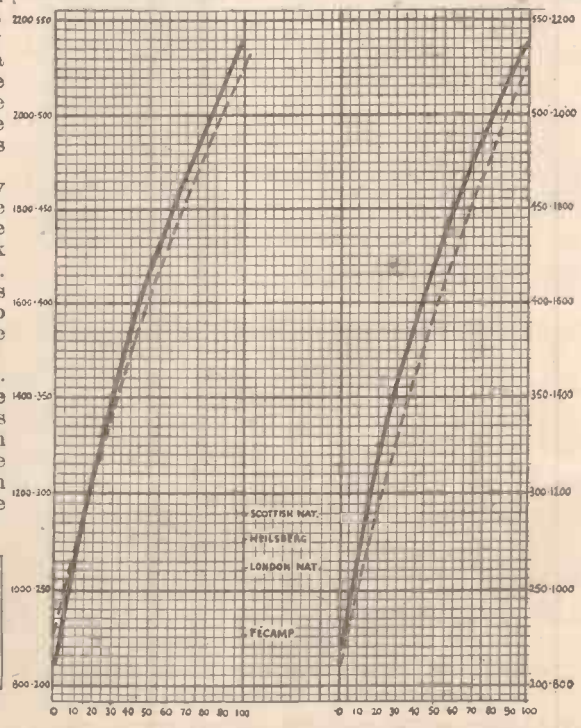
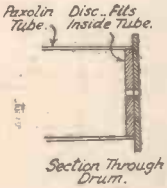


Fig. 2.—Details of the case.

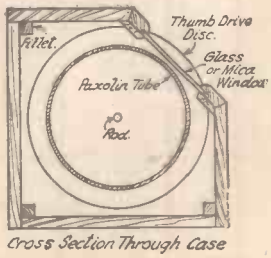


(Below) Fig. 1.—How the chart is prepared.

To find the name or wavelength of a station turn the drum by means of the thumb drive till the hair line cuts the curves at the dial readings, or *vice versa*.



Additional details of the drum and containing case.



Cross Section Through Case

The following Dubilier Condensers and Resistances are chosen for the "Wren-Easton" Class B Receiver.

One Type 620 with clips .0001 mfd. 1/3.

Two Type 620 .01 mfd. 3/- each.

Two Type 9200 2 mfd. 3/6 each.

Two Dubilier Metallized Resistances, 1 watt 2 meg, 1/- each.

One Dubilier Metallized Resistance, 1 watt 30,000 ohms, 1/- each

One Dubilier Metallized Resistance, 1 watt 10,000 ohms, 1/- each

One Dubilier Metallized Resistance, 1 watt 1,000 ohms, 1/- each

DUBILIER CONDENSERS & RESISTANCES chosen for the "Wren-Easton Class B Receiver" for dependability

Dubilier Condensers and Resistances and R.I. Coils are the foundation upon which the circuit of the "Wren-Easton" is constructed. The inevitable result is a receiver outstanding in every particular. Extensive tests prove its performance and reliability.

DUBILIER
CONDENSERS & RESISTANCES

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA RD., N. ACTON, LONDON, W.3

The wonderful

WREN-EASTON Micronised "CLASS B" RECEIVER

NONE BUT

ORMOND COULD GIVE SUCH SATISFACTION

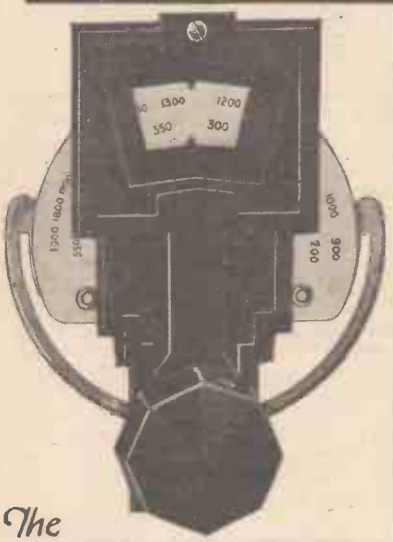
incorporates these unrivalled

ENGINEERING "ORMOND" COMPANY LTD.

(Brit. Regd. Trade Mark)

PRODUCTS

Was ever a more striking tribute paid to any radio components? With an incomparable reputation to maintain, the R.I. designers considered Ormond Products to be the ones worthy of a place in their new wonder instrument. Their specification is gratifying to us. It will be even more gratifying to *you*, for not only will you obtain, in Ormond Products, the performance commended by R.I., you will also obtain that unsurpassed Value for which Ormond components were ever notable.



The ORMOND *New Disc* DRIVE

This new dial is being used for the first time in Wren-Easton Receiver. It is fitted with a moulded escutcheon plate which covers the surface of the panel to the driving knob and includes the usual window. Slow-motion movement ratio approx. 9 to 1 is incorporated. The new wavelength scale ensures the greatest of ease in tuning.
Cat. No. R/365 W.E. Price **2/6**

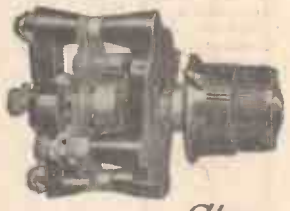
The ORMOND *Permanent Magnet* MOVING COIL CHASSIS

A perfectly-balanced frequency response ensures sustained brilliance of tone. Fitted with a pressed-steel chassis and large permanent magnet to give reliability with long life. Supplied with specially-designed output transformer for Class B.
Cat. No. R/494 C.T. Price **26/-**

The ORMOND No 6 CONDENSER

This condenser is constructed of aluminium and is very robust, the whole being a precision instrument designed to follow the logarithmic law.

The vanes are perfectly rigid, and firmly secured to slotted spindles. The special mounting of the fixed vane support reduces dielectric losses to a minimum. The moving vanes are connected to the frame, thus eliminating stray capacity effects.
Cat. No. R/483. Capacity .0005. Price **4/-**



The ORMOND *Slow Motion* DIFFERENTIAL CONDENSER

Insulation is provided between fixed and moving vanes, obviating all danger of short circuiting.

Slow-motion movement ratio approx. 9 to 1 is incorporated in the condenser, and controlled by the upper knob, direct drive being obtained on the lower knob.

Cat. No. R/190. Capacity .0003. Price **3/-**

THE ORMOND ENGINEERING CO., LTD.,
ORMOND HOUSE, ROSEBERY AVENUE, LONDON, E.C.1.
Telephone: CLERKENWELL 5334-5-6 & 9344-5-6. Telegrams: ORMONDENGI, ISLING.

IN PRICE & EFFICIENCY!

REVIEWS OF THE LATEST RECORDS

By **T. Onearm**

OLD time waltzes are always appreciated by a large number of music lovers, and *Waltz Memories, Sterno* 1322, will have a strong appeal. This record introduces a number of well-remembered tunes in "Till we meet again—There's a long, long trail—When I lost you—If you were the only girl in the world—I'm for ever blowing bubbles—Someday I'll make you love me—and Three o'clock in the morning," all of which are played by the Casani Club Band, directed by Charlie Kunz, the vocal refrains being sung by Eve Beck and Harry Bently. Charlie Kunz makes another fascinating record in *Come up and see me sometime* and *Edie was a Lady, Sterno* 1323, both tunes being from the new film, "Take a Chance." A very bright and cheery selection of dance tunes is given by Sydney Lipton and his Band, all of them up-to-the-minute favourites. They are *This is Romance* and *I've got you on my Mind* (this being from the musical comedy "Gay Divorce," which is now running in London), *Sterno* 1234; *You'll Never Understand* and *Sweet Georgia, Sterno* 1325; and *The Aunt Sally Selection*—Parts 1 and 2 on *Sterno* 1326.

The Romany Band has a way with melodies that is unique, and in their latest double-sided record, *Lou'siana Lullaby* and *My Song Goes Round the World, Sterno* 1237, they show their artistry in a very marked degree. This is a really fine record.

Light Music

Emperor Waltz and *Der Fledermaus Waltz, Sterno* 1238, are two Strauss waltzes that are sure to be favourites, both having the old world lilt about them that has made this composer's dances world famous.

Minuet in B Flat and *Die Werber*, played by Mantovani and his Tipica Orchestra, *Sterno* 1239 is a fine piece of recording. In this record Mantovani makes a delightful rendering of the exquisite minuet from the B Flat Symphony which is one of Haydn's most alluring compositions. The waltz on the reverse side is a real gem, all too seldom heard.

Serenade and *Souvenir, Sterno* 1330, played by Pierre Fol and his Quintette of Strings, is a fine record that will appeal to many. For real melody could any record contain more than this, two of the ever famous excerpts of Drdla? We all know these tunes, and still have a real regard for their beauty; Pierre Fol gives a rendition of each.

Accordion Bands have a way of attracting even the most modern of highbrows, and *There's a Home in Wyomin'* and *Sunny, Sterno* 1331, are a couple of fox-trots which should be in every collection.

Vocal Records

George Hocking, who has made a number of fine records for the British Homophone Company, gives us yet again two fine ballads in *A Father's Early Love* and *Love Thee Dearest, Sterno* 1332. Although they were composed very many years ago these two beautiful melodies have very few rivals to-day.

The "Hill-billy" song is something new in the world of music. Tex Richardson gives us four Hill-billy songs in *Home on the Range* and *Prairie Lullaby, Sterno* 1333, and *The Prisoner's Song* and *Lullaby Lady, Sterno* 1334. All the songs have a tale to tell replete with a catchy rhyme and melody. The songs mentioned above are very good examples of this kind of artistry.

Long-playing Records

The concert arrangement of the dance numbers recorded by Mantovani will have an appeal for all who like real music, and the Military Band selections will need to have no introductions except that they introduce the principal tunes of the operas. *Gipsy Fiddles* and *Heartless, Sterno* 5012, played by Mantovani and his Tipica Orchestra, and *Maritana* and *Martha, Sterno* 1503, played by the Sterno Military Band, are two special long-playing records (playing time equals two ten-inch records) which will be appreciated by many.

More Up-to-the-Minute Dance Tunes

All the latest dance tunes are obtainable on the new Homochord releases for this month. Archie Merser's Band introduce four popular tunes in *When He Tries to Kiss Her by the Duck Pond* and *Sweet Georgia, Homochord HR*48, and *An Old Old Man with an Old Old Pipe* and *Just Making Conversation, Homochord HR*49. *You Ought to See Sally on Sunday* and *Everybody Loves my Marguerite, Homochord RH*50, played by Dick Rose and his Band; *The Winds in the West* and *We'll all go Riding on a Rainbow, Homochord HR*51, played by Alec Newman's Band; *No Funny Business* and *Symphony of the Breeze, Homochord HR*52, played by Al Gold and his Band, are a few of the latest popular numbers.

Et cetera

I always thought the Americans doffed their hats when sponsored radio programmes were mentioned. Not so Eddie Pola. He guys mercilessly the "advertisers" who have hired stars of the first magnitude to put across a great concert. The company with Mr. Pola imitate with excellent effect such artists as—perhaps it's better to leave you to find out! A very funny and clever record—*Columbia DX*499 and the title, *America Calling*.

Paris sends us a good one in Josephine Baker's *Si J'Etais Blanche* and *Madiana* (*Columbia DB*1175). They are sung in French, and both have good tunes—French and Spanish.

Read about the 1934 Fury Four Super On page 850

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).

Excellent Value

SIR,—I duly received my pocket tool kit and must say I am agreeably surprised at the excellent value of the gift. It is fully in keeping with the high standard of your paper. My only regret is that I did not commence reading this journal when it was first published, as I seem to have missed some of the "good things" you have offered to your readers.—ALEX GILES (Glasgow).

A Liverpool Reader's Appreciation

SIR,—I have just received my copy of the "Encyclopædia of Popular Mechanics," for which I thank you. After looking through it I think it is just the sort of book which any handy man wants. It is *the* companion volume to the "Encyclopædia for Wireless Constructors" which I am also pleased to possess. I would like to express my appreciation of PRACTICAL WIRELESS. I have found it of great help. —ALBERT W. LOONEY (Liverpool).

S.W. Superhet Wanted

SIR,—I have been a reader of your paper since its birth in 1932. Being in the Service I am keenly interested in S.W. reception and desire to take abroad a really good S.W. superhet to get the Empire station. A letter from Gordon Harrower, F.R.C.S., of Singapore, in the December 30th issue, prompted me to write to you. Your short-wave section, in fact that of all the wireless journals in England, deals with the obsolete and inefficient type of circuit, viz., Det. and 2 L.F. We passed this nearly ten years ago, and why it is still retained for S.W. work is a problem. Please let us have a good battery (2 volts) superhet. It is more universal to conditions abroad. I suggest a 6-valve 2 volt superhet, range 12-50 metres solely.

Valves: 1 H.F. pentode signal frequency; 1 Heptode or triode det. oscillator. 2 S.G. or H.F. pentode, int. frequency; 1 2nd det. double diode triode and A.V.C.; 1 output, 1 watt pentode or driver and Class B.

Coils: Iron coil S.W. and I.F. coils.

Chassis: Celluloid, aluminium, sealed box type.

Expensive? Yes, but it's quite impossible to get any results at less costs. I might mention that it is impossible to buy or hear demonstrated in England a good S.W. set, and I am seriously thinking of ordering one made by Americans, who seem to be the only people abreast of the times in S.W. work.—"LEON" (Meopham).

A Shrewsbury Reader's Thanks

SIR,—Many thanks for the Pocket Tool Kit which I have received safely. It is a splendid gift, and will be very useful to me. Also I must thank you for the "Encyclopædia of Popular Mechanics"; it is a splendid volume, and a good companion to the "Wireless Constructors' Encyclopædia." I also look forward every week to PRACTICAL WIRELESS and have had every copy for the last twelve months.—F. C. SMITH (Shrewsbury).

From a Reader in Ceylon

SIR,—May I suggest that details of a really efficient long range short-wave receiver would interest readers living in the Colonies, for we, in the East at least, have to rely on the band up to 600 metres for most satisfactory programmes and, of course, nearly all use batteries. I think a set using S.G. Det. and two other stages would be popular, as the three valve sets do not seem to have enough punch for the loud-speaker. I have not come across the Class B out here yet. Components should be capable of withstanding damp, as our rainfall is mostly between 120 to 250 inches annually, and you can imagine the difficulty in keeping "oneself" and furniture, etc., reasonably dry and in good condition.—J. STANHOPE LOVELL (Norwood, Ceylon).

CUT THIS OUT EACH WEEK.

Do you know

—THAT the self-capacity of the wiring of a short-wave receiver is of much more importance than on a normal broadcast receiver.
—THAT resistance-capacity H.F. amplifiers are very efficient on the higher wave-lengths.
—THAT for short-wave receivers operated from mains the removal of hum becomes a very important matter.
—THAT for all volume control purposes the use of a tapered, or graduated, control is recommended.
—THAT the same frequency range is not required in an amplifier designed for gramophone record reproduction as is required in a broadcast amplifier.
—THAT the fitting of bunches of radial wires to an aerial does not necessarily improve its efficiency.
—THAT very compact tone compensators are now obtainable for use with gramophone pick-ups.
—THAT the maximum output of a receiver is required only for the loudest item and the general response level must therefore be kept down to permit of this.

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.

THE COSSOR WIRELESS BOOK

AN entirely new edition of this handy little book has just been issued by A. C. Cossor, Ltd. Its pages are packed with useful information concerning many new types of Cossor valves, and various phases of the latest radio technique. The book, besides assisting in the selection of the correct types of Cossor valves for a particular receiver, also helps to solve many little radio problems that frequently arise in radio reception.

Among the subjects dealt with are Resistances, Chokes and Condensers; Inter-Valve Coupling; Method of H.F. Coupling: Class B Amplification; and the Super-het—and How it Works. A useful table of Resistance Values for Decoupling and Voltage Dropping, and lists of European Broadcasting Stations and the Chief S.W. Stations of the World are also included, together with a miniature Broadcasting Map of Europe. At the end of the book seven pages are devoted to definitions of various radio terms. Readers are advised to write for a copy of this invaluable little book to A. C. Cossor, Ltd., Publicity Dept., Highbury Grove, London, N.5.

"LESDIX" VIBRANT MICROPHONES

A VARIED range of microphones for home recording, band repeating, and public address work is given in a folder issued by Electradix Radios. Every type of "mike," from pocket voice amplifiers to stand instruments, is listed. Also included in the folder is a range of microphone transformers, telephones, and microphone parts. Copies of the folder can be obtained from 218, Upper Thames Street, London, E.C.4, by enclosing a stamp for postage.

COLVERN FERROCART COMPONENTS

USERS of Colvern Ferrocart coils will find much useful information concerning the terminal connections of these coils in a booklet published by Colvern, Ltd., Mawncys Road, Romford, Essex. Coils for aerial coupling, intervalve coupling, oscillator coils, and Ferrocart intermediate frequency transformers are dealt with, and a number of circuit diagrams are included. The coils described include the self-contained type with terminals and switch, and the new type of ganged coil assemblies. Any reader interested can obtain a copy of the booklet from the address given above.

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.

GOLDERS GREEN AND HENDON RADIO SCIENTIFIC SOCIETY

Recently a most absorbing lecture was given entitled "The Truth about Wireless," by Mr. D. N. Corfield. Each part of a wireless receiving circuit and its components was dealt with in turn, starting from the aerial and ending with the loud-speaker.

The following interesting and most useful points were made. The lecturer deplored the fact that whereas the B.B.C. take the greatest care to transmit frequencies up to 10,000 cycles, some commercial receivers are designed to cut off all of the frequencies above about 3,000 cycles, irrespective of the desires of its owner. Characteristic curves of various receivers were shown which were most illuminating. A demonstration of music followed, with and without the above mentioned cut off. Where space was immaterial the best tuning coil was an air-cored coil. The various forms of detection were then dealt with, and afterwards demonstrations of each were given under suitable conditions.—H. Ashley Scarlett, 60, Pattison Road, N.W.2.

SLADE RADIO (Affiliated to the R.S.G.B.)

Readers are cordially invited to attend a meeting of this society on any Thursday at 8.15 p.m., prompt. Head-quarters: Parochial Hall, Broomfield Road, Slade Road, Erdington. The programme for the current quarter is as follows:—

Jan. 18th—The technical aspect of ultra violet rays. Special demonstration by Mr. L. G. Coade.
Jan. 25th—"Junk Sale."
Feb. 1st—Lecture. Radio Gramophone Development Co. Ltd.
Feb. 8th—Lecture. Marconiphone Co. Ltd.
Feb. 15th—"Short Wave Gear." Eddystone.

At a meeting of this Society held recently a lecture on "A.V.C." was given by Mr. G. F. Clarke. After stating that it was a question of control of amplification he went on to give details of the various systems which had been tried, including mechanical means. It was explained that it was not volume but carrier strength that is required constant, and that the variable-mu valve had solved most of the difficulties. Details were given of the diode, double diode, double diode triode, and delayed A.V.C. was explained. Demonstrations were given, using a straight set and also a superhet, in both of which different systems of obtaining A.V.C. were used. Several methods of adding A.V.C. to existing sets were explained and also details of the double-diode-pentode. The lecture proved very interesting, and at the conclusion a considerable number of questions were dealt with. —Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE CROYDON RADIO SOCIETY

Quality at all costs was demonstrated for the New Year's first meeting on Tuesday, January 2nd. The occasion was a demonstration of his home-made 10-watt amplifier and five loud-speakers, by Mr. H. K. Robin, and to carry out this demonstration the more easily, a motor-coach transported members of the society to his house at 38, Tooting Bec Gardens, S.W.16. He was supported by Mr. Bywaters, member in charge of transport arrangements. A novel loop aerial outside the house gave ample selectivity and, what was more, completely removed heterodyne whistle. He had designed the receiver for a level frequency response from 25 to 10,000 cycles. Following two H.F. pentodes came a Westector metal rectifier coupled to two L.F. valves in push-pull, and Mr. Robin made mention here of a unique bass corrector for records. An A.F.7C. transformer coupled the first L.F. stage to the output, two Micromesh valves in push-pull, and consuming 60 milliamps each. There were four specially chosen moving-coil speakers, and in conjunction with them an electrostatic speaker was used which was most effective. Finally, Mr. Robin demonstrated his apparatus on radio and frequency records. PRACTICAL WIRELESS readers are urged to apply for the new fixture card, containing programmes until end of session.—Hon. Secretary, E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

REPLIES TO BROADCAST QUERIES.

R. NORTON (Topsham): (1) W6GLQ, George S. Osborne, R.1, Box 84, Sebastopol (Cal.); (3) W2BAT, Robert Bode, 54/57, Nurge Street, Maspeth, Long Island (N.Y.); (4) W1BI, Willard H. Northrop, 71, East Brown Street, Westhaven (Conn.); (5) W1GW, R. F. Quail, 8, Pine Street, Boston (Mass.); (6) CT1GV, Abilo J. Salgado, 18b, Rua Mont'Arroios, Coimbra, Portugal; (8) G5XZ, F. Percy Hillier, 8, Denehurst Gardens, Hendon, N.W.4; (11) W3AXP, Roland L. Hudson, State Hwy., Laurel, Delaware, U.S.A.; (12) IRT, Rome-Torrenova (Italy), advertised on 45.72 m.; (13) HBC, Berne (Switzerland), 26.8 m.; (14) FXM, Beyrouth (Levant), 43 m.; (15) WIW, Sayville (N.Y.) advertised as 27.75 m.; (16) EAM, Aranjuez, Madrid (Spain), 30.7 m.; (17) LCJ, Jeløy (Norway), 30.06 m.; (18) FPE, Taiohae (Nuka-Hiva), advertised as 40 m.; (19) CVS, Herastrau (Romania). UN7UU, Jugo-Slavian amateur; address not published. Write: Stephen Liebermann, 9, Meduluceva, Zagreb, Jugo-Slavia. For details regarding Spanish amateur, *i.e.*, EAR307, write to: Asociaçion E.A.R., Apartado de Telegrafos, Santander, Spain. ALEXANDER PAUL (Stevenston): WCAU, Philadelphia (Pa.), 256.3 m. M. U. D. (Tottenham): (1) CT1IP, Adriano de Mesquita P. de Magalhaes, 11, Rua Nova de Santa Cruz, Braga, Portugal; (2) F8DW, Pierre Gibert, Poulaines (Indre), France; (4) G2VR, H.B. Old, "The Shack," Spring Lane, Lambley, Nottingham, Notts.; (5) F8AB (C?) Leon Deloy, 55, Boulevard du Mont-Boron, Nice, France; (8) CT1JV, Jose d'Almeida Brottas Cardoso, 37, Avenida Casal, Ribeiro, Lisbon, Portugal. For details regarding EAR270, EAR262 and EAR347 write: Asociaçion E.A.R., Apartado de Telegrafos, Santander, Spain. SEARCHER (Glasgow): (1) PRBA, Rio de Janeiro (Brazil), 36.65 m. Broadcasts are sponsored by the Radio Club of Brazil; (2) regret, but details are too vague to trace; (3) we can trace the following call-signs: G5CU, J. A. Cuthbertson, "Dunromyn," Cross Lane, Burniston Road, Scarborough, Yorks; G2AO, O. H. Relly, "Gavinwood," Willingdon Road, Eastbourne; G6KV, A. R. Dellbridge, "Normanhurst," High Road, Laindon Hills, Essex; G5QP, J. V. Parsons, 24, Upper Holland Road, Sutton Coldfield, Birmingham; G6XD, J. J. G. Taylor, "Willowby," Radford Road, Plymstock, Devon; G6XM, W. James, 31, Grant Square, North Camp, Aldershot, Hampshire; G5YV, H. Beaumont, 58, Soothill Terrace, Crackenedge, Dewsbury, Yorks; G2LZ, F. A. Meyer, "Stilemans," Wickford, Essex; G5AW, A. E. Wood, 247, Leigham Court Road, London, S.W.16; G5PH, B. V. Phillips, 144a, Cwm Road, Bonymaen, Swansea; G6CW, H. W. Stacey, 42a, Hamstead Road, Fairfield, Liverpool; G6SV, M. Savage, "Noss Mayo," Pheasants Way, Rickmansworth, Herts; F8WC, Pierre Blanchon, La Rochette par Fourneaux (Creuse), France; F8VW, Gabriel Vernet, Rinxent (Pas de Calais), France; F8EB, Georges Bedu, 43, Rue Jean Jaurés, St. Quentin (Aisne), Vrance; LA3Y, Leif Hellevik, K. Wilhelmsgaten 30, Aalesund, Norway; OX4NU, call-sign apparently wrong; regret, cannot trace; N.Z.D.X.C. (Cleveleys): G5YY, W. A. Mead, "Addiscombe," Branston Road, Burton-on-Trent, Staffs.

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.

COMPACT TELEVISION RECEIVER

"I have become very interested in television, but I have noticed from all the published instructions that the disc has to be about twenty inches in diameter. This rules television out from my home as I could not be pestered with such a massive piece of apparatus in addition to my receiver. Surely it should be possible to make the apparatus much more compact than this? Is there no way of making the disc smaller without sacrificing results?"—B. R. A. (Weymouth).

The brilliancy of the received picture depends (in the disc type of receiver) upon the size of the hole, and obviously if you make the holes in the disc too small there will be less light passed, resulting in a dim picture. The size of the hole depends on the size of the disc, and therefore the twenty-inch disc has been decided upon as that which gives the best illumination consistent with clarity, as a large hole results in the picture being broken up into squares and also introduces other defects. Thus, whilst it is possible to use a disc as small as 6in. in diameter, the holes would be so small that the picture would require very great optical magnification, which would be expensive and difficult to attain without distortion. The final result would also lack brilliancy. The mirror-drum does, of course, result in a more compact receiver, but there have been several suggestions for building a disc type of apparatus in a small compass. So far, however, the only compact apparatus which we are able to offer to our readers is the "Portovisor" which was described in a previous issue, and this is certainly small enough to take its place in the home without being obtrusive.

TELEVISION SYSTEMS

"I am very interested in the modern television problem and have been reading your various articles on this subject. Before I spend any money on apparatus I should like you to clear up a doubt which exists in my mind regarding the use of a disc for receiving transmissions which are carried out with a mirror. It seems to me that this cannot be productive of good results, and I should like you to confirm that a disc apparatus will not be a waste of money."—K. R. G. (Huddersfield).

It is quite true that there is a difference in the two methods you refer to, but the results are exactly the same in principle. That is to say, no matter whether a disc or a drum is used (for transmitting or receiving) thirty lines of light are produced having a certain area. The difference which does exist, however, is in the actual shape of the light area so produced, that from the mirror-drum being a straight-sided figure, and that from the disc having curved sides. When a close-up is being transmitted the principal detail is in the centre of the picture and thus any distortion is unnoticeable. In extended scenes the movement of the object, and its smallness will prevent any really noticeable distortion at the edges from being seen, and, therefore, you need have no doubts regarding the employment of a disc for receiving mirror-drum transmissions.

CLASS B AND COMMERCIAL SET

"I have a commercial set, and last week connected up a Class B unit, with moving-coil speaker to it. I also purchased one of the latest type eliminators for Class B giving an output of 25 milliamps. The set when connected up worked all right for a day and suddenly stopped. I have tested the set without Class B and it works. Do you think I have damaged the eliminator in any way?"—NO NAME (Cardiff).

DATA SHEET No. 70.

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

CLASS B VALVE CHARACTERISTICS

Type	Filament Amps. (2-volt)	Grid Bias	Anode-to-Anode Load	Quiescent Anode Current (mA.)	Max. Undist. Output Watts	Price
Cossor 220B	0.2	Zero	12,000	2.5	1.2	14/-
Cossor 240B	0.4	Zero	8,000	3.0	2.0	14/-
Ferranti HP2	0.4	Zero	8,000	3.0	2.0	14/-
Hivac B220	0.2	Zero	14,500	2.5	1.25	10/6
Marconi B21	0.2	—4½	12,000	1.65	0.9	14/-
and Osram		—4½	8,000	1.65	1.4	14/-
Mazda PD220	0.2	Zero	17,000	2.0	1.0	14/-
		Zero	11,500	2.0	1.4	14/-
Mullard PM2B	0.2	Zero	14,000	3.0	1.25	14/-
Triotron E2205	0.3	Zero	18,000	2.5	1.35	10/6

We suggest that you try the combination of the receiver and the Class B Unit with a battery supply in order to ascertain which of the units (the mains unit or the Class B unit) is at fault. If the eliminator proves faulty we would advise you to send it to the makers for examination, and if the Class B unit is at fault you should carefully examine the valveholder contacts and also the adaptor plug contacts. If these all seem to be satisfactory, you should have the unit seen to by the makers.

AERIAL EFFICIENCY

"I have heard a lot of talk about the necessity of having a good aerial and must protest that the statements which you have made from time to time are not correct. You say the earth lead should be as short as possible and the lead-in should also be kept away from walls, etc. In my case the lead-in comes in at the drawing-room window, is tacked to the picture rail right round the room, passes through the door and crosses one wall of the next room before being joined to the set. The earth lead runs in the same manner to the drawing-room window and then passes along a 15ft. passage way before being buried in the ground. On my two-valver I can get dozens of stations with ease. What can you say to that?"—T. G. (Surbiton).

The reply to your query is that you are using a fairly efficient circuit and are situated in an ideal position for reception. There is also the possibility that your lead which passes through two rooms is acting alone as an aerial, the connection between it and the aerial proper being in the form of a very high-resistance joint. As a matter of interest, we would recommend that you take the receiver into the drawing-room and connect it direct to the lead-in, and try also to connect a short earth lead to the set. We guarantee that you will find results even better than those which you now get. It must, of course, be appreciated, that individual conditions vary a lot, and the statements which are made in any technical paper are generalities which in many cases may be suitably modified to suit a particular individual condition. Such modifications should not, however, be made unless the full consequences of the modifications are appreciated.

A FAULTY RECEIVER

"I have assembled a two-valve set which receives the local station at good strength, but I cannot get any other station, even on a good pair of 'phones. When I move the variable condenser (which is a .0005 mfd.) I can get the apparatus to oscillate on several positions without trouble, and sometimes perhaps I may hear a distorted voice or music. When the set is oscillating on the various settings I find that hand-capacity is very noticeable, and there is a continuous loud whine in the 'phones. I enclose the diagram and should also like to know what alterations would be necessary to use the receiver on 200 and lower wavelengths."—SPARK-GAP (Ireland).

The circuit which you have enclosed is incomplete, as you show no variable condenser in any position. We presume that this is included across the aerial coil, in which position it would be quite in order. Although you do not indicate it, we presume reaction is controlled by the position of the anode coil, and it may possibly be that you have coupled this in a permanent position. To control reaction of this nature either the coil should be mounted so that it may be moved, or it should be fitted close to the aerial coil, and a variable condenser joined between one end of it and earth. It would be preferable to disconnect the end which is at present joined to the L.F. transformer, and to join that end to the variable condenser (.0003 mfd.), and to connect an H.F. choke between the anode of the detector valve and the now vacant transformer terminal. The grid leak should also be fitted so that it is joined between the grid of the detector valve and the L.T. positive lead, not, as you have it, between grid and L.T. negative. We think these alterations will enable you to get the set to work, and for the lower wavelength it is only necessary to use a smaller coil in the aerial circuit. A No. 35 will prove most suitable for the range you mention.

FREE ADVICE BUREAU

COUPON

This coupon is available until January 27th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 20/1/34.

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).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnificatlon Screen-grid, low magnification Screen-grid, Variable-Mu Screen-Grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5/6 each. Indirectly-heated Pentode. 12 watt output Triode (P.X.4 Type). 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6.

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 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps, 27/6; other outputs to order at pro rata prices.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys., 6/-; 150 milliamps. 30 hys., 10/6; 60 milliamps. 80 hys., 2,500 ohms, 5/6.

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

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000, 50,000, 25,000 ohms, any value; 3/6.

SPECIAL Offer—Microphones by prominent manufacturers, 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, 0-10, 0-15, 0-50, 0-100, 0-250 m.a., 0-1, 0-5 amps.; all at 6/-.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 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., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6; 4v. 3-5a., 22v. 1a., 8/6; 10v. 3a., 14v. 4a., 10/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., 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/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

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

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt, 10/-.

CENTRALAB Potentiometers, 50,000, 250,000 half meg. and 1 meg., any value, 2/-; 200 and 400 ohms, 1/-.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, 3/- per coil; ditto Iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output 8v. half amp, 14/6; 8v. 1 amp, 17/6; 15v. 1 amp, 19/-; 6v. 2 amp, 27/6; 30v. 1 amp, 37/6.

MAGNAVOX D.C.144, 2,500 ohms, 17/6; D.C.154, 2,500 ohms, 17/6; D.C.152 Magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 18/6.

GRAMPION P.M. Loud Speakers, 9in. cone, handles 4 watts; 18/6.

GRAMPION M.C. Loud Speakers, 2,500 ohm field, 9in. cone, handles 5 watts; 21/-.

ELLIOT First-grade Moving Coil Meters, 0-30, 0-50, 0-100, 0-150 m.a., projecting types, 15/- each; 0-100, 0-150 m.a. flush types, 17/6 each.

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

AMPLION Moving Coil Speakers, type E.M.644, dual fields, 2,500 and 5,000 ohms (100 and 200v.), with output transformer, 12/6; A.C. conversion kit for this speaker, 10/- extra.

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

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.

POLAR 3-gang, totally screened, 0.0005, with complete disc drive, spit end vanes, 5/-; ditto, with trimmers, 8/6; Polar 2-gang, with complete disc drive, padding condenser and trimmer, 0.0005, 6/6.

COLLARO Electric Gramophone Motor, complete with all fittings, turntable and automatic stop, 100-250v. A.C.; 35/-, listed £3.

ORMOND Condensers, 0.0005 2-gang, semi-shielded, 2/6; brass vanes, with trimmers, 3/6.

WIRE Wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms, 2/-; 500,000 ohms, 3/-.

HOME Radio Microphone, complete, 5/-; simply plug in to pick-up terminals.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers, at a fraction of original cost for callers.

WESTERN ELECTRIC Mains Transformers, 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a. C.T., 4v. 1a. C.T., 19/6.

1,000 Ohm 150 m.a. Wire Wound Variable Resistance, 2/-; Burndept 2-watt resistances, all values from 0.5 to 50 ohms, 3d. each; holders, 2d. each.

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

T.C.C. Electrolytic Condensers, 440 volts working, 4 mf. or 8 mf., 3/-; 15 mf. 100v. working, 1/3; 6 mf. or 15 mf., 50v. working, and 50 mf. 12v. working, 1/-.

T.C.C. Block Condensers, 250v. working, 4×4×1×1×0.5, 3/6; 2×2×2×0.1, 2/-; 2×2×2×1, 2/3; 2×2×1×1×1×1×1×0.1×0.1, 3/-; the above three condensers at same price on Dubilier 300v. working.

H.M.V. Block Condensers, 400v. working, 4×4×1×1×0.5, 5/6; 4×4×1×1×1×1×0.1×0.1×0.1×0.1, 6/-; 4×2×1×1×1×0.5, 4/6.

DUBILIER Condensers, 2 mf. 1,200v. working, 4/-; 4×4×2 300v. working, 3/-; 8 mf. dry electrolytic, 450v. working, 3/-; 0.01 mica, 1,000v. working, 1/-.

THE Following Lines 6d. Each, or 5/- per dozen.—Chassis valve holders, screened screen grid leads, any value 1-watt wire and resistances, wire and condensers, 0.0001 to 0.1, R.I. varicaps, oxydised escutcheon plates, trimming condensers.

PLEASE mention PRACTICAL WIRELESS when ordering.

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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.4.Vs, M.V.S.G.s, A.C.S.2/Pens. M.M.4Vs, 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.4.V.s, A.C.S1/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.4.V.B.s, M.S.G./L.A.s, D.S.B.s, A.C.S/2s, D.C.28.G.s, 9/6. U.14s, 10/-. "Class B": P.M.2.B, 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; 215P.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, L210s, 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. Westinghouse rectifiers unused H.T.8, 10/-; H.T.9, H.T.10, 11/3. Dubilier or T.C.C. electrolytic condensers 8 M.F.D., 3/9. Magnavox, D.C. 152 (2,500 ohms) or 6,500 ohms, 9in. cone, 25/-. Carriage Paid. Cash with Order or c.o.d.—Ward, 45, Farringdon St., E.C.1. Holborn 9703.

MAINS and Battery Valves wanted, also clean surplus components.—Newport Surplus Stores, 24a, Newport Court, Charing Cross Road, W.C.2.

CABINETS: Handsome polished Walnut Cabinets, contrast edging, complete with speaker frets, brand new. Sunbeam, 16¾ x 13 x 9¾, 14/3; Philco, 15 x 12½ x 7¼ (undrilled), 10/9; Botolph, 15¼ x 13¾ x 8¾ (undrilled), 12/9. Cash with Order, or C.O.D.—Epton, 93, New Road, London, E.4.

COLVERN Orbit Coils and Varley Unit For Sale. Unused, 28/6. Call:—4 Glenelg Road, Brixton.

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L.E.C. CLASS B BARGAINS. Special. Philco drivers, 3/11. G.M. drivers, 4/11. Output chokes 4/11. V.-holders, 6d.; Conversion kit, 10/6; '362' valve, 9/-; C1.B. P.M.M.C. Speaker, 18/10; Complete unit mounted P.M.M.C. speaker and valve, 35/-.

L.E.C. COIL BARGAINS. Dual Range. Brownie, 1/-; Screened Iron Cored, 4/3; Screened ordinary, 2/6. Ready Radio (list 6/6) short wave, 2/6.

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MAKING YOUR SET SELECTIVE

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SELECTIVITY SIMPLIFIED

A Concise Explanation of What is Meant by Selectivity, with a Description of the Various Methods of Attaining it. The Main Causes of Lack of Selectivity are also Fully Discussed.

THE problem of obtaining adequate selectivity to make possible the easy elimination of one station so that any other can be received free from interference is as old as wireless itself. Despite this, the actual degree of selectivity required of a wireless set has gradually increased as more and more stations have come into operation. The Lucerne Wave-plan has been drawn up with the object of relieving the selectivity problem to a certain extent by allowing for a more uniform separation between stations, and by so adjusting matters that transmitters working on very high power are as widely separated as possible in regard to either their wavelengths or geographical positions. But, in spite of all that has been done, it is more necessary than ever to employ a really selective receiver in order to derive the maximum benefit from broadcasting.

Wireless receivers have approached a point which is well-nigh equivalent to perfection in so far as quality of reproduction and sensitivity are concerned, so that it now behoves every listener to use the most selective receiver he can. Ample selectivity can certainly be obtained by buying or building a set of the very latest type, but there are millions who, for one reason or another, do not wish to have a new set, and who are desirous of making the best of the one they already possess. It is the object of this book to enable such readers to modify their present receivers by the most convenient and economical method. A large number of modifications are described, most of which can be applied to a receiver of any type.

What is meant by "Selectivity."—It must be admitted, then, that no more vexing problem faces the user of a wireless set at present than that of selectivity. That it arises from the increase in power and number of the broadcasting stations and in the re-arrangement of wavelengths has already been explained, but how to tackle it is not so clear. A solution *can* be found and the home constructor wants to know the "how" and "why."

Why is one circuit more selective than another? Why does H.F. amplification give more selectivity than L.F.? Why is one tuning arrangement better than another?—and so on. Such questions are always being asked, and it seems that all too often they are left unanswered, or else are answered in such a delightfully indefinite manner as to leave the inquirer with just as hazy a conception as before.

The Effect of Resistance.—The selectivity, or in other words, the sharpness of tuning, of a receiving circuit is dependent on the ratio of its resistance to its inductance. The reduction of resistance, therefore, is all important.

This resistance, which might be termed the "wasteful" resistance, is due to various losses which occur in the circuit. They may be classified as follows:—

(1) Conductor losses (copper losses, etc., in the wire itself).
(2) Dielectric losses.
(3) Losses in surrounding conductors.
(4) Losses at terminals or contacts.
(5) "Dead-end" losses.

Fig. 1 illustrates this point. Here is a group of resonance curves. They represent the signal strength obtained with various circuits over a band of frequencies. Curve *a* shows a very efficient circuit. It will be noticed that a large response (loud signals) is obtained at what is called the *Resonant Frequency*, that is, the point at which

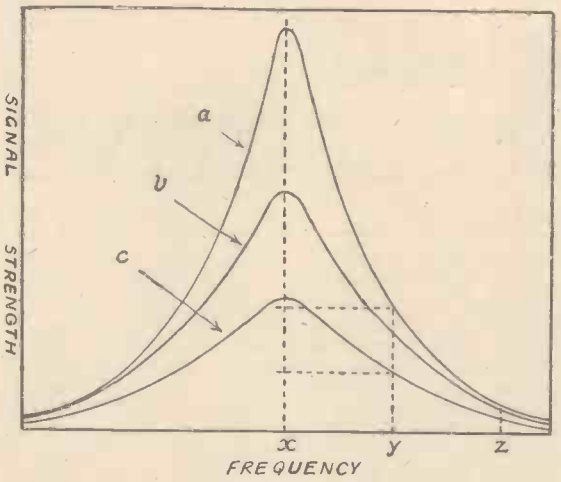


Fig. 1.—Group of resonance curves for circuits of varying efficiency. Curve b shows an average curve.

the circuit is exactly in tune with the broadcasting station. This is shown by the height of the curve at the point *x* on the graph. On either side of the resonant frequency, however, there is a quick falling off in response. This means that another station of equal power broadcasting on a nearby frequency, say at *y*, would give in this case less than one-third of the response (compare height of curve at *y* with that at *x*). Again at *z*, still further from resonance, there is practically no response. Contrast this with curve *c*, that of the most inefficient of the three circuits, and see how it differs. In this case the maximum response, even when the wanted station is dead on tune, is not as good as with the first circuit. The most important point, however, is the shape of the curve. Instead of being pointed it is comparatively flat. The result of this is that the broadcasting station at *y* would come through comparatively loudly, actually at about half the strength of the wanted station. This can be seen by comparing the height of the curve *c* at *x* with its height at *y*.

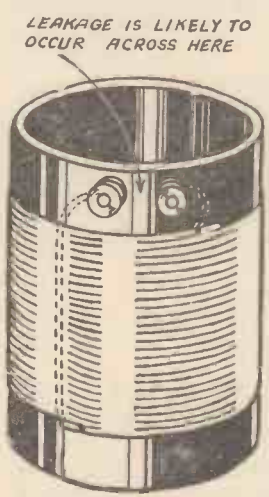


Fig. 2—In designing efficient coils, terminals connecting the extreme ends of the windings should not be mounted close together.

How to Improve Selectivity in a Simple Circuit.—In considering a set with a simple tuned circuit, such as is found in most sets of the "det. and 2 L.F." type, the problem which arises is, how can the resonance curve be made to approach that of *a* ? Well, first of all there should be a good tuning coil.

The former of the coil should not be too small (two to three inches is suitable), and the insulation between the turns should be of a high order. In this connection silk is better than cotton as a covering for the wire, and the windings should not be coated with shellac varnish or wax. A ribbed former is better than a plain one, as there is less risk with the ribbed type of leakage from one turn to another through the material of the former. Again, avoid bringing out the ends of the coil to terminals placed very close together as in Fig. 2, as the full voltage across the coil will then be applied across the narrow strip of material between them, and unless the insulating properties of this is of the very highest order there will be leakage between the terminals. Even if the former is of the finest ebonite, it is better to have the terminals well spaced because of the possibility of surface leakage due to the accumulation of dust or moisture.

Attention to these points will all help to reduce losses (2), (3) and (4). We have yet to consider losses (1) and (5), namely, conductor losses and dead-end losses. Not much need be said regarding the former beyond reminding the reader to use wire of a reasonable thickness, by which is meant, not thinner than about 28-gauge. On the other hand, no useful purpose is served by having it of a larger section than 22 gauge, as it only makes the coil bulky.

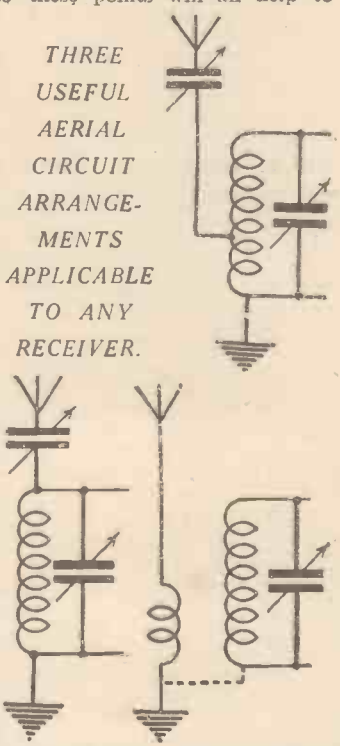


Fig. 3—Various methods of obtaining selectivity in a single tuned circuit. They all suffer from certain drawbacks. (See text.)

Self Capacity.—There is one point in connection with tuning coils which has not been mentioned. Reference is made to *self capacity*, that is, the capacity between the turns of wire. This should be kept as low as possible by avoiding pile winding (winding one turn over the other to save space), and in the case of short-wave coils by spacing the turns. Wave-change switches associated with the coil should also have low self capacity; why only switches intended for use in H.F.

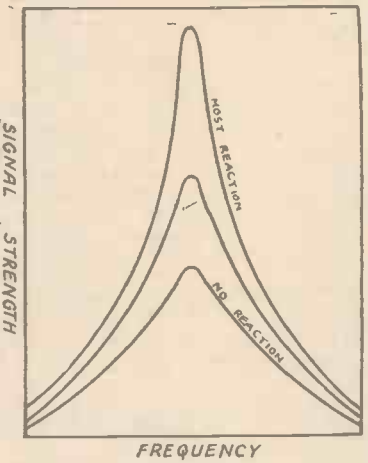


Fig. 4.—Graph showing how sensitivity and selectivity increase with the addition of reaction.

circuits should be used, some types of plugs and jacks and many types of mains switches being quite unsuitable.

The tuning condenser is another component in the tuned circuit which should be above reproach. Most modern types are very good and losses here are almost certain to be confined to the dielectric. For this reason the minimum solid dielectric is advisable, therefore an air dielectric instrument is preferable to one with bakelite between the vanes.

Selectivity and Signal Strength.—A low-loss coil and condenser alone will not give sufficient selectivity for modern needs, so recourse has to be made to one or more of the dodges shown in Fig. 3. Unfortunately, all these arrangements cause some loss in signal strength for the gain in selectivity. Fitting a series aerial condenser, using a loose-coupled semi-aperiodic aerial coil, or tapping the aerial on to the coil near the earthed end, all have much the same effect in that sensitivity drops rapidly with the increase in selectivity. This means that where interference from the local station is very bad the series condenser has to be reduced to such a small figure or the tapping has to be taken to such a low point that sensitivity is reduced, with the result that the wanted station then becomes weaker.

The Effects of Reaction.—The fact is that the single tuned circuit has its limitations; therefore if the best is to be got out of it it should be carefully designed. There is, however, one easy means of overcoming the losses already mentioned, that is by using *Reaction*. The effect of reaction is virtually to negative the resistance of the circuit. "Well, then," it may be asked, "why bother about having the circuit efficient if all the losses can be overcome by a twist of the reaction knob?" The answer is that the difference lies in the ease of operation. The inefficient circuit has to be made to work on the edge of oscillation in order to maintain the maximum response, which response will drop to a low figure if the reaction is reduced slightly. The low-loss circuit, on the other hand, will give quite a good response even with minimum reaction.

That reaction is able to increase selectivity is shown by Fig. 4, which gives the different resonance curves obtained with varying degrees of reaction. If these curves are examined it will be seen that an increase of reaction means a great increase in sensitivity at the resonant frequency, but only a very slight increase at other frequencies. This means that if one had tuned in to a station and was experiencing interference from another station, an increase in reaction would produce a large increase in the strength of the wanted station, but only a small increase in that of the unwanted. It does not mean that interference from the unwanted station would disappear on bringing up the reaction as many people seem to expect. True selectivity is determined by the *ratio* of the two signal strengths. One must not overlook the fact that although the strength of the unwanted station is slightly greater when reaction is applied, yet the strength of the wanted station becomes *many times* greater than it was before.

Now suppose we reduce the strength of the wanted station by means of a variable condenser in series with the aerial or some similar device until it is back at its original level. What will happen to the unwanted signals? Well, naturally, they will be reduced also. In fact, they will either become very weak indeed or else disappear.

This quite clearly shows there is an increase in selectivity because without reaction the desired station is of a certain strength, but accompanied by interference, but with reaction it is still the same strength, but without interference.

The method just described of reducing the input from the aerial and compensating for the resultant loss of signal strength by increasing the reaction is quite commonly used, and is a very useful way of reducing interference from other stations.

Band-pass Filters.—The single tuned circuit has its limitations, and if it is found that such a circuit when efficiently designed and used with a judicious amount of reaction is still inadequate, then the only thing to do is to use more than one tuned circuit.

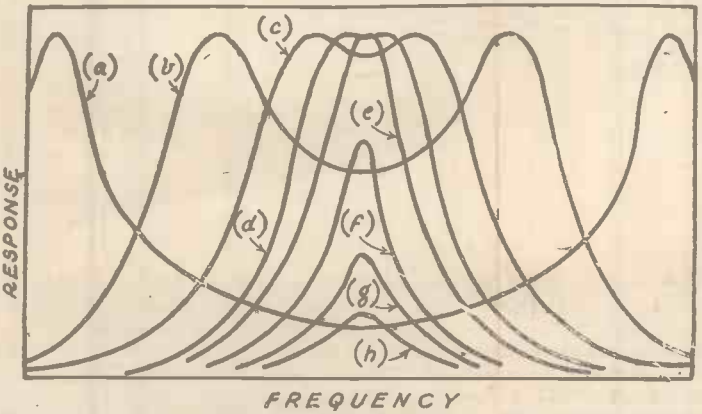


Fig. 5.—Resonance curves of a coupled circuit with various degrees of coupling.

Perhaps the simplest arrangement is the addition of another tuned circuit before the detector. The two circuits are loosely coupled, the degree of coupling determining the shape of the resultant response curve. The advantage of this scheme is that it gives increased selectivity without a very great loss in signal strength. Such an arrangement is known as a band-pass filter, and this produces a flat-topped response curve of the form shown at *d* in Fig. 5.

The fitting of a band-pass arrangement to an existing receiver, and the adoption of other devices to improve the selectivity, are fully dealt with in the following pages of this booklet.

AERIAL SYSTEMS AND SELECTIVITY

Particulars in Regard to the Most Suitable Aerial Arrangement for the New Conditions are Given in this Section

IT is not always realized that the aerial-earth system can have a pronounced effect upon the ability of a receiver used with it to eliminate unwanted stations. This is an important point which should receive careful attention when trying out various methods of improving selectivity. The maximum length for an outside aerial permitted by the Post Office authorities is 100ft., and some years ago everyone who erected an aerial felt it his duty to make full use of the maximum length allowed. That was all very well when the greatest possible range was required regardless of sharp tuning (which was not necessary, due to the few stations in operation), but to-day it is scarcely ever wise to attempt to employ an aerial longer than 70ft. or so (this length includes the lead-in), whilst when the receiver itself is not of an inherently-selective type the length can generally be cut down to some 30ft. with advantage.

Height—Not Length.—In any case it is not the length of the aerial wire which is most important, even when the question of selectivity can be ignored, but it is the height which is all-important.

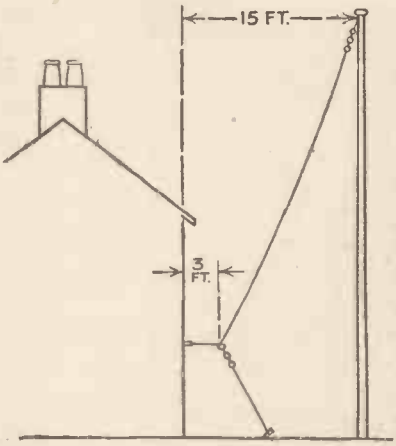


Fig. 7.—Excellent results are to be obtained by using an aerial consisting of an almost vertical wire as shown above; such an aerial is non-directional.

Increasing the effective height by 5ft. will nearly always prove considerably more effective than extending the length by so much as 50ft. The aim, therefore, in erecting an aerial should be to obtain the greatest possible height combined with the shortest length with which the necessary "pick-up" required by the particular receiver in use can be secured.

Low Capacity.—For an aerial to be selective it must, like all other portions of the receiver tuning circuits, have a low resistance (more correctly, impedance) to the high-frequency currents which flow through it. This does not only mean that the wire itself should be of a fairly heavy gauge and of stranded form, but that it must have a low capacity to earth. The latter requirement is most important, and to comply with it the aerial should always be kept as far away as conveniently possible from roofs and walls of the house, trees, etc. Fig. 6 shows the general arrangement and approximate dimensions of what might be considered an almost ideal aerial for modern conditions and for use with the average type of receiver. The wire itself is of the so-called 7/22, and it is thoroughly insulated at each end by means of a string of egg insulators. Notice also that the supporting wires at each end of the aerial are "broken" by a couple of insulators so that they do not in themselves act as small aerials and "rob" the proper one of some of the H.F. current.

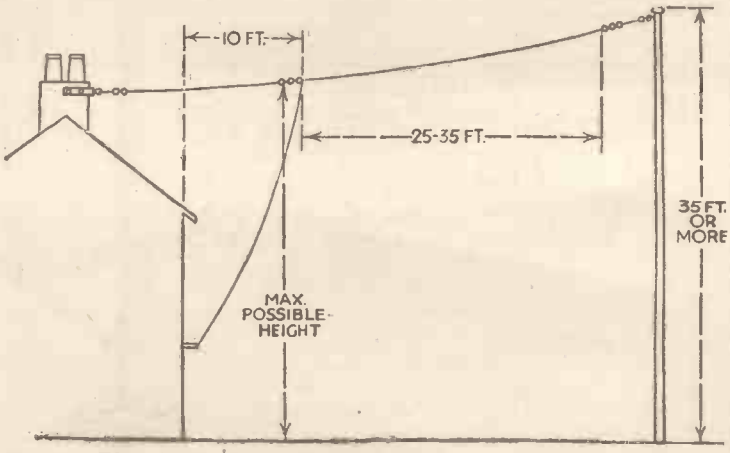


Fig. 6.—This sketch shows the approximate dimensions for a selective and efficient aerial.

Aerial Direction.—The direction in which the aerial "points" can have a fairly pronounced effect, even if not upon the actual selectivity, on the ability of the receiver to eliminate the signals of a powerful local station. All "inverted-L-type" aerials are most sensitive to signals coming in a direction in the line of the horizontal span, particularly to those coming towards the lead-in end. Because of this

it is often possible entirely to eliminate local interference without altering the set in any way, but merely by changing the direction of the aerial. A better way, in situations where it can be adopted,

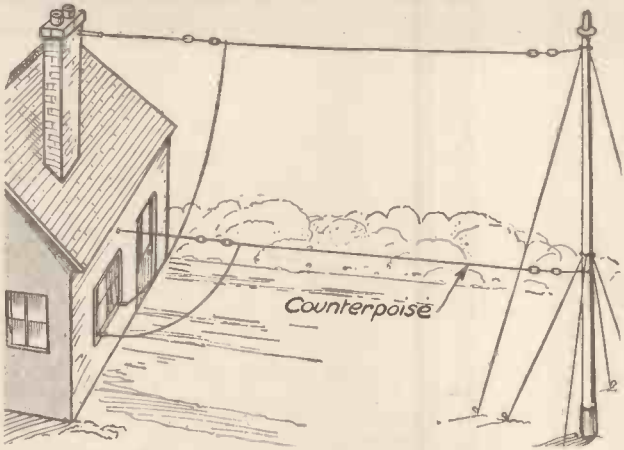


Fig. 8.—How to fix up a simple counterpoise earth.

is to let the aerial consist of a vertical portion only, or, at least, of a nearly vertical stretch, as shown in Fig. 7. The pole or other support should be as high as possible—40ft. or more is excellent—and the wire should, naturally, be kept as far away from the walls of the house as possible.

Make Sure the Earth is Good. — The earth connection is often more important than the aerial from the point of view of selectivity, and very often a little spare time can be well spent in trying different forms of earths. When the receiver is installed in a ground-floor room and reasonably close to a window, one cannot do better than employ one of the many "chemical" earthing devices which are on the market. Although these are generally fairly effective even when they are only buried to a depth of a few inches it is nearly always better to sink them three or four feet and, if possible, into a layer of clay. Where an earth of the kind just referred to is impracticable a water pipe will often make a good substitute. But water-pipe earths must not be taken too much for granted, as they often are, since it will very often be found that the pipe employed does not go into the earth until it has traversed a fairly considerable distance through various rooms and, perhaps, even through another house. To be really good the pipe must take a direct path into the ground.

Another point to watch in using a water-pipe earth is that the pipe is a cold-water one, because many of those carrying hot water do not actually go to earth at all.

Counterpoise Earths.—When a really effective earth connection of one of the types mentioned cannot be obtained, a good substitute can often be found in the form of a sheet of wire-netting or gauze placed under a carpet, and connected by means of a wire to the earth terminal. Yet another form of earth which sometimes gives excellent results consists of a large metal plate fitted in the bottom of the receiver cabinet. With some receivers an "earth" of this kind gives much sharper tuning than does one of the more orthodox pattern.

A still better "earth" can be obtained by taking a wire about 6ft. above the ground and parallel to the horizontal span of the aerial. This "counterpoise earth," as it is called, must be insulated in just the same manner as the aerial and connected to the earth terminal of the set in the usual way (Fig. 8). The only objection to the counterpoise earth is that it increases the directional effect of the aerial; often this can be put to good account, however, by arranging the aerial and earth in a direction which is at right-angles to the line between the local station and the receiver.

Indoor Aerials.—Most of the above remarks apply with equal force in cases where an outside aerial is impossible and an indoor one must be used instead. There are a few additional points which should be raised in respect to indoor aerials, but before dealing with them it should be stressed that an outside aerial, if properly arranged, is almost invariably to be preferred to an indoor one, both on the score of selectivity and sensitivity. With an indoor aerial it is usual to take the wire, or one of the special materials sold for the purpose, along the walls of the room. Whilst this is convenient and neat, however, it is not always the best method since the capacity of the aerial to earth (the walls of the room in this case) is higher than it need be. Because of this, it is better, where conditions allow, to let the aerial consist of a single length of wire going across the centre of an attic or the underroofing. The wire should be as far away from the walls and the roof as possible, and the same conditions regarding its direction apply as in the case of outdoor aerials. In all probability the lead-in *must* come down close to the wall, so make it as short as possible.

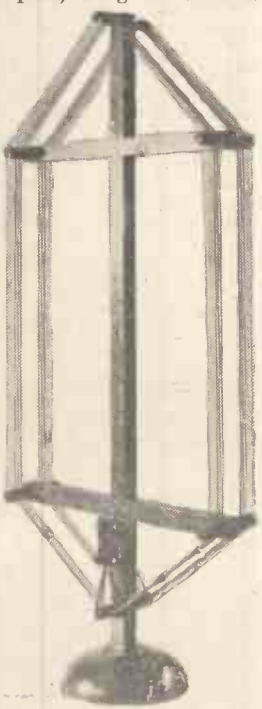


Fig. 9.—A typical commercial frame aerial.

Frame Aerials—The directional property of an aerial can be put to good use by employing a frame aerial, which can be rotated at will to cut out any unwanted signal. This advantage must

be paid for, however, in the way of decreased sensitivity, so that it is not generally successful to attempt to employ a frame with any receiver having less than one efficient S.G. stage. In connecting a frame to an ordinary receiver it is necessary first of all to remove the aerial tuning coil, since the frame serves its purpose besides acting as an aerial. Then the two ends of the frame aerial are connected in place of the "grid" and "earth" terminals respectively of the tuner so that the frame is tuned by the normal aerial tuning condenser. All the necessary connections are shown in Fig. 10, where it is assumed that the frame is fitted with its own wave-change switch and that a ganged tuning condenser is not employed in the set. When a ganged condenser is used a frame aerial is out of the question unless one is prepared to fit a separate condenser for use with it.

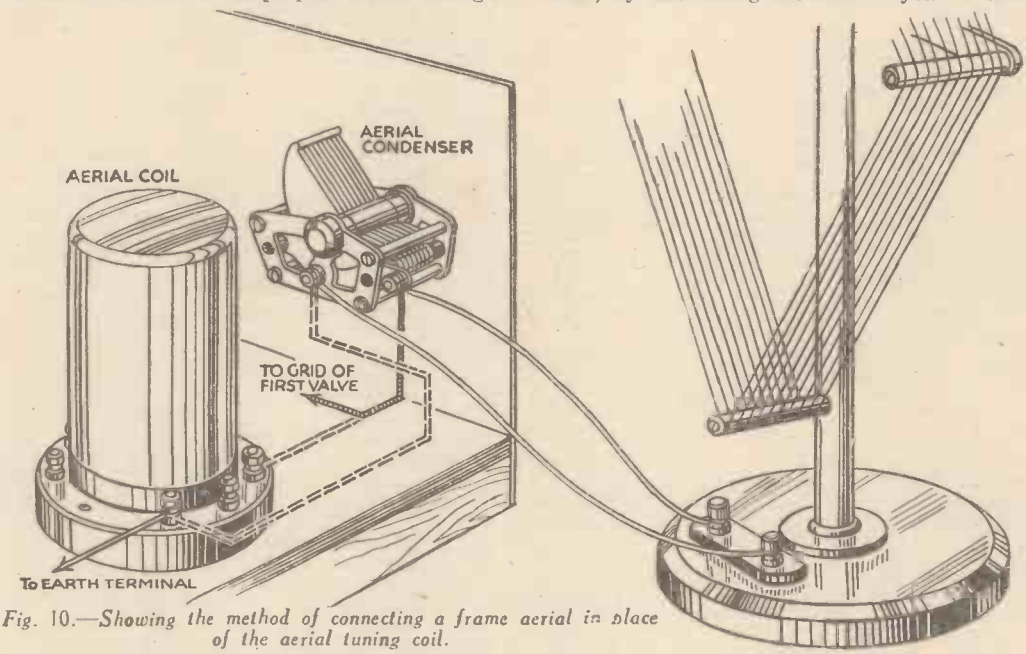


Fig. 10.—Showing the method of connecting a frame aerial in place of the aerial tuning coil.

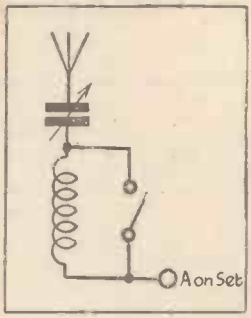
SELECTIVITY DEVICES

In this Section Reference is Made to a Number of Simple Devices by Means of Which a Greater Degree of Selectivity may be Obtained

BECAUSE increased selectivity, or sharpness of tuning, is required, it does not necessarily mean that the receiver must be completely rebuilt or even drastically modified, since there are a number of little devices which may be fitted to produce the desired effect. The simplest of these is the well-known pre-set aerial series condenser which is simply joined between the aerial lead-in and the aerial terminal on the receiver as shown in Fig. 11. Pre-set condensers are to be obtained in a variety of (maximum) capacities between about .0001 mfd. and .002 mfd. but, in the majority of cases a capacity of either .0002 mfd. or .0003 mfd. will prove most suitable. Once the condenser has been connected in circuit, it must be adjusted to its optimum setting by means of the small ebonite knob provided for this purpose. It will soon be found that if the capacity is made *too* small, by unscrewing the knob beyond a certain point, signal strength and maximum volume will suffer. On the other hand, if the capacity is too great, the increase in selectivity might be insufficient. It will, therefore, be clearly understood that the best setting should be found by experiment and by carefully checking results at various capacities. On altering the capacity it will at once be found that (with most receivers not provided with a gang condenser), the dial readings for the various stations will be modified, the actual reading being higher when the pre-set capacity is reduced, and vice versa. Because of this, it is desirable that the optimum pre-set adjustment should be found before the receiver is finally calibrated, and the dial readings entered on the special chart given free with the current issue of PRACTICAL WIRELESS.

Sometimes it is desired to increase the selectivity of the receiver only when receiving certain stations, and to retain the maximum amount of sensitivity on other stations. In such cases, it is best to mount the pre-set condenser on the panel so that the knob is easily accessible; a simple method of doing this is illustrated in Fig. 12. Another method which is better in many respects is to employ a .0003 mfd. variable condenser in place of the pre-set. This may be of either the air or bakelite dielectric type and, if an ordinary knob is fitted, a few marks can be made on the panel so that the optimum settings for particular stations can quickly and easily be duplicated.

A Simple Form of Series-Aerial Condenser.—Quite often it is found with a rather old-fashioned "local station" receiver, that the tuning is not even sufficiently sharp to enable the two nearby transmitters—Regional and National—to be entirely separated. Such a state of affairs definitely points to a most inefficient set, but if the owner has no intention of replacing it by a new one a great improvement can be effected by employing one of the methods just described. An even simpler and less-expensive system can be made use of, however, and the idea is illustrated in Fig. 13. A short length of twin flex acts as a perfectly effective small-capacity pre-set condenser, the end of one strand being joined to the aerial lead-in, and the end of the other to the aerial terminal. The most suitable length of wire can best be found by trial, starting with a piece about 4ft. long and gradually unwinding it at one end as shown. When the correct capacity has been found, the wire can be cut off to the correct length. Perhaps it should be mentioned in passing that the ends of the two strands should not normally be allowed to touch each other, or else the device will have no effect. At the same time, if the full sensitivity of the set is ever required for receiving a distant station while one of the locals is closed down, the condenser can easily be put out of circuit by twisting the bared ends of the flexible wires together.



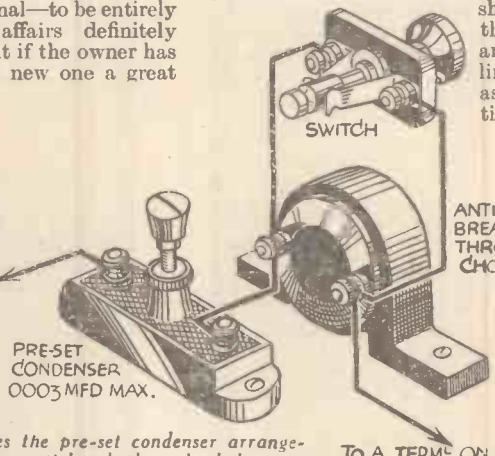


Fig. 11.—This diagram illustrates the pre-set condenser arrangement with the addition of an anti-break-through choke.

Using Different Coils.—There is no doubt that one of the most effective ways of all to increase selectivity, especially with a comparatively old set, is to replace the coils by others of more advanced type. This subject is fully dealt with, however, in another section of this booklet under the title of "Choosing Coils," so there is no need to deal with it here.

Modifying the Detector.—It is frequently possible to obtain a very useful increase in selectivity by making slight alterations in the detector circuit. The simplest of these is to exchange the detector valve for one of higher impedance, such as an H.L., H.F., or even an R.C. one. This will give the necessary increase in selectivity without introducing any ill effects in other directions, provided that the valve is not preceded by a very powerful high-frequency amplifier, and that the transformer connected in its anode circuit is of an efficient pattern.

If the slight extra expense and wiring modification are not objected to, it is an excellent plan to replace the detector valve by one of the screened-grid type. The method of doing this is clearly shown in Fig. 14, where the previous connections are shown as broken lines, and the new ones as full lines. A potentiometer is not an absolute essential for supplying the screening-grid potential, but it is well worth while, since it enables the optimum screening-grid potential to be found under working conditions. The connections shown are equally applicable to either battery or mains-operated sets. There is one little point which should be borne in mind when changing over to the S.G. detector, which is that the impedance in the anode circuit of the valve should be as high as possible. For that reason it is most satisfactory to connect the following transformer on the resistance-capacity system, using an anode resistance of not less than 100,000 ohms and connecting this to the highest H.T.+ voltage tapping available.

Grid Condenser and Leak Alterations.—A good deal of improvement can often be made by the simple process of altering the values of the detector grid condenser and grid leak. Reducing the former to about .0001 mfd. and increasing the latter to some 5 megohms will, in many instances make quite a considerable improvement. For purposes of trial it is an excellent idea to fit a .0003 mfd. pre-set in place of the fixed grid condenser, and try various settings. The only objection to this suggestion is that if a high signal voltage is applied to the detector, there is some chance of overloading and consequent distortion, although in the majority of cases, especially where an effective

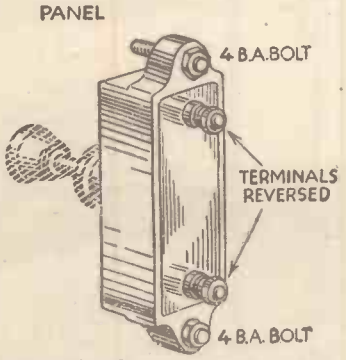


Fig. 12.—It is sometimes more convenient to mount the pre-set condenser on the panel and this can be done as shown, by reversing the terminals.

pre-detector volume control is fitted, there will be no difficulty whatever in this respect.

Changing to Anode-bend.—Anode-bend detection is scarcely ever used at the present time, but it is very useful in providing sharpness of tuning, due to the low damping which is imposed on the preceding tuned circuit. Luckily, it is only a matter of moments to change over from leaky-grid to anode-bend and the necessary alterations are shown in Fig. 15. The grid condenser is short-circuited and the leak disconnected, whilst the connection from the "earth" end of the grid coil is replaced by a lead going to a tapping on the grid-bias battery. It is sometimes better to include a decoupling resistance in the G.B. lead to prevent instability and this is shown by broken lines in Fig. 15. When the decoupling resistance is found necessary a .1 mfd. fixed condenser should be connected in the position indicated by broken lines, so that correct tuning is not affected by the modification. The optimum value of grid bias for the detector will depend upon the type of valve employed and also upon the H.T. voltage supplied to its anode, but will generally prove to be either 1½ or 3 volts.

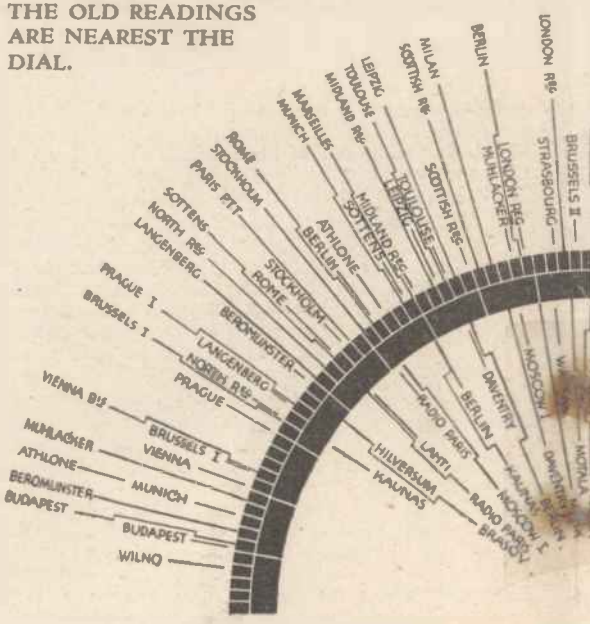
Reaction Improvements.—It is widely known that reaction is one of the very best aids to selectivity, and, therefore, it need hardly be stressed that any alteration which improves the "smoothness" of control will be a great help in the quest for interference-free reception. Some of the methods already dealt with, particularly those by which the values of detector grid-circuit components are modified and where an S.G. or anode-bend detector are used, will automatically improve reaction control to a noticeable extent. Another useful idea is to insert a non-inductive fixed resistance of between 100 and 500 ohms between the anode of the detector valve and the reaction condenser, whilst a second way is to connect a .0002 mfd. fixed condenser between the anode and earth. Any of the other well-known methods of "steadying" reaction, such as varying the detector's H.T. voltage and using a more efficient H.F. choke, are well worthy of trial.

Superhet Principle.—Where the utmost selectivity is desired, it is obviously essential to employ the superheterodyne circuit, although, where accurate methods of matching can be employed, it is possible to obtain a similar high degree of selectivity with two or more H.F. stages. The latter arrangement, however, requires that all tuned circuits are very accurately matched, and this is not a simple matter for the home-constructor. On the other hand, the superheterodyne feature may be employed by a home constructor with every confidence, as the separate coils which are required may now be purchased from many different firms, and the assembly of correct parts will enable a highly-efficient receiver to be built up. The reason for the selective properties of the superheterodyne circuit is to be found in the method in which the frequency of a received station is changed into some other pre-determined frequency, and subsequent amplification carried out at this new frequency. The circuit consists of a first detector (which may or may not be preceded by a standard H.F. amplifier); an oscillator valve tuned to oscillate at a definite frequency; one or more H.F. amplifiers which are pre-tuned to the new frequency; a second detector; and finally, normal L.F. stages. The intermediate frequency amplifiers which follow the oscillator circuit are provided with H.F. transformers which are tuned to a high wavelength (usually in the region of 2,000 metres), and thus there is no necessity for tuning condensers for these stages.

ADAPTING EXISTIN

WHERE a commercial receiver is in use, and this is provided with a tuning scale upon which station names are engraved, it will be found that with the new conditions these names will be in the wrong positions. This may be remedied in the majority of cases by communicating with the actual manufacturers of the receiver and they will be found to be quite prepared to furnish a new scale (upon receipt of the type number of the set) at a really nominal cost. If, for some reason, a new scale cannot be obtained it should not be a difficult proposition either to remove the original scale, or cover it with a thin strip of good-quality

THE LONG-WAVE STATIONS ARE SHOWN IN THE INNER CIRCLE. THE OLD READINGS ARE NEAREST THE DIAL.



COMMERCIAL SELECTIVITY DEVICES.

THERE are, of course, a large number of readers who do not wish to make any modification to the existing receiver, either because it is a commercial model and they are afraid of damaging it, or because they do not feel that they possess sufficient mechanical ability to carry out any alterations. Such readers are well catered for, however, by the many manufacturers of commercial wireless accessories, and the following brief list gives some indication of the types of device which may be obtained, and the methods of using them.

The most common arrangement is a tubular condenser, known in earlier wireless days as a Billi Condenser. It consists of a tube of metal inside which slides a metal rod, the two being kept from contact by a thin sleeve of insulating material such as bakelite or mica. The Pix is a good example of this device, as is also the Pressland Cop. The tube is fitted with one terminal for connection to the aerial lead, and the sliding rod is furnished with another terminal for connection to the aerial terminal of the set. The device is, of course, a pre-set condenser having a maximum value of approximately .0003 mfd. or so, and by withdrawing the sliding rod the capacity may be reduced and selectivity thus controlled.

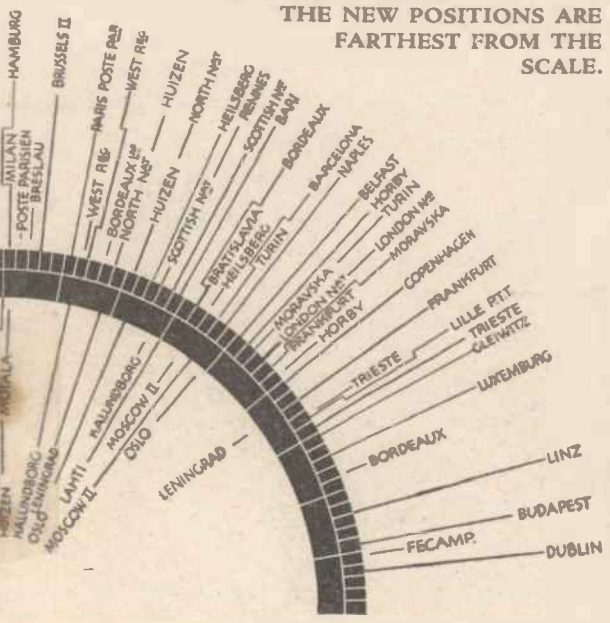
Another device which also makes use of the aerial pre-set condenser arrangement, without, however, actually employing any standard condenser arrangement, is the Varial. This relies for its function upon the capacity existing between two pieces of wire twisted together, and the adjustment is effected by sliding a moulded bakelite section along the wires during the course of which it untwists them or twists them together. There is also the neat Graham Farish device known as the "Slot," built up on the small condenser principle. In addition, sundry other commercial devices are available, but, as previously stated, they rely in the majority of cases upon the small semi-variable condenser principle.

In addition to the insertion of one of these devices in the aerial lead it must not be forgotten that the efficiency of the earth connection plays a very important part in the selectivity of a receiver. Thus a very poor earth will result in flattening of the tuning and also in a greatly reduced range, whilst in some cases it may even lead to instability. To improve the earth connection one of the principal points to watch is the condition of the actual soil surrounding the buried material. The latter should, of course, be of large area, and whilst a coil of copper wire dropped loosely in a hole and then covered, will provide a fairly good arrangement, it is preferable to take a large sheet of metal, or even a bucket, bath, etc., and solder the earth lead to this. To avoid failure of the joint, it is worth while to paint this or bind it with good quality insulation tape. Coke or other moisture-retaining material should be packed round the earth connection to ensure that the ground is kept in a really damp condition and resistance thus kept down. Amongst the many commercial schemes for retaining moisture and also providing good metallic connection may be mentioned Filt. This is a small copper canister which is filled with a special chemical, and the earth lead is attached to a terminal on the side of the canister. Ronnie is a similar arrangement, and this is obtainable packed into a copper earth tube. Siltit makes use of the chemical in a copper tube into which a multi-strand copper cable is soldered, and the ends of the wire are spread out to furnish a large surface and also to dispense with all risk of the connection coming adrift, and at the same time providing a greater area of contact.

G TUNING SCALES

paper or thin ivorine. This should be fixed in position with strong adhesive so that there is no possibility of movement, and the new indications should be prepared by the simple expedient of tuning in as many stations as possible, and marking their positions on the scale. In some cases it will then be found possible to draw up a chart and from this to ascertain the positions of the remaining stations and to mark them on the scale, although in most receivers an improvement will be effected by marking only a few stations (preferably those which are received constantly at good strength) and leaving the remainder of the scale blank.

THE MEDIUM-WAVE STATIONS ARE SHOWN OUTSIDE THE DIAL. THE NEW POSITIONS ARE FARTHEST FROM THE SCALE.



CHOOSING COILS FOR SELECTIVITY

This Section Deals With the Types and Arrangement of Coils which Should be Adopted when Maximum Selectivity is Called For

The correct choice and use of coils have, generally speaking, a greater effect upon selectivity than any other items in connection with the receiver. It is fortunate that there is now available an extremely wide range of efficient coils, most of which can be interchanged without much difficulty with older types already fitted in the set. The latest iron-core coils are extremely good from the point of view of selectivity, but as they are also more efficient than most coils of the older kinds it is not always wise to use them as replacements in receivers of the more complicated types, unless one is prepared to make other slight modifications to ensure complete stability. In the case of detector-L.F. types of receivers, however, the change can be made without any difficulty arising. It would be impossible here to mention all the various makes of iron-core coils available, or to give the connections for each, but full details as well as circuit diagrams can be obtained from any of the manufacturers without charge.

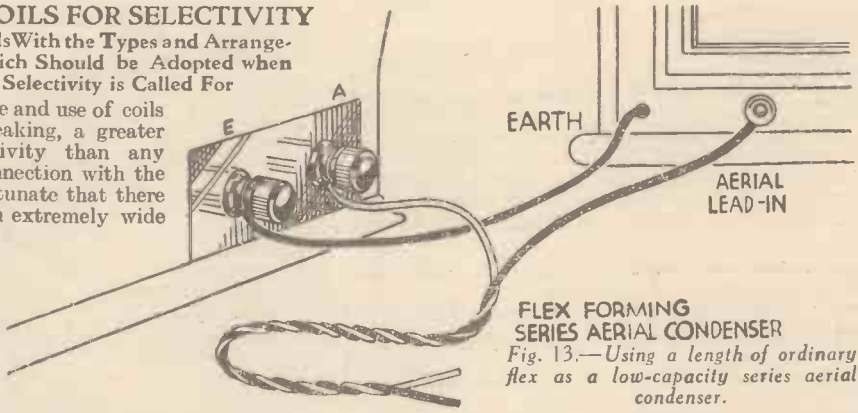
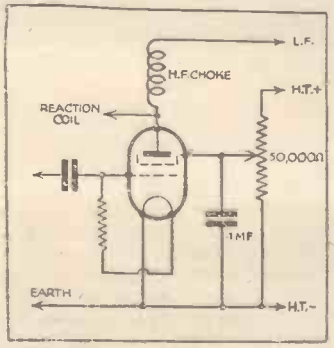


Fig. 13.—Using a length of ordinary flex as a low-capacity series aerial condenser.

Loose-coupled Aerial Windings.—Considering first of all the simple detector-L.F. type of set, it can be said that, in choosing a new tuner, it is wise to obtain one of the kind provided with a loose-coupled aerial winding which has tappings by means of which the degree of selectivity can be varied to suit any set of circumstances. The circuit diagram of a tuner of this type is given in Fig. 17 as an illustration of the statement just made. It will be seen that the aerial can be attached to any one of the tappings on the winding shown on the left, so that the effective size of this winding, and, consequently, the degree of coupling obtained, can be varied.

Transfer-tappings.—Another form of tuner which is particularly good, on account of the fact that it provides an equal degree of selectivity on both long and medium waves, is theoretically shown in Fig. 18. In this case both the medium-wave and the long-wave windings are tapped (to reduce the inevitable "damping" effect of the aerial), and an aerial change-over switch is combined with the ordinary wave-change switch. Many coils of this type are available, whilst a slightly different one which produces the same effect was described on page 633 of PRACTICAL WIRELESS, dated December 9th, 1933. Coils of this type can be used in any type of receiver, whether it has several H.F. stages or none at all.



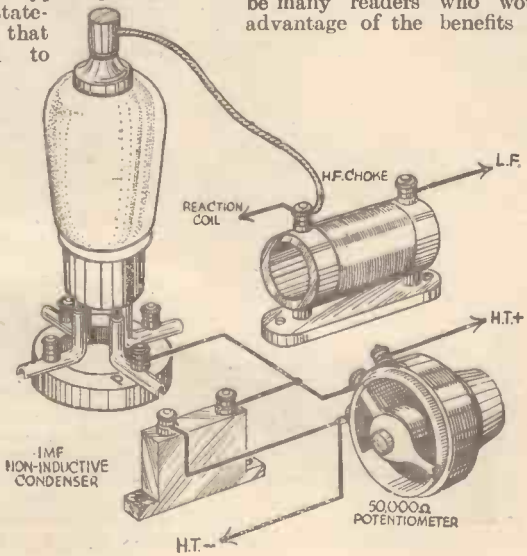


Fig. 14.—The additional connections required when using an S.G. valve as detector.

Modifying Existing Coils.—There will no doubt be many readers who would like to take advantage of the benefits offered by coils of the types just mentioned, but who do not feel disposed to buy or make a set of new ones. A simple method of adding a loose-coupled winding to an existing coil is shown in Fig. 21 whilst Fig. 20 shows how transfer-tappings can be provided and made use of in conjunction with a switch of the single-pole-change-over type. In the latter case a connection

can be made to the middle turn of the medium-wave and long-wave windings by scraping away the insulation for a length of ¼in. or so, and soldering on a short length of thin flex. To prevent burning the windings whilst soldering it is a good plan to place a slip of mica underneath the wire. In the case of the long-wave winding, it might in some cases be necessary partly to unwind it, since the turns will not otherwise be so easily accessible. Although it has been suggested that the tappings be taken from the centre of the windings, this is not always the best place, but it is generally effective. If a little experimentation is not objected to, however, it is a good plan to try various tapping points and then choose those which sharpen tuning to the greatest extent. Long-wave selectivity will rarely present any difficulty, and so it will perhaps be sufficient to try alternative medium-wave tappings only. This can be done easily by attaching an ordinary pin to the end of the flex and pressing this between adjacent turns at various points on the winding. The pin will scrape away the insulation and so make contact with the wire.

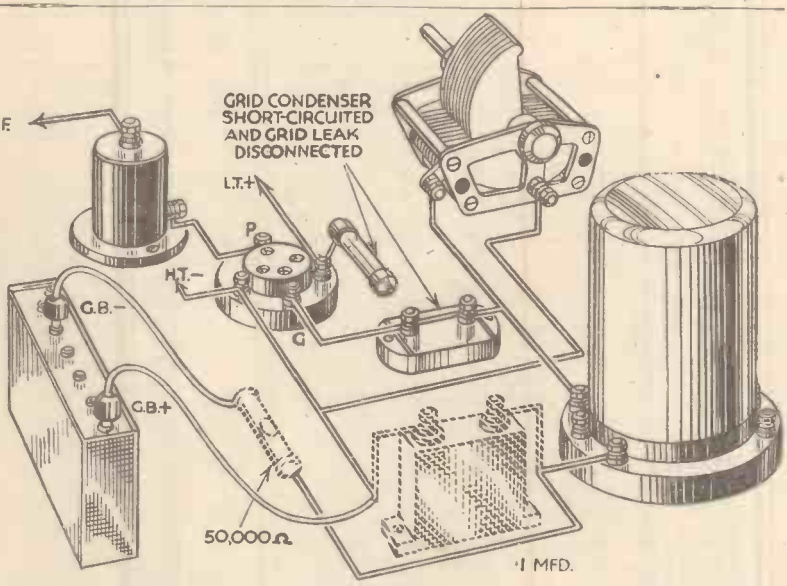


Fig. 15.—This shows the method of changing over from leaky-grid to anode-bend detection.

Using Band-pass Tuners.—In nearly every case a useful improvement in selectivity, especially with sets not having an H.F. stage, can be secured by replacing the single-circuit aerial tuner by a band-pass one. The connections will, naturally, depend upon the make of the tuner chosen, but all details will be found on the instruction sheet issued by the makers. In most instances the modification will make it desirable to employ a two-gang condenser for tuning, but this is not essential if the owner does not mind operating two separate condensers simultaneously.

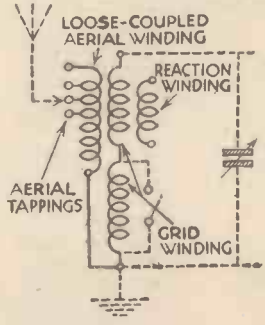


Fig. 17.—The circuit of a selective tuner with tapped loose-coupled aerial winding.

Instead of scrapping the present tuner, it can in nearly every case be used in conjunction with another similar one to provide a band-pass circuit. The principal modifications required in making this alteration are shown in Fig. 19, where it has been assumed that the coils are of the screened type and that they are to be tuned by means of separate condensers (this being practically essentials). The value of the coupling condenser is shown as being .01 mfd., since this is generally most suitable. If, however, the coils are unscreened, a capacity of about .04 mfd. will be required and the coils should be placed fairly near together and with their axes at right-angles.

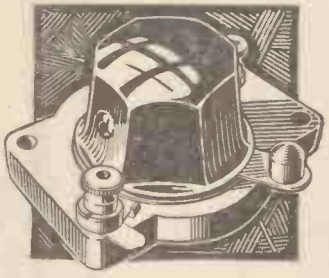


Fig. 16—The Graham Farish "Slot" Selectivity Device.

Medium-wave Breakthrough.—Though it is not quite the same thing as inselectivity, breakthrough of a medium-wave transmission when listening to long-wave stations can result in serious interference. Probably the best method of preventing breakthrough is to use coils which are specially designed with this end in view; for this purpose the aerial winding is usually designed so that it does not resonate to any station frequency on the medium waves; they generally give a circuit arrangement similar to that shown in

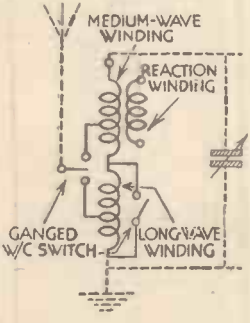


Fig. 18.—An aerial tuner with transfer-tapping is illustrated by this diagram.

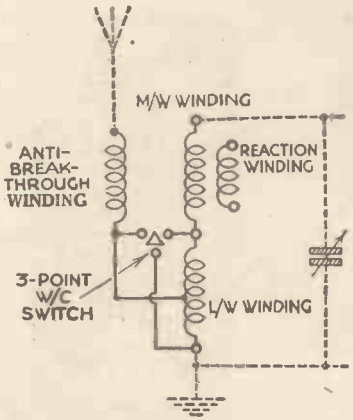


Fig. 20a.—Circuit arrangement of a tuner intended to prevent medium-wave breakthrough.

was described on page 684 of PRACTICAL WIRELESS, dated December 16th, 1933.

Another way is to include a special anti-breakthrough choke in the aerial circuit, as shown in Fig. 22a. The choke is used only for long-wave reception and is short-circuited by means of a push-pull switch when it is desired to listen to medium-wave stations. If desired, a suitable choke can be made quite easily, as shown in Fig. 20a, where a loose-coupled aerial winding is in series between the aerial terminal and a tapping on the long-wave winding. Several coils of this type are on the market, and the method of making one is described on page 684 of PRACTICAL WIRELESS, dated December 16th, 1933.

Another way is to include a special anti-breakthrough choke in the aerial circuit, as shown in Fig. 22a. The choke is used only for long-wave reception and is short-circuited by means of a push-pull switch when it is desired to listen to medium-wave stations. If desired, a suitable choke can be made quite easily, as shown in Fig. 21a. The bobbin can be turned in ebonite, or may be built up from five discs of stout cardboard, two of which are ½in. diameter and three ¾in. The discs can be fastened together with glue, or by means of a 4 B.A. bolt passed through them. The winding consists of 220 turns of 38-gauge enamelled wire, of which 110 turns are placed in each slot. In using an anti-breakthrough choke of any type it should be mounted as far as possible away from unscreened coils or chokes and with its axis at right angles to them.

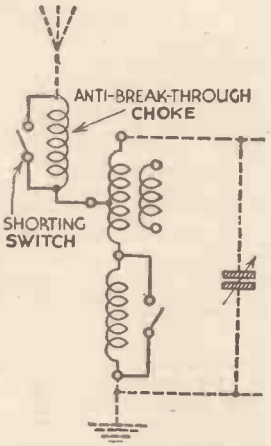


Fig. 22a.—This shows the connections for an anti-break through choke.

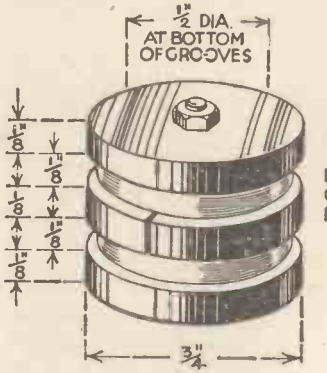


Fig. 21a.—Details of an easily made anti-breakthrough choke.

Using Plug-in Coils.—It has already been mentioned that in order to attain a sufficiently high degree of selectivity for the new conditions, it is often desirable to use either a loose-coupled aerial coil or a band-pass filter. Both of these arrangements can be provided quite easily with plug-in coils if a little extra complication is not objected to. Fig. 23 shows how a loose-coupled aerial coil can be used in conjunction with the dual-range tuning circuit consisting of two plug-in coils. The additional coil might

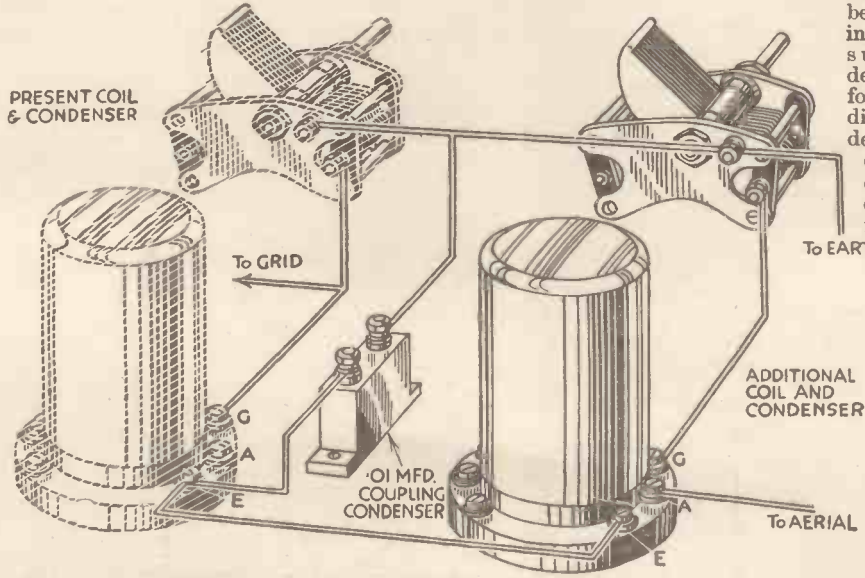


Fig. 19.—This sketch shows how nearly any tuner can be made into a band-pass arrangement by adding a new coil, tuning condenser, and coupling condenser.

conveniently be a size 25 or so for medium-wave reception, but the optimum size must be found by trial, since it will vary considerably with the type of aerial in use and the degree of selectivity required. It is sometimes possible to find a particular coil with which the set's sensitivity is just as good as with the less selective arrangement.

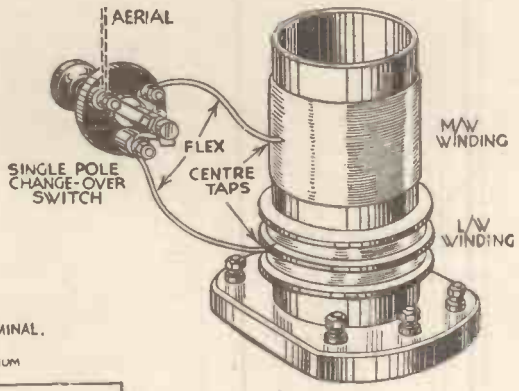


Fig. 20.—A simple method of providing a transfer aerial tapping on a standard type of dual-range coil.

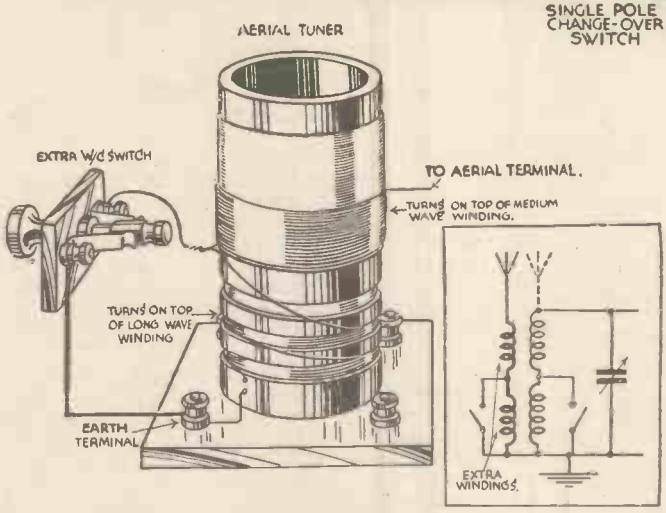


Fig. 21.—Improving selectivity by adding an aperiodic aerial winding.

VALVES & SELECTIVITY

Use the Correct Valves.—In many cases vast improvements in the selectivity of a receiver may be accomplished by the simple expedient of replacing existing valves with those of modern or more-up-to-date design. For instance, a receiver may possess only a detector stage, followed by one or more L.F. stages. Obviously such an arrangement, even if band-pass tuning is incorporated, is not one that can be desired from the point of view of selectivity combined with signal strength. When, in addition, a valve of the type designed one or two years ago is used, the improvement when fitting an up-to-date valve must be heard to be believed. At the time referred to a detector valve, or one of the so-called "General Purpose type," probably had an impedance of 20,000 ohms or more and an

Band-pass with Plug-in Coils.—The arrangement of Fig. 23 is only suitable for the aerial circuit of an S.G. receiver, because it could not conveniently be modified for use with reaction. When reaction is to be applied to the aerial, as in a Det.-L.F. set, the only really efficient way to obtain ultra-selectivity is by the use of a band-pass tuner. The connections for a band-pass circuit with reaction are shown in Fig. 22. It will be seen that five coils are used in all, two of them forming a dual-range circuit, and the other three acting similarly with the addition of a reaction circuit. The two circuits are tuned by separate condensers, but a single three-point wave-change switch acts on both. Coupling between the two circuits is on the "capacity" system, a .01 mfd. non-inductive condenser being used for coupling purposes. It is essential that a screen should be placed between the two tuned circuits, and it is also advisable to place the two sets of coils with their axes at right angles, as shown in this diagram.

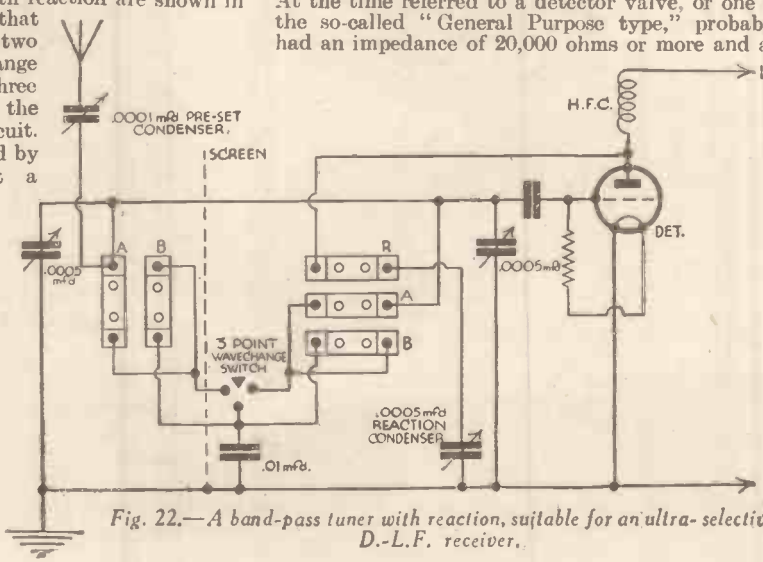
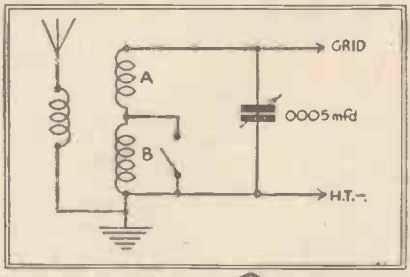


Fig. 22.—A band-pass tuner with reaction, suitable for an ultra-selective, D.-L.F. receiver.

amplification factor of 7 to 10. To-day a valve for this stage may have an impedance as low as 11,000 ohms combined with an amplification factor of 20 or more. This means that not only is its efficiency very much greater, but due to the higher amplification, louder signals will be obtained and in addition selectivity will be improved owing to the lower impedance. The reason for this is rather involved and it is not proposed to take up valuable space by delving into the question of valve-damping, anode current and kindred matters. Suffice it to say, that an improvement will be immediately noticeable if a valve having the above characteristics is substituted for one of the old design. It must also be remembered that if the valve has been in constant use for two years or so the emission may be failing, and the purchase of a new type of valve will thus be well merited by the general improvement of the receiver.

Variable-mu Valves.—Where the receiver employs one or more H.F. stages, and these are of the ordinary S.G. type, the substitution of variable-mu or even variable-mu pentodes will prove invaluable. To convert a receiver for use with variable-mu valves it will be necessary to incorporate some arrangement for applying the bias to the valves, and where the circuit is of the single coil type, then all that is necessary is to disconnect the lower end of the coil from the earth line and to take this to the arm of a potentiometer connected across a grid bias battery. The latter may have a voltage of 9 to 16, depending upon the type of variable-mu valve which is purchased. These are known respectively as "short" or "long base" valves. There is not a great deal of difference, except that the short base provides approximately the same degree of volume control with a 9 volt battery as is obtained with the larger battery on the long base valve. If it is not desired to alter the coil, owing perhaps to fear of upsetting ganging, the bias may be applied to the grid of the valve direct, a grid leak and condenser being joined in the grid lead. The wire at present joining the grid to the tuning coil and condenser is removed, and a fixed condenser joined in its place. The grid leak is then joined between the grid and the arm of the potentiometer. The latter may have any value from 20,000 to 50,000 ohms and it is worth while when purchasing this component to ask for one of the graded type. The control then gives a more gradual effect, and it is necessary to connect it in circuit in the correct sense. The makers usually enclose an instruction sheet with these components so that there is little risk of joining it the wrong way round. The improvement in selectivity will be found to be easily controlled in the following way. With the volume control potentiometer at maximum the receiver will function exactly in the same way as with the present valves. As the control is reduced so is selectivity improved, and although this results also in loss of signal strength, the reaction condenser should then be adjusted to bring back the original strength, with a great improvement in selectivity. The characteristics of these valves, as in the first case mentioned, are also of such a nature that their mere substitution will greatly improve a receiver.



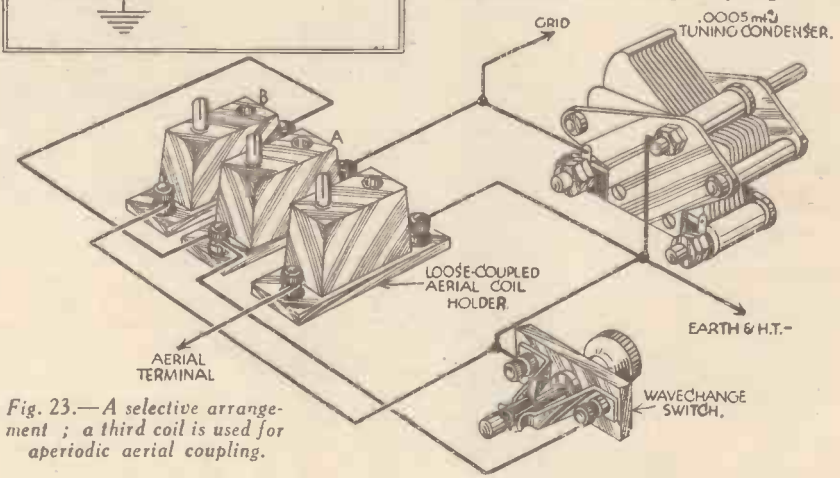


Fig. 23.—A selective arrangement ; a third coil is used for aperiodic aerial coupling.

S.G. Detector Valve.—This may also be used in a simple detector stage to effect an improvement. In this case the extra grid is joined to some point on the H.T. supply which gives the required results. Quite a vast range of control will be afforded by the correct adjustment of this voltage, and the only point to bear in mind when making this type of substitution, is that the anode is joined to the cap on top of the valve. It will be necessary, therefore, to remove the wire at present joined to the anode terminal of the valveholder and to take this in the new case to the cap on the valve. A flexible lead is

then joined to the original anode terminal and tapped into the H.T. battery.

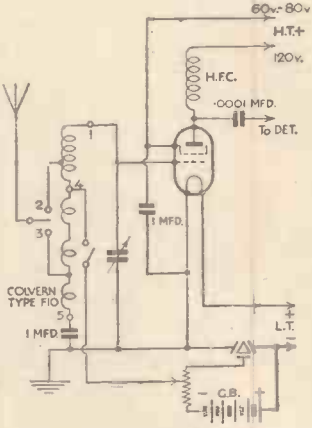
In powerful mains receivers, it will be found of value to employ a screened lead for connection to the anode of the S.G. valves. This lead should be of the thinnest wire, say 30 gauge, and it should be run inside the standard screened braiding. Risk of direct pick-up on the anode lead is thus avoided.

ADDING AN H.F. STAGE

Advantages of an Additional Tuned Circuit.—It is well known that where only one single tuned circuit is in use, selectivity must be very poor. If, however, the output from such a circuit is passed to a second tuned circuit, the selectivity will be improved, and thus the use of two or more tuned circuits is an aid to improved selectivity. Unfortunately, however, the transference of the signal from one circuit to the next results in a slight loss, and therefore we cannot add such circuits indiscriminately to a receiver owing to the fact that we should lose too much of our original signal. It seems quite logical to state, therefore, that we may add a second tuned circuit to improve selectivity, provided we also add some form of amplification to make up for the loss, and as the valve is such an ideal form of amplifier the simplest method of carrying out such a conversion is to build up a complete H.F. amplifying stage. A unit of this nature will work wonders with the majority of receiving installations, and the work involved is of the very simplest nature.

The apparatus required is simple, may be obtained at any good wireless shop, and the entire parts may be assembled and wired in an hour or so. The theoretical circuit of a suitable amplifier is given in Fig. 24 on this page, but the actual shape of the base, panel, etc., has not been given, as many readers will prefer to make up this unit to match an existing receiver. It may, for instance, be built as a small compact unit having a panel and base of the same dimensions as the existing receiver, and it may then be stood alongside the present set to make up a complete receiver for permanent use. Alternatively, the unit may be roughly constructed to be employed only when distant reception is desired. Where the complete existing apparatus is home-made it may be found worth while to build the unit as an integral part of the present receiver and then to enclose the combination in a cabinet.

Construction.—Fig. 25 shows the parts laid out on a base and wired up, and this arrangement should be adhered to if it is at all possible. The coil is of the dual-range type, and is screened to avoid direct pick up. The valve is of the latest variable-mu type, and the condenser will enable the full range of the present broadcastng wave-band to be explored. It will be noticed that there is no H.T. negative lead supplied for the unit, and this will be automatically obtained when the unit is joined up to the present receiver. A separate 9-volt grid-bias battery is required, and although it is possible to use this also for the L.F. portion of the present receiver, it is worth the additional expense to use a separate battery in order to prevent risks of instability. The switch must be of the three-point type in order to disconnect the grid-bias battery at the same time as the L.T. supply. If this is not done the bias battery will be continually discharging through the potentiometer. It will be seen that this unit is designed to provide not only higher selectivity, but range



FOR PICTORIAL DIAGRAM OF THIS CIRCUIT SEE PAGE 16.

Fig. 24.—Theoretical circuit of a simple H.F. stage.

combined with complete stability, by-pass condensers having been included at certain points for the latter purpose.

Having decided upon the method of assembly to be used in your particular case, mount the parts in approximately the positions shown, and wire up from the wiring diagram. It will be seen that a four-way battery cord is wired to certain parts of the apparatus, and that the ends of this cord are taken to H.T. and L.T. supplies. The two H.T. leads should be furnished with ordinary wander plugs and these should be inserted into the H.T. battery at the voltages shown on the theoretical circuit. They may require slight modification when the apparatus is in use, but this will easily be ascertained when the unit is tested out. The two L.T. leads should preferably be joined direct to the terminals on the existing receiver which bear similar markings.

Using the Unit.—To use the unit, remove the aerial lead from your present receiver and attach it to the terminal on this unit marked Aerial. The flexible lead marked Output should then be joined to the original aerial terminal, and the battery leads joined up, when the complete apparatus is ready for use. Rotate the arm of the potentiometer to a position approximately half-way round, and switch on both receiver and the unit. Now rotate the tuning control of both pieces of apparatus and you will soon find the combination of settings which will enable you to obtain the local, probably at very much greater strength than you have heard it before. The potentiometer will be found to give a wonderfully smooth control of volume, reducing the local to a whisper when required. Obviously, if the tuning coil in your present set is of the same

type as that chosen for the unit, the tuning points on both condensers will match up, but if different coils are employed the tuning points will not agree. It will not take many minutes, however, to find the relation between the two pieces of apparatus, and tuning will not be found by any means difficult. As the coil is screened, there is no need to screen the entire unit, as it will not be possible for interaction to take place between the coils in the two pieces of apparatus. It must, of course, be remembered that when switching off after use, both the unit and the receiver switches must be operated. This operation of both sets of switches must also be remembered when changing

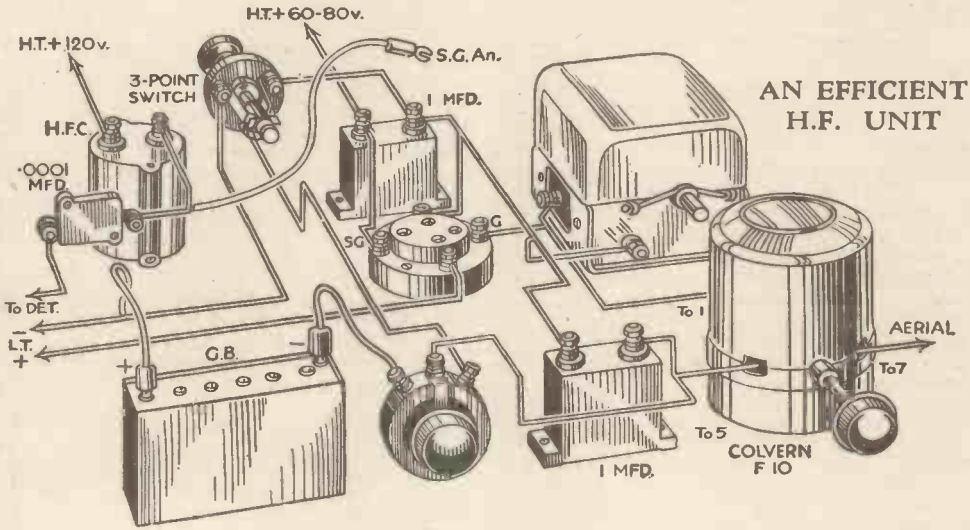


Fig. 25.—The theoretical circuit of Fig. 24 in pictorial form.

from medium to long waves, the appropriate wave-change switches both being operated to effect the change-over.

Swamp Areas.—Those living in swamp areas require special advice, and in many cases it will be necessary to deal with individual cases in special ways. As a general rule it may be stated that within a few miles of a powerful B.B.C. station much of the selectivity trouble is due to direct pick-up on the actual wiring of the receiver. Where this is proved to be the case the entire receiver will have to be screened. To ascertain whether this direct pick-up or shock excitation is responsible, remove the aerial and see if the local can still be heard. It may be necessary to retune slightly, but it may be definitely stated that if the local can be heard with both aerial and earth disconnected from the receiver, then the wiring is responsible. In some cases the earth lead will be found responsible, in which case it should be screened. Removal of the earth wire and/or the aerial wire will enable you to ascertain which is responsible in the particular case, and although the aerial is required for distant reception it will be found that an improvement can be effected by using the new screened lead specially obtainable.

If the receiver is home-made, then it will probably be found a simple matter to make up a metal box to accommodate the receiver, with the control knobs projecting from one side. Obviously, no portions of the receiver or controls should be permitted to come into contact with the metal in view of possible short-circuits. If metal working is considered too difficult, a wooden case may be made (or the existing cabinet adapted) by using a lining of metal foil, or using the Metaplex board supplied by Messrs. Peto-Scott. In the case of the foil lining or the special board it is essential that each side should be bonded, either by soldered leads, or by otherwise attaching some metallic link between adjacent sides. No matter whether a metal box or the special metal lining is employed, the entire assembly must be earthed, and this will be most conveniently carried out by joining the case to the earth terminal of the receiver.

Other suggestions for sufferers in swamp areas include such devices as varying the length of the aerial; altering its direction; using a vertical wire or metal post instead of the orthodox horizontal wire, etc. See also "AERIAL SYSTEMS and SELECTIVITY."

In the foregoing pages an attempt has been made to cover every phase of the selectivity problem in a full and comprehensive manner, but in spite of this there might be some readers who will experience some little difficulty in particular cases. To such readers we would point out that the PRACTICAL WIRELESS Technical Staff is always ready to assist them in every possible way FREE OF CHARGE. All you have to do is address your query to the Editor, marking the envelope "Advice Bureau," and enclosing a coupon cut from the current issue of the paper. Helpful advice will be speedily forthcoming.

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Extras

PRACTICAL WIRELESS

1934 WAVELENGTH GUIDE & STATION LOG

Compiled in Order of Wavelengths. B.B.C. Stations are shown in Black Type thus: NATIONAL.

MEDIUM WAVES.

Metres.	K/cs.	Station	Country	Dial Settings Left	Dial Settings Right
203.5	1474	**Plymouth ... Bournemouth**	**Gt. Britain**		
208.6	1438	Magyarovar ... Nyiregyhaza, etc.	Hungary ...		
209.9	1429	**Newcastle ...** Cork ...	**Gt. Britain** I.F. State ...		
216.8	1384	Warsaw (2) ...	Poland ...		
222.6	1348	**Aberdn (temp)**	**Gt. Britain**		
224	1339	Montpellier ...	France ...		
227.1	1321	Budapest (2)...	Hungary ...		
230.2	1303	Danzig ...	Germany ...		
238.5	1258	Riga ... ... San Sebastian (EAJ8)	Latvia ... Spain ...		
243.7	1231	Gleiwitz ...	Germany ...		
245.5	1222	Trieste ...	Italy ...		
247.2	1213	Lille (PTT) ...	France ...		
251	1195	Frankfurt-am-Main	Germany ...		
253.2	1185	Kharkov (2) ...	U.S.S.R. ...		
255.1	1176	Copenhagen ...	Denmark ...		
257.1	1167	Monte Ceneri	Switzerland		
259.1	1158	Moravska-Ostrava	Czecho-Slovakia		
261.1	1149	**Lon. National W. National (temp.)**	**Gt. Britain**		
263.2	1140	Turin ...	Italy ...		
265.3	1131	Hoerby ...	Sweden ...		
267.4	1122	**Belfast** ...	**N. Ireland**		
269.5	1113	Kosice ...	Czecho-Slovakia		
271.7	1104	Naples ...	Italy ...		
274	1095	Barcelona ... (EAJ1)	Spain ...		
276.2	1086	Falun ... Zagreb ...	Sweden ... Jugo-Slavia		
278.6	1077	Bordeaux PTT	France ...		
280.9	1068	Odessa ...	U.S.S.R. ...		
283.3	1059	Bari	Switzerland		
285.7	1050	**Scot. National**	**Gt. Britain**		
288.6	1040	Rennes PTT Leningrad (2)	France ... U.S.S.R. ...		
291	1031	Heilsberg ...	Germany ...		
296.2	1013	**N. National (temp.)**	**Gt. Britain**		
298.8	1004	Bratislava ...	Czecho-Slovakia		
301.5	995	Hilversum ...	Holland ...		
304.3	986	Genoa ...	Italy ...		
307.1	977	**W. Regional (temp.)**	**Gt. Britain**		
309.9	968	Grenoble PTT	France ...		
312.8	959	Poste Parisien	France ...		
315.8	950	Breslau ...	Germany ...		
318.8	941	Algiers ... Goeteborg ...	N. Africa ... Sweden ...		
321.9	932	Brussels (2) ...	Belgium ...		
325.4	922	Brno	Czecho-Slovakia		
328.6	913	Limoges PTT	France ...		
331.9	904	Hamburg ...	Germany ...		
335.2	895	Radio Toul'se	France ...		
338.6	886	Graz	Austria ...		
342.1	877	**Lon. Regional**	**Gt. Britain**		
345.6	868	Poznan ...	Poland ...		
349.2	859	Strasbourg PTT	France ...		
352.9	850	Bergen ... Valencia ...	Norway ... Spain ...		
356.7	841	Berlin ...	Germany ...		
360.2	832	Moscow ...	U.S.S.R. ...		
368.6	814	Milan ...	Italy ...		
373.1	804	**Scot. Regional (temp.)**	**Gt. Britain**		
382.2	785	Leipzig ...	Germany ...		
386.6	776	Toulouse PTT	France ...		
391.1	767	**Midl'd Reg'n'l (temp.)**	**Gt. Britain**		
395.8	758	Katowice ...	Poland ...		
400.5	749	Marseilles PTT Viipuri ...	France ... Finland ...		
405.4	740	Munich ...	Germany ...		
410.4	731	Seville ... Tallinn ...	Spain ... Estonia ...		
415.5	722	Kiev ...	U.S.S.R. ...		
420.8	713	Rome ...	Italy ...		
426.1	704	Stockholm ...	Sweden ...		
431.7	695	Paris PTT ...	France ...		
437.3	686	Belgrade ...	Jugo-Slavia		
443.1	677	Sottens ...	Switzerland		
449.1	668	**N. Regional**	**Gt. Britain**		
455.9	658	Langenberg ...	Germany ...		
463	648	Lyons PTT ...	France ...		
470.2	636	Prague (1) ...	Czecho-Slovakia		
476.9	629	Lisbon ... Trondheim ...	Portugal ... Norway ...		
483.9	620	Brussels (1) ...	Belgium ...		
491.8	610	Florence ...	Italy ...		
499.2	601	Rabat ... Sundsvall ...	Morocco ... Sweden ...		
506.7	592	Vienna ...	Austria ...		
514.6	583	Madona ...	Latvia ...		
522.6	574	Muehlacker	Germany ...		
531	565	Athlone ... Palermo ...	I.F. State ... Italy ...		
539.6	556	Beromuenster	Switzerland		
549.5	546	Budapest ...	Hungary ...		
559.7	536	Wilno ...	Poland ...		
569.3	527	Ljubljana ... Tampere ...	Jugo-Slavia Finland ...		
578	519	Innsbrueck ...	Austria ...		
696	431	Oulu	Finland ...		
726	413.5	Boden ...	Sweden ...		
748	401	Moscow (3) ...	U.S.S.R. ...		
765	392	Ostersund ...	Sweden ...		
824	364	Smolensk ...	U.S.S.R. ...		
845	355	Rostov-Don ...	U.S.S.R ...		

LONG WAVES.

Although, as stated, alterations of wavelength do not appear to be possible in the present circumstances, as regards the "long wave" transmitters, according to the Lucerne Plan the channels have been allotted as under :—

Metres.	K/cs.	Station.	Country.	Dial Settings Left	Dial Settings Right
1107	271	Moscow (2) ...	U.S.S.R. ...		
1145	262	Lahti ...	Finland ...		
1186	253	Oslo	Norway ...		
1224	245	Leningrad (1)	U.S.S.R. ...		
1261	238	Kalundborg ...	Denmark ...		
1304	230	Warsaw ...	Poland ...		
1345	223	Huizen ... Kharkov ...	Holland ... U.S.S.R. ...		
1389	216	Motala ...	Sweden ...		
1442	208	Minsk ...	U.S.S.R. ...		
1500	200	**D'ntry Nat'n'l (later Droitw'h)**	**Gt. Britain**		
1570.7	191	Koenigs Wusterhausen	Germany ...		
1639	183	Reykjavik ... Kaunas ... Ankara ...	Iceland ... Lithuania ... Turkey ...		
1714	175	Moscow (1) ...	U.S.S.R. ...		
1796	167	Radio Paris ...	France ...		
1875	160	Brasov ...	Romania ...		

THE BIG CHANGE-OVER

WILL NOT AFFECT YOUR SET

IF

YOU HAVE A PIX IN YOUR AERIAL

The re-shuffling of the wave-lengths on January 15th is sure to interfere with your enjoyment of wireless programmes, and unless you have some compensating device to increase selectivity you are pretty certain to find it more difficult than ever to get any particular programme free from another.

Freedom from background and unfettered choice of programmes make all the difference to the pleasure you get from listening-in. The various broadcasting authorities cannot please everybody's individual tastes, and local receiving conditions vary widely, but it is within reach of any listener to arrange a free choice of programmes by fitting a PIX in his aerial.

Want of selectivity is mostly due to damping, and a PIX will largely reduce the damping of the aerial which is the outstanding cause of broad tuning, and so increase the selectivity of the broadest tuning set. It only takes a few moments to adjust the PIX, and once set it need not be interfered with.

Even in America, where 10/12 valve superhets are in general use, the PIX has been found indispensable by thousands of owners of these expensive sets.

THE PIX IS THE PROVED ANTIDOTE FOR WIRELESS INTERFERENCE

2/-

With Handy Holder **2/6**

GET REAL PLEASURE FROM YOUR SET

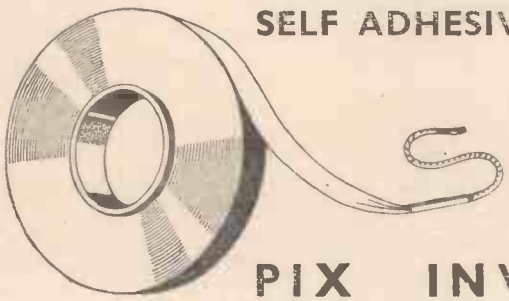
by fixing in your aerial lead-in wire a PIX—the cheapest *efficient* selectivity device. There is nothing like the PIX—the principle is patented—and in buying the PIX you are buying a device which has been definitely *proved* to increase the selectivity of any set.

INSIST ON PIX

Of which 1,500,000 *are in use in all parts of the world*

THE WORLD'S HANDIEST AERIAL

SELF ADHESIVE, BEST PICK-UP, NEATEST



A revolutionary idea in Aerials. Just unroll the tape and press it up in position around the room or up to the attic—and it sticks. One pull and it's down and leaves no mark. No danger from lightning, reduces static interference and increases selectivity. Ideal for artistic homes. Excellent pick-up for flats. Obtainable everywhere.

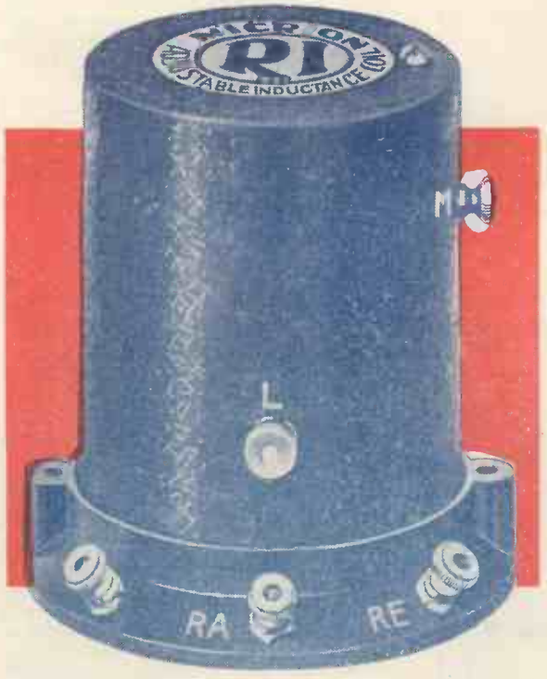
British Pix Co. Ltd., London, S.E.1.

2/-

DOUBLE LENGTH **3/6**

PIX INVISIBLE AERIAL

Remarkable Selectivity given by:- MICRION Adjustable Inductance Tuning



THE "MICRION" COIL
with the Adjustable Inductance

THE SECRET OF SELECTIVITY

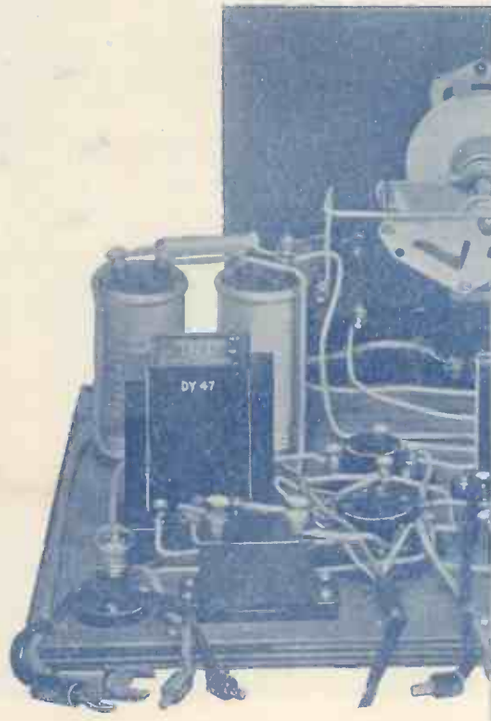
The "Micrion" Iron cored, Adjustable Inductance Coil is the greatest invention of modern radio, described in a test report by "Wireless World" (one of the most authoritative of Radio Technical Journals) as 30% to 40% better than other coils. It is being adopted as standard for greater selectivity in tuning by the most reputable set manufacturers. "Micrion" can be fitted to replace existing coils and can be matched to suit existing components and calibrations, by a mere turn of the inductance screws. It may be purchased separately. See component list on back page.

"WREN-EASTON," THE EASIEST SELECTIVE SET IN THE WORLD TO CONSTRUCT AND UNDERSTAND

This circuit has been specially designed for trouble-free assembly. It is made possible by the utilisation of the two latest developments in Radio—"Micrion" tuning and "DRIVERMU" Class B amplification—which give the selectivity of a multi-tuned receiver with none of its complications. "WREN-EASTON" is a masterpiece of simplified construction that everyone even without radio knowledge can build.

MICRIONISED TUNING—THE NEW SINGLE SYSTEM

"Micrionised" tuning is the latest and greatest development in modern radio. It has conquered the problem of Broadcast Station interference and for the first time has made possible the design of a single tuned receiver that brings in station after station with no trace of overlap, and by the mere touch of the controls. It is the system of tuning that gives the selectivity essential with the greater power that is being employed by more and more broadcasting stations.



DIAL CALIBRATED IN WAVE LENGTHS SUITABLE FOR ANY GOOD AERIAL

The dial calibration of the "Wren Easton" is in wave metres covering the new Lucerne wave length plan down to 190 metres and is adjustable to practically any good existing aerial—a twist of the inductance screw, in the side of the case of the "MICRION" COIL makes this miracle of aerial tuning possible. It means that you can take your "WREN-EASTON" to a friend's house—couple up to his aerial and earth system—adjust the "MICRION" COIL inductance screw to the aerial working conditions and tune in the stations at the same dial reading as usual.

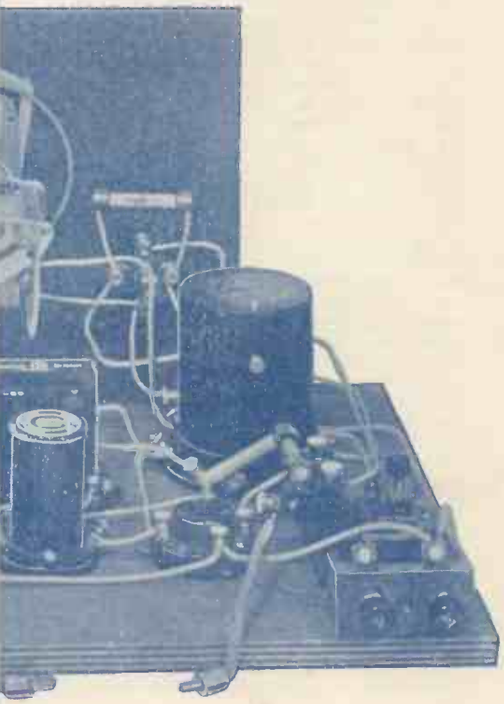
RI LTD

WREN-EASTON The Sim

Realistic Tone *and* Great Volume given by DRIVERMU 'Class B' Amplification

BEAUTIFUL QUALITY REPRODUCTION — LIFE-LIKE IN ITS REALISM — THE BEST CLASS B PERFORMANCE

The R.I. "DRIVERMU" Class B and "HYPERMITE" Transformers are primarily responsible for the magnificent tone of the "WREN-EASTON" receiver. The designer has simplified the "WREN-EASTON" circuit by the most successful scheme of reaction, which relies on the special properties of the "Micrion" dust core coil used in conjunction with the Nickel Iron Transformer. This combination is quite unique and is without doubt a most important feature in radio receiver design.

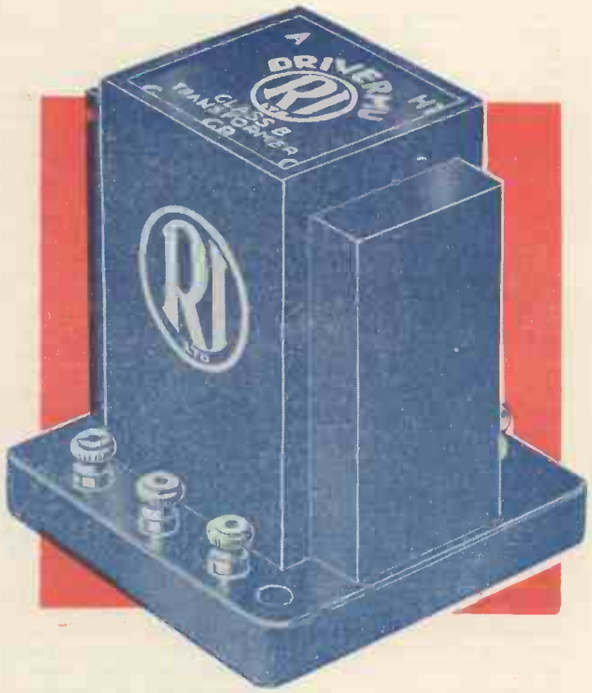


PLENTIFUL POWER OUTPUT AND VOLUME VERY ECONOMICAL H.T. CONSUMPTION

The amount of volume with this easy to build set is ample on all stations. There is no undue use of H.T. current as the Class B system is employed, and consequently H.T. Battery replacement costs are reduced to the minimum. A permanent magnet moving coil speaker is specified, through which the set renders reproduction equal to an all mains receiver.

AMPLE RANGE OF ALL USEFUL STATIONS

The "WREN-EASTON" Receiver brings in all the stations and more than the average listener requires. Throughout the range the tone is clear, volume good and selectivity excellent. Performance in general will give wide satisfaction, and above all, the set is designed with a full allowance for alterations in broadcasting, which will undoubtedly make it serviceable when many kits and sets are rendered obsolete.

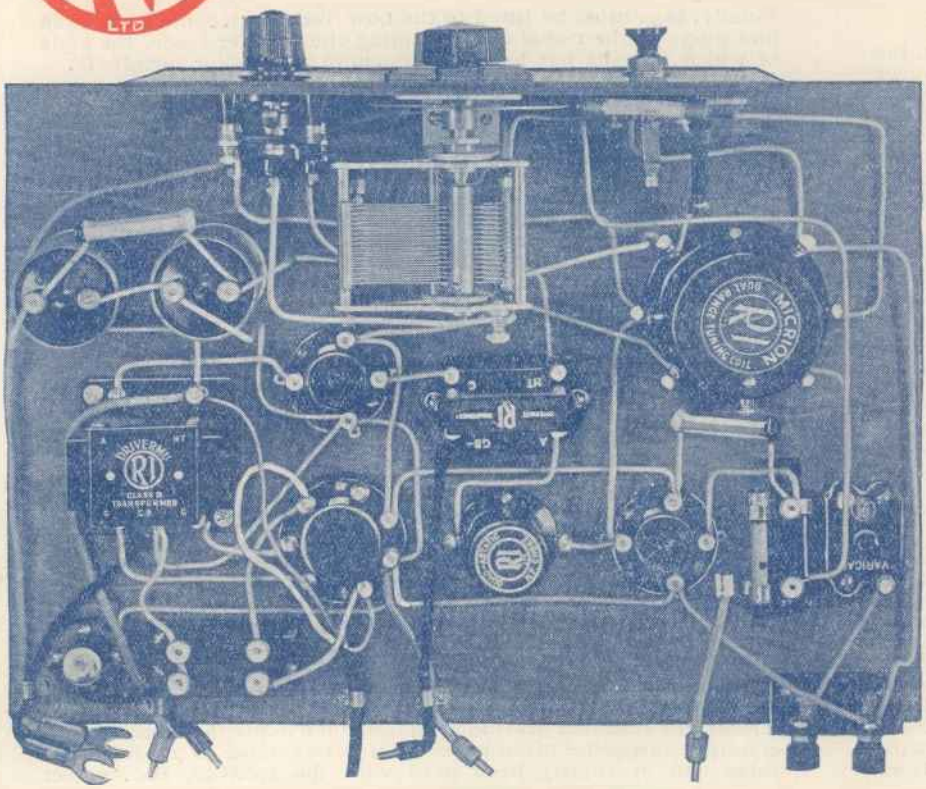


R.I. "Drivermu" Transformer

"Class B" is all a matter of amplification to give much greater output of power to the speaker of a battery set without the excessive and costly use of H.T. current. It is primarily a valve development, but without the very high transformer efficiency of the R.I. "DRIVERMU" Components which control this big valve magnification, "Class B" advantages cannot be so fully utilised, and as a result the high quality performance and H.T. economy would not be realized. These components may be purchased separately. See list on back page.

plest Set to Build for Real Selectivity

"WREN-EASTO



THE COMPLETED "WREN-EASTON" RECEIVER

The masterly design of the "Wren-Easton" is so simple that anyone of average intelligence can build it. Complications have been studiously avoided for the constructor. The only knowledge needed is that of handling a screwdriver and pair of pliers—no soldering is necessary and the complete set can be assembled within a few hours.

The "Wren-Easton" Class B model receiver is arranged for assembly on a base-board with a modern panel front. This method of construction was deliberately chosen because of its absolute simplicity and freedom from any liability of trouble that sometimes may occur with a metal chassis.

Also, this arrangement was selected in the interests of the hundreds of thousands of R.I. enthusiasts who already possess some of the suitable R.I. components and can employ them in this new and advanced "Class B" receiver without difficult drilling and problems of placing

IMPORTANT NOTE

The successful performance of this remarkable receiver is due to the combination of the R.I. Drivermu Transformer and the R.I. Micrion Coil, without which the enormous power, purity of tone and extremely critical selectivity are impossible

In the event of any difficulty in obtaining the components or complete kit, write direct to Radio Instruments Ltd., Croydon, Surrey.

N" MICRIONISED CLASS B RECEIVER

LIST OF COMPONENTS AND VALVES

Your Radio Dealer will supply components or Kit. In event of difficulty in obtaining write direct to R.I., Croydon.

1 R.I. Micrion Coil, 12s. 6d.
1 R.I. D.Y. 20 "Hypermite" Transformer, 12s. 6d.
1 R.I. D.Y. 41 "Drivermu" Class B Transformer, 11s. (Royalty 1s. 6d.)
1 R.I. F.Y.2 Quad Astatic Choke, 3s. 6d.
1 R.I. .0003 Varicap, 2s. 6d.
1 Ormond .0005 Variable Condenser No. 4, R423, 4s. 0d.
1 Ormond Dial No. R365, 2s. 6d.
1 Ormond .0003 Differential Condenser, R.190, 3s. 0d.
1 B.R.G. S.P. Push-Pull Switch, 1s. 0d.
1 B.R.G. D.P. Push-Pull Switch, 1s. 6d.
1 Dubilier .0001 Grid Condenser and Clips, No. 620, 1s. 3d.
2 Dubilier .01 mfd. Condensers, No. 620, 3s. 0d. each
2 Dubilier 2 mfd. Condensers, 7s. 0d.
1 Dubilier .1 meg. 1 watt Resistance, 1s. 0d.
2 Dubilier 2 meg. 1 watt Resistances, 1s. 0d. each
1 Dubilier 30,000 ohm 1 watt Resistance, 1s. 0d.
1 Dubilier 10,000 ohm 1 watt Resistance, 1s. 0d.
1 Dubilier 1,000 ohm 1 watt Resistance, 1s. 0d.
1 Valve Holder, 7 Pin W.B., 2s. 3d.
2 Valve Holders, 4 Pin W.B., 6d. each
2 Belling Lee Terminal Blocks, 6d. each
4 Belling Lee Type R Terminals, A.E., and P.U., 3d. each
1 Peto Scott Walnut Faced Ply Panel, 2s. 0d.
1 Peto Scott Metaplex Baseboard, 14" × 10", 1s. 9d.
1 B.R.G. Fuse Lamp and Holder, 6d.
12 yds. Flex, Connecting Wire, Screws, and 5 Cable Clips
2 L.T. Spade Terminals
5 Wander Plugs

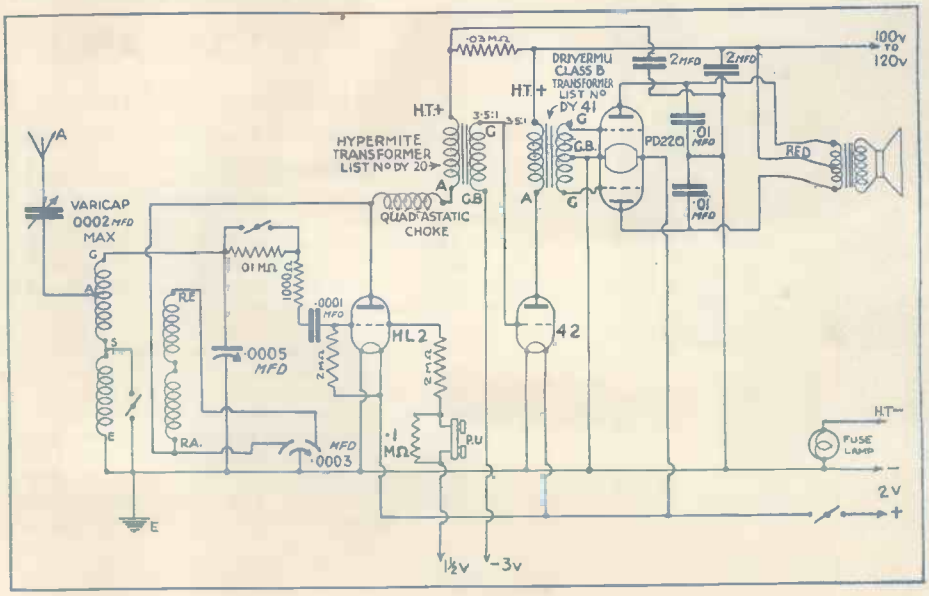
Valves—
1 Mazda "Class B" P.D. 220,
1 Mazda Driver L.2,
1 Mazda Det. H.L. 2,

Batteries—
1 "Drydex" H.T., Battery, H.1006
1 "Drydex" 4½v. G,B. Battery, H.1041
1 Chloride 2 volt Accumulator Type D.F.G.

Ormond Class B Loud Speaker, 25s. 0d.

The R.I. 'Wren Easton" 3 Valve Set, including all components, less Valves and Cabinet, can be built for 90s. 0d.

R.I. "WREN-EASTON" THEORETICAL DIAGRAM



THE RI WREN

MICRIONISE

INCORPORATING THE TWO LATEST
ADJUSTABLE INDUCTANCE TUN

For the First Time in Radio History —A Single Tuned Set that Separates the Stations with the Selectivity of a Multi-Tuned Receiver

The Easiest Set in the World to Build

Power and Purity of Tone equal to a Mains Set. Very low H.T. Consumption.

SELE

ISSUED AND PUBLISHED BY RADIO INSTRU
Contractors to the Admiralty, War Office, Air Ministry, Post Office, Crown Agents and Government Departments. *Established 1922* *Telegrams : Instradio*

-EASTON

ED 'Class B' Receiver

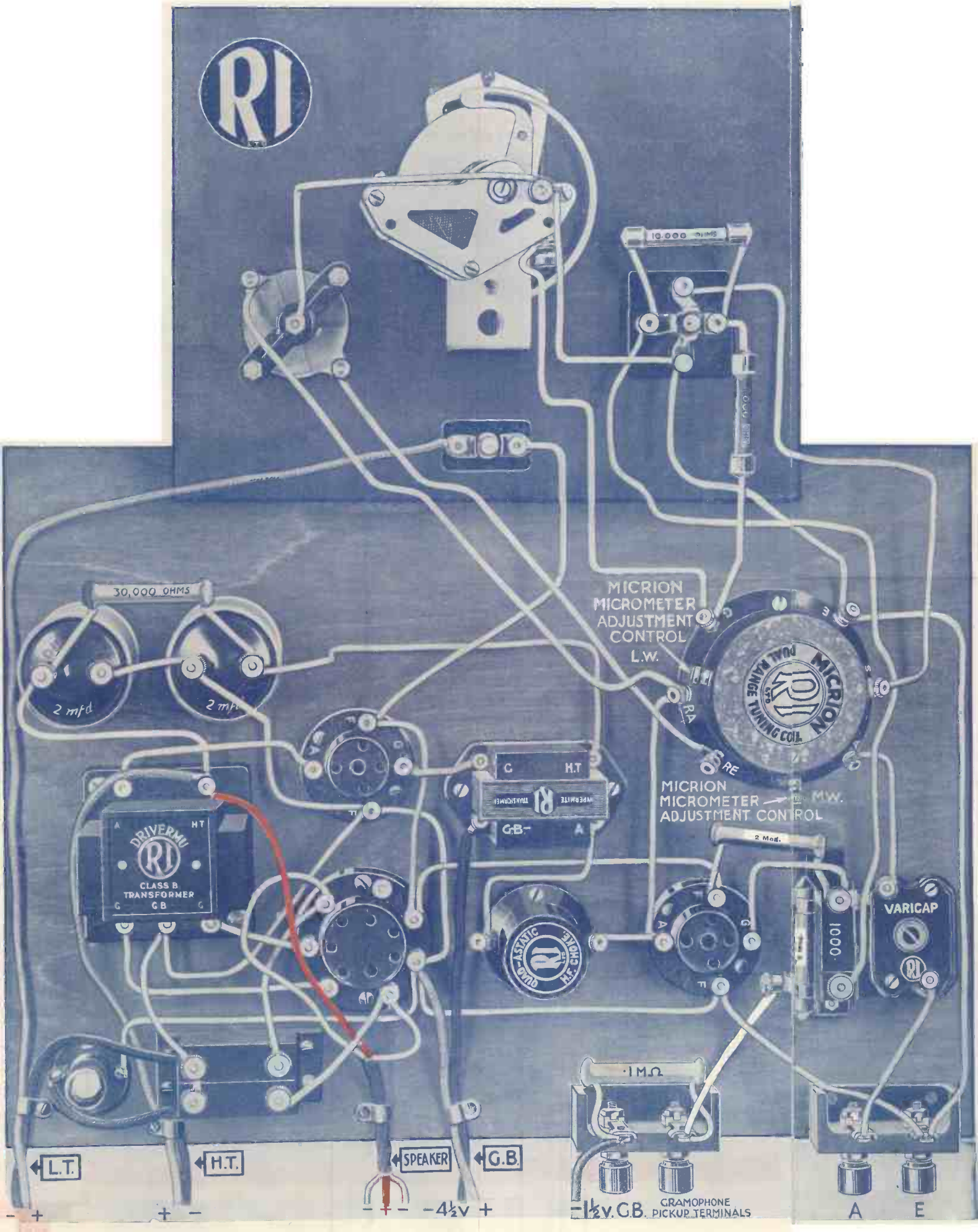
DEVELOPMENTS IN MODERN RADIO :— THE "MICRION"
ING AND "DRIVERMU" "CLASS B" AMPLIFICATION

CTIVITY SIMPLIFIED

FULL SIZE
PHOTO CHART
& COMPLETE
INSTRUCTIONS
FOR BUILDING

6d.

UMENTS LTD. CROYDON, SURREY
s, British Broadcasting Corporation, L.C.C., and Principal Colonial
o, Croydon TELEPHONE: THORNTON HEATH 3211 (5 lines)


10,000 OHMS
30,000 OHMS
2 mfd
2 mfd
MICRION
MICROMETER
ADJUSTMENT
CONTROL
L.W.
MICRION
MICROMETER
ADJUSTMENT CONTROL
M.W.
MICRION
DUAL RANGE
TUNING COIL
RA
RE
C
H.T
G.B-
A
DRIVERMU
CLASS B
TRANSFORMER
G B
HT
2 Mfd.
·1000·
VARICAP
·1 MΩ
QUAD-ASIATIC
CHOKE
L.T.
H.T.
SPEAKER
G.B.
+ -
+ -
- + - -4½v +
-1½v. G.B.
GRAMOPHONE
PICKUP TERMINALS
A
E

The instructions that follow on this page are primarily intended for the constructor who intends to build the complete set with components as specified. A circuit diagram is given overleaf for constructors who may wish to use some of their existing components that are suitable.

Before commencing to build the set, be sure that you have all the necessary components, valves and parts to hand, together with a small screwdriver, pair of round nosed pliers and a pair of small flat nose pliers. A normal size pair of pliers will also be handy for tightening larger sized nuts, and a small but fairly long bradawl will be useful.

The majority of the components are screwed down to the baseboard. Round headed wood screws are to be employed (see list of parts, back page).

STAGE 1

Pin down the full size photographic chart on to the baseboard after you have placed it in position with the edges of the actual baseboard exactly under and coinciding with the edges of the photographic baseboard. When chart is securely pinned down, mark the position of each component by pricking holes around the outside edges of each illustration, through the paper into the baseboard. It is necessary that the components should be in the correct position as illustrated.

STAGE 2

Screw down all the baseboard components in their respective places. Each illustration on the chart enables easy identification of the correct component in each case, but BE CAREFUL TO PLACE EACH COMPONENT THE RIGHT WAY ROUND in order that the terminals may be in the correct position. It is important to lay down the components in the following order :—

1. AERIAL AND EARTH TERMINAL BLOCK. Use $\frac{7}{8}$" No. 4 screws and fit the terminals after the block is screwed down. Be careful to see that the two terminals, A and E, are in their correct position.
2. Gramophone Pick-up block and terminals. Fit as described in No. 1.
3. VARICAP CONDENSER. Use $\frac{7}{8}$" No. 4 screws.
4. DUBILIER MICA .0001 CONDENSER. Use $\frac{1}{2}$" No. 4 screws. After screwing down, fit the two resistance holders —one to each terminal, and be careful to put the insulated one on the correct terminal as illustrated.
5. THE THREE VALVE HOLDERS. Be sure to screw them down with their terminals correctly in place as illustrated. Note that two are alike with four pin sockets, and one only has seven-pin sockets. This last needs special attention in placing, therefore compare the actual article with its photographic counterpart carefully for position before screwing down. Use $\frac{5}{8}$" No. 4 screws.
6. R.I. "DUAL ASTATIC" CHOKE. Use $\frac{1}{2}$" No. 4 screws.
7. TWO .01 DUBILIER MICA CONDENSERS. Place tightly side by side as chart illustration. Use $\frac{1}{2}$" No. 4 screws. Be sure you have the correct two condensers of .01 each.
8. SMALL LAMP HOLDER FUSE. Use two $\frac{1}{2}$" No. 4 screws. Fit any pocket battery lamp bulb 3.5 volt.
9. "HYPERMITE" TRANSFORMER. Use $\frac{1}{2}$" No. 4 screws.
10. "DRIVERMU" TRANSFORMER. Use $\frac{7}{8}$" No. 4 screws.
11. TWO DUBILIER PAPER CONDENSERS. Unscrew the metal base caps of each condenser and screw down in position with two $\frac{1}{4}$" No. 4 screws each. Afterwards screw the condenser into the caps.
12. MICRION COIL. Before screwing down remove the top adjustment screw which projects from the side of the case. This is in order to leave a clear way for the screwdriver whilst fitting. Use $\frac{7}{8}$" No. 4 screws and replace the adjusting screw before proceeding further.

STAGE 3
WIRING THE BASEBOARD

As no soldering is necessary it will be advisable to remove all the soldering tags that may be provided under the terminals of the various components. This may be done as the wiring proceeds. The valve holder tags cannot be removed.

The wiring from point to point is clearly illustrated on the photographic chart. It will be understood that the wires shown connected to the front panel components from baseboard points are illustrated longer in some cases than necessary when the actual panel is in the correct position.

Here are the simple instructions to be studied before commencing :—

1. Make a loop at the end of a length of the bare wire (it is assumed you will use No. 20 gauge tinned copper wire). Do this with the round nosed pliers, so —

2. Remove the terminal from one of the components, the "Varicap" Condenser for instance, and place the loop over the screw and, note importantly, that the loop must be laid over so that when you screw on the terminal it will turn the loop tighter. In other words, the direction of the turn of the looped wire must be the same as that of the thread of the terminal screws, left to right, otherwise the screwing action will open the loop and electrical contact may be faulty as a result.
3. Now, having fixed one end of the wire, stretch it to the the next terminal point, and allowing about 1" for looping cut it and leave it, whilst you cut a similar length of insulated sleeving. Fit the sleeving over the wire tight up to the fixed loop on the "Varicap," leaving the 1" of wire protruding at the other free end. Convert this 1" of wire into a loop BENT ROUND FROM LEFT TO RIGHT. Place over the aerial terminal screw and tighten up. You will then have made your first wired connection and all others should be similarly fitted excepting where it is possible to continue from point to point with one wire without cutting and, by making a loop, by simply bending round each succeeding terminal screw, remembering to always fit the length of sleeving first between each point and to bend the wire round in loops left to right as you go.

Carry on until you have completed the baseboard wires. Leave good lengths of those wires that remain for connection to the front panel components.

Now fit the various resistances in their respective places as follows :

Resistance 2 Meg. Red with metal ends and green spot fit in clips on top of Dubilier Condenser .0001 mfd.

Resistance 2 Meg. Red with green spot and one black end and wire each end. Loop wires and connect to terminals on Dubilier Condenser .0001 and first detector valve holder.

Resistance 30,000 ohms. Orange with one black end and wire each end. Loop wires and fit to two outside terminals on Dubilier Paper Condensers.

Resistance 1,000 ohms. Brown with orange spot, metal ends fitted with wire. Loop wires and connect one end to Micrion Coil terminal. Leave other end free ready for coupling to wave change switch on front panel later. Fit sleeving to wire ends of each resistance before looping.

Resistance .1 Meg. White body, metal ends, with end wires which loop and connect, one to each Pick-up terminal.

It is advisable to leave the various battery and speaker leads as last job of all, to be fitted after front panel has been wired.

STAGE 4 FITTING AND FIXING THE CONTROL PANEL

The front of the panel is faced with a figured walnut facsimile and is highly polished. The back is dull and of a nondescript colour. It is drilled and pierced to accommodate the five component parts which it supports. THREE ONLY WILL BE FITTED FOR THE TIME BEING—the other two comprising the variable condenser and the combined slow motion dial and variable condenser mount must be left until the wiring of the baseboard components has been nearly finished by connection with those on the panel, which must be fitted as follows :—

1. THE REACTION CONDENSER. Remove the control knobs by unscrewing the small grub screws, and unscrew the hexagon nut from spindle which now insert from the back of panel through the left hand hole. Replace nut on spindle at front and tighten with pliers. Be careful to see that the component is positioned exactly as illustrated on chart so that the stops are on the under side of diagonal bar and the NAME " ORMOND " ON THE BAKELITE FRAME IS UPSIDE DOWN. The stop piece must be at rest on the right hand groove provided for it in the bakelite frame

STAGE 4 (continued)

(back view), so that the control knobs turn from left to right (front view) for increase of reaction to maximum stop. Replace the first control knob with the pointer, which should be exactly horizontal, pointing left before being fixed. When this is correctly adjusted replace slow motion knob and fix. This second knob is to enable a closer adjustment of the reaction tuning necessary with this extremely selective set.

2. ON AND OFF SWITCH. Unscrew knob and top nut and washer. Insert spindle through bottom, centre hole on panel and position as chart illustration. Replace washer, screw up nut and tighten with pliers. Replace knob.

3. WAVE-CHANGE SWITCH. Fitting is identical to the on and off switch. Note position—long contact springs must be top and bottom, otherwise connections will be incorrect.

Now screw the front panel to the blocks provided on the baseboard—it must be fitted dead centrally. Do this by first holding the panel vertically with bottom edge on the table and with the baseboard against the back of it. You can hold it to the baseboard by gripping the little block and panel firmly together with your thumb and fingers of the left hand, whilst you make a start for the screw through the left hand screw hole with a bradawl. After getting the first screw home, examine the position of the panel again to see that it is dead central, then put in the rest of the screws which in this case are No. 6 counter sunk $\frac{7}{8}$" wood screws.

Next, complete the wiring of the baseboard components with those now on the panel (refer to photo chart carefully) including the Resistance 1000 ohms already wired to the " Micrion" Coil, which needs coupling to the wave-change switch. Also fit the 10,000 ohms resistance :—white with metal ends and end wires, which loop and fit to short wave (side terminals) of wave-change switch.

The Ormond Variable Condenser may now be fitted together with the slow motion dial, condenser mount and dial escrutchion, which latter must be fitted first.

Remove the control knob and unscrew the hexagon nut from spindle. Unscrew also the small bolt and nut at top and remove escutcheon, which must be positioned on the front of the panel with the Escutcheon dial frame inserted in the square hole cut to receive it. The metal mount should now be placed, and held behind panel with the slow motion spindle inserted through the lower hole in panel. Next, pass the small bolt through the top hole in escutcheon, panel and metal mount and secure with the nut. Screw on the hexagon nut on spindle at front and tighten. Finally replace knob. The small lamp holder sometimes given with this component part may be disregarded.

Now remove the nut from the spindle of the variable condenser. Unscrew the fixing screw in centre bush of slow motion dial. Insert spindle of condenser through top hole of slow motion mount. Screw in hexagon nut and tighten after getting condenser into position as illustrated, on photo chart, which shows the condenser completely closed, and at full capacity. Adjust dial so that its highest reading is immediately against the pointer in escutcheon dial frame. Tighten fixing screw in slow motion centre bush. There are now three wiring connections to be made to the condenser to complete the coupling—these are clearly shown on photo chart.

STAGE 5 FITTING THE LEADS & COUPLING

When preparing the end of the various flexible connecting leads, it is advisable to cut to length and to push back the outer silk covering to expose the rubber insulation by about one inch. The rubber must be removed, using a knife for the purpose, with the blade held at an angle that does not dig into the rubber. A scraping movement only is necessary and will not sever any of the wire strands, which should be twisted to hold them together as one wire, which may be looped in the same way as with the other wires to fit the various terminals, taking care that none of the fine strands of wire are left projecting as these entail risk of damage to the valves and batteries and would impair performance. The ends of the loud speaker leads must be carefully connected, and to ensure accuracy the centre red lead is printed in red on the illustration.

Finally, tags must be fitted to the Low Tension accumulator leads and plugs to the remainder excepting the speaker leads, the ends of which may be left bare for attaching to speaker terminals.

COUPLING THE CLASS B SPEAKER

The type of speaker recommended has been designed for direct connection to the Class B output valve. Three connecting leads are used, combined to form one cable. The lead covered with red rubber insulation should be joined to the centre terminal of the three terminals at the back of the speaker. The opposite end of the red lead connects to the H.T. plus terminal of the " Drivermu " transformer. The two grey or blue rubber-covered leads connect to the speaker outer terminals at one end and to the two terminals indicated on the 7-pin valve holder at the other end, assuming that the constructor will use a cabinet similar to that illustrated on the front of this Broadsheet. A small baffle board is necessary and is mounted inside the front of the cabinet for supporting the speaker which can be screwed into position using $\frac{3}{4}$ inch round-headed wood screws. When mounting the speaker be sure that the holes for the screws are not drilled too deeply as this might result in perforation of the front of the cabinet.

CONNECTING EXISTING SPEAKER

Should a speaker be already available which it is desired to use in place of the type recommended, a " Drivermu " Class B Output Matching Choke, type DY.40, will be required. This should be screwed in a position on the floor of the cabinet just to the right of the speaker, with the H.T. and the two A terminals on the right hand side. Connect the red covered wire of the three wire output lead to the choke terminal marked " H.T." and the grey or blue leads to the terminals indicated in the following table. Now connect by means of a pair of additional wires the appropriate choke terminals to the two speaker terminals. Suitable ratios for various speakers previously suitable for use with different types of output valves are given below. If, for example, a triode output valve had previously been used with the speaker, the correct ratio is obtained by reading from left to right from the word triode. This as will be seen necessitates a ratio of 1.5/1 and is obtained by connecting the set output leads to terminals 1.2 and 1.2 and the speaker which of course already has a transformer, to terminals 1.8 and 1.8.

It should be pointed out that in general, a better performance is to be expected where the recommended type of speaker fitted with a Class B transformer is used, as it is sometimes found that the adaptation of other types of speakers results in unstable working and poor quality.

Fitting the various leads needs care.

Each lead can be checked on large photo chart to ensure correct connection.

Table showing DY40 Class B Choke Ratios to be used with P.D.220 Valve when L.S. is not fitted with Class B Transformer

Loud Speaker Normally Suitable for		DY40 Class B Choke		
VALVE	Optimum Load Impedance Ohms	RATIO	Connect Anodes to	Connect L.S. to
TRIODE	6,000 to 7,000	1.5/1	1.2 and 1.2	1.8 and 1.8
PENTODE (Medium Power)	8,000 to 10,000	1.2/1	A and A	1.2 and 1.2
PENTODE (Small Power)	11,000 to 18,000	1/1	1.2 and 1.2	1.2 and 1.2

OPERATING THE "WREN-EASTON"

AERIAL

This should be not less than 25 feet in height and 50 or 60 feet in length, as may be determined by circumstances. An indoor aerial is not advised for this type of receiver unless strictly local reception is desired. Good insulation at all points is of utmost importance and the greatest possible space should be allowed between all parts of the aerial or lead-in, and any trees or buildings. The lead-in, where passing through a room, should be, preferably, suspended freely and not closely supported against the walls, as this method definitely results in great loss of efficiency. A good earth is equally important, and can most conveniently be made by a tight wire binding around a main water pipe that has been scraped clean for the purpose. The joint is best covered with adhesive insulation tape, as this will help to prevent corrosion, a condition which frequently accounts for poor performance. Connect the aerial to A and the earth lead to E terminals as marked.

BATTERIES

Stand the batteries consisting of

L.T. 2 volt G.B. 4½ volt

H.T. 100 or 120 volt

in the space behind the speaker and connect the L.T. leads. The red lead to L.T. plus and the black lead to L.T. minus.

The G.B. (grid bias) leads with red to G.B. plus and black to —4½ volt and the lead from the 2 pick-up terminals to —1½ volt. The grid battery plugs should be a tight fit in the sockets because valve efficiency can be permanently impaired by operation without grid bias. Should the plugs fit loosely, spread them slightly with a penknife to ensure a good fit.

The H.T. plus and H.T. minus lead should be plugged into the H.T. plus 100 volt and the H.T. minus sockets. Greater output will be obtained when 120 volts are used.

VALVES

Place the valves in their respective positions as marked on the diagram and fit an ordinary 3.5 volt flash lamp bulb in the fuse lamp socket. All connections now being made the set may be switched on.

TUNING

Set the tuning dial to the position corresponding to the wavelength of the local transmission and set the wave-change switch to the correct wave band. This will be OUT for wavelengths between 200 and 540 metres, and IN for those between 1000 and 2000 metres. Turn the reaction knob in a right-hand direction until a faint click is heard and then turn back slightly while adjusting the tuning knob to the best position. The tuning positions of the dial correspond to reception with an average aerial, and it is advisable to screw the knob of the "Varicap" condenser RIGHT IN where a small aerial is used and OUT BY TWO OR THREE TURNS WHEN A LONGER AERIAL IS EMPLOYED. To obtain the closest agreement between the tuning scale and the actual wavelengths, use should be made of the "Micrion" Coil adjusting screws. The upper screw controls the medium wave, and the lower screw the long wave scale positions. Turning the screws inwards will have the effect of lowering the scale position and vice versa. A final adjustment of the "Varicap" will have greatest effect on the lowest dial readings. It is important that the reaction control knob should not be kept in a position where continuous whistling is heard. Should this occur, turn the knob slightly in a backwards direction until the whistle ceases; this position will be found the most sensitive for reception of the more distant stations. Should any difficulty be found in maintaining this sensitive position a re-adjustment of the 1½ Grid bias tapping may be made. This in some cases can be increased to as much as 4½ volts with greatly improved smoothness of reaction control. Too great an increase of grid voltage at this point will result in reduced sensitivity. Local reception will not require any great use to be made of the control knob.

SPECIAL ENLARGED ISSUE!

Practical Wireless

3D

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

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1934 FURY 4 SUPER

Full Details Inside!

FOR THE NEW WAVELENGTHS

—and how to put it right

to be without this Wireless "Doctor"

OUR latest Gift Offer has been received with tremendous enthusiasm by readers of "Practical Wireless." Reservations are pouring in from all parts of the country, and if *yours* is not among them, the only way to avoid disappointment is to post the Forms alongside without delay.

Remember, this unique and helpful Work has been specially written by F. J. Camm, the Editor of this paper. It is chock-full of practical and intensely interesting advice and hints. It is right up to date and deals with every form of Reception trouble. If your aim is to get the *best* results from your Radio, be sure to avail yourself of this most generous offer before it is too late.

READ THESE SIMPLE CONDITIONS:

Complete the Forms on right in ink. Fill in and post Form No. 1 and stamped addressed label. If not already a regular reader, hand Form No. 2 to your Newsagent.

On receipt of Form No. 1 and the addressed label, we will send you a Voucher on which to qualify for your copy of Newnes' Everyman's Wireless Book. The volume will be reserved for you, and will be despatched immediately we receive the completed Voucher.

Affix to the Subscription Voucher which we post to you on receipt of your Reservation Form (No. 1) 9 Gift Stamps cut from the bottom left-hand corner of the back cover of "Practical Wireless" for 9 weeks commencing this or last week.

When your Subscription Voucher is complete, send it, together with a Postal Order for 2s. 0d., which will include the cost of registration, postage, packing, insurance, etc., to "Practical Wireless" Presentation Department, and your Volume will be despatched to you immediately. No reader may qualify for more than one copy of the Encyclopædia.

This offer applies to persons residing in Great Britain and Ireland. Readers in the Irish Free State must pay any duty imposed.

Any query regarding this offer must be accompanied by a stamped addressed envelope.

This Gift Offer is closing very shortly. Delay, therefore, is dangerous. By sending in your Reservation Forms *at once* you will ensure a copy of Newnes' "Everyman's Wireless Book" being specially set aside in your name and you can immediately start qualifying for it in accordance with the simple conditions set out above.

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Address .....

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In accordance with the conditions of your special offer, please send me a SUBSCRIPTION VOUCHER on which to qualify for my copy of Newnes' Everyman's Wireless Book. I am a regular reader of "Practical Wireless."

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Full Address.....

.....

Newsagent.....

Address.....

Reader's Signature..... *Leave blank.*

Fill in this form and the label on left in Block Letters. Stamp the label as directed and post both of them in an *unsealed* envelope (½d. stamp only required).

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If undelivered, please return to Geo. Newnes, Ltd., 22, Tavistock Street, London, W.C.2.

½d. *Stamp must be affixed here.*

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Street.....

Town and County.....

Practical Wireless

EDITOR:
Vol. III. No. 71 || F. J. CAMM || Jan. 27th, 1934.
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

Six Million Licences

IT is fully expected that by the time these lines are in print, the Post Office will have disposed of its six millionth listening licence, as during November and December the number sold brought up the figures almost to that mark. During the past twelve months over 750,000 were added to the previous total. If, as it is computed, there are twelve million homes in Great Britain, we may now assume that every other house possesses a wireless receiver. There is, therefore, no question of having attained saturation point.

No Reason for Complaint

DURING 1933, the B.B.C. carried out transmissions amounting to 59,966 hours, during which period the average breakdown did not exceed .019 per cent. This is certainly a matter of congratulation, and reflects great credit on the technical staff.

Television in the U.S.A.

ALTHOUGH at times much is heard of the progress of television in the United States, it is interesting to learn that so far no radiovision receivers have been placed on the market by the American wireless industry. Four of the leading television transmitters which were carrying out experimental broadcasts on channels between 100 and 200 metres during 1932-33 have since closed down. At present nine laboratories are working small stations on 2,050 or 2,800 kilocycles. Tests are being specially carried out on ultra-short wavelengths. The National Broadcasting Company now transmits regularly from Radio City (Empire State Building) on 6.8 metres (120 lines).

Another Wavelength Conference

IT is reported that the next meeting of the *Union Internationale de Radio-diffusion* (European Broadcasting Union), will take place in England on June 12-20, when the results of the new Lucerne Wave Plan are to be examined and discussed.

Our Free Query Service

New readers should note that we answer all readers' questions FREE, PROMPTLY, ACCURATELY AND CHEERFULLY.

Germany's Short-wave Network

THE new Zeesen-Koenigs Wusterhausen short-wave transmitters were launched on the ether during the Christmas holidays. They have been provided with directional aerials for broadcasts to Asia, Africa, North and South America. Special programmes for the East are transmitted through DJA on 31.38 metres, those destined to Africa through DJD on 25.51 metres and DJL on 49.83 metres. Transmissions for South America are sent during the late hours of the night *via* DJA on 31.38 metres. Between G.M.T. 23.00 and 02.00 all broadcasts to the American Continent are taken over by DJL on 49.83 metres. For these transatlantic services a selected series of wireless entertainments will be provided, and only certain items of the Berlin programme, of international interest, will be included. Short-wave enthusiasts will find these transmissions of interest.

The New Call from Radio-Paris

SINCE December 18, when Radio-Paris "took the air" as a State-owned transmitter, the station is advertised as the *Poste National* Radio-Paris, and power has been increased to 80 kilowatts. This energy, however, is not considered adequate by the authorities, and steps are to be taken in 1934 to push the power up to 150 kilowatts.

A Cheaper Wireless H.T. Dry Battery

A SUBSTANTIAL concession is given to wireless battery users of the power or triple capacity type of battery by the decision of The General Electric Company, Ltd., to reduce the price of the G.E.C. 60 volt triple capacity H.T. battery (Catalogue No. L.260) from 12s. to 8s. 6d.

Wireless for the Blind

WE are informed that further orders have been placed with Messrs. Burne-Jones & Co., Ltd., of 296, Borough High Street, London, S.E.1, for wireless sets for the use of the blind. This firm has now manufactured and supplied some 24,000 sets of special types, including single and double circuit crystal sets, the latter types being for the use of blind persons in remote areas. Each set employs a special tuning system using Braille characters. It is interesting to note that owing to the stringent method of testing employed, servicing problems are practically nil, amounting to less than ¼ per cent.

Revival of "Florodora"

LESLIE STUART'S popular musical comedy has been specially arranged for broadcasting, and the microphone version of *Florodora* will be given in the National programme on January 29 and through the Regional network on January 31. This famous musical comedy success was first produced at the Lyric Theatre, London, in 1899.

Possible Fate of the Eiffel Tower

IN French wireless circles the fact that in the distribution of the new channels the State has not yet disposed of the national common wave-length of 206 metres leads certain authorities to believe that the wave-length will be reserved to the Eiffel Tower. Such an allocation would permit a continuance of its broadcasts, and the station might carry on a series of experimental transmissions for the French P.T.T.

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

Talk on Bicycle Development

ANOTHER talk in the Midland "stock-taking" series will be heard on January 24th. Dr. William Cramp, who is Professor of Electrical Engineering at Birmingham University, has made a special study of bicycle development in the Midlands, where many notable changes have been introduced. The title of his talk is "From the Penny-Farthing to the Modern Cycle."

Transatlantic Debate

THE next Transatlantic debate will take place on January 27th, and will be between Oxford and Chicago. The subject is: "Resolved, that the Profit motive be eradicated." The Chicago students will speak in the affirmative and the Oxford students in the negative. Mr. Vernon Lyon and Mr. Wells Burnette represent Chicago, and Mr. John Cripps and Mr. David Lewis are the Oxford representatives. Mr. Lewis is a Rhodes scholar from Canada and Mr. Cripps is a son of Sir Stafford Cripps.

Southwell Minster's New Organ

THIS instrument—which has two keyboards, one in the triforium and one in the nave—is to be opened on February 1st. The second of the month marks the jubilee of this fine Norman church's advance to Cathedral status as the centre of a diocese. On the latter date there is a relay from Southwell of an organ recital by the Minster Organist, G. T. Francis, F.R.C.O., and this is to be preceded by a short talk on the Minster, the jubilee, and the previous day's ceremony, by the Ven. Archdeacon W. J. Conybeare, Provost of Southwell. Built by Archbishops of York, Southwell Minster is unique among English cathedrals in having three Norman towers still standing after eight hundred years.

Orchestral Concerts from Birmingham

THE City of Birmingham Orchestra appears in the programmes four times during the week. There is a light orchestral concert from the studio on January 30th, with three Slavonic Dances by Dvorák, ballet music by Delibes, and two of the shorter pieces by Delius in the programme. On February 1st, the Orchestra's luncheon hour concert in Birmingham Town Hall will be relayed; it opens with a Weber overture and closes with Elgar's *Pomp and Circumstance* march in G. Then, on February 3rd, the Children's Concert, which includes six movements from the Nutcracker suite, is to be relayed in the afternoon, and in the evening the Symphony Concert, in which the chief work is Beethoven's Eighth. Leslie Heward conducts at all except the Children's Concert, which is taken by Harold Gray.

Droitwich's New Transmitter

CONSIDERABLE progress has been made with the building of the new long-wave transmitter at Droitwich, which is to replace Daventry 5XX, and we understand that the installation of the plant will begin shortly. It is expected that the station will be ready for service in the early summer this year. The opening of the Droitwich station will mean that the field strength of the National programme over a large part of the country will be such as to make it practicable for listeners in the London, North, and West Regions to receive their National programme from Droitwich instead of the medium wavelength National transmitters in their respective regions. The B.B.C. has, therefore, decided to close down the London, North, and West National transmitters, thus releasing two wavelengths (the London and West National transmitters share a wavelength) for providing a better service in areas which will not be well served, even when the Droitwich transmitter is in operation.

INTERESTING and TOPICAL PARAGRAPHS

FERRANTI VALVES IN THE MAKING

Ferranti valves are made in their entirety at the Hollingwood works, and our illustration shows a portion of the valve assembly department.

Talks on Various Phases of the Supernormal

PSYCHICAL research, telepathy, dreams and what they portend, ghosts, survival after death and other phases of the supernormal are to be discussed in a series of broadcasts in the New Year. The speakers, dates and subjects will be as follows:—January 26th, Lord Charles Hope—"Physical Mediumship"; February 2nd, Professor Seligman—"Primitive Practices and Ideas"; February 9th, Professor Seligman—"Ritual and Healing"; February 16th, Mrs. W. H. Salter—"Telepathy"; February 23rd, Dame Edith Lyttelton—"Dreams and Pre-Vision"; March 2nd, Sir Ernest Bennett—Discussion with another speaker not yet selected on "Guests and Haunted Houses"; March 9th, Sir Oliver Lodge—"Do We Survive?"; March 23rd, Professor C. D. Broad—A Summing Up.

Listeners in the South of France

CORRESPONDENCE received at Broadcasting House from residents in the South of France draws attention to the inability of listeners in that part of Europe to receive the London National programme since the synchronization of the London National and West National wavelengths. Last winter the London National transmissions were very easily picked up all over the Continent, and were greatly favoured, especially by people in the South of France. The B.B.C. points out that a substitute can readily be found. The North National transmitter, working on 301.5 metres (995 kc/s) still gives an excellent service on the Continent of the National programme at night, although this may not be known generally by people who have been trying to get London National. Pending the completion of the new long-wave transmitter at Droitwich, listeners on the Continent would be well advised to tune in to the North National transmissions. On and after January 15th, North National wavelength will be 296.2 metres (1,013 kc/s).

SOLVE THIS!

Problem No. 71.

In his search for better quality Arrowsmith decided to replace his transformer-coupled L.F. stage by a Choke-capacity coupled stage. He therefore purchased a .5 mfd. fixed condenser, a good quality H.F. choke, and a 250,000 resistance, and joined these in the correct manner in place of the transformer. Results were, however, very disappointing, and although he carefully checked all connections he could find nothing wrong. What mistake had he made? Three books will be awarded for the first three correct solutions opened. Envelopes should be marked Problem No. 71 and addressed to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. All entries must be received not later than January 29th.

SOLUTION TO PROBLEM No. 70.

In wiring up the seven-pin valveholder for his Class B Unit, Atkinson had misread the connections to the pins, and had consequently reversed the anode and grid connections. The following three readers succeeded in correctly solving Problem No. 69 and books have accordingly been forwarded to them: C. M. Dower, 28, Gartmore Road, Goodmayes, Essex; G. C. Jervis, 343, Birchfield Road, Westneath, Redditch, Worcs; J. Simpson, Castlefield, Cupar, Fife.

"Florodora" Broadcast

A BROADCASTING version of the famous musical comedy, *Florodora*, first produced at the Lyric Theatre, London, in 1899, will be given in the National programme on January 29th and in the Regional programme on January 31st; this was one of the most charming of the musical plays of Leslie Stuart; the book was by Owen Hall and the lyrics by E. Boyd-Jones and Paul Rubens—a combination which, in its day, was supreme in its own field. The adaptation and production are the work of Gordon McConnel.

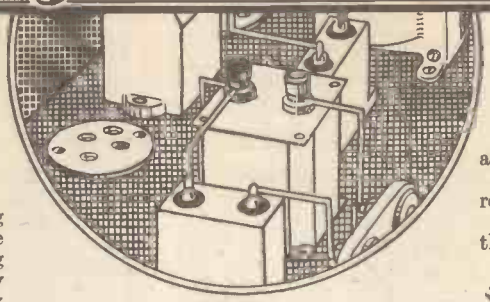
Change of Address

THE Fuller Accumulator Co. (1926) Ltd., announce that the address of their Manchester Depot is now 53, Back George Street, Princess Street, Manchester. Telephone No.: Central 6356.

Improving the L.F. Amplifier

Some Useful Hints for Improving the Efficiency of the L.F. Stages of a Receiver are Given in This Article

By P. S. NICOLL



HERE are a few hints for improving the quality of reproduction at little cost, and at the same time increasing the output from the set. If we can supply a higher voltage to the low-frequency valves, it can easily be seen that the output will be greater and the quality improved. Suppose, for convenience, that the existing set is connected to 120 volts H.T., and that we have .25 megohms in the plate circuit of the detector valve, a coupling condenser of about .002 mfd., and a grid-leak of about 2 megohms (see Fig. 1). These were considered normal values only a short time back. The voltage-drop across the .25-megohm resistance will be 62.5 when the detector valve is passing only .25 milliamp. This means that the valve will be working a long way from its maximum output.

A fuller use of the valve can be obtained by replacing this anode resistance by one of 50,000 ohms: there will be a voltage drop of only 50 when the valve is passing as much as 1 milliamp., which will improve results considerably. Since we have altered the anode resistance we must also alter the grid-leak of the L.F. valve, otherwise the balance of the circuit will be upset. A suitable value is ½ megohm, although other values may be tried.

Parallel Feed

The next thing is to parallel-feed the next valve. To do this the primary of the transformer (usually marked I.P. and O.P. or H.T. and Plate) must be disconnected.

To make this improvement a choke (which will only cost a few shillings) of about 30 henries must be obtained. This choke is connected in the position previously occupied by the transformer primary; the end that was connected to the plate now has a condenser of about .5 mfd. also connected to it, the other condenser terminal is connected to the primary winding and earthed through the transformer, as shown in Fig. 2.

The final improvement consists of disconnecting the speaker and in its place inserting a choke of inductance as high as we can afford. If of the same value as before it will do, but its resistance should be low, about 300 ohms; in fact the lower the better. To the plate of the output valve connect a 2 or 4 mfd. condenser and earth this through the loud-speaker. The grid bias should be increased on both the L.F. valves by one or two volts. The amount of this can easily be ascertained by trial.

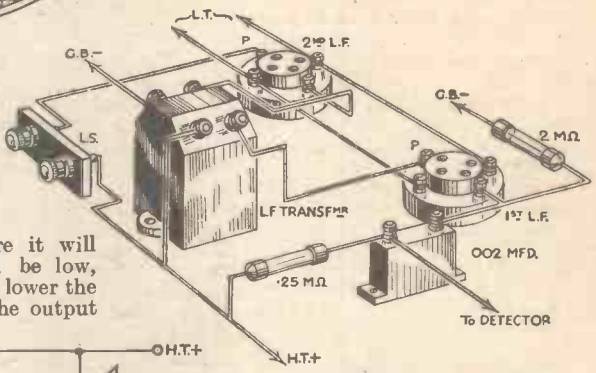
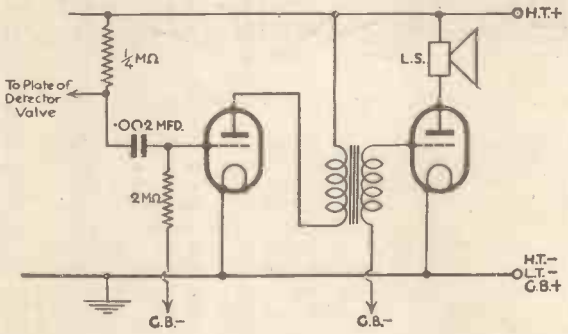


Fig. 1.—An R.C.C. stage employing a high-value anode resistance.



Advantages of the Modification.

The advantages shown by the modified circuit are :—

(*a*) The first L.F. valve can be run at practically full H.T. voltage, there only being a small drop across the choke winding.

(*b*) No direct current passes through the transformer winding, and thereby the inductance will be maintained higher than in the ordinary transformer coupled amplifier. Thus quality will be improved.

(*c*) Again quality will be further improved because the output valve will be working at almost full H.T. voltage.

(*d*) Any tendency to howl will be reduced, the last valve being decoupled.

(*e*) The speaker winding is isolated, and thus a large power valve may be used without any danger of damaging the speaker.

(*f*) The extension wire to the speaker may consist of only one insulated wire, the other terminal of the speaker can be earthed to any convenient point.

The main disadvantage of the circuit is that the two chokes require rather a large amount of space; unless these chokes be large the whole advantage of using them is lost. The chokes and transformer should be well spaced out.

If these components are not provided with iron cases they should also be arranged so that the windings are in opposition, although the provision of an iron case round one of them, and an earth connection to the case, will prevent instability due to interaction. A certain amount of care should be exercised in the choice of the components in order to obviate the risk of over-amplification of a certain frequency due to a similar peak in each component.

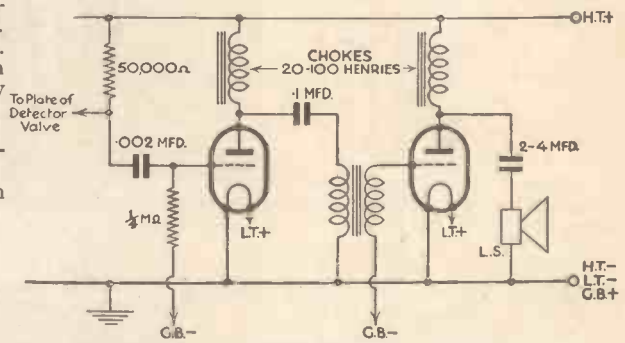
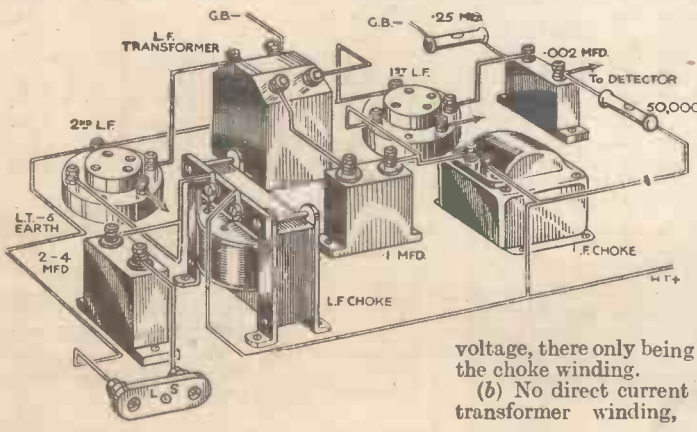


Fig. 2.—Using an L.F. choke in place of an anode resistance, and choke-coupling the speaker.



A NEW LOUD-SPEAKER DESIGN

Details of a Unique Piezo-Electric Loud-Speaker, Specially Designed for the Reproduction of the Higher Audible Frequencies

By "LAMBDA"

BEFORE we can examine the possibilities of the piezo-electric loud-speaker it is really necessary to ascertain what piezo electricity is, in what substance it is found, and how it is obtained.

By compressing a piece of quartz crystal it has been found that charges of electricity appear at its extremities, one side being positive and the other negative. Also, by exerting a force which would tend to extend the crystal, this difference of potential will again manifest itself, but the polarity will be reversed. This phenomena is known as the piezo-electric effect. It is not new, as it has been known for about fifty years. Only in recent years, however, has it been put to practical use.

Rochelle Salts

In addition to quartz, the effect just described is known to exist in such substances as tourmaline and rochelle salts. The former substance is comparatively rare and is, therefore, not suitable for commercial use. Rochelle salts can be made in the laboratory in any quantity, and it is this substance which was selected for employment in the design of this new loud-speaker.

It has certain disadvantages, being affected by moisture and heat, but this does not appear to have made the design of a piezo-electric loud-speaker impracticable. This remarkable peculiarity of certain substances—namely, the piezo-electric effect—has been utilized in the production of a loud-speaker capable of responding to the higher frequencies up to about 16,000 cycles. A remarkable achievement, offering great possibilities in the direction of improved frequency response, with consequently still greater improvement in the quality of reproduction.

The Piezo-electric Effect

How can we apply this effect to the design of a loud-speaker?

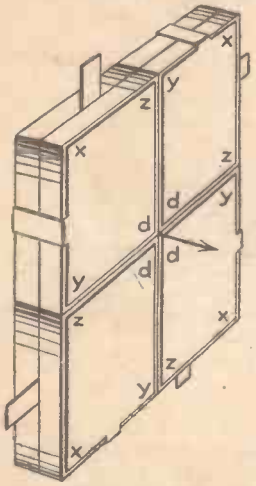
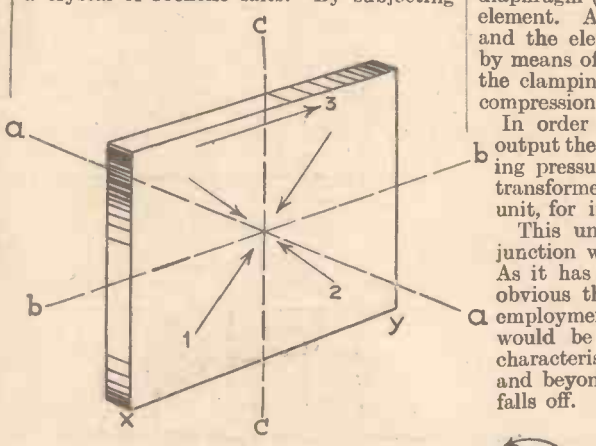


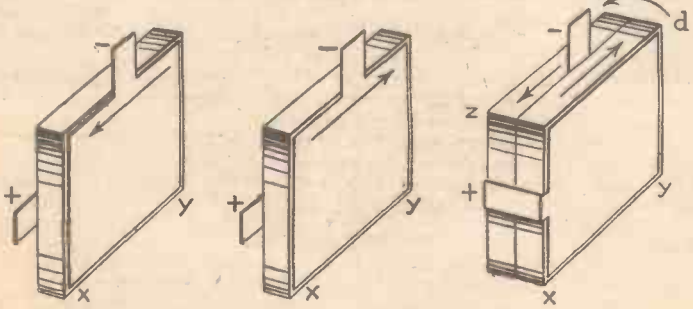
Fig. 3.—Construction of the piezo-electric element.

Before we can answer this question it will be necessary to carry our investigations of the piezo-electric effect a step further. It is known that the piezo-electric effect is considerably greater in rochelle salts than in other substances, consequently, this substance appears to be the most suitable for our purpose.

In Fig. 1 is illustrated a plate cut from a crystal of rochelle salts. By subjecting this plate to an electric field along *a* — *a* it tends to be strained in a direction 45 degrees to the axes *b* and *c*. The arrows 1 and 2 indicate the direction of the strain.

Now let us clamp the corners *x* and *y*; this will result in a slight motion of the upper edge in the direction shown by the arrow 3. In Fig. 2 are shown two such plates provided with metal foil electrodes. They are so arranged that their motions are in opposite directions. This is indicated by the arrows at the upper edges. If the near faces are cemented together and the edges *x* and *y* clamped, the upper corners of the assembly will now tend to twist in response to a potential difference between the foil electrodes. Now clamp the upper corner *z*; the remaining corner *d* will then tend to move in the direction indicated by the arrow.





Figs. 1 and 2.—Diagrams illustrating the principle of the piezo-electric speaker.

Application to Loud-speaker Design

Advantage is taken of this fact in the design of this new loud-speaker. Four of these "torque-responsive" units are employed. Their edges are cemented together and so form the assembly shown in Fig. 3. If this unit is clamped at the edges, or at the corners *x-y-z*, the central points *d*, which are in reality the individual corners of the four separate crystals, as shown in Fig. 2, then these corners will tend to move inwards and outwards.

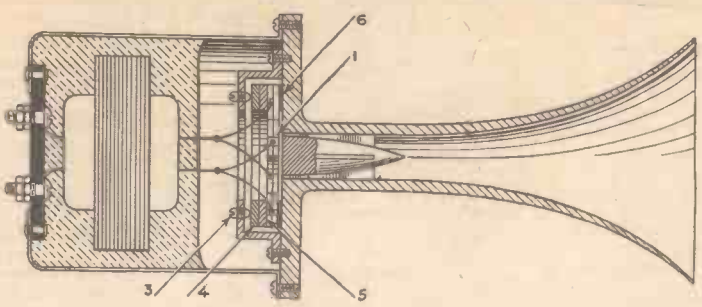


Fig. 4.—Section of the piezo-electric loud-speaker.

An examination of the section through the loud-speaker (Fig. 4) will serve to illustrate the method of construction. The diaphragm (1) consists of the piezo-electric element. A ringed spacer is provided (6) and the element is clamped into position by means of the screws (3) which act upon the clamping ring (4) situated behind the compression ring (5).

In order to obtain the greatest sound output there is a certain maximum clamping pressure which must be exerted. A transformer is mounted at the rear of the unit, for impedance-matching purposes.

This unit is designed for use in conjunction with a moving-coil loud-speaker. As it has a cut-off at 1,000 cycles, it is obvious that it would not be suitable for employment by itself, as bass response would be non-existent. It has a rising characteristic up to about 10,000 cycles and beyond this point the response again falls off.

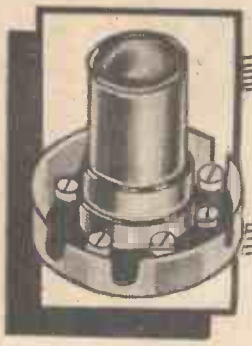
Advantages

All that is necessary to employ this additional unit is to connect it in parallel with the existing moving-coil loud-speaker and place it as near as possible to it.

By a combination of moving-coil and piezo-electric speaker, an approximately straight-line frequency response up to about 10,000 cycles can be obtained. The lower limit depends upon the low-frequency response of the moving-coil loud-speaker and the characteristics of the amplifier.

No filter or other arrangement is necessary to divert the power between the two speakers. This is due to the fact that the reactance of the unit is inherently capacitative, and when connected in parallel with a unit having an inductive impedance, the power divides naturally.

Another advantage of connecting a capacitative unit in parallel is when pentode output valves are employed. In this case the presence of the high-frequency unit has extremely beneficial effects. The presence of the capacity in parallel restricts the rise in response of the moving-coil loud-speaker with increasing frequency, which happens when the output stage employs a pentode valve.



IS PERMEABILITY TUNING DIFFICULT?

What Has Happened to Permeability Tuning? In This Article the Author Throws Considerable Light on the Problems Involved

THE inductance of an air-core coil depends *principally* on the geometrical dimensions with, generally, a small correction factor depending on the frequency of the current flowing in the circuit. In the case of the newly-developed coils with iron cores, however, the inductance depends not only upon the dimensions of the coil, but also upon the physical properties of the core, and these properties are variable.

Technically speaking, the matter is expressed by saying that the magnetic flux density B, which is induced in a sample of iron by a magnetizing force H, is given by the simple formula $B=\mu H$, and the term indicated by the Greek symbol μ is called the permeability.

A Complex Variation

It is easy to prove, however, that μ is not constant for any one sample, but varies in a complex manner with B or H, as will be seen from Fig. 1, and also varies within wide limits for different samples of iron. The inductance of an iron-cored coil, therefore, depends on the permeability of the iron, and this varies over the cross section of the core, since H is not constant over that area. Moreover, and this is a point which is frequently overlooked when we are dealing with currents which vary as they do in radio circuits, if the current in the coil, by which H is produced, varies, then the value of μ will change. In consequence, as a general rule, in any calculation work it is only possible to select some average value for μ, which experience has shown to be representative for the coil in question.

Readers will therefore appreciate from the foregoing that the problem we are examining is somewhat complex in character. With an air-core coil μ has a value of unity and all is plain sailing, but not so when iron is introduced into the coil.

Not Strictly New

Of course, strictly speaking, tuning by a variation in the inductance of a coil is not by any means new. Those readers who have been working at radio for several years will recall quite readily the variometer tuners, a sample of which is shown in Fig. 2. Two coils, joined in series, were mounted so that one rotated inside the other. In one case, when the planes of the coils were co-axial, the inductance effects of each were additive, but when the movable one was rotated through 180 degrees, the magnetic fields were opposite and the total inductance reduced, intermediate values being secured in intermediate positions. Although a very unselective device, when the broadcasting stations were few and far between, or in those cases where a simple crystal set was sufficient to satisfy the household needs, the component proved quite satisfactory.

Inductance or permeability-tuning devices to contend with modern conditions of broadcasting, however, need a form of design radically different from this. Iron

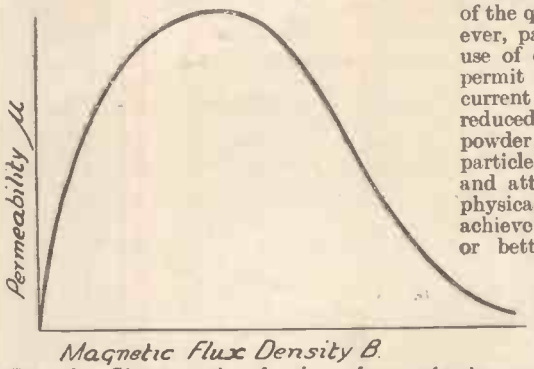


Fig. 1.—Showing the familiar form of a permeability curve.

cores, which can be employed at radio frequencies, have been instrumental in

Fig. 2.—An early form of inductance tuner.

changing coil design very considerably, and in condenser-less tuning the cores play an important part.

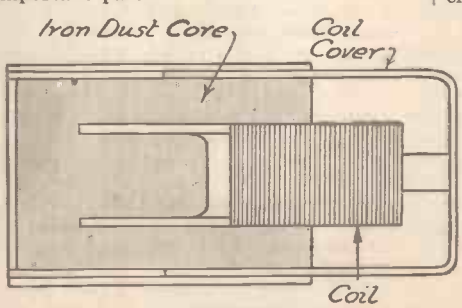


Fig. 3.—One form of permeability tuner arrangement to give telescopic motion between iron dust core and coil.

Modern Iron Cores

Ordinary iron cores, or even thin laminations, are productive of such high losses that their use in high-frequency coils is out of the question. Over forty years ago, however, patents were taken out to cover the use of compressed iron-dust cores, but to permit radio frequency working, the eddy current paths have had to be still further reduced by employing the finest iron powder and also completely insulating the particles. Then, again, the greatest care and attention has had to be paid to the physical design of the cores themselves to achieve a measure of performance equal to, or better than, ordinary tuned circuits.

Two names closely associated with this work are W. J. Polydoroff in America, and Hans Vogt in Germany.

In Fig. 3 is shown one form of design used by the former inventor to change the coil inductance by sliding it over a core of iron dust. As will be seen, the core is arranged to go both inside and outside the coil, while closely-fitting metallic shields of copper or aluminium act as guides for the core when it is inserted into the windings.

An Important Feature

Reverting for the moment to an oscillatory circuit tuned by the usual .0005 mfd. variable condenser, there is one important aspect which has always proved a drawback. In fact, it would not be too much to say that it was partly responsible for the introduction and popularizing of superheterodyne receivers. I refer to selectivity. The inductance of a given coil has to be designed to give the highest wavelength (minimum frequency) when the moving plates of the variable condenser are wholly in mesh with the fixed plates (maximum capacity).

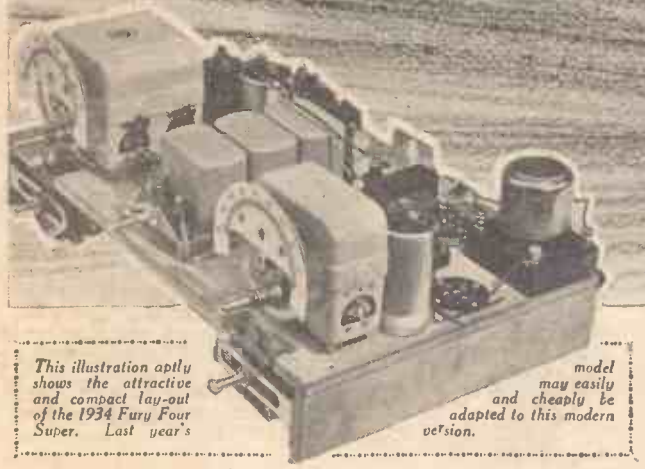
Under these conditions, a good measure of selectivity can be achieved, a factor which can be proved readily both theoretically and practically. As the wavelength is reduced, however (that is frequency increased), the selectivity becomes worse, for with the increase in frequency the losses become greater, while the inductance remains sensibly constant. Hence the ratio of inductance to resistance decreases, and at the minimum setting of the condenser on the medium waves the selectivity condition may be three or four times as bad when compared to the maximum condenser setting.

A Better Condition in Theory

Coming now to an oscillatory circuit arranged for inductance or permeability tuning, it is possible to improve matters very considerably from the theoretical point of view. First of all

(Continued on page 927)

F. J. CAMM'S 1934 FURY 4



This illustration aptly shows the attractive and compact lay-out of the 1934 Fury Four Super. Last year's model may easily and cheaply be adapted to this modern version.

Full Constructional Details of the 1934 Version *Practical Wireless* last year. This really is a Super Super Station Getter. It Worthily Upholds the Standards in Home-Constructed Receiver Design. Readers who made the original Fury Four will be

I EXPLAINED in last week's issue that the latest PRACTICAL WIRELESS receiver is really a modified and considerably improved version of the "Fury Four" which created so much interest and enthusiasm among home-constructors last year. Although there has been no attempt slavishly to adhere to the principal features of the original "Fury Four," it has been found possible to retain many of those which were so popular and which marked a definite forward step in the technique of wireless set design. The same type of chassis has again been used, although in the present case the latest metallized material has been employed for it. It has even been possible to retain the very same chassis dimensions, so that those thousands of readers who made the original "Fury" will be able to make use of the same cabinet (which is often one of the most expensive parts of a receiver). Although in one way the combination of valves is the same as in the 1933 "Fury"—that is, two H.F. stages, followed by a leaky-grid detector and a high-efficiency pentode—the first two valves are now of the variable-mu type, and are used to provide complete volume and selectivity control under any combination of circumstances.

Distortionless Volume Control

The amount of high-frequency amplification provided by the set is truly enormous, and is easily sufficient to make it an easy matter to tune in dozens of stations at full loud-speaker strength without making any use whatever of the effective reaction control. At the same time, the volume of any transmission can be reduced to no more than a whisper by means of the volume control which serves to vary the bias on the two variable-mu valves. Needless to say, this volume control is entirely distortionless, and does not have the slightest effect on the quality of reproduction.

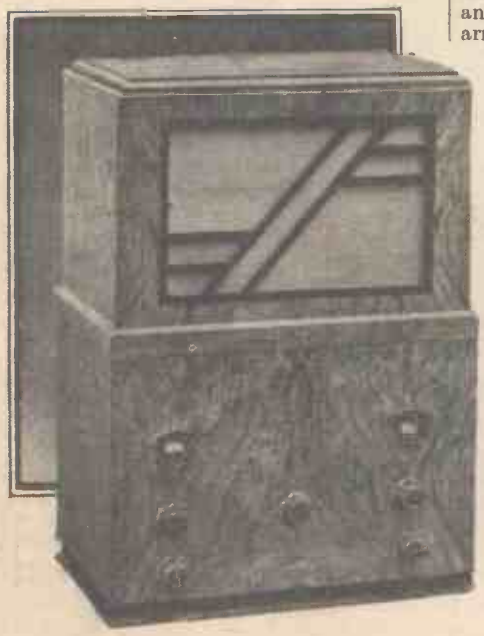
"Mixed" Coupling

The circuit arrangement is particularly interesting, embodying, as it does, a number of unusual and particularly good features. For example, instead of using the same method of coupling between the first and second variable-mu valves as between the second variable-mu and the detector, a tuned-grid circuit is made use of in the first position and tuned anode is used in the second. This will at first seem rather unusual, but it has the extremely beneficial effect of rendering the receiver absolutely stable under all conditions, despite the enormous degree of H.F. amplification which is provided. This does not affect the correct ganging of the two-gang condenser, as might be expected, since the

Mr. F. J. Camm, demonstrating his 1934 Fury Four Super.

of the Fury Four which was Fully Described in Receiver—Super Quality, Super Selectivity, and a Best Traditions of its Predecessor and the Best A Better Four-Valve Receiver does not exist. able to Modify Last Year's Model at Trifling Cost

The 1934 Fury Four Super in its cabinet.



The two-piece cabinet of the 1934 Fury Four Super is here illustrated.

coils themselves are accurately matched and are perfectly suitable for this circuit arrangement. In order to ensure that the voltage applied to the screening grids of the two H.F. valves shall be perfectly accurate, a potentiometer device has been incorporated in preference to the usual series resistance arrangement, and this is in turn provided with decoupling circuits to avoid any possible instability in this part of the receiver. The usual drawback to this arrangement, namely, the continual drain on the high-tension battery caused by the potentiometer across the total supply, has been avoided by the method of utilizing a four-point on-off switch, about which more will be said anon.

Low Detector Grid-circuit Damping

The detector-grid circuit is of rather unusual design, and avoids one of the principal difficulties experienced when high-efficiency coils are employed. The grid condenser, it will be seen, is connected direct to the anode of the second high-frequency valve, and this is in turn connected to a transfer tapping on the grid coil, thus providing a constant load on long or medium waves and enabling full use to be made of the efficient coil on both wavebands. The grid circuit is provided also with a change-over switch for gramophone-record reproduction, and the only slight departure from usual practice here is the method of connecting the grid leak to the grid direct, instead of to the grid condenser. Although this means that the leak is in circuit even when the gramophone pick-up is being employed, it enables the leak to be connected in the most direct manner to the grid, and ensures stability on radio by dispensing with an otherwise long lead. The remaining lead, as well as that for one of the pick-up connections, is carried in the usual metal braiding, which is earthed, and it will be found that the set is thus perfectly stable on both settings of the switch.

Uniform Reaction Control

The reaction circuit, although perfectly normal as a whole, incorporates a small resistance in series with the condenser in order to prevent any possibility of parasitic oscillation on either waveband, and the small anode by-pass condenser forms an essential part of this circuit.

A New L.F. Coupling

Coupling between detector and output valve is carried out by a newly-introduced L.F. coupling device, which includes in the moulded case the anode coupling resistance, a coupling condenser, an L.F. transformer, and yet a further resistance

Every care has been taken to ensure that readers of PRACTICAL WIRELESS can obtain the same results as from the original 1934 Fury Four Super. Mr. F. J. Camm is here seen giving his final O.K. to the drawings.

of high value, which is connected in series with the grid of the output valve, as a further precaution against instability. Thus it will be seen that at every part of the circuit great care has been taken to ensure that no possibility of instability can occur. The high-efficiency pentode valve feeds the loud-speaker through an output filter comprising a tapped choke and large-capacity fixed condenser, whilst also connected in this part of the circuit is a battery economizer of the latest design. The purpose of this is to reduce the normal high-tension current and thus provide one of the principal advantages of Class B amplification, whilst retaining the additional benefits conferred by the pentode. The economizer reduces the total anode current required by the pentode when no signal, or a very quiet signal, is being received, and yet permits the current to rise to any required value to produce loud notes without distortion. We have already explained in PRACTICAL WIRELESS how this is accomplished by a variation of the grid bias applied to the last valve, and a metal-oxide rectifier forms an important part of the arrangement.

Sufficient has been said to show that from every point of view the circuit has been studied and designed to produce maximum efficiency and economy, and the constructor may go ahead in the certain knowledge that yet another "star" receiver has been designed for his especial benefit, and one which is a worthy successor to the original "Fury Four."

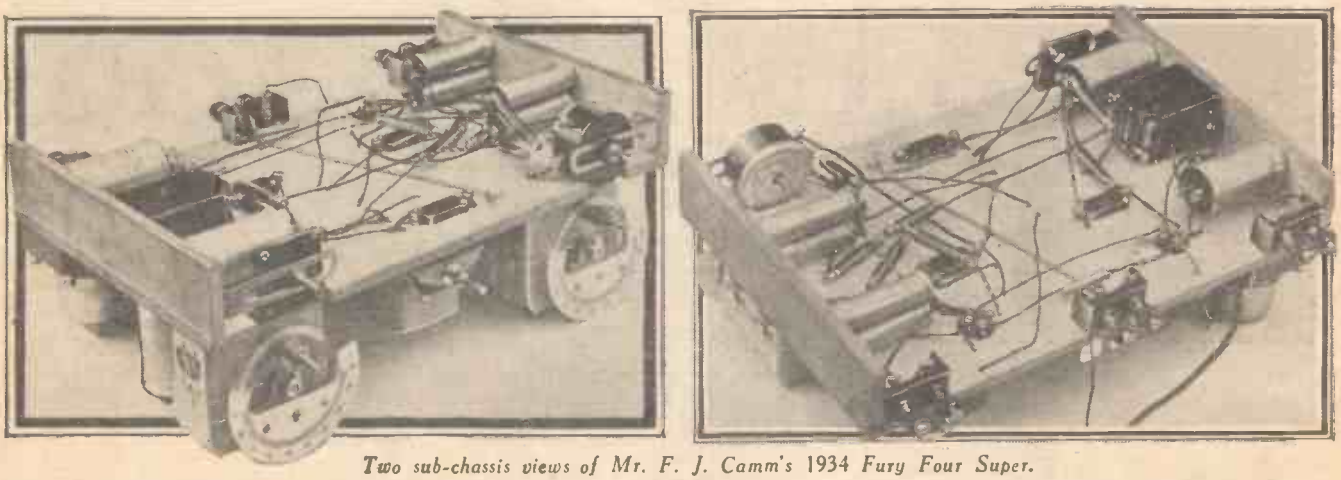
The Construction

The chassis, as supplied by the makers, will be found ready for the components to be mounted, although small clearance holes will have to be drilled in certain places to permit of interconnecting wires being passed from one side of the chassis to the other. The position of these holes may be obtained from the wiring plan (page 906), and, therefore, the first thing to do is to place all the components on the chassis, as shown in this diagram, and to mark their positions. The screw holes may then be started and the wiring holes drilled. The template which is supplied by the condenser manufacturers should be positioned on the chassis and the necessary clearance holes drilled to accommodate the holding-down screws. When this has been done, the two component brackets should be mounted on the side runners, and it will be found easier, although not essential, to mount the fixed condensers on these runners whilst they are still unscrewed from the base of the chassis. In this manner the screws are driven home without difficulty.

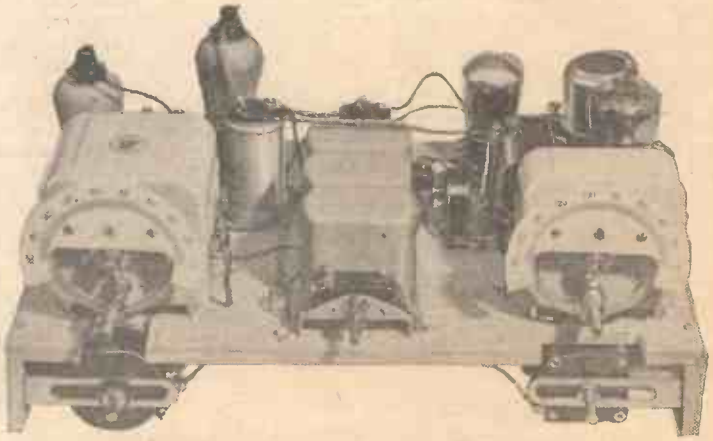
The Coils

The coils will be found to have soldering lugs projecting below the baseplate, and, before the assembly is mounted, nine-inch lengths of connecting wire should be soldered to the required lugs as shown by the wiring plan. It will be seen that two of the wires are kept on the upper side of the base and connected to the fixed sections of the two-gang condenser, whilst the remainder pass down through holes in the base for subsequent connection on the underside of the chassis. These holes are shown in the centre of the wiring plan, and the lugs to which they are connected are indicated by the numbers at the side of these holes. The coils are supplied without a switch on the end of the spindle, and it is most important that the correct type be used in this position. The switch

(Continued on page 905)



Two sub-chassis views of Mr. F. J. Camm's 1934 Fury Four Super.



A neat lay-out, simple construction, extreme selectivity, and easy operation are salient features of the 1934 Fury Four Super.

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*†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/-
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**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

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*D.H.L.	Detector	13,000	58	4.5	13/6
D.P.	Power Output	2,800	17	6.0	14/-
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

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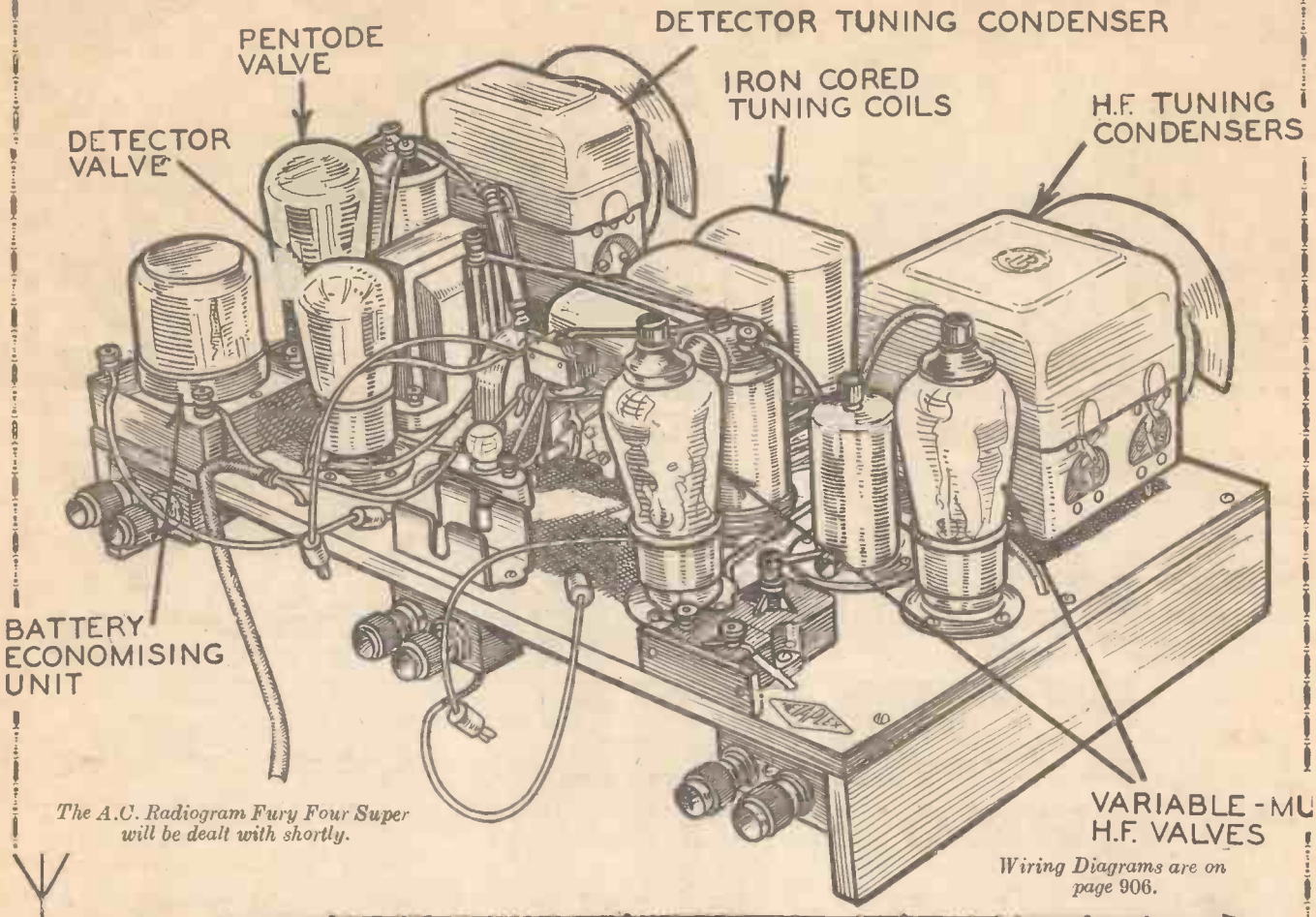
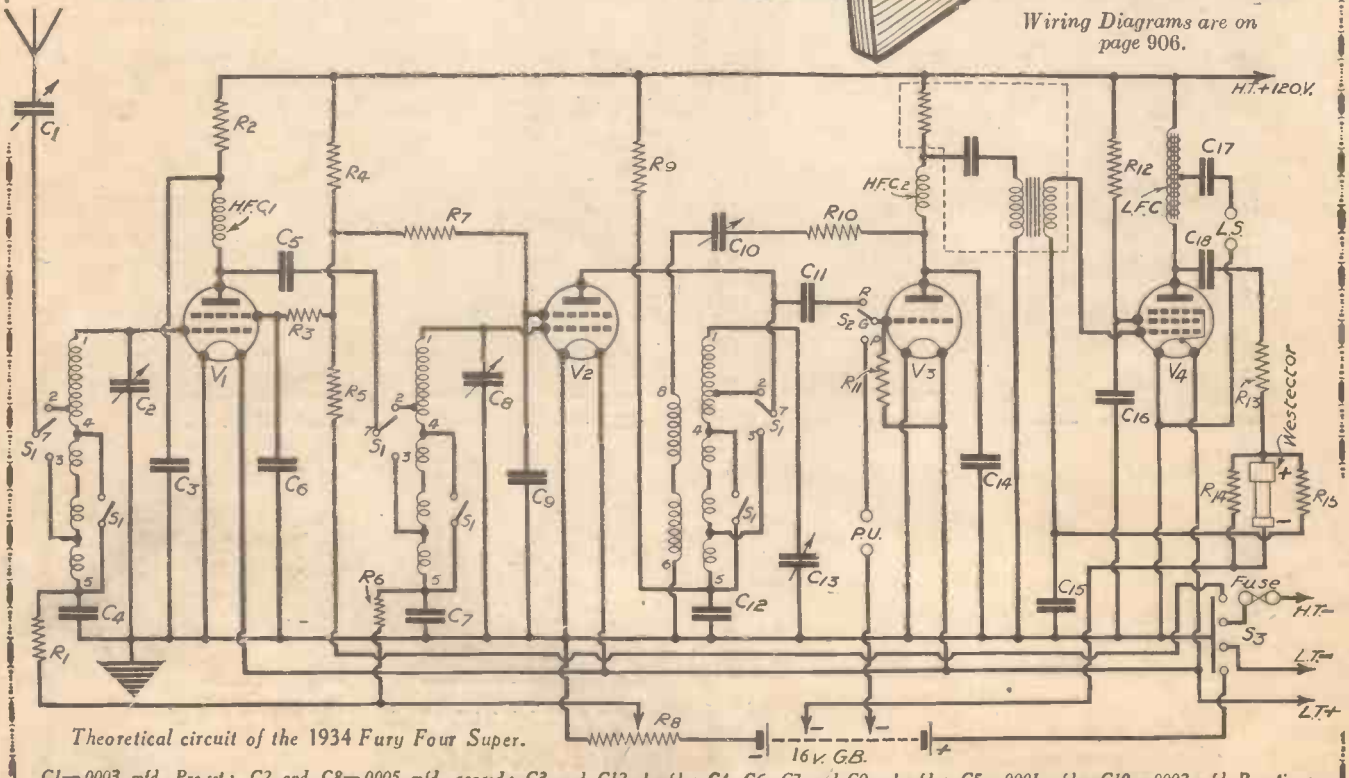
SEE ADVERTISEMENT ON PAGE 933.

The 1934 Fury Four Super—Our Artist's Impression



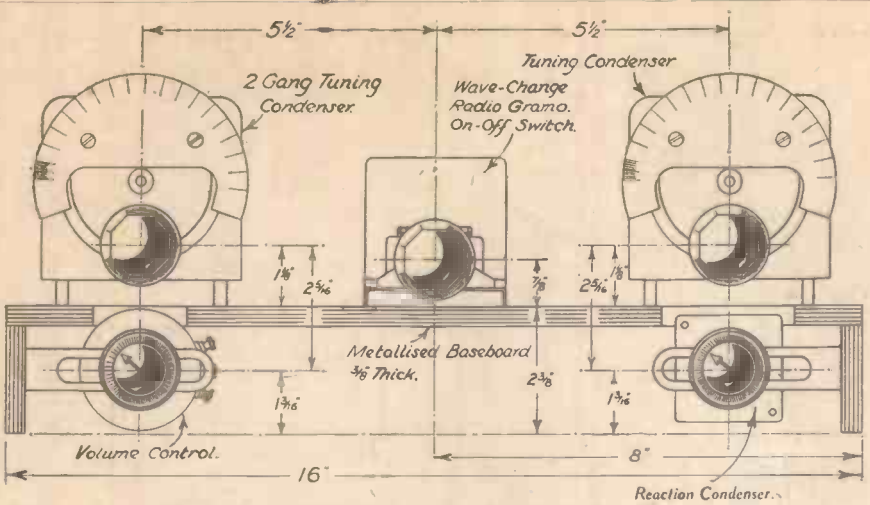
The A.C. Radiogram Fury Four Super will be dealt with shortly.

Wiring Diagrams are on page 906.



Theoretical circuit of the 1934 Fury Four Super.

C1—.0003 mfd. Pre-set; C2 and C8—.0005 mfd. ganged; C3 and C12, 1 mfd.; C4, C6, C7 and C9—.1 mfd.; C5—.0001 mfd.; C10—.0002 mfd. Reaction; C11 and C14—.0002 mfd.; C13—.0005 mfd. Variable; C16 and C17—2 mfd.; R1, R5 and R6—50,000 Ohms; R2, R3, R7, R9 and R12—1,000 Ohms; R4—25,000 Ohms; R8—10,000 Ohm Potentiometer; R10—500 Ohms; R11—1 Megohm; C15, C18, R13, R14 and R15 are all included in the Graham-Farish Booster Unit.



Dimensioned front view of the 1934 Fury Four Super.

(*Continued from page 900*)

is a Bulgin Type 87a, and it may be obtained with the coils at an extra cost of 1s. 6d. The switch must, of course, be mounted so that the small finger at the end of the coil-switch rod operates the dolly of the switch in the correct manner, and this will be when the two end contacts are towards the right, the coil being viewed from the front. Now screw down the coils, passing the connecting wires down through the holes in the base, and proceed to mount the remainder of the components, using as your guide the wiring plan. There are no difficult points to explain in this part of the assembly, as all parts are quite easy to get at, and there are no pitfalls for the unwary. Before the Booster Unit can be mounted it will be necessary to fit the Westector into the clips provided on its under side. When this has been attached the receiver is ready for wiring, and this should be carried out in a neat manner, avoiding slackness and making quite certain that good contact is provided at the required points.

Earth Returns

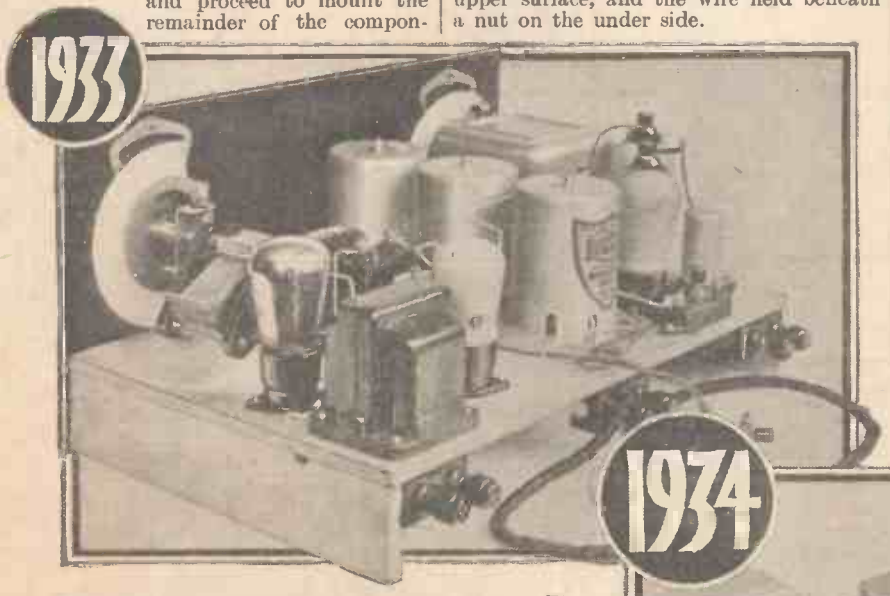
It will be noticed that there are one or two points on the wiring plan marked "M.B.," and these are earth return connections which are connected to the metallized surface of the chassis, and in the case of those connections on the upper surface it will be sufficient to twist the wire into a loop to be held down by an ordinary round-head wood screw. Where these letters appear on the under-surface it will be necessary to pass a small bolt through the chassis, with a washer beneath the head making good connection on the upper surface, and the wire held beneath a nut on the under side.

The screened leads must be passed through the metal braiding, and this should be turned back at each end to avoid short-circuits on the inner wire, and small metal brackets used to clamp the braiding to the metal surface. These brackets may easily be made from odd scraps of metal, or they may be purchased from Messrs. Peto-Scott. There is no necessity to screen any leads other than the two indicated in the wiring plan.

Next week we shall give full operating details, together with a Test Report.

LIST OF COMPONENTS FOR THE 1934 FURY FOUR SUPER.

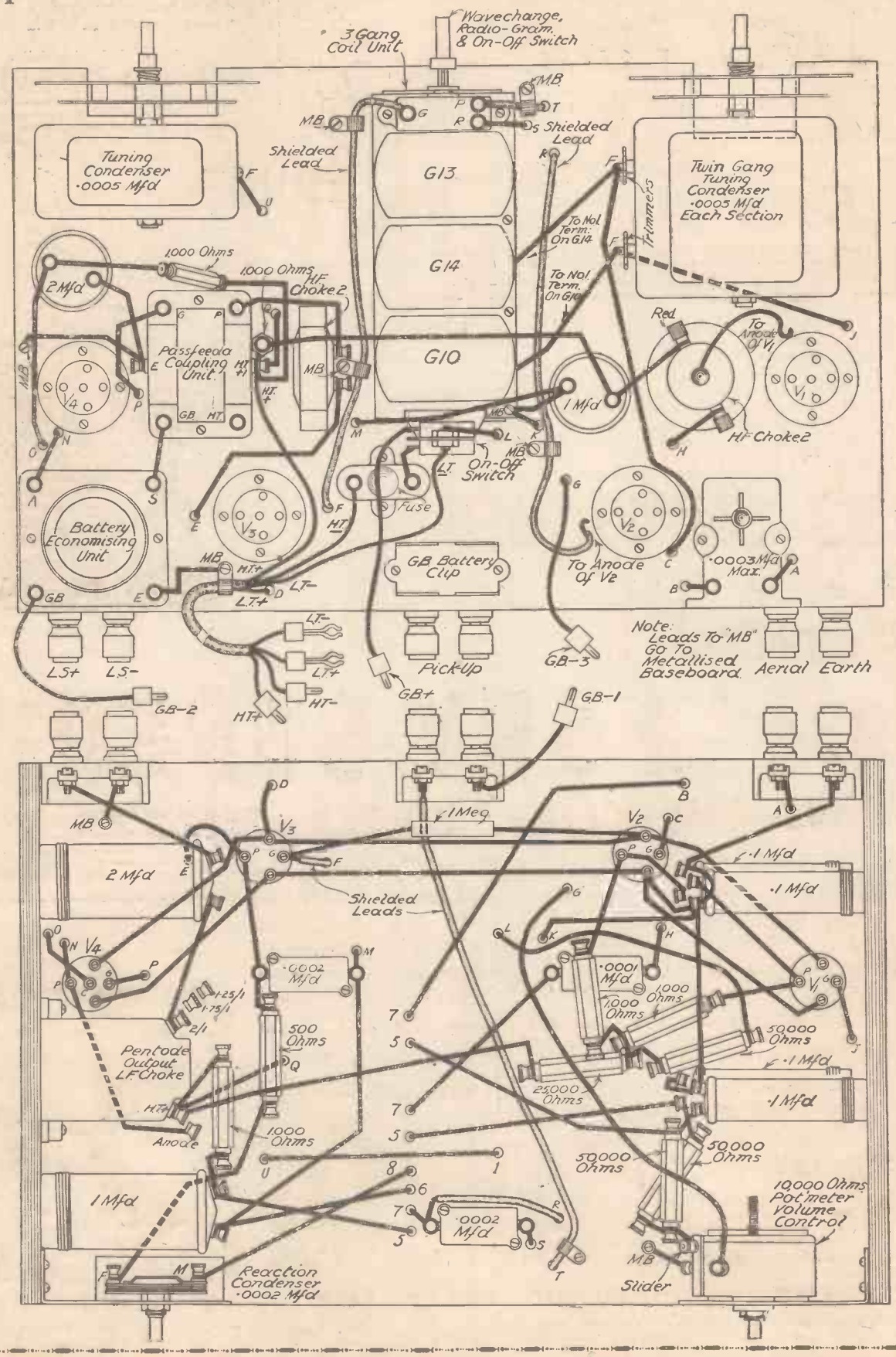
One Set "Ferrocart" Type "G" Coils (G.10, G.14, G.13) (with Switch—see Text) (Colvern).
One "Nugang" Single Variable Condenser, .0005 mfd. with Type A Drive (C.13) (Jackson Bros.).
One "Nugang" 2-gang Variable Condenser, .0005 mfd. with Type A Drive (C2, C8) (Jackson Bros.).
One Disc Type H.F. Choke (H.F.C.2) (Lissen).
One 1 megohm resistance with wire ends (R11) (Lissen).
One Pre-set Aerial Condenser, .0003 mfd. (C.1) (Lissen).
One "Pentode" Nichoke (Varley).
One Graded Volume Control, Type C.P.158 (R.8) (Varley).
One Super H.F. Choke, Type H.F.4 (H.F.C.1) (Bulgin).
One Fuse Holder, Type F.5 (Bulgin).
One 100 m.a. Fuse (Bulgin).
One G.B. Bias Clip, Type 2 (Bulgin).
Three 50,000 ohm 1½ watt "Ohmite" Resistances (R1, R5, R6) (Graham Farish).
Five 1,000 ohm ditto (R2, R3, R7, R9, R12) (Graham Farish)
One 25,000 ohm ditto (R4) (Graham Farish).
One 500 ohm ditto (R10) (Graham Farish).
One .0002 mfd. Reaction Condenser (C10) (Graham Farish).
One "Booster" Unit (Graham Farish).
Two 1 mfd. Fixed Condensers, Type 9200 B.S. (C3, C12) (Dubilier).
Four .1 mfd. ditto (C4, C6, C7, C9) (Dubilier).
Two 2 mfd. ditto (C16, C17) (Dubilier).
One .0001 mfd. ditto Type 670 (C5) (Dubilier).
Two .0002 mfd. ditto, Type 670 (C11, C14) (Dubilier).
Three 4-pin Chassis Type Valveholders (Clix).
One 5-pin ditto (Clix).
Four Wander Plugs marked G.B.1, G.B.2, G.B.3, G.B.+ (Clix).
One Passfeeda Coupling Unit (B.R.G.).
Two Large Component Brackets (B.R.G.).
Three Terminal Mounts (Belling-Lee).
One 4-way Battery Cord (Belling-Lee).
Six Type B Terminals (Aerial, Earth, L.S.+, L.S.—, Pick-up, Pick up) (Belling-Lee).
One "Westector" Type W.4. (Westinghouse).
One "Metaplex" Chassis (Peto-Scott).
One "Fury Super" Cabinet (Peto-Scott).
Four Valves, Types P.M.12M., P.M.12M., P.M.2DX., P.M.22. (Mullard).
One Moving Coil Loud-speaker, Type P.M.6. (W.B.).
One 120-volt H.T. Battery (Siemens).
One 16-volt G.B. Battery (Siemens).
One 2-volt L.T. Battery (Block Batteries).
Connecting Wire, Length Metal Braiding, Screws, etc.



Last year's outstanding success—the Fury Four. This did not incorporate such modern refinements as iron core coils, for such were not then available.

The 1934 Fury Four Super provides the solution to all selectivity problems.

Top and Sub-baseboard Wiring Diagrams of the 1934 Fury Four Super



Mr. Camm's
"FURY FOUR"
(W.B. Speaker Solely Specified)

Mr. Camm's
"SUPERSONIC SIX"
(W.B. Speaker Solely Specified)

Mr. Camm's
"1933 SUPERSET"
(W.B. Speaker Solely Specified)

AND NOW THE
1934 "FURY SUPER"
W.B. MICROLODE SOLELY SPECIFIED

Mr. F. J. Camm has specified a W.B. 'Microlode' Speaker SOLELY for EVERY important set since its introduction first astonished the wireless trade and public.

There are vital reasons for this splendid tribute from a famous pioneer of receiver design ● Perfect matching to the receiver, due to the unique 'Microlode' feature, gives better balance of tone ● The unique 'Mansfield' magnet, 30 per cent. stronger than a good cobalt steel magnet of equal weight, gives better sensitivity and wonderfully crisp attack ●

You should hear the difference a 'Microlode' will make to your set: it will amaze you!

MICROLODE
(Regd. Trade Mark)
Moving - coil Speakers

PM6	32/6
PM4A	42/-
PM2A	79/6
PM1A	120/-

WHITELEY ELECTRICAL RADIO CO. LTD., DEPT. D, RADIO WORKS, MANSFIELD, NOTTS

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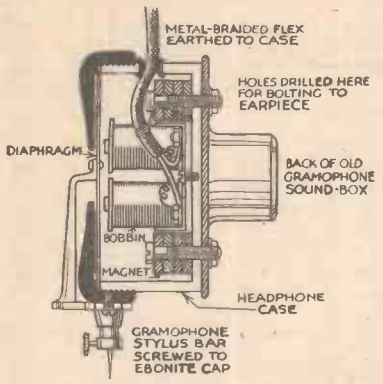
READERS' WRINKLES

THE HALF-GUINEA PAGE

A Home-made Gramophone Pick-up

A VERY efficient pick-up may be made from an old pair of head-phones and an old gramophone sound-box. Remove one of the ear-phones, unscrew the top,



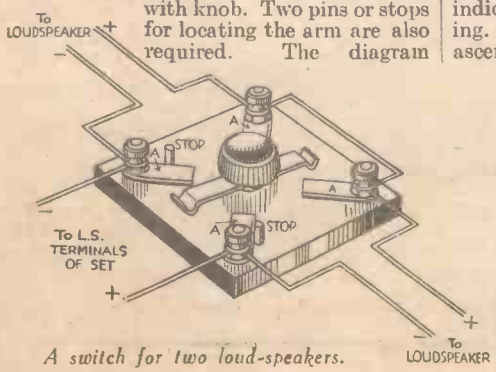
A home-made gramophone pick-up.

and remove the diaphragm, replacing the old lead by a piece of metal-braided flex, long enough to suit your own requirements. At the same time, earth the case by means of the metal braid on the flex. From the old gramophone sound-box remove the back and the needle-holder. Remove the screws which hold the magnets to the ear-phone case and replace them by others about ¼in. longer. Drill two holes in the soundbox back so that they are exactly opposite the protruding screws on the ear-phone case, and fit the two together, holding the soundbox back in position by nuts.

Tap two screw holes in the ebonite cap, and screw the needle-holder to it, fastening the top of the needle-holder to the ear-phone diaphragm by means of the screw provided. Screw the ebonite cap back in place on the earphone and connect up as you would an ordinary pick-up.—J. H. HEYES (Liverpool, 4).

Simple Switch for Loud-speakers

THE switch illustrated is useful for switching into circuit one or other of two loud-speakers. It consists of a piece of ebonite about 2in. square, four terminals, four strips of brass about ¼in. wide (A in diagram), and a moving contact arm with knob. Two pins or stops for locating the arm are also required. The diagram



A switch for two loud-speakers.

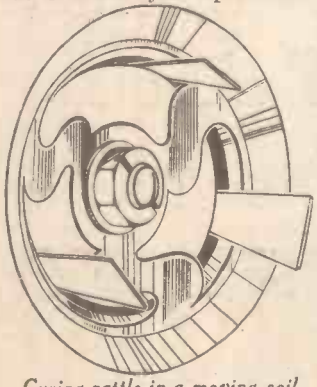
THAT DODGE OF YOURS!

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.

is self-explanatory, a turn of the knob bringing either one or both speakers into play.—G. HOWARD (Liverpool, 4).

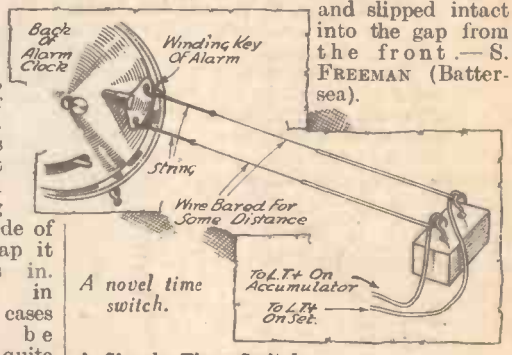
Curing Rattle in M.C. Loud-speaker

MANY set owners are, no doubt, rather chary of adjusting their own moving-coil type loud-speakers. There are, of course, numerous faults which can develop, but without doubt the most common is that of a bad rattle caused by the speech coil fouling one side of the gap it moves in. This in most cases can be cured quite easily provided the actual centring spindle or the diaphragm is not damaged. It is imperative that the speaker be taken out of the cabinet. The trouble can now be traced by running the finger lightly round the extreme edge of the diaphragm while the speaker is working. It will be found that the rattle gets very pronounced at one point, and naturally the rattle should almost disappear when the finger is placed on the opposite side. This merely serves to indicate the point of fouling. Now this has been ascertained, a light visiting card should be cut in to three strips, cut V shaped at one end. The screw which holds the spider in position should be slackened off and one piece of the card *gently* pushed between the speech coil and gap on *the inside*. It is preferable that this should be put where the fouling is occurring. The other two pieces are put equidistant from each other in the same way. It will be realized that the speech coil is now held in the actual middle of the gap.



Curing rattle in a moving-coil speaker.

The fixing screw can now be re-tightened and the slips withdrawn. It should be noted that the thickness of card will vary according to type of speaker. In most cases where P.M. types are used a very thin card or piece of paper must be used, while in a large energized type a considerably larger gap is employed necessitating a thick card to fill up the space. Where the centring of the loud-speaker is done from the back of the diaphragm, a complete piece of paper can be formed into a circle, and slipped intact into the gap from the front.—S. FREEMAN (Battersea).



A novel time switch.

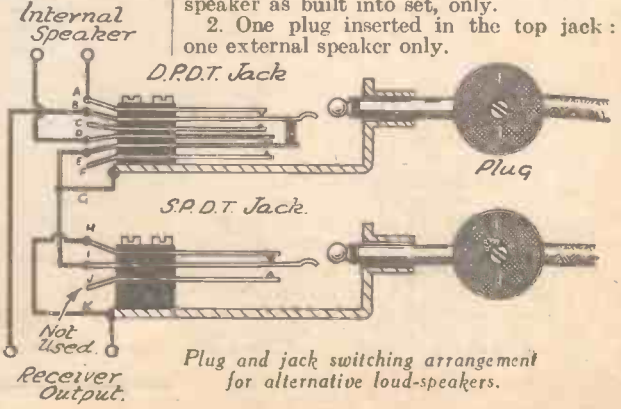
A Simple Time Switch

THE accompanying sketch shows a simple "time switch" for use with a wireless set. The illustration is almost self-explanatory. It will be noticed that when the alarm is set, the key turns, thereby twisting or untwisting the wires. This idea can readily be used for turning a set on or off at any given time.—P. NEWTON NIELD (Loughborough).

Connecting Alternative Loud-speakers

THE following plug-and-jack system, built into the household set, offers many advantages and costs next to nothing. As well as providing a ready means of comparing and testing new speakers, the house may be wired, and by merely inserting one or both plugs the following combinations can be obtained:

1. Both plugs withdrawn: internal speaker as built into set, only.
2. One plug inserted in the top jack: one external speaker only.



Plug and jack switching arrangement for alternative loud-speakers.

READERS' WRINKLES

(*Continued from previous page*)

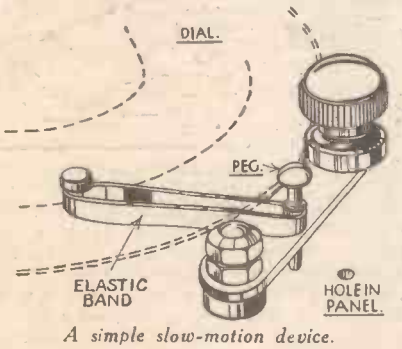
3. One plug inserted in lower jack; internal speaker and one external speaker.

4. Both plugs inserted: two external speakers only.

Output transformer must not be built into set, but wired with the speakers used, unless all speakers are of the same type. —T. S. Ross (Greenford Green).

A Slow-motion Improvement

THE slow-motion gadget, often recommended for attachment to the ordinary condenser in the form of a small spindle with rubber tubing attached, is quite useful, but has its disadvantages. In the first place, the sharp edge of the condenser dial cuts into the rubber in a very short time, and becomes practically useless, and it has to be replaced. This can be avoided by putting a slight flat on this edge by filing in the lathe. Secondly, this state of affairs is hastened because it is possible, when the dial is turned quickly with the ordinary handle, that the small spindle revolves at a fast rate. The writer overcame this difficulty by fixing up the gadget shown in sketch. The small spindle was mounted on a thin strip of brass, working as a pivot at right angles to the periphery of the dial. A movable peg in the strip was connected with a rubber band to a peg fixed in the panel underneath the dial. The rubber band keeps the spindle in contact with the dial. A small hole drilled in the panel enables the small spindle to be put out of gear by simply



A simple slow-motion device.

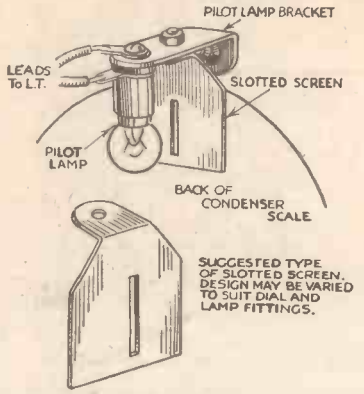
stretching the rubber band and placing the peg in the hole. This prevents wear on the small spindle when the dial is revolved the greater distance, and the small spindle is quickly put in action again by releasing the peg. The operation includes drilling three small holes in the panel, one being beneath the dial, which is removed for the purpose.—W. H. Grayling (Cambridge).

A Simple Counter for Coil Winding

IT is generally quite a tedious job to count the turns when winding, say, a mains transformer or other component which demands a fairly high degree of accuracy. By employing this simple dodge the work is considerably simplified. The idea consists of coupling the winder to a sewing-machine, either hand or treadle-driven. Whilst winding one should "stitch" (without cotton) along a piece of paper, meanwhile counting the turns of the winder. When 100 turns have been wound and the paper "stitched" the latter should be cut at the end of the stitches. Now, every time the paper is "sewn" from one end to the other, 100 turns will have been put on, and it is, of course, a simple matter to calculate the total number. It is possible, of course, to use any number as a "base," but 100 seems to be the most convenient.—P. Newton Nield (Loughborough).

An Improved Dial Light

THE usefulness of an ordinary dial light can be increased by employing the simple little dodge illustrated in the accompanying sketch. All that is required is a small piece of thin card or metal,

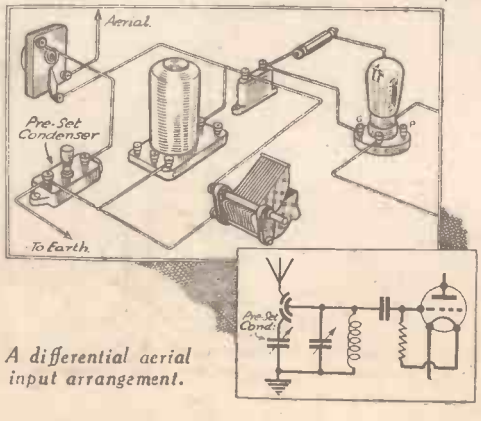


A neat dial-light arrangement.

with a narrow slit cut in it by means of a sharp knife. The card or metal is then attached to the bracket which supports the lamp-holder so that it comes between the light and the dial. By this means the whole of the dial showing through the escutcheon is not illuminated, but only a narrow strip of it which comes opposite the cursor or pointer. As a result it is somewhat easier to adjust the condenser and accurate tuning is simplified.—P. F. (Leeds).

Differential Aerial Input

A COMMON fault of many H.F. input volume controls is their effect upon the tuning of the circuit which they precede, and amongst others the series aerial condenser possesses this disadvantage. The effect is caused by the transference of a variable capacity, formed by the natural capacity of the aerial to earth, and the capacity of the variable series aerial condenser, to the tuned circuit. As the series aerial condenser is varied, so is the amount of capacity across the circuit varied. It is obvious that if it were possible to simultaneously place across the circuit as much capacity as was removed by the reduction of the series capacity, then the tuning would remain unaltered. The desired effect is obtainable in the manner indicated in the accompanying illustrations. A differential condenser of suitable capacity is substituted for the series condenser, leaving one fixed terminal on the differential condenser free. This terminal is connected to one contact of a semi-variable



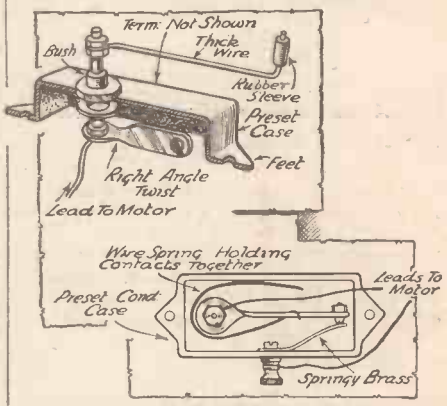
A differential aerial input arrangement.

condenser, the other connection from which is made to earth. In operation, the receiver is accurately tuned to a transmission with the differential control set for maximum volume (*i.e.*, with the aerial plates in circuit). The control is then set to nearly the minimum position, and the pre-set condenser adjusted to give maximum signal strength. The value of the pre-set condenser will depend upon the size of the aerial, but a condenser having a maximum value of .0003 microfarad, with a fairly low minimum value, will be large enough to equal the capacity of aerials of normal size.

The principle of operation is simple, and consists merely in the setting of the pre-set condenser to give a value exactly equal to the value of the capacity to earth of the aerial. This will ensure that the capacity to earth of the upper end of the tuned circuit will remain sensibly constant at all settings of the differential condenser.—Norman Rollason (Canterbury).

Automatic Gramophone Stop

THE accompanying sketch shows an easily-made automatic stop for electric gramophone motors which can be made from odds and ends from the scrap box. The sketch is self-explanatory and shows all the constructional details. To



An automatic gramophone stop.

set the switch it should be screwed to the motor board, the pick-up placed on the last groove of the record and the arm of the stop swung over until it touches the pick-up arm. The switch will then take care of itself.

Of course, it can be adjusted to suit all sizes of records by swinging the arm round as per sketch.—T. Preston (Coventry).

Improvised Resistances

A TEMPORARY resistance can very simply be made by taking a 3in. square of ordinary newspaper, moistening it, and folding it to form a strip about ⅛in. wide. This can then be connected across the ends of the defective resistance by binding short lengths of bared wire round its ends. The actual resistance value might not at first be correct, but it can be adjusted within reasonably wide limits by varying the dampness of the paper.

It will be understood that the resistance will not be of a permanent nature, but it can be kept in use for a whole evening without attention. If it is required for longer periods the paper should be moistened at intervals. A more permanent resistance can be made in a similar way by dipping the paper into Indian ink instead of into water. The ink should be allowed to dry before the resistance is put into use.

Practical Television

Presented Free with "Practical Wireless."

JANUARY 27th, 1934. Vol. I. No. 4.

PHOTOMETRY

Its Application to the Measurement of Cathode Ray Oscillograph Tube Characteristics for Television.

By A TELEVISION ENGINEER

IN the very near future the essential component of the household television receiver will no doubt be a cathode ray oscillograph tube, since, with the advent of ultra-short-wave wireless transmission of vision, high definition will be possible. Much research work is being carried out in several leading laboratories, and in the testing and measuring of tube characteristics photometry plays a leading part. Apart from actual picture tests and the screen colour, it is desirable to know the spot brightness in candle-power, and the spot size in relation to the negative voltage applied to the Wehnelt cylinder, as, with this information, the modulation efficiency of the tube can be seen at a glance. Therefore, before readings can be taken, one must possess a light source whose light intensity is accurately known. This is determined by balancing a suitable lamp against a sub-standard source; and the Hefner lamp is probably the simplest and most satisfactory for this purpose.

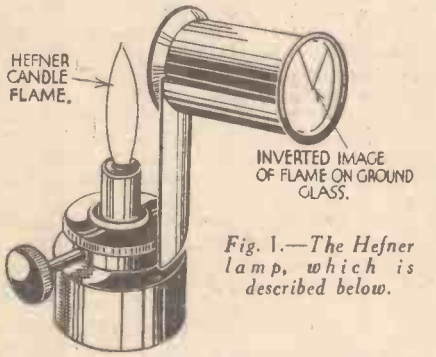


Fig. 1.—The Hefner lamp, which is described below.

Hefner Sub-standard Lamp

Fig. 1 illustrates a Hefner lamp. A wick consisting of fifteen to twenty strands of twisted cotton is inserted through a tube 15 mm. high, 8 mm. internal diameter, and 0.15 mm. thick, into the container, which is filled with a pure grade of amyl-acetate ($C_5H_{11}C_2H_3O_2$). After lighting, the flame tip is adjusted to a height of 40 mm. above the tube level by viewing the inverted image of the flame cast on the ground-glass screen, and adjusting the wick till the tip of the image cuts the horizontal hair line.

Although the lamp is rated to be 0.9 International candle, this is subject to correction, so that

$$I = 1 + .0055(8.8 - e) - .00011(760 - b)$$

I = Corrected candle-power.

e = Humidity in litres of water vapour/cubic metre.

b = Atmospheric Pressure in mm. of mercury.

In the following experiments carried out by the writer, actual figures are given to show how results are obtained.

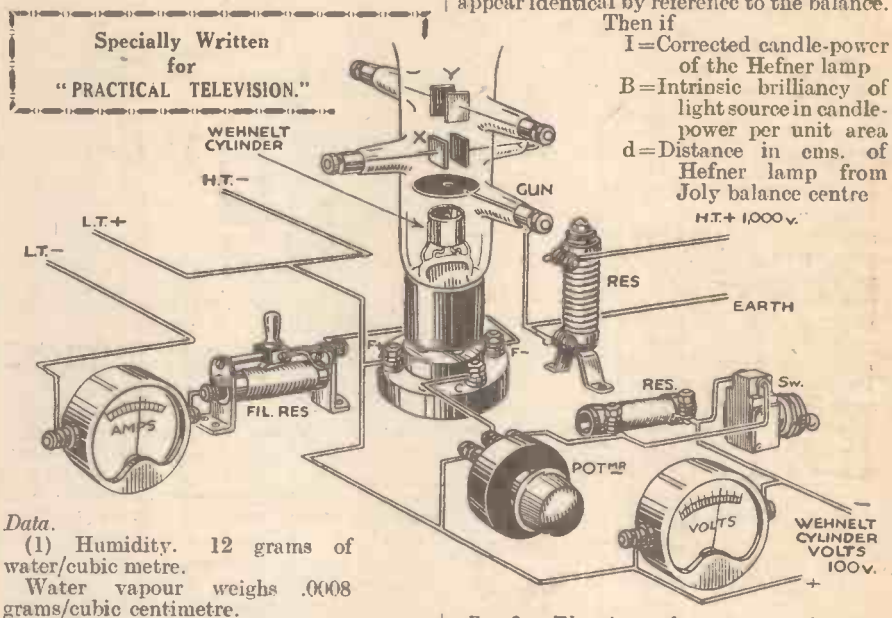


Fig. 3.—This shows the connections for the cathode tube.

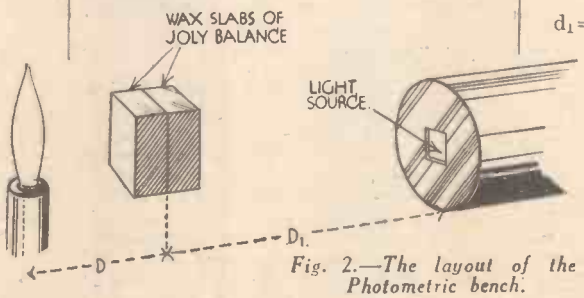


Fig. 2.—The layout of the Photometric bench.

Data.

(1) Humidity. 12 grams of water/cubic metre.

Water vapour weighs .0008 grams/cubic centimetre.

∴ Litres of water vapour/cubic metre of moist air

$$= \frac{12}{10^3 \times .0008}$$

$$= 15 \text{ litres} = e$$

(2) Temperature = 14° C.

Density of mercury at 14° C. = 13.56.

∴ Height of mercury column

$$= \frac{1.016 \times 10^6}{981 \times 13.56}$$

$$= 764 \text{ mm.} = b$$

Substituting in the formula, we have

$I = 1 + .0055(8.8 - 15) - .00011(760 - 764)$

$= 0.9659$ candle-power (neglecting the last term).

ENGLISH TELEVISION TRANSMISSIONS. (30 LINE SYSTEM)

	Vision	Sound
MONDAY	11 p.m. to 11.30 p.m. 261.1 m.	391.1 m.
TUESDAY	11 p.m. to 11.30 p.m. 261.1 m.	391.1 m.
WEDNESDAY	11 p.m. to 11.30 p.m. 261.1 m.	391.1 m.
THURSDAY	NO TRANSMISSION	
FRIDAY	11 p.m. to 11.30 p.m. 261.1 m.	391.1 m.
SATURDAY	NO TRANSMISSION	
SUNDAY	NO TRANSMISSION	

Method of Determining Candle-power of Light Source

A 6v. 30-watt lamp is enclosed in a light-tight box and its beam concentrated down a tube, over the end of which is placed a piece of ground glass. This in turn is covered with a metal cap in which an aperture of 1 sq. cm. is cut (Fig. 2).

A Joly balance consisting of two slabs of wax intersected with a piece of reflecting metal is utilized as the balance. The lay-out of the photometric bench is easily seen by reference to Fig. 2.

The balance is moved in the optical plane of the lights until the intensities appear identical by reference to the balance. Then if

I = Corrected candle-power of the Hefner lamp

B = Intrinsic brilliancy of light source in candle-power per unit area

d = Distance in cms. of Hefner lamp from Joly balance centre

d_1 = Distance of light source in cms. from centre of the balance,

the light intensity being inversely proportional to the square of the distance,

$$\frac{I}{d^2} = \frac{B}{d_1^2}$$

and $$B = \frac{Id_1^2}{d^2}.$$

With d = 16.6 cm. and $d_1 = 21.4$ cm., a value for B is obtained = 1.725 candle-power per sq. cm.

Determination of Spot Brightness and Size of Cathode-Ray Oscillograph Tube

The screen of the cathode ray tube is substituted for the Hefner lamp, and set at a distance of y centimetres from the balance.

The tube is connected in circuit as shown in Fig. 3. No time base being necessary, the X and Y plates are joined to the earth terminal to prevent the spot from moving over the screen.

For varying voltages on the Wehnelt cylinder the spot diameter is measured in mm., and the light source adjusted to x centimetres from the balance until the intensities appear the same.

When the tube possesses colour, a Wratten filter of the same shade is first placed over the light source aperture before measurements are taken.

The actual tube under measurement necessitated a blue Wratten filter having a transmission factor of 2.9 per cent., and

(*Continued on page iv*)

Simple Television Optics

It is Almost Impossible to Grasp Thoroughly the Operation of Television Transmission and Reception Without Some Knowledge of the Science of Light, and This Article, While Avoiding Advanced Theory and Mathematics, will give Just the Information which the Amateur Requires.

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

WHEN our eyes perceive an object, it is because light from that object enters our eyes and stimulates the optic nerves, giving rise to the sensation we call "sight." We must, therefore, find out something about the nature of this Light.

Light is simply one form of radiant energy and belongs to the same group as heat and radio waves; that is to say, it consists of vibrations in the ether. The difference between light waves and radio waves is simply one of frequency or wavelength. Whereas radio waves range from a matter of a few yards to several miles in length, the wavelengths of light range over a few hundred-thousandths of a centimetre.

When light is emitted from a luminous object, it travels outwards in all directions just as the waves from a transmitting aerial, but while it is perfectly correct to think of light waves as ever-growing spherical waves, like the endless successive layers of an onion, it is more convenient to imagine light as an infinite number of rays, projected forth from the source of illumination like, shall we say, the spines of a rolled-up hedgehog.

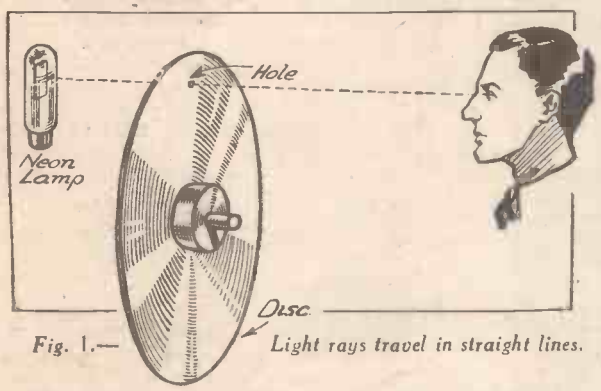


Fig. 1.—Light rays travel in straight lines.

In Straight Lines

We can study light and understand the functions of such devices as mirrors and lenses much more easily if we try to follow their effects upon individual rays of light.

The first point to note about a light ray is that it travels in a straight line through any one transparent medium. Thus, when the light in the studio is projected through the holes in the scanning disc, it falls upon the object to be televised at the spot exactly opposite the hole, and similarly, when viewing the neon lamp through the scanning disc, we see just that spot on the lamp which is, for the moment, in a direct line with the hole in the disc and with our eyes, as illustrated in Fig. 1.

Those substances like air and glass which allow light to pass through them are called transparent; those which stop or absorb light are called opaque; translucent bodies like ground glass absorb some light and allow some to pass through, and these last named are used for making up the screens employed in projection television receivers, such as the lens disc and mirror drum sets.

Persistence of Vision

We shall see later that while light rays proceed in straight lines through transparent bodies, they may have their direction changed in various ways. Before dealing with this part of the subject, however, let us consider a little more the effect of light upon the eye. It has been stated that light gives rise to the sensation of sight, but another very important point is that the sensation of sight remains for an appreciable fraction of a second after the light has ceased. It is this "persistence of vision" as it is termed, which enables us to build up a moving television image in our eyes by presenting several complete pictures in rapid succession with the image-reconstituting device.

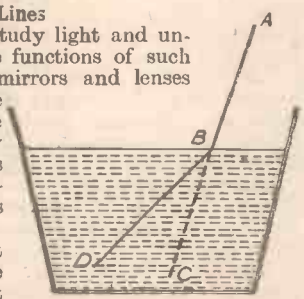


Fig. 4.—A simple example of refraction.

Reflection of Light

In many types of television receivers it is essential to change the direction of the beam of light once or twice, so the next point that arises is how this can be carried out. Everyone is familiar with the effect known as reflection as produced by a mirror. Highly-polished metallic surfaces "stop" rays of light and, in effect, reverse their direction. Fig. 2 represents a mirror and its effect upon a single light ray. The important point to note is that the reflected ray leaves the mirror at the same angle at which it meets it, and in the same plane as the normal. The angle is measured between the ray and an imaginary line called the "normal" at right-angles to the surface of the mirror at the point where the light strikes it. Thus, in Fig. 2 the two shaded angles are equal.

A very good example of how this mirror reflection is put into practice is furnished by an illustration given last week (Fig. 16, page iv). Here we have an experimental television receiver in which the beam of light from the bottom of the tube on the right, containing a signal modulated source, is projected on to the vertical mirror set at an angle of 45 degrees with the tube. This turns the light through a total angle of 90 degrees (angles of incidence and reflection being equal as we have just seen) on to the mirrors of the drum which are normally rotating. Each individual mirror is inclined slightly to the vertical mirror, and the beam reflected back from the small mirror surface on to the vertical mirror is once more turned through 90 degrees and impinges on a small screen mounted on the front of the receiver so as to create vertical strips of light as the mirror drum revolves.

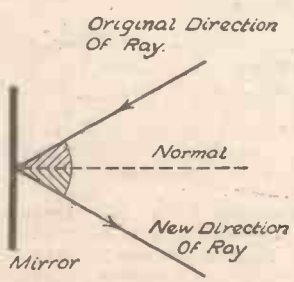


Fig. 2.—When light is reflected the angle of incidence equals the angle of reflection.

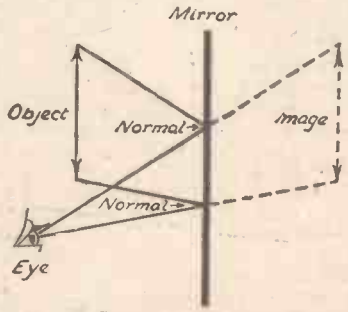


Fig. 3.—Showing why the reflected image appears to be behind the mirror.

It is at first rather difficult to see how this change in the direction of light permits us to see reflections "in" the mirror, but Fig. 3 will explain this. Rays of light from the object are reflected into the eye and obey the ordinary laws of reflection just enunciated. But the eye, used to seeing things only in a straight line, refers the image back along the new path

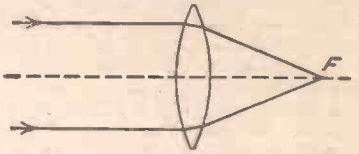


Fig. 5.—The focusing effect of a double convex lens on a parallel beam of light.

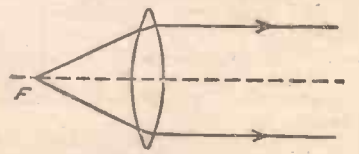


Fig. 6.—A parallel beam from a point source of light using a lens.

of the rays, and *imagines* the object to be as far *behind* the mirror as it is *in front* of the surface.

There is another means by which light rays can have their direction changed. It is called "refraction" or bending, and occurs when light passes from one medium (say air) into another, such as glass or water. Most readers are familiar with the illusion that a stick when dipped into a bucket of water appears to be bent as in Fig. 4. We *know* that the true position of the stick is ABC, but it appears to be ABD.

The reason is that the light rays are bent, and actually this is due to the fact that the light travels at a different speed in different media.

Lenses

It is as a result of this phenomenon of refraction that lenses (commonly termed magnifying glasses) possess their special qualities. Fig. 5 shows a very usual type of lens—namely, a double or bi-convex lens, consisting of a disc of glass whose two surfaces are worked and ground to a curvature corresponding to part of a sphere. A single convex lens has one flat surface and one spherical surface. If a parallel beam of light is passed through the double convex lens, each ray will be bent or refracted as it enters, and again as it leaves, the glass. There are definite mathematical laws connecting the angles to which the light is bent, depending in part on the relative density of the media (glass and air) and the angle at which the light enters the lens. The choice of a spherical curvature ensures that all the rays of a parallel beam are so bent that they meet at a point (F in Fig. 5) called the focus.

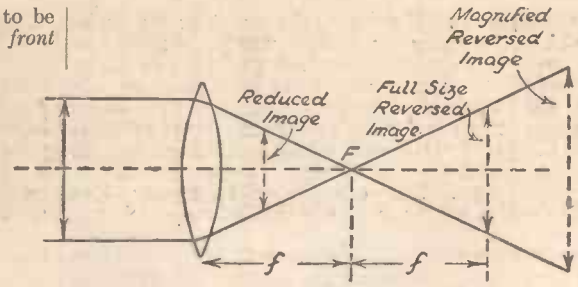


Fig. 7.—Position of the image at different distances from the lens.

It should also be clear that if at the point F we placed a point source of light, the divergent rays collected by the lens will be bent to a parallel beam (Fig. 6).

Again, if an illuminated object is situated on one side of the lens and a screen be placed on the other side, a reduced image the right way up will be formed if the screen is placed nearer to the lens than the focal point, while an inverted image will be formed if the screen is placed beyond the focus (Fig. 7). This inverted image will be reduced if the screen is less than twice the focal distance from the lens, and will be magnified if the screen is more than twice the focal distance.

Users of television receivers will no doubt have noticed that in comparatively few cases is a single lens used to produce the magnified image, this applying particularly to a disc and neon machine.

Using Two Lenses

The reasons for the use of a more complicated optical system are twofold. In the first place, it is due to inherent defects in all simple lenses which form part of a sphere. While the image projected by the central portion of the lens is quite clear and sharp, there is a considerable amount of light "dispersion" at the outer edge of the lens. It is found preferable, therefore, to use two lenses, such as a single and double-convex, as in the case of the recent "Portovisor," using the accurate central portions of the first lens slightly to concentrate the beam on to the central portion of the second lens.

Secondly, where it is desired to focus a beam of light on to a mirror, partial concentration is performed by one lens, (the "condenser") using, of course, the central portion, and accurate focusing by the second lens. By using two lenses the apparatus can be so designed that the second lens can be accurately adjusted in position to "focus" the beam exactly, and in this way secure a "cleaner" image.

AN ENGINEER LOOKS AT TELEVISION

In this Outspoken and Provocative Article Our Contributor Examines the Progress of Television from the Engineer's Outlook and Points out What He Considers to be a Number of Neglected Points on the Mechanical Side.

By RADIOPTIC

AS an engineer more interested in mechanical than theoretical aspects of television, I feel great disappointment when I come to survey from my mechanical point of view the progress that has been made in the science during the past few years. It is granted that it is possible to obtain a better televised image to-day than it was, say, two years ago, but I am strongly inclined to the belief that the improvement is on the transmitting, rather than the receiving, side. The majority of television receivers of the kinds which are considered by many television experts to be remarkably efficient appear to me as a mass of badly-made components assembled in the most amateurish way. There might be reasons for using forms of construction which, to the engineer, are unsound and unreliable, but I feel convinced that considerable improvements could be made if our television theorists would deign to call in the services of competent men who have received a thorough training in the design and construction of mechanical and electrical apparatus. Such men would at once remedy many of the faults to be found in eighty per cent. of the television receivers and components on the market, and their work would prove far more valuable than much of the research work which the theorists are doing to improve the clarity of televised pictures by evolving new systems employing weird and wonderful devices in order to obtain their 90, 120, and 180-line scanning. These latter developments are, perhaps, inevitable for the progress of television, but they should come *after* numerous obvious mechanical refinements which are owing to the apparatus at present in use. It is a case of learning to walk before attempting to run!

When these facts are pointed out to many of these non-mechanical television technicians, they are all too ready to explain that improvements are unnecessary and would be futile with the present systems of transmissions. They are, in fact, very careless in their outlook, and are apparently much too absorbed in the future to give reasoned and studied thought to the present. This is indeed unfortunate, because it seems to me that there can be no doubt whatever that *real* television must come—and in the very near future. Let us hope that our engineers and designers will pay more attention to the mechanical side of things before television receivers are installed in nearly every home in the country. If they do not, the popularity of looking-in is sure to be delayed unnecessarily.

Perhaps those who are responsible for the development of television will consider that the remarks I have just made are unfounded, or that they cannot be justified. I will therefore attempt to be more specific in pointing out details of design which appear very unreliable and distinctly bad from the mechanical point of view. It is particularly important that the electric motor employed to revolve the scanning disc, mirror-screw, or mirror-drum should be maintained at a constant speed. Additionally, it is stressed by those responsible for television that the motor should run dead truly—this is, of course, obviously correct, since the dimensions of the holes or the positions of the mirrors are very important, and should be perfectly accurate. And yet, how many motors do we find whose armatures and driving spindles are accurately balanced? Every engineer knows that a shaft which is revolving at the comparatively high speed of 750 revolutions a minute is bound to vibrate and "whip" if it is not properly balanced. Again, great efforts are made to reduce the weight of the disc or drum in order to reduce the "fly-wheel" effect and make synchronization easier of accomplishment, but despite this a brass spindle bush of 2in. or more diameter is employed to mount it on the motor spindle. Surely it would be more reasonable to make use of one of the innumerable aluminium alloys, many of which are equally as strong as brass.

Disc or Drum Mounting

Although efforts are made to ensure that the disc or drum shall run truly it is invariably attached to the motor spindle by passing a grub screw through the mounting flange. This again is most unscientific and un-mechanical, for it is obvious that the pressure of the screw against the spindle must, of necessity, throw the flange out of truth. What better method could be employed as an alternative? There are several, the most obvious of which is to make use of a slightly tapered motor spindle on to which the flange could easily be driven. Such a method of mounting would be ideal, despite its utter simplicity, because the flange, or rather the spindle, would be entirely self-centring.

Scanning discs, as at present made, strike the engineer as being remarkably flimsy affairs, which are liable to be buckled with the slightest touch. And once they are buckled, it is almost impossible to make the holes "line up" again. Is it beyond the resources of our so-called television engineers to devise a disc, or a wheel

(*Continued overleaf*)

(Continued from previous page)

with the necessary holes in it, which would be much better mechanically and equally as good in effect as the present disc of aluminium foil? Surely there are many ways of achieving such a result by making use of the principles of the bicycle or racing-car wheel.

Punching the Disc

Not only are the manufacturers of television apparatus to blame for much of the downright bad workmanship which goes into the production of television components, but it seems that those who describe how some of the parts can be made at home do not get down to "brass tacks" in regard to the constructional work. They tell the amateur to make his parts by similar unreliable means to those adopted by the professional manufacturers, instead of encouraging the mechanically-minded amateur to adopt more scientific methods. One example that seems particularly bad is in connection with the punching of holes in scanning discs. The constructor is merely told to buy or make a punch of such-and-such a size and to make holes through a prepared aluminium disc along a helical line drawn round the disc. Why does not someone describe how to make a trammel arrangement with screw adjustment so that a scriber is moved the correct distance towards the centre by giving the screw a single turn? And why not a simple press of some kind by means of which the holes can be made without the crude method of striking a punch with a hammer and thereby stretching the metal and causing it to buckle unnecessarily? If there is any reason why the holes should be made with a punch, why not a clamp to grip a large area of the metal so that stretching and buckling is reduced to an absolute minimum?

Perhaps I am too critical, but I do feel that the mechanical aspects of television—and it seems that the whole process is a purely mechanical one—should be considered far more carefully if the science is to make the rapid strides which I should very much like to see. What about it, you television theorists?

Recording Television

THE present television transmissions occupy only half an hour on four days a week, and this naturally restricts the amount of experimenting which can be carried out by the average enthusiast. It must be remembered, however, that it is just as easy to record the television signals as it is to make records of ordinary broadcast music and speech. The standard aluminium disc and a cutting stylus in a gramophone recorder are connected to the output terminals of the receiver and the television transmission (London National, 261.1 metres) is tuned in and the record blank filled. Although this will not enable a complete item to be recorded, it will present sufficient subject matter for subsequent use at a more convenient time. The record is, of course, simply played back through the medium of a pick-up connected in the grid circuit of a valve in the same way as is an ordinary gramophone record, with the television apparatus connected in place of the loud-speaker.

Universal Scanning Disc

The English television system requires that the neon lamp (with a disc receiver) is arranged at the right-hand side and, consequently, produces a vertical picture in which the ratio of the height to the width is as seven is to three. The principal Continental system, whilst utilizing the same ratio, requires that the picture shall be situated at the top of the disc in a horizontal position. If, therefore, it is desired to receive both Continental and English transmissions on a disc receiver, it is necessary to swing the lamp round to occupy the alternative position. It should not be found a difficult matter to arrange a bush round the motor spindle (or on the same level) in order that an arm may be pivoted at that spot to carry the neon lamp-holder. Of course, where the entire receiver is enclosed in a cabinet it will be necessary to arrange a suitable window (with magnifying devices) at both positions.

TELEVISION TOPICS

Push-pull and Television

Many readers prefer the push-pull method of L.F. amplification, and are rather at a loss to know how to join the neon lamp in order to obtain the necessary striking voltage. When the lamp is joined direct in the anode circuit there is, of course, the normal anode current of the valve passing through the lamp, and provided this is of a suitable value it develops the initial glow in the lamp, and this is subsequently modulated by the speech currents. In the push-pull output circuit a centre-tapped choke (or transformer primary) is joined across the two anodes, and it seems at first sight impossible to join a lamp to obtain the necessary striking voltage. The following scheme, however, will be found perfectly satisfactory. The usual centre-tapped choke is joined across the two anodes, and the centre point connected to high-tension positive. A fixed condenser of approximately 2 mfds. is then joined to each anode and the other end of each condenser is joined to the anode and the cathode of the Neon lamp. H.T. positive and H.T. negative are then joined direct to anode and cathode of the neon, and if required, a resistance of the variable type may be joined in the negative lead in order to adjust the neon to the required brilliancy. The fixed condensers prevent a short-circuit of the H.T. supply, whilst they permit the speech current oscillations to pass to the Neon lamp.

PHOTOMETRY—(Continued from page I)

the corrected value of B now becomes equal to $.029 \times 1.725 = .05$ candle-power.

The results are then tabulated. The following figures are taken from a tube with 1,000 volts on the plate and at heater current 0.9 amps.

Intrinsic brilliancy of source = B candles per sq. unit = .05.

Total brightness of spot = K

y cms.	x cms.	Wehnelt Cylinder Volts	d m/m	$K=\frac{a^2By^2}{x^2}$
5.15	69.8	—5	30	.000613
	80	—10	25	.000466
	68.5	—15	23	.000634
	67.25	—20	20	.000659
	66	—25	17	.000684
	75	—30	10	.00053
5.15	29.2	—35	2	.0035
	38.1	—40	1	.00206

Diameter of spot in mm. = d

Area of source = a^2 = 2.25 sq. cms.

Then $\frac{a^2B}{K} = \frac{x^2}{y^2}$

and $K = \frac{a^2By^2}{x^2}$ candle-power.

From the tabulation two curves are then plotted:—

(1) K in relation to Wehnelt voltage (see Fig. 4).

(2) d in relation to Wehnelt voltage (see Fig. 5).

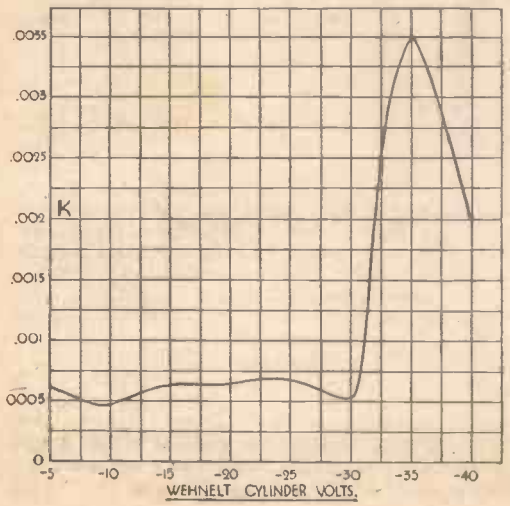


Fig. 4.—Graph showing the relationship between the Wehnelt voltage and K.

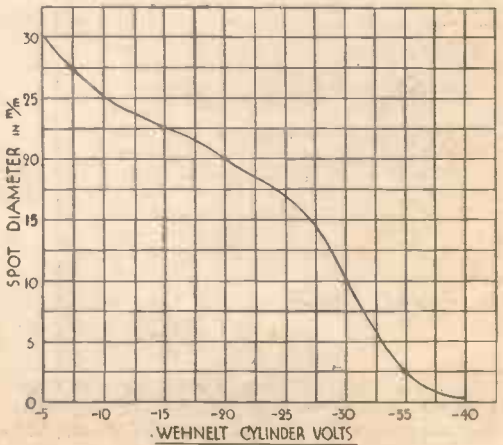


Fig. 5.—This graph shows how the distance d varies with the Wehnelt voltage.

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1 Bulgin Fuse-holder type F.5			6
1 Bulgin 100 m.a. Fuse			6
1 Bulgin G.B. Bias Clip type 2			4½
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5 Graham Farish 1,000-ohm 1½ watt "Ohmite" resistances		7	6
1 Graham Farish 25,000-ohm 1½ watt "Ohmite" resistance		1	6
1 Graham Farish 500-ohm 1½ watt "Ohmite" resistance		1	6
1 Graham Farish .0002-mfd. Reaction condenser		2	0
1 Graham Farish Battery Economiser		7	6
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4 Dubilier .1-mfd. fixed condensers, type 9200/B.S.		8	0
2 Dubilier 2-mfd. fixed condensers, type 9200/B.S.		7	0
1 Dubilier .0001-mfd. fixed condenser, type 670		1	0
2 Dubilier .0002-mfd. fixed condensers, type 670		2	0
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MILLIAMPS WITHOUT MATHS—(Part II)

Assembling the Meter Described Last Week. By E. L. PARKER

IN the previous article details were given of suitable shunts for a milli-ammeter in order to make it into a multi-range meter. This week I am going to tell you how to mount the meter in a cabinet with the shunts, but first it is proposed to show how the meter can be made to read volts. It is a well-known fact that if we place an increasing voltage across a resistance the current passing through the latter will increase in direct proportion to the voltage. Let us assume that we have a potential of 50 volts across a resistance of 50,000 ohms. The current flowing will be exactly 1 milliamp. Now if we double this potential and make it 100 volts the current flowing will also be doubled and will become 2 milliamps. It appears, then, that reading the current flowing, providing we know the value of the resistance, is an indirect means of reading the voltage. If a meter reading 1 milliamp suddenly jumps to 2 milliamps we know that the voltage originally applied has been doubled, or if the reading drops to ½ milliamp, then the applied voltage has dropped to half its original figure.

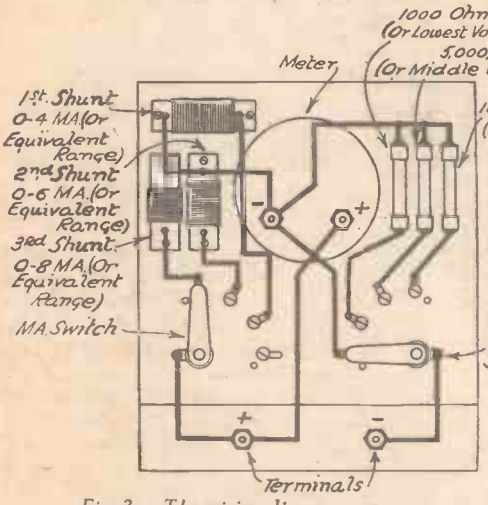

Fig. 3.—The wiring diagram.

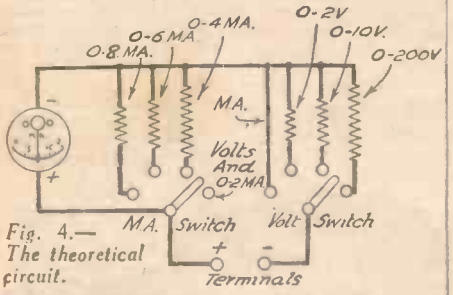

Fig. 4.—The theoretical circuit.

This direct connection between voltage and current, providing the remainder of the circuit remains constant, makes it possible to put resistances in series with the milliammeter with the object of reading volts. The values of these resistances are easily worked out, but to save all trouble an easily-read chart is appended which will enable you to pick out the values of the resistances to give the three most suitable ranges for your meter. By suitable is meant the ranges that will most easily be read on the present scale. For instance, the most suitable ranges for a 0—5 millammeter are, 0—5 volts, 0—10 volts, and 0—150 volts. All the values of the resistances in this chart are easily obtainable at any wireless shop, but if you require your meter to be exceptionally accurate it is wise to get specially-tested resistances. The more accurate the resistances are, the more correct will be the readings, and any of the well-known manufacturers would be pleased to let you have resistances tested to a very fine limit at a cost little in excess of the standard price. It might be helpful for you to know that with an error of 4% (low) a 30,000 ohms resistance in circuit with a 0—5 milliammeter will actually record 144 volts if a potential of 150 volts is applied, so that if resistances with an accuracy of 2% either way are used, the results will be quite as accurate as normal use will require.

Mounting the Meter

You now have the meter, shunts, and resistance; it only remains to fit them into a cabinet. Although it may seem somewhat old fashioned, it is recommended that they are fitted into a neat cabinet with a sloping front, because you will most likely find that in general use it presents the meter in the most easily-read position. But whichever design you decide on, the meter can be built up on an ebonite panel in the manner shown in Fig. 3. The switches cannot be described in detail because the exact design must depend upon the parts used to build them, the remainder of the afore-mentioned filament resistance will probably be very convenient for one of them.

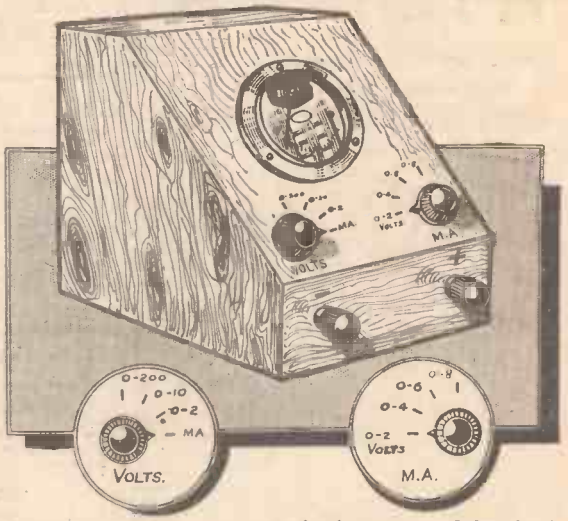

Fig. 5.—Perspective view of the finished meter and details of dial markings.

The wiring can easily be followed from the wiring diagram, but for convenience the theoretical circuit is also given (Fig. 4). If the terminals of your meter are differently marked from those of the meter in the diagram, do not forget to alter the markings on the outside terminals. The switch studs can be round-headed or cheese-headed screws, fitted with solder tags. For simplicity the switches could be built up on pieces of 3/16 in. ebonite or, if preferred, they can be built up on the panel. If built on the panel a thin sheet of ebonite, bakelite, or any other suitable material can be neatly stuck over the front of the panel to cover the holes which must be made to take the studs. If the holes are drilled slightly smaller than the screws you will find that they will cut their own thread and obviate the necessity for tapping. The switch knobs should have pointers attached and the panel should be marked to agree with the various positions. It is important that no matter what readings you have chosen for your meter, the associated shunts and resistances should be fitted in a corresponding order to those shown in the wiring diagram (Fig. 3). The

(Continued on page 934)

TOPICAL TECHNICALITIES

Frequency Doubling

It was shown last week how the crystal can be employed for the purpose of rendering the oscillations in a circuit constant. It is highly improbable, however, that this frequency will be that upon which it is required to transmit, and we must therefore adopt some form of changing circuit. It is by now well known that an oscillation is accompanied by harmonics, and in practice it is found that the second harmonic will prove most useful when converting out crystal-controlled oscillation into the frequency of our transmission. Consequently a valve circuit is supplied at its grid with the oscillations from the crystal-controlled source, and in the anode circuit of the valve a tuned circuit is connected. This tuned circuit is adjusted so that its frequency is twice that of the controlled frequency. By providing the valve with certain optimum voltages it will be found that there is present in the anode circuit an oscillation having a frequency exactly twice that of the original controlled source. Where it is desired to use some other frequency than this, the process may be repeated, each successive frequency-doubler providing the harmonic oscillation, but naturally with reduced strength. It is obvious, of course, that the tuned circuits are critical, as are also the voltages applied to the frequency-doubling valve.

WHICH STATION WAS THAT?

Some Interesting Notes which will help you to Identify the Stations Received Under the New Conditions.

By J. GODCHAUX ABRAHAMS

THE owner of a multi-valve wireless set who limits his activities to the reception of broadcasts from the home stations puts me in mind of the amateur gardener who is satisfied to potter around a ten by four flower bed when he could roam at random and with full freedom through Kew Gardens.

The P.M.G.'s licence for which you are asked to pay ten shillings a year entitles you to listen to *any* broadcast you may be able to pick up in the ether, in addition to the wireless entertainments provided for you by the B.B.C. When you find that with the same ease in handling a receiver you can tune in at will twenty or more different transmissions of interest both to you and to your family, irrespective of distance, the variety of the radio programmes at your disposal from so many sources will whet your appetite. Like Oliver Twist you will ask for more.

To-day, most wireless receivers will gratify these legitimate desires. The bare fact that your knowledge may be confined solely to the English language or, alternately, that you only possess a smattering of foreign tongues—perhaps merely the few words and sentences learnt at school—should not deter you from listening to Continental broadcasters; the actual identification of any individual transmitter, in practice, is much simpler than it would appear in theory. Without any particle of doubt, interest in the programme is considerably enhanced if you know from what country and city it emanates. Possibly when twirling the dials you may have tuned in signals of which you could not trace the origin; possibly, again, you did not recognize the language and to complicate matters during the period you were listening, no call was given and no interval signal was heard. It is true that for some of these reasons the identification of a station may not be an easy one; to beginners in wireless it may appear to be an almost hopeless problem; to others a matter of guesswork, or a question of chance, as by standing by, one might pick up some kind of announcement in the course of the broadcast. Some slight experience, however, acquired later, will definitely prove that although at the time the tyro failed to secure evidence, much of the necessary information was clearly offered to him; *in fact, on most occasions sufficient data is forthcoming to allow him to arrive at a correct conclusion.*

The Logging Chart

It is to be presumed that one of the first "accessories" invested in by the beginner is a complete list of European transmitters with their respective wavelengths. Such a list was given free with last week's issue of PRACTICAL WIRELESS. Now, to identify a broadcast, it is essential to know the channel on which the transmission is carried out as it is to this wavelength or frequency that the receiver is tuned. There are various methods by which this information can be obtained, namely: (a) by actual measurement with a calibrated wavemeter, (b) by plotting a graph based on data already in your possession or immediately available, (c) by compiling your own list of condenser readings worked out on previous loggings of known and identified transmissions and, finally, (d) by inference drawn from the condenser dial degrees in relation to other readings taken of stations heard on previous occasions. Many wireless receivers have their condenser dial or dials marked in degrees (0—100, 0—120, or 0—180); others are calibrated in wavelengths; others, again, bear the names of the stations corresponding to the various wavelengths and/or frequencies. No doubt, at first sight the last method would appear to solve the problem of identification straight away; it would were it not for the fact that many stations have a bad habit of either straying from their allotted channels or of changing their wavelengths to suit their own convenience. The new Lucerne Plan *may*, however, remedy this. In the allocation of wavelengths the geographical position of the transmitter plays an important part and there is every chance that modifications to the original plan will yet have to be made to avoid mutual interference between neighbouring high-power stations. Other factors may also be disclosed which cause unforeseen complications. This would mean inevitable adjustments which would change the position of a number of stations in the broadcasting band, and for this reason alone it would be unwise to rely exclusively on the printed information given on a condenser dial. In my opinion on this ground alone readings in wavelengths, kilocycle frequencies, or mere degrees will be found more useful for establishing a log of stations heard and identified.

Tracking a Station

The first point to ascertain is whether the transmission is made on a channel above 1,000 metres or below that wavelength. The greenest of beginners can establish that fact without further explanations as, barring the oldest type of sets, all receivers are equipped with a switch or other gadget for the selection of the long or medium band. If the required station is broadcasting on the latter band, find out roughly its position in respect to some of the better known home transmitters, such as your local station. Doubtless, at the outset you will have picked up one or two of the B.B.C. National or Regional transmissions, and a glance at your condenser dial will show you whether it is below, say, Midland Regional and above Scottish Regional, or between, say, North National and West Regional. This will greatly limit your search by giving you some rough idea of the wavelength. Here let me suggest two ways of making a note of the data obtained. The easiest perhaps is to jot down, as soon as you have tuned-in a transmission, the exact condenser readings. Where you have obtained a call or recognized the transmitter—there can be no doubt in regard to the British stations—append this information against its wavelength. When a few have been logged you will have collected some definite landmarks, and a glance at the list in conjunction with the readings of the "wanted" transmitter will show approximately the channel on which it is operating.

A more accurate method, and one which may be strongly advocated if the work is taken seriously, is to plot a graph, a description of which has already appeared in these columns. If a little care is used in keeping it up-to-date as each transmission is recognized, much valuable information will be collected. Gradually you will find your log grow, with the result that when a mystery broadcast crops up a glance at the dial, followed by a consultation of the graph, will confine the search to three or four stations, and thus reduce the problem to its simplest form.

The Relays

The question of relays may sometimes prove puzzling, inasmuch as the same programme will be taken by a number of stations, but if, as already explained, a note is made of the groups of transmitters, it is not difficult to trace the relay broadcast back to its "feeder" or mother station. To give an example. If you look at a list you will see that Frankfurt-am-Main, Stuttgart, Langenberg, with their respective relays Cassel, Trier, and Freiburg, take the same wireless entertainment, and that Milan, Turin, Genoa, Florence and Trieste work in the same manner. The calls heard in these instances

(*Continued on facing page*)

NEON DANGER BEACON AT RUGBY WIRELESS STATION

A neon danger beacon which will be visible 50 miles away is being built to the order of the Air Ministry to warn aircraft of the 12 giant wireless masts at Rugby station. Work began only a week ago—a few days before the crash at Ruysselede, Belgium, when an air liner flew into a similar group of wireless pylons with the loss of 10 lives.

(*Continued from facing page*)

will be those of the original station from which the broadcast is made. To continue the illustration, if you heard *Firenze* (Florence) on a reading below that of London National, a reference to your list of wavelengths (and later to your log or graph), will prove that you were *not getting the programme direct*, but will establish the identity of the relay, and so on.

The Language

Next in importance comes the question of language, and this is the one which I think offers to most beginners the greatest difficulty. Roughly speaking, in Europe we must classify the tongues spoken into three large groups, namely, Latin, Teutonic and Slavonic or kindred languages. In the first we find French, Italian, Spanish, Portuguese, in the second, German, Dutch or Flemish, Norwegian, Swedish, Danish, and in the last Russian, Polish, etc. In order to avoid further puzzles I have not extended the classification, but you will also pick up Czech, Romanian, Finnish, Magyar, Slovak, and others.

As you may surmise, it is a difficult matter to give you a concrete idea of what a language sounds like, but a few pointers in this connection may help you. If you hear such words as: Allo! Station (phon: *star-see-ong*) émission (*ay-mees-ee-yon*), *poste*, you may take it that you are listening to a French broadcaster, to Brussels No. 1, or to Sottens (Switzerland). The condenser readings will decide which of these it can be. German is undoubtedly a roughish tongue full of *ach's* and other guttural sounds; Dutch, although somewhat softer, is perhaps more akin to English, as is also Danish. You should find it easy to identify Italian as most of the words end in a vowel; in addition, all studios have women announcers. Spanish, although possessing some resemblance, is more guttural, and Portuguese is a shade harder. Flemish, as picked up from Brussels No. 2, resembles Dutch. When once you have heard Russian—the transmissions are quickly found on 857 metres (Leningrad) and 1,481 metres (Moscow)—you will not fail to recognise it the second time as it is so different from other tongues. Polish is full of *ski's* and Czech seems to contain more *z's*, *d's*, and *b's* than any other letter of the alphabet. Although, perhaps, it may at first sight seem to be a waste of time, it is worth while when tuned in to a Continental station, to "hang on" for a few minutes, even when a news bulletin is being broadcast, if only to catch the intonation and sound of the foreign tongue used.

If you listen frequently to Continental stations your ear will familiarize itself to these different sounds, and after a short period you will be surprised to discover with what ease you can distinguish the family to which a foreign tongue belongs. You may not understand words, but definitely you will be able to say, for instance, that although not French or Italian it may be Spanish or Portuguese.

The Interval Signals

Where interval signals are concerned, be they metronome, bells or musical box, a solution to the problem is at once forthcoming. All you need do is to refer to the list of interval signals published last week in these columns. Familiarity with these sounds again will enable you to identify without hesitation the source of the broadcast and a quick reference to your log will tell you through which channel it is being heard.

WHY SOME RECEIVERS FADE MORE THAN OTHERS

An Interesting Explanation of Phenomena Which are Generally Overlooked

By PERCY RAY

EVERY owner of a "foreign-station-getting" receiver is aware of that annoying phenomenon called fading. In some up-to-date sets this rise and fall in volume is offset by some form of automatic volume control, but it is receivers which are not so equipped that give rise to the question, "Why do some receivers fade more than others?"

Readers will already be aware that fading is due to natural causes outside the control of the receiving set and, from what little is known, the transmitter also. Hence it would, at first sight, seem ridiculous to suggest that one receiver should fade more than another.

There is no question that some types of superhet receivers, and to a lesser extent "straight" receivers, actually accentuate fading, sometimes completely spoiling a broadcast that would have been acceptable on a receiver not troubled with this peculiar fault which, for the purpose of clarity, we will call "Accentuated Fading."

"Accentuated Fading" is a combination of the rise and fall in volume of the received signal *plus* a rise and fall in set efficiency consequent upon it; that is to say, the overall amplification varies with different input voltages.

This state of affairs is due to a valve that is working on a portion of its characteristic curve where small changes of input bring about relatively large changes in the working characteristics. What actually happens is that when the signal fades the declining input brings about a corresponding decline in the efficiency of the receiver. From this it will be seen that there are two forces, both reducing the signal strength and accentuating the original degree of fading.

Due to the Detector

It is interesting to explore the possible stages in which "Accentuated Fading" may arise. If it were anywhere in the low-frequency portion of the receiver the effect would be to make soft passages of music almost inaudible, and would come into effect on the orchestration of the music more than on the varying strength of the incoming signal, consequently the trouble must arise somewhere between the aerial and detector.

"Accentuated Fading" could occur to a very small extent in a screen-grid stage, but it would be too slight to make its presence known to the human ear, even if two or three stages were concerned. All stages have now been eliminated except the detector or second detector in straight or superhet receivers respectively; in a superhet there is also the first detector, but this usually has a small load in its anode circuit and a relatively high anode voltage, and further does not handle powerful signals—consequently it can be ruled out.

Anode Bend

The biggest offender is an anode-bend detector, particularly if it has a high working impedance in the region of a megohm or more. An anode-bend detector that is behaving in this manner can often be improved by a change in screen voltage accompanied by an appropriate change of grid bias; but, unfortunately, this procedure often brings about considerable sacrifice in efficiency before an acceptable improvement is brought about.

The true solution is to do away with anode-bend rectification altogether, as even if the constructor is willing to buy another type of screen-grid valve and to try using this method again, there is no assurance that matters will be any better unless he has the means and knowledge to gather together a mass of data relative to both valve and set.

The alternative is to use power-grid detection, but this method must be approached with care for two reasons. The use of a triode valve is out of the question, owing to lack of amplification, unless there is more H.F. amplification available than was originally necessary. The most obvious thing to do is to use either a low-impedance screen-grid valve or a high-frequency pentode as a power-grid detector, which will offset, with something to spare, the adverse effects of the necessary grid current damping imposed (by a grid detector) on the preceding tuned circuit.

Secondly, certain types of I.F. transformers will to a small extent lose efficiency out of proportion to the increase of grid current damping, thus accentuating fading.

Leaky-grid Detector Faults

Leaving the question of superhets. adverse fading can occur on a simple three-valve receiver; if battery valves are employed it is usually due to the grid leak having developed an abnormal value, or to a leak in the grid condenser.. In a mains receiver the trouble may also be attributed to the use of a power-grid detector arranged to handle a far bigger input than the single high-frequency stage can offer it from a distant station; on the other hand, the trouble can be caused by an overloaded detector, but distortion would make itself apparent; more so than "Accentuated Fading." Remember that fading will only occur on a distant station, and the overloaded detector will, therefore, seldom be the root of the trouble.

There is no doubt in the writer's mind that "Accentuated Fading" will develop into a serious problem, especially if ordinary fading continues to become worse, as it has done for the last four years. This article does not pretend to point out the true remedy, but it shows how it may be minimized. It is probable that all the H.F. and I.F. stages contribute to this undesirable happening.

For the benefit of those who would like to point out that it does not matter as the sets of the future will have A.V.C., it will be well to point out that A.V.C. does not do away with the distortion that accompanies fading, and "Accentuated Fading" will turn to "Accentuated Distortion." For those who would submit the diode detector as a "cure-all," there is the point that another I.F. stage is almost inevitable, which will bring other troubles in its wake.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

Persistent Mains Hum

IT sometimes happens that a mains set is troubled with a bad mains hum that nothing will stop; the set may be made of the best components and material obtainable, and everything known to stop mains hum may have been incorporated without the least improvement. Such persistent trouble is almost sure to be due to a defect in the actual valve itself, a short-circuit or low-resistance path between the cathode and heater wire, allowing the A.C. that is feeding the heater to reach the cathode. The only cure is, of course, to use another valve.

Faulty A.V.C.

NOW that automatic volume-control is becoming quite general, certain pitfalls are beginning to show themselves. A very common trouble with an A.V.C. circuit is failure of the system to function so that the set works exactly as it would if A.V.C. were not incorporated. This is almost always due to either a broken resistance connected to the diode, or to the A.V.C. decoupling condenser leaking; it is imperative that this condenser is perfect.

A Novel Tester

AN American firm has just placed upon the American market a simple gadget which they are pleased to call a "growler." This is a very useful device; it consists of a torch case, but the usual bulb is replaced by a small buzzer; there is also a small pick-up coil provided. The idea is to enable the amateur to test almost every component with no additional equipment other than a pair of headphones. It can be connected across a transformer with the headphones across the other winding and a broken winding would be instantly noticeable. It will also test condensers, tuning coils, continuity of any description, or lack of it, and with the pick-up coil it is possible to trace short-circuits.

Queries to Manufacturers

MANY listeners have occasion to correspond with the manufacturers of some component or receiver regarding trouble or advice; if the product in question can be readily identified the reply is likely to be more detailed and helpful than if the answer has to be a scanty reference to six or seven different types. It is not sufficient to refer to a receiver as a Blanker three-valve screen-grid; the makers possibly have issued a dozen sets that would answer to this description. When referring to a product quote the catalogue number or name ("Panther," "Pye Q," etc.); do not use a general name like "Melody Maker" that is used for a series of models.

Self-Winding Speaker Leads

IN Germany almost every loud-speaker has a self-winding cord concealed in the base; when it stands on the set it appears to have a neat taut lead a few inches long. When the speaker is required in another room, it is only necessary to pick it up and carry it in; when returning it to the set the lead automatically winds itself up into the base.

Anode Current and Screen Voltage

MANY experimenters have found that a low voltage on the anode of a screened-grid or pentode valve makes practically no difference to the anode current, even if it is dropped from 150 to, say, 50 volts. The reason for this is that the *anode* current is almost entirely controlled by the *screen* voltage.

Interference with a Vengeance

A RADIO scientist has discovered that there are over 3,000 different electrical devices in a big city that can interfere with radio; can anybody think of another, or, better still, can everybody thinking together compile such a list? We doubt it.

Crystal Detector and A.V.C.

A CORRESPONDENT suggests using a crystal detector for rectifying the signal to provide bias for an A.V.C. system instead of the usual metal rectifier. Theoretically, this may sound all right, but a crystal has a relatively low reverse resistance. Anyhow, who would like to adjust the cat's whisker before starting the evening's ether tour?

Keep Sets Free from Damp

DAMP is likely to cause premature breakdown in a receiver, and it also impairs reception. If a set stands in a damp place, such as near French windows that are often open, it is a good plan to cover all the ventilation holes, except one, for an hour about once per week; care should, of course, be taken to see that the set does not get unduly overheated.

Time Delay on A.V.C. Systems

SOME constructors are experiencing a *time* delay on their A.V.C. systems; that is to say, the volume adjusts itself some two or three seconds after the station has been tuned in; on a powerful station the row can be awful during this delay. The trouble is due to over-generous decoupling on the A.V.C. line. A 2 mfd. condenser takes some little time to charge up through half a million ohms, especially if the condenser has even the smallest leak.

The Ultra-short Waves

IN spite of all this 5-metre work that we are hearing so much about, there does not seem to be much progress in this field. The old theory that the waves might behave like light has died a gradual death as the experiments have progressed and, really, what reason is there to suppose that this should be so? X-Rays and light rays are nearer to each other than light rays and 5-metre radio rays, yet X-Rays are certainly very different from light rays. The comparison of "ultra-short waves" to light may have been the result of early experiments, since many shielding effects can be noted, but now it has definitely been shown that sometimes the 5-metre

(Continued on next page)

(Continued from facing page)

radiations can get round corners which light cannot get round. It is now generally recognized that very little progress is likely to be made, at any rate in the matter of long-distance records. The waves below about 10 metres are known to penetrate both the known "ionospheres" or refracting layers, and unless a third layer exists or comes into existence at some other time in the eleven-year cycle, all communication must be done by the direct ground wave, which dies away rather quickly.

Progress is, however, being made in the apparatus used for local communication. In the receiving line the receivers are being more carefully constructed and are very much easier to handle. The super-regenerative type predominates and for this there is a very good reason. Down on the 5-metre wavelength oscillators become very unstable in the same way that receivers do, and when the oscillator is modulated with speech, the wavelength goes "all over the place." It is as if the London Regional wobbled up and down between 300 and 400 metres! Super-regenerative receivers are easy to tune and can be made extremely small for portable work, this being an important consideration. In such sets rods, mounted on insulated handles, are used in place of the more usual frame aerials. One interesting result is that a stronger signal is received when the rod is tilted towards the ground than in the horizontal position, but the directive effect is stronger in the horizontal position.

Good Situations

THERE has been much talk lately of the merits of short-wave receivers of different designs. One writer has for several years now insisted that if anyone cannot hear distant stations in some part of the world or another, then his receiver must be at fault. Only in one case in one hundred is the bad situation of the receiving station to blame. That is his opinion! But I am sure that few short-wave listeners in the eastern part of London will agree with this theory. I have heard of few spots worse than these regions, and I am sure it is not because all the people in East London build bad receivers and all the people in South London build good ones. So long as a receiver is well constructed and operation is easy, then I think that it will work well in a good situation and must work badly in the bad districts. The statement that every case, except one in a hundred, where bad reception is encountered is due to the receiver is rather wild.

My own receiver is simply awful in the matter of bringing in DX stations, though the locals come in at terrific strength. When DX is to be heard here I always get it very weakly, but at the same time stations in other regions get it at almost local strength. It is not mere bragging on the others' part, because I have visited them and heard the signals for myself. Some time back, however, an opportunity arose to take the receiver to an amateur field-day, and the performance was wonderful. The situation was in Essex, about twenty miles from London, and the journey down did not do the set much good. In fact, when I arrived I found one of the fellows of the district hard at work with a soldering iron, somewhere in the bottom of the set! But when we got the set working, what signals were to be heard! On 80 metres American amateur telephony was received at fine loud-speaker strength, a thing which has certainly not occurred at home.

NAPS

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A BRAND NEW WORD CONTEST FOR OUR READERS

SECOND WEEK OF OUR NEW PHRASE-FORMING CONTEST

"Naps" is the title of our new phrase-forming competition which we feel sure is bound to make an appeal to all readers. It is quite simple. You form a sentence from a list of words and compose another phrase having an apt bearing on the sentence. Now read the full details and make up your mind to win a prize with your first attempt.

HOW TO WIN

First, from the list of words choose from one to four to form an Example line. In order to give you greater scope, you may take any two which, joined together, form one, such as MAD and CAP—MADCAP, or FOOT and BALL—FOOTBALL. These would each be counted as one word. After you have made your Example line you compose an apt sentence consisting of not more than five words—using any five words you like.

Here is a specimen of joined words to use in the formation of an Example. The word "NO" combined with the word "WHERE" gives "NOWHERE." Run on the two words TO LIVE and "NOWHERE TO LIVE" becomes an Example line. Compose a phrase such as "ANOTHER RANK OUTSIDER," and you have a "Nap" that is bound to catch the judges' eye.

A good Example line, compiled of separate words from the list, would be "ON THE ICE" and a "NAPS" phrase, such as "ONLY CRACKS COUNT" would immediately attract the judges' eye. But these are merely helpful suggestions. It's "up to you" to go one better and win.

LIST OF EXAMPLE WORDS

MAD	MOTHER	ON	COCKNEY
CAP	CRY	TENDER	WHERE
FROM	IN	GOLD	SAID
NO	THERE	WHY	CUP
FOR	FORE	AGAIN	TIE
TO	FAILED	WHEN	NEIGHBOURS
A	STUPID	WOMEN	LOCAL
THE	FROM	RULE	GOSSIP
AND	TENT	SIMPLE	NEWS
OF	LAW	TOWN	AGENT
AT	GOING	BAND	MANSIONS
PA	JUST	CATCHING	LIVE
FOOT	ICE	COLD	BROTHER
BALL	VENT	WHAT	

A FEW READY-MADE EXAMPLES

NOWHERE TO LIVE	TO THE FORE
STUPID LAW	THE RULE OF GOLD
ON THE ICE	IN THE NEWS
THE FOOTBALL CUP	MANSIONS TO LIVE IN
CATCHING PA	LOCAL JUSTICE
FROM TENT TO TOWN	MADCAP FROM TOWN
FORE !	FROM MOTHER TO PA
JUST MOTHER	STUPID AND TENDER

Mr. GILBERT FRANKAU, the famous author, has agreed to examine and adjudicate upon the selection of attempts submitted to him by the Judges. He will select those attempts which appeal most to him and arrange them in order of merit.

RULES.—1.—You may enter as many "NAPS" as you wish. 2.—The entrance fee is 3d. for one line, 6d. for two, and so on. Postal Orders for amounts of 6d. and over should be made payable to "Editor," *Tit-Bits*, crossed "& Co.," and YOUR FULL NAME AND ADDRESS MUST BE WRITTEN ON THE BACK. 3.—The Prizes will be awarded in the order of merit, according to the opinion of Mr. Gilbert Frankau, who will make the final decision. 4.—The Editor's decision in all other matters relating to this contest is final. 5.—Proof of posting will not be accepted as proof of receipt or delivery. 6.—No employes (or members of their families) of George Newnes, Ltd., and associate companies are allowed to enter.

Signed.....

Address.....

No. of Postal Order.....P.L.W. 2.

EXAMPLES, ONE TO FOUR WORDS.	"NAPS," ONE TO FIVE WORDS.	
		3d.
		6d.
		9d.
		1/-
		1/3
		1/6
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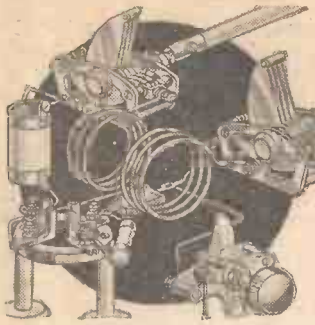


Short Wave Section

BELOW TEN METRES (PART 2)

An Experimental Oscillator and Wavemeter.

By B. PEDDER

CONSTRUCTORS of ultra-short-wave receivers who wish to calibrate the condensers and check the wavelength range of various sizes of inductance coils and loops will find that the simple oscillator and wave-meter here described will not only enable them to do this, but also prove useful in other interesting experiments. The circuit diagram (Fig. 1) shows the oscillator, which consists of two single-turn loop coils A and B and two small-capacity variable condensers C and D. The latter act as balancing condensers and serve for tuning. The wavelength of the oscillations is increased by increasing the capacity of condenser C, while a decrease in the capacity of condenser D counterbalances this by decreasing the wavelength, and thus, by adjusting both, a perfect electrical balance is obtained for any desired wavelength within the range of the coils and condensers employed. The remainder of the components are a fixed condenser, the value of which is not critical, and may be between .001 mfd. and .005 mfd., a space-wound high-frequency choke and a variable resistance of from 1,000 to 5,000 ohms. A 2-volt power type valve is suitable. Loose-coupled to the oscillator is another single-loop coil connected across the ends of two parallel wires bridged by a small indicator lamp (Fig. 2). This may be set at various points along these extended wires for calibrating the wave-meter, as shown.

The Lay-out

The lay-out of the components for the oscillator is shown in Fig. 3. Each single loop coil of 18 S.W.G. bare copper wire is mounted on a pair of ebonite or fibre rod pillars, ⅜in. diameter, standing on washers of the same material, about ¼in. thick. These are set up so that the coils are about 1¼in. apart, and the top ends of the pillars are drilled and tapped 4 B.A. to take short, threaded brass stems, the connecting wires being put on first and secured by means of a thin brass nut, whilst the coil loop is added last and fixed by a small nut again. This allows of other loops of different overall diameter or another gauge of wire being tried. The connecting wire from the fixed terminal of the 40 m/mfd. condenser to the grid socket of the valve-holder, the loop of coil B and the remainder of the wire to the terminal of the variable resistance could, with care, be all in one piece, so that there are no joins, the same plan being followed with the other loop. These two coils must be correctly coupled or it will not be possible to obtain the required effect and wave-range, unless the winding sense is the same; hence the crossed connection to condenser D. The .002 fixed condenser interrupts what would otherwise be a two-turn coil between the anode and grid sockets of the valve-holder.

The Condensers

Small variable condensers of the "Midget" type have been used. C has a capacity of 15 m/mfds., and D is 40 m/mfds.; the former was made up from another 15 m/mfd. size to have less plates, and the metal bar passing underneath the set of fixed plates is drilled and tapped to fit on the end of the screw which comes up through the stand-off insulator, only enough screw being left above the locknut to pass into the condenser frame. Both sets of moving plates are connected together and to L.T. negative. A small panel for each condenser has been indicated by dotted lines if it is desired to mount the condensers in this way. A piece of ply-wood fixed to the edge of the baseboard in these positions, and having one side covered with a thin cardboard scale drawn in Indian ink, is used to mark condenser settings. A short-wave type valve-holder is mounted on four legs 1½in. high, secured to the baseboard by means of wood screws from the bottom

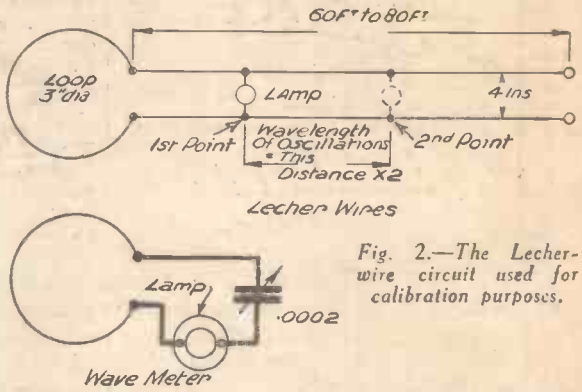


Fig. 2.—The Lecher-wire circuit used for calibration purposes.

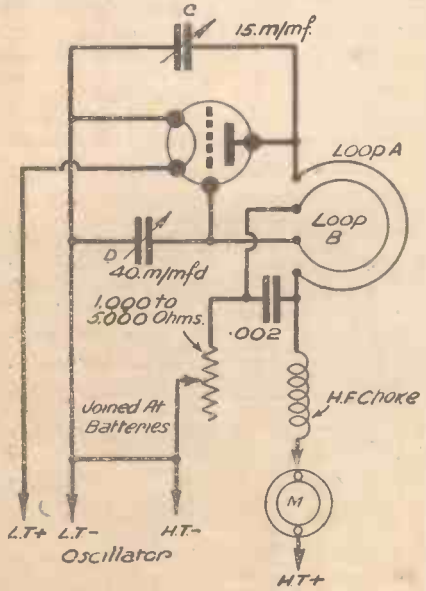


Fig. 1.—Circuit arrangement of the oscillator described.

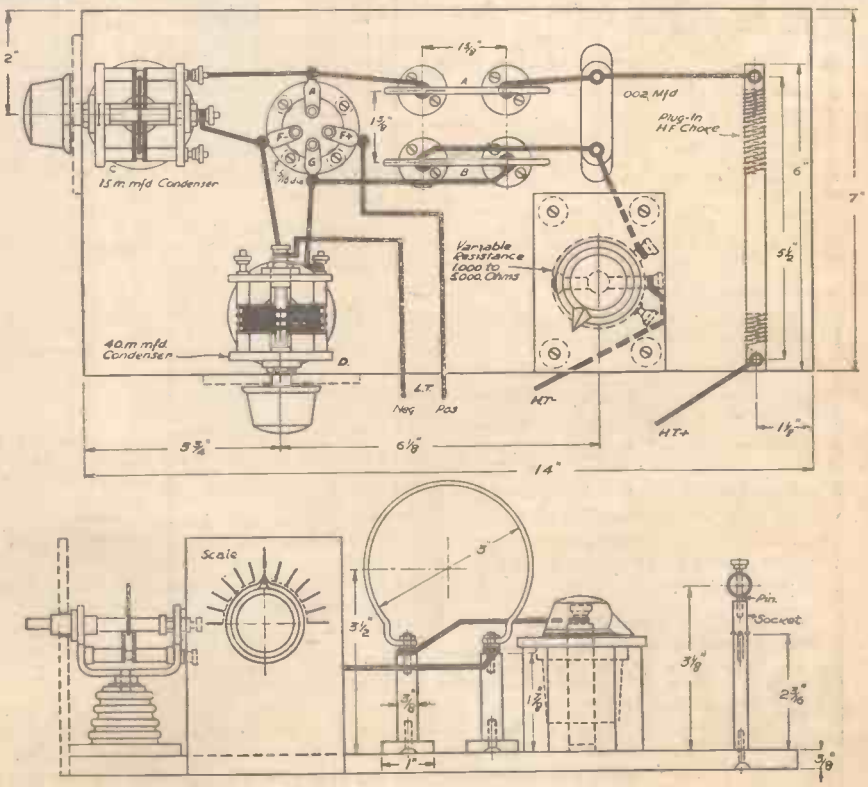


Fig. 3.—Showing the lay-out of the oscillator.

(*Continued from previous page*)

and the variable resistance is fixed to a small panel on legs secured in the same way. Two ¼in. diameter by 2 3/16in. long pillars are fixed at 5½in. centres for the H.F. choke, and the top ends are drilled and tapped to take two brass sockets with threaded stems such as were used at one time for valve-holders, tags being soldered on to each for connecting; ⅜in. diameter rod (dry wood dowel or ebonite with screw threads), 6in. long over all, is used for the high-frequency choke. Split-pins with screwed stems and terminal nuts are fitted at each end, and the wire fixed under these. More than one choke may be made up, using the same length of rod with pins but a different winding. The one shown had 60 turns of No. 28 S.W.G. D.C.C. wire on ⅜in. ebonite rod threaded 14 threads per inch, so that the turns are spaced apart.

The Wavemeter

There is little in the wavemeter construction (Fig. 4) to call for comment, except that the flash-lamp holder is raised on a small wood block, and the 3in. diameter loop of 12 S.W.G. copper wire is at the same centre height as the coils on the oscillator and receiver previously described.

Several flash-lamp bulbs will have to be tested before a suitable one is found, and those which give the brightest glow when the wavemeter is moved well away from the oscillator should be used, and one or more set aside as spares.

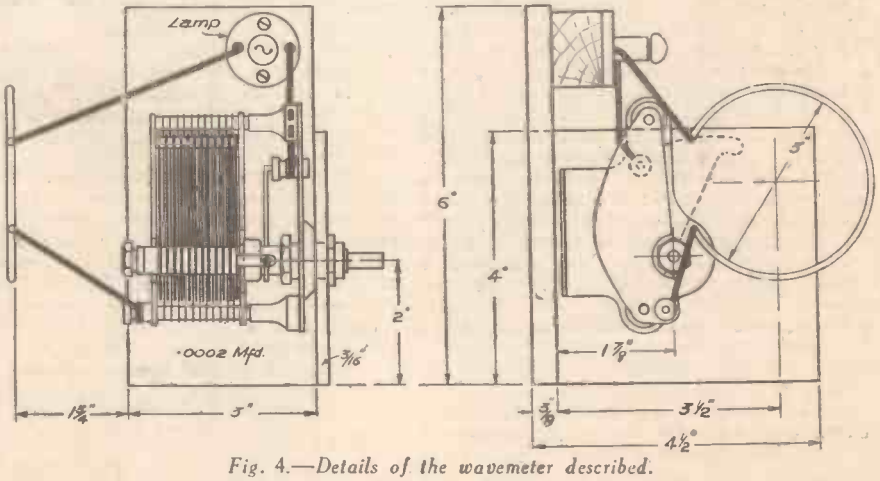


Fig. 4.—Details of the wavemeter described.

A suitable aerial for coupling to the oscillator consists of another 3in. diameter loop of No. 12 S.W.G. copper wire on pillars similar to the pairs used for coils A and B and placed at about 3 to 4in. from coil A; two equal lengths of the same wire, each 18in. long, are fixed to each pillar in contact with the coil ends.

For calibrating, Lecher wires are used, the length being 60ft. or more, and the two wires spaced 4in. apart and about 4ft. above the ground, well insulated at both ends and at two or three points along the length by light spreaders. A small tubular flash-lamp holder with contact screws and two stiff wire leads of equal length, say about 2½in. long, are required to slide along the Lecher wires. The test bench ends of the Lecher wires are connected to the coupling coil used for the aerial in place of the 18in. lengths. Hook the slider lamp over the Lecher wires and the apparatus is ready for use. A milliammeter should be connected in the H.T. positive lead, and the batteries joined up. Set condenser C so that moving plates are half-way out, and adjust condenser D to obtain the balance point which is indicated by a minimum anode current reading on the milliammeter. Slide the lamp along the Lecher wires until a point is found where the bulb glows brightest, note the position and move the lamp along till a second point is found where the bulb again glows brightest. Twice this distance between glows in meters is the wavelength of the oscillation. If this wavelength is too low, increase capacity setting on condenser C and re-balance. If too high, decrease on C and re-balance. The process is carried out until the required wavelength is obtained. It may be noticed that as condenser D is moved there is an unsteady movement of the milliammeter pointer, and in this case the variable resistance should be set to a lower value, and the correct setting is found when the current falls steadily to the minimum and then rises again as condenser D is adjusted to and past the position of balance.

Calibrating the Wavemeter

The wavemeter is calibrated by having it as loosely coupled as possible to the oscillator, and getting the brightest glow in its flash-lamp bulb at the greatest distance away and adjusting it to resonate with the oscillator. Repeat for different wavelength settings and note the wavemeter dial readings for each and make a chart on squared paper, checking with the measured distances along the Lecher wires.

LIST OF COMPONENTS FOR OSCILLATOR.

3/8in. thick baseboard 7in. by 14in.
15 m/mfd. variable condenser—Jackson Bros.' "Midget" or Eddystone "Microdenser."
40 m/mfd. variable condenser—Jackson Bros.' "Midget" or Eddystone "Microdenser."
2 Stand-off insulators—Eddystone No. 916.
1 Short-wave type valve-holder.
1 variable resistance 1,000 to 5,000 ohms.
1 .002 mfd. fixed condenser.
18 S.W.G. copper wire for coils and connection wires, etc.
Assorted pieces of ebonite rod, etc.—"Belco."

LIST OF COMPONENTS FOR WAVEMETER—FIG. 4.

1 .0002 mfd. variable condenser—"Utility."
1 No. W181 micro-dial—"Utility."
2 Flash-lamp bulb-holders for baseboard mounting.
2 Flash-lamp bulbs.
Wooden base, 3in. by 6in.
Panel, 4in. by 4½ to 5in.
12 or 18 S.W.G. wire for loop coil.

(Continued from page 897)

the coil is designed so that it has a good selectivity performance at low wavelengths, by employing a small coil shunted by a fixed condenser considerably higher in capacity than the minimum of a variable condenser. The inductance to resistance ratio can be made quite high, equally as good as the high wavelength condenser tuning condition. And then what happens as the core is inserted gradually to tune to the higher wavelengths? The high-frequency resistance of the coil itself is reduced (reduced frequency), but the *effective* high-frequency resistance (this is equivalent to the increased losses owing to the insertion of the iron core) is increased. The inductance is also increased, however, and by careful design it is possible to keep the inductance to resistance ratio substantially constant and so give uniform selectivity.

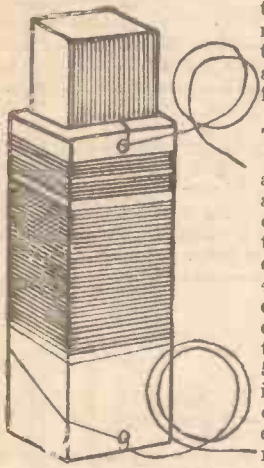


Fig. 4.—An experimental tuning coil with movable iron core.

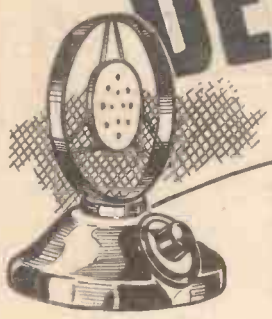
Tuning Range

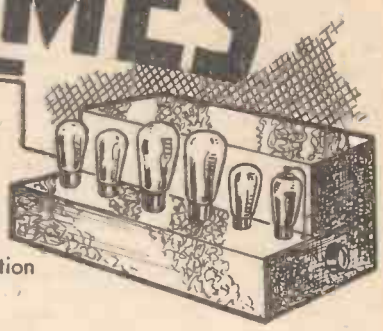
Some months ago I carried out a few tests in connection with this permeability question, and Fig. 4 shows one of the experimental coils employed. To tune from 200 to 550 metres an inductance change of nearly eight times is necessary, while on the long wave-band, that is, 1,000 to 2,000 metres, the change is four times. The iron powder is best produced chemically to achieve the necessary degree of fineness for low losses, and this can then be moulded into a core with bakelite as a binder.

With core withdrawn, that is, small inductance, the permeability can be taken to be the same as air which, of course, is unity. The resonant frequency under this condition is given by the well-known expression $\frac{1}{2\pi\sqrt{LC}}$. When the core is inserted and the presence of the iron becomes noticeable, the formula is changed to include the permeability term, and is now expressed as $\frac{1}{2\pi\sqrt{\mu LC}}$. The effective average permeability increases as the coil is still further inserted, and, in consequence, very careful measurement and design becomes necessary to produce a component which efficiently carries out the purpose for which it is required, together with uniform amplification.

Another very important factor which bears on this problem is the question of ganging so that two, three, or even four tuners may be operated from a single drive, and yet keep in step. No doubt this can be solved by using air-condenser trimmers, as is the case with present condenser ganged circuits. If so, then the overall dimensions of not only a single permeability unit, but also the complete ganged component, should be considerably smaller than its present coil and condenser counterpart. This, of course, falls in with modern design, which aims at smaller chassis.

DEAF AID SCHEMES





In This Article the Author gives a great amount of Useful and Practical Information in regard to the Construction and Improvisation of Various Types of Amplifiers to Enable Those who are "Hard of Hearing" to listen to Broadcast Programmes and General Conversation

By FRANK PRESTON

THERE are very many people to whom broadcast programmes are of little interest, due to the fact that they cannot be followed in comfort because of defective hearing. In a large majority of cases, however, these unfortunate persons could hear perfectly well if they had a suitable device for amplifying sounds. It is not suggested that all deaf folk could be enabled to enjoy broadcasting, but those who are only partially deaf or, to use a common expression, are "hard of hearing" can certainly benefit by the use of a simple amplifying device.

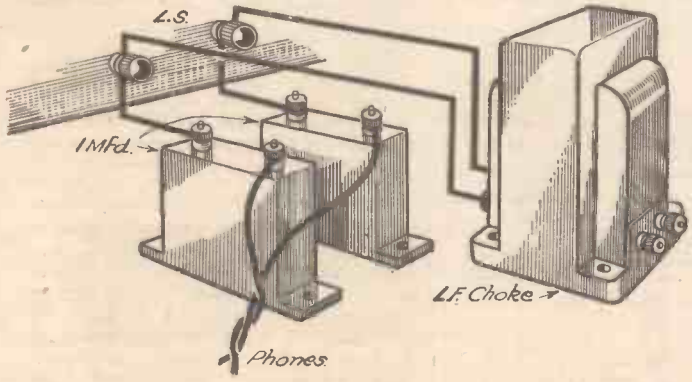


Fig. 1.—A simple method of connecting 'phones to the speaker terminals of a powerful receiver.

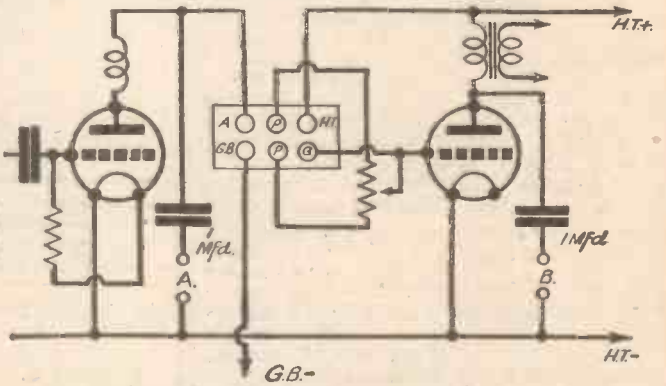


Fig. 3.—Two alternative positions in which 'phones can be connected are shown in the above circuit. The T.C. transformer represented is a multitone.

High-note Response

Merely to use a microphone in conjunction with a valve amplifier would probably prove only partly satisfactory in many instances, since most people whose hearing is defective can hear high-pitched sounds much more easily than low ones. For that reason it is in nearly every case advantageous to employ an amplifier which gives greater response to the high than to the low notes. Probably the ideal system is to equip the amplifier with an effective tone-control device, so that the response can be varied at will to suit individual requirements.

Rather than simply give a single design for a deaf-aid amplifier, it is proposed to offer a number of practical suggestions which can be tried out in the easiest and most economical manner by any reader. Obviously, the most convenient type of amplifier in most cases is the L.F. side of the ordinary broadcast receiver. When this is to be used to amplify speech it is only necessary to connect a microphone (which must be provided with the requisite transformer and battery) to the pick-up terminals on the set and then to join a pair of ear-phones to the speaker terminals. This can usually be done without the need for any modification, but in the case of a more powerful receiver, particularly one of the mains-operated type, it is necessary to isolate the 'phones from the high-tension circuit by some means or other. The most straightforward is shown at Fig. 1, where a low-frequency choke is connected to the two speaker terminals, the 'phones being connected through a pair of 1 mfd. fixed condensers. These latter should be of a good make and have a rated working voltage of not less than 400, so that they will be free from the possibility of breakdown.

In order to prevent overloading of the 'phones, and also to keep down the volume to a reasonable level, it is essential that some kind of L.F. volume control should be incorporated. Most modern sets already have such a control, but when they have not it is a simple matter to connect one in the microphone circuit as shown at Fig. 2.

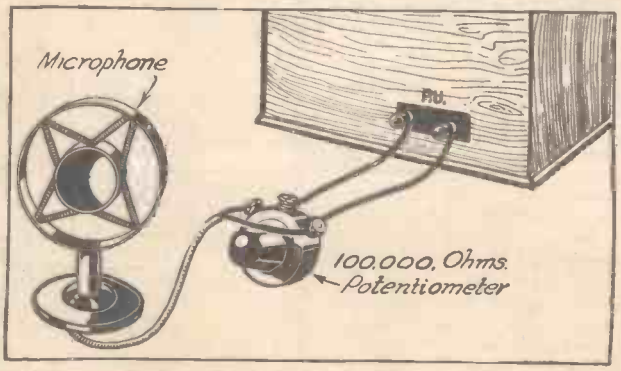


Fig. 2.—A simple method of connecting a volume control between the microphone and set.

Tone Control

It has already been mentioned that those whose hearing is not too good are more sensitive to the higher frequencies. Thus, if a tone-control knob is provided on the set, this should be adjusted to the "high" or "treble" position. When tone control is not a feature it will be found worth while to incorporate it in some form or other.

The easiest way of doing this, for the purpose under discussion, is to replace the first L.F. transformer by one of the type designed for extra high-note response, connecting a variable resistance between the terminals provided for it. By so doing, additional emphasis can be given to the higher frequencies when desired or the normal tone can be obtained simply by varying the setting of the resistance.

Another way, which is somewhat better in the case of a receiver which is for normal domestic use, is to replace the first transformer by one designed for complete tone control. It will then be possible either to "raise" or "lower" the normal pitch of reproduction given by the set in an instant. Special tone-control transformers are made by two or three firms, and in most cases they can simply be used as replacements for others of ordinary type, the only difference being that a potentiometer must be connected to three terminals provided for it.

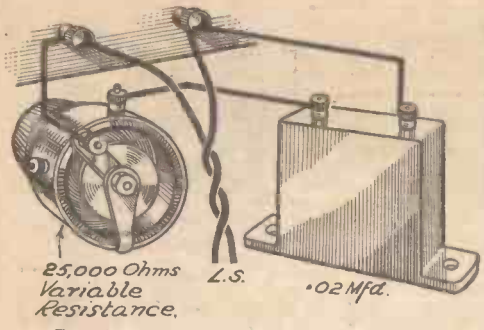


Fig. 4.—A tone-control arrangement for reducing high-note response by the speaker.

In every instance the manufacturers give full particulars for fitting.

Screen the Microphone Leads

At this juncture it might be mentioned that when the receiver is employed as an amplifier along with a microphone, it will generally be found most convenient to place the latter on a table in the centre of the room, connecting it by means of a long double wire to the set. The wire used for connecting the microphone should be screened, for otherwise there will be a danger of introducing L.F. instability, which will give rise to an objectionable "hum" or "groan" in the ear-phones. The metal screening should, of course, be connected to the earth terminal on the receiver.

It need hardly be mentioned that the methods of using a set with 'phones and a microphone which have been described are equally applicable to ordinary radio reception, and the same points in regard to high-note response should be observed. In the majority of cases several people—in addition to the one who is deaf—will wish to listen to the broadcasts at the same time, and therefore the method of connecting the 'phones which was mentioned above is unsuitable. There are two ways of overcoming this difficulty, however, the more obvious of which is to replace the L.F. choke by the loud-speaker, leaving the 'phones connected as before. The disadvantage of this is that loud-speaker reproduction will be "screechy" because of the increased high-note response. Additionally, the 'phones might be grossly overloaded, although the volume of reproduction from the speaker is probably quite inadequate for comfortable listening. This state of affairs can be remedied most simply by connecting the 'phones in an "earlier" part of the receiver—in the anode circuit of the detector or first L.F. valve; the two most convenient positions in the circuit are shown theoretically in Fig. 3. Position B is better because the 'phones then "follow" the tone-control transformer so that full use is made of the additional high-note response provided. To prevent this affecting speaker reproduction, however, it will be necessary to fit an "opposing" tone-control arrangement across the speaker terminals. The control will merely consist of a .02 mfd. fixed condenser wired in series with a 25,000 ohm resistance as shown in Fig. 4.

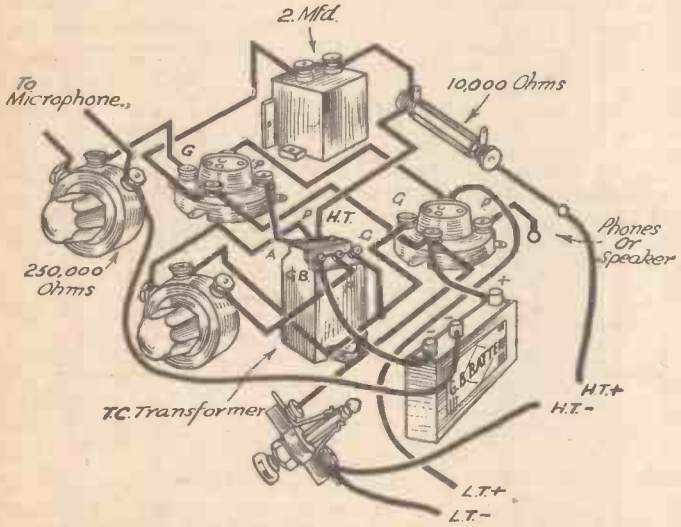


Fig. 5.—The circuit arrangement for a two-valve deaf-aid amplifier.

A "Deaf-Aid" Amplifier

Many readers might prefer to construct a special amplifier for "deaf-aid" use, and this can be done very easily by making use of the circuit arrangement given at Fig. 5. It will be seen that two valves are employed, these being coupled together by means of a tone-control transformer. A 250,000-ohm potentiometer is used as an input volume control from the microphone, and this will serve to vary the signal strength in the 'phones from maximum to the quietest whisper. Apart from the tone-control arrangement the circuit is perfectly standard and identical with that made use of in numerous gramophone and wireless amplifiers. An objection to a circuit such as this is that it cannot be made up in a really portable form, although it is quite ideal for use in the home. When it is desired to carry the amplifier about, a somewhat simpler, though less efficient, system must be adopted. An ultra-simple circuit for a single-valve amplifier, which can, if necessary, be built into a cigar box, is shown at Fig. 6. It will be seen that the valve is a pentode, and that it receives only 16½ volts H.T. with 1½ volts G.B. There is no provision for volume control, and tone control is cut out because the pentode itself tends to give emphasis to the higher frequencies. As a matter of fact, the whole arrangement is just about as simple as it could possibly be made, and lends itself admirably to the requirement of portability.

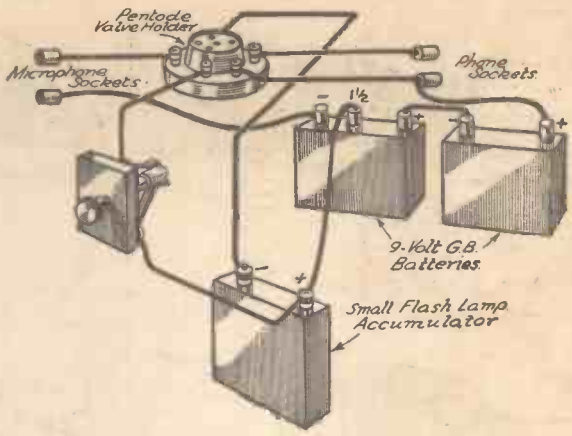


Fig. 6.—A single-valve amplifying circuit using a pentode with only 15 volts H.T.

A Portable Amplifier

So as to give an idea of the appearance of an amplifier built around this circuit Fig. 7 has been drawn. This shows the most suitable lay-out of the parts, and also shows that high tension and grid bias are supplied by a couple of 9-volt grid-bias batteries fixed into the box by means of a brass strap. Low tension is obtained from a small unspillable accumulator which may be of the "flash-lamp" type or one of those made for use in model boats. Alternatively a 3-volt dry battery could be used by wiring a suitable resistance in series with one L.T. lead, but this would not prove nearly so satisfactory or economical. Four insulated sockets are fixed in the end of the box, two of which are for connecting the microphone and two for the ear-phones. The outfit does not call for any further description, but it might be mentioned that the box will need to be of the "50" or "100" size and should be chosen according to the dimensions of the G.B. batteries and L.T. supply which it is proposed to use.

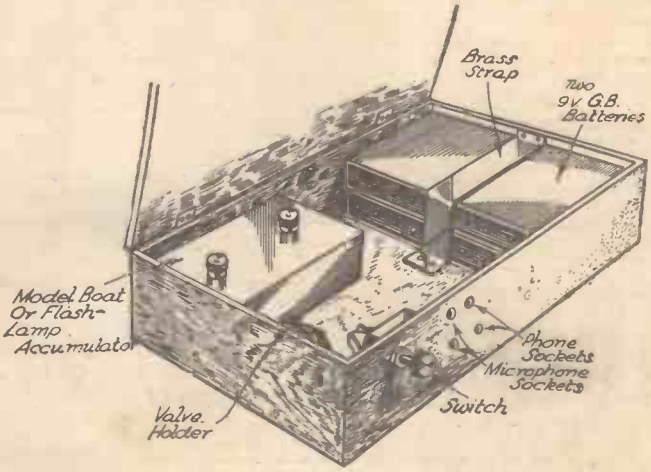


Fig. 7.—A practical arrangement of the circuit given at Fig. 6.

By T. Onearm

THOSE who scoff at the music of great masters cannot fail to have their opinion altered if they listen to some of the records mentioned here. The greatest achievement of the list, and, in fact, one of the greatest achievements in the history of the gramophone, is an almost complete recording of Strauss's delightful opera, *Der Rosenkavalier*, on thirteen double-sided records, *H.M.V. DB*2060-72. Here is a performance of this melodious opera, with its entrancing waltz, which it has never been possible to perform in the flesh. If one's pocket will not stretch to the complete set of records the following numbers should be heard without fail: *DB*2061, *DB*2065-7, and *DB*2071-2. Whilst these records are the most juicy plum that has fallen to opera lovers during the last few years, musicians will delight in the recording of Yehudi Menuhin and the Orchestra Symphonique de Paris, of Lalo's *Symphonic Espagnole*, on *H.M.V. DB*1999-2002. It is a unique work in many ways; although it is called a symphony, it is really a concerto; it has a Spanish tang, and was written by a Frenchman, and has four movements instead of the usual three. The conductor, Georges Enesco, was Menuhin's teacher, and the boy genius is now a greater artist at the violin than his master. Chopin's *Fantasie in F Minor* is the subject of two brilliant records, *H.M.V. DB*2031-2, by Alfred Cortot.

New Gilbert and Sullivan Triumph

Another achievement by the "His Master's Voice" Company is an abridged recording, made under the personal supervision of Mr. Rupert D'Oyly Carte, of *The Sorcerer*, in which many past and present Savoyards are responsible for the principal parts. These include Dorothy Gill, Darrell Fancourt, Muriel Dixon, and Derek Oldham. Gilbert and Sullivan enthusiasts all over the world have been grateful to H.M.V. for the authentic recordings they have issued in the past of all the Gilbert and Sullivan operas with the exception of this one. These new records, *H.M.V.* 8054-59, in order that they may reach a wide public, have been issued at a popular price.

Record of the Month

Many will consider the best single record of the month to be Lawrence Tibbett's dramatic recording of *The Song of the Flea*, coupled with *The Pilgrim's Song* on *H.M.V. DB*1945. This artist, who possesses one of the finest baritone voices, has given a remarkable performance of this song, which depicts the adventures of a flea that went to court. Another more than good vocal record of music, which can only be described as ethereal, is Richard Crooks' singing of the lovely *Dream* from *Manon* on *H.M.V. DB*2093. Those on the look-out for a bargain in operatic records should secure Joseph Schmidt's recording of *Blazing to the Sky* from *Il Trovatore* and *So Pious* from *Martha* on *H.M.V. B*8036. Rarely is singing of this high order obtainable on a plum label record.

Among a good batch of vocal records in English is Derek Oldham singing *I Still Love Mary*, which is a sequel to *Her Name is Mary*, on *H.M.V. B*8087. These two "Mary" ballads were written by a cinema organist and refer to his wife.

Joseph Hislop sings *The Island Herdmaid* and *An Island Sheiling Song*, from *Songs of the Hebrides*, at the beginning of one of which he explains the significance of a phrase in the song.

Stuart Robertson, who has a seafaring father, gives authentic representations of *The Bay of Biscay* and *The Saucy Arethusa*, and Peter Dawson has produced another stirring record, *Song of the Drum* and *Westward Ho!* both composed by McCall. As McCall is Peter Dawson's pen name there is little doubt that these songs are sung as the composer intended.

First Father-and-Daughter Disc

Records of piano duets do not often appear in gramophone companies' lists, and the first of this kind made by father and daughter is released by "His Master's Voice" this month. On *H.M.V. C*2634 Mark Hambourg and his fourteen-year-old daughter, Michal, give a brilliant performance of Schumann's *Andante and Variations, Op.* 46.

Several records of light orchestral music will be of interest, including the London Philharmonic Orchestra's performance, conducted by John Barbirolli, of Quilter's *Children's Overture*, *H.M.V. C*2603, which has, of course, popular nursery tunes as its theme.

Cinema organ admirers will want *Lily of Laguna* and *Il Bacio*, by Sydney Gustard, on *H.M.V. B*8088, whilst adherents of brass bands will be interested in a Medley of Sousa Marches by the Coldstream Guards on *H.M.V. C*2598, and the last record made at the Tidworth Tattoo—*Marche Militaire* and *Bullfighters March* on *H.M.V. B*8039.

Dance Records

Dance band enthusiasts are also in luck this month, for there are at least three big hits among the new H.M.V. records. On *H.M.V. B*6438 Ray Noble and his Orchestra play *My Song Goes Round the World* and *Song Without Words*, and on *B*6432 *When You Were the Girl on the Scooter*, with *La-di-da-di-da* on the other side, played by the orchestra and sung by Bobbie Comber, who is responsible for this number in the show *That's a Pretty Thing*. A very polished performance of *Without that Certain Thing*, by Jack Jack-

(*Continued on page 934*)

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.

BURNT OAK AND DISTRICT RADIO SOCIETY

A Radio society has just been formed at Burnt Oak, and is endeavouring to increase its membership. Any readers in the district who are at all interested are cordially invited to write for fuller details to the Hon. Sec., Mr. A. Donati, 59, Horsecroft Rd., Burnt Oak, Edgware.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of the Smethwick Wireless Society, Dr. Hughes, of the Multitone Electric Co., Ltd., gave a lecture on "Sound." He said that all forms of reproduction began and ended with sound, and that the object of the apparatus used was to give as good a copy as possible of the original. Further, the human ear being an uncertain instrument, it was necessary to measure, and analyse, input and output by scientific methods. He went on to explain the range of frequencies required for reproducing various instruments and the Rayleigh disc and condenser microphone methods of measurement. Polar diagrams and response curves for various types of loud-speakers and microphones were given, and finally the effects of tone control were briefly mentioned. The lecture was illustrated throughout by a series of interesting lantern slides.—Hon. Sec., Mr. E. Fisher, 33, Freeth St., Oldbury, Nr. Birmingham.

SLADE RADIO

A lecture on "Metal spraying" was given by Mr. G. Gordon Hoare at a recent meeting of this society. After stating that it was difficult to describe in a short lecture the very wide field the process covered, he went on to describe the various substances to which it could be applied. The reasons for use, including prevention of oxidation of metals, corrosion, or attack by acids, were given, also the apparatus was described, after which followed details of the progress which had been made since the year 1900. Examples were then given of the various metals which could be used and also the effects of same. On the radio side he showed the large number of uses to which the process could be put, and illustrated his remarks with a number of excellent slides. A few words on a medical application of the process concluded an exceedingly interesting lecture.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

It has been decided to form a branch of this society in the Gravesend district, and Mr. E. Ingleton, "The Haven," Chalk, Nr. Gravesend, Kent, has undertaken the duties of secretary, from whom particulars can be obtained by enclosing a stamped addressed envelope. A strong membership is anticipated as there are a large number of keen radio and television amateurs in the locality.

Y.M.C.A. RADIO CLUB (BOLTON)

At a meeting of this club held on January 6th an interesting lecture was given by Mr. Dean, of the Mullard Valve Company. The lecture was much appreciated by the audience. Interested readers residing in the district are invited to attend any of these lectures, which are given every Thursday evening at 8 p.m. Admittance is free. Further particulars of this club can be obtained from the Assistant Sec., Mr. J. E. Crompton, Y.M.C.A., 125, Deansgate, Bolton, Lancs.

THORNTON HEATH RADIO SOCIETY

A meeting of this society was held at St. Paul's Hall, Norfolk Road, on Tuesday, the 9th instant. Mr. S. J. Meares presided. Mr. O. L. Crossley gave a talk on Light and Optics, dealing with the likeness of the wireless wave to the light ray, and explaining that television was a combination of both. In the course of his lecture Mr. Crossley mentioned the speed at which a ray of light travels, and also explained the method adopted by scientists to calculate this speed. He also explained how the discovery that light was made up of several colours was made, and demonstrated this with the aid of a lantern and a glass prism. He also showed how a ray of light passing through a tank of water was deflected, and finally demonstrated the use of the polariscope. Particulars of future lectures and demonstrations can be obtained on application to the Hon. Sec., Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

It was members' night at the meeting of the London Chapter held at the R.A.C.S. Hall, Cavendish Grove, Wandsworth Road, S.W.8, on Friday, 5th January. The first half of the evening was given to Morse Instruction under Mr. L. F. Reading (2ATI). This will be a regular feature at each meeting from 7.45–8.15 p.m. Mr. P. J. L. Macfarlane (G5MK), then continued his talk from the last meeting on short wave receiver design. Members' own receivers were then demonstrated.—A. E. Bear, Sec., 10, St. Mary's Place, Rotherhithe, London, S.E.16.

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).

Band-pass and S.G. Detector Circuit Wanted

SIR,—I have followed your excellent paper from almost its first publication, and I would like to praise its never-ending source of interest. You have designed so many circuits that I hesitate to suggest yet another. The circuit I would like to see is a band-pass arrangement with an S.G. detector. Something like the band-pass H.F. unit, recently described, but followed by two L.F. stages, instead of the usual detector circuit. I think an arrangement like this would prove very economical, and have ample selectivity. A short time ago Mr. H. J. Barton Chapple talked about quality, and mentioned a receiver he was designing. Please let us have this soon.—INTERESTED READER (Newcastle).

German S.W. Station : New Address

SIR,—The German short-wave transmission and programmes are now a separate organization, as regards administration, under the Hitler Government, and it may be of interest to you to note that I have just heard the new address announced recently in English, as follows: Germany Short-Wave Station, Broadcasting House, Berlin, Germany.—ALF. W. MANN (Middlesbrough).

An Engineer's Approval

SIR,—I received the tool kit quite safely, and wish to thank you for it. I am very pleased with it, and I think it is a fine and accurate set of tools. I am an engineer and, of course, have a good knowledge of tools. I am only a beginner in radio, however, so I have been fortunate in securing good tools to start with. I like your paper very much and am most interested in your problems. I do not attempt to solve them at present, but am contented to read them and learn. I wish you and your paper every success in the future.—S. HALL (Newark).

"Canned" Television

SIR,—I have followed up your articles on television, which are interesting but, of course, outside the scope of the average wireless enthusiast owing to cost and lack of programmes. To my mind, television would become more popular if it were "canned" or "bottled," so to speak.

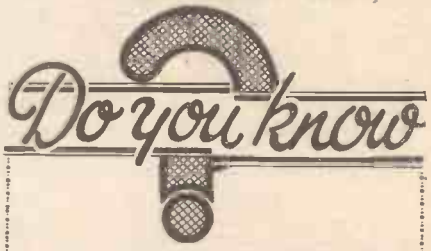
I see no reason why sound and vision should not be recorded on one record by the gramophone companies, the sound taking one-half of the record and the vision the other half, each commencing with a "start" mark and recorded at a slow speed, say thirty-three revolutions per minute (same speed as cinema records). At the receiving end the motor driving the scanning disc could be geared down sufficiently to drive a turntable with two pick-ups, each connected to their respective amplifiers for vision and sound, thus serving a double purpose. In this way one could have unlimited pleasure in "looking" and "listening" in without having to wait until last thing at night to receive half an hour's programme, which, you must admit, does not encourage the average listener.

I know this sounds ambitious, but it does not strike me as being improbable.—H. HEVEY (Dagenham).

Congratulations from S. America

SIR,—Allow me to congratulate you on the "Wireless Constructor's Encyclopædia," which I have just received. It is splendid. Just the book required by all amateurs. I also wish to thank you for the handy little spanners I received some time ago with PRACTICAL WIRELESS, and which I have found to be very useful. At the same time I wish you every success with your weekly journal. I am sure we in this part of the globe would appreciate it very much if you would publish in PRACTICAL WIRELESS an A.C. three-valve short-wave circuit with home-made coils. The coils you use in your circuits are all factory-made, and are unobtainable in this country.—J. PUDDINGTON (Buenos Aires, S. America).

CUT THIS OUT EACH WEEK.



—THAT a water-pipe is not an efficient earth connection unless it passes straight to earth from the point of connection.
—THAT many water-pipes pass up to a cistern in the upper part of the house and are effectively insulated at the point of junction with paint.
—THAT the glass of a window may be used as the dielectric of a series-aerial condenser by connecting the lead-in to a metal plate stuck on one side, and taking a similar lead to the receiver from the other side.
—THAT a small value fixed condenser may temporarily be constructed by twisting two insulated wires together.
—THAT H.F. chokes should be joined in the output circuit of a short-wave receiver in order to avoid losses.
—THAT hum can be caused in a battery-operated receiver by induction from the house wiring through a wall.
—THAT a screened lead-in, fitted with a specially-designed transformer at each end, will enable practically any length of wire to be used without ill effects.

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.

FACTS & FIGURES

Components tested in our Laboratories

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

COLVERN GANGED COILS

THE Ferrocart coils produced by Messrs. Colvern have before been mentioned in these pages, and have, in fact, been employed in several of our receivers. The latest form of this coil is the "G" type, in which the coil screens are not cylindrical as in the first type, but are flattened at the side, thus enabling the entire assembly to be made more compact. In addition to this feature the base-plate is designed to accommodate both an on/off switch and a radio-gram change-over switch. No terminals are provided for connection, but short lugs project below the coils and are very clearly indicated by numbers embossed on the underside of the aluminium base-plate. The coils may be obtained with various types of switch, whilst the radio-gram change-over switch is permanently fitted to the base nearest the control knob. At first sight it might appear that the lack of provision of terminals might reduce the usefulness of the coils, but from experiments which we have carried out we much prefer this arrangement, as it not only permits of simpler connection to the remainder of the circuit components, but reduces one of the troubles of the usual canned coil, namely, short-circuits to the coil screen. With the ordinary type of coil terminals are arranged round the upper surface of the coil base and the screen is slotted to fit over the wires which are joined to these terminals. It often happens that the connecting wire is bare where it passes through this cut-out and short-circuits arise which either prevent the set from working or result in damage. With these new coils this trouble is very definitely removed, and we have employed the assembly in the new Fury Four which is described in this issue. As will be seen in the constructional details of this receiver, we recommend that nine or ten-inch lengths of connecting wire be soldered to the connecting lugs, and these wires either passed down through holes in the chassis or brought out through the slots provided at the side of the base-plate. The unit is then screwed to the chassis and connections completed in the ordinary way. The coils themselves are totally enclosed in bakelite mouldings, and they may be obtained in various types. The control knob is clearly marked for the various positions of the switch, which operates in a very definite manner with a snap action which can be felt as well as heard. The three-gang assembly costs 37s. 6d., and an extra 1s. 6d. is charged for the switch, which may be of the mains type or for battery use.

The "G" type Colvern Ferrocart coil unit.

CENTRALAB POTENTIOMETERS

FROM Messrs. Rothermel we have received some samples of the well-known American Centralab potentiometers, and these have many features not usually found in components of a similar type produced on this side of the Atlantic. They are extremely compact, occupying a back-of-panel space of less than an inch and being only just over an inch in diameter. The case is of bakelite with a small metal dust-cover over the end. The actual movement is very ingenious, and is insulated from the control spindle. The element is of the usual carbon or graphite track deposited on a strip of material which is coiled round the inside edge of the container. Just inside this is a thin metal ring, slightly smaller in diameter than the composition ring. At the end of the control spindle is a cam-shaped metal disc, to the end of which is fitted a curved arm bearing at its end a small block of hard wood. This is soaked in oil and bears against the inner metal ring, and is of such a length that it presses the latter into contact with the resistance element. Thus, as the control arm is rotated, the inner metal disc rocks and is in contact with the resistance element over a small section, which travels round the entire circumference. This results in an absolutely noiseless movement and is also delightfully smooth to the touch. The friction is just enough to enable one to "feel" the control, and the passage from minimum to maximum is carried out in a most easy and smooth manner. The control may also be obtained fitted with a mains-type switch rated at 1 or 2 amps, and this comes into operation at the end of the travel of the arm, in a crisp and certain manner.

A NEW TUNGSRAM RECTIFIER

THE latest addition to the already comprehensive range of Tungsram Universal AC/DC valves is the indirectly heated Rectifier PV 4018. This rectifier may be used as a voltage-doubler or as a half-wave rectifier. The rectifier PV 4018 comprises two separate cathodes and two separate anodes. If a half-wave rectifier is required, it is only necessary to connect the anodes together and the cathodes together, and the rectifier will then deliver a rectified current of 100 milliamps. However, the most useful feature of this rectifier is that it may be used as a voltage doubler, i.e., at a mains supply voltage of 110 volts a D.C. output is obtained of approximately 200 volts at 40 milliamps. This feature, of course, makes the rectifier an indispensable part of an A.C. receiver operating from a low mains supply voltage. Full operating details of this rectifier are available on request to The Technical Department, Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford St., London, W.1.

CLIX CONTINENTAL VALVE-HOLDERS

THE increasing popularity of the continental high-voltage mains valves has led Messrs. Lectro Linx Ltd., to develop a model of their well-known Clix chassis-type valve-holder to accommodate these valves. Until recently they were only obtainable from the suppliers of the actual valves, and were of continental origin. The arrangement of the pins on these valves is different from any English arrangement, and furthermore certain types of these valves are provided with a short metal screen inserted in the bakelite base of the valve and connected to the cathode and in some cases to the external gauze screen with which the valves are fitted. The heaters are joined on one side of this screen and the remainder of the electrodes (except in certain cases) on the other side, and thus hum is prevented owing to this ingenious screening device. In order to complete the screening the valve-holder, when used with this type of valve, should be similarly provided with a screen and the valve-holder in the lower part of the illustration shows this screen. The price of this holder is 1s. 8d. with terminals, and 1s. 3d. without terminals. The unscreened holder costs 9d. without terminals and 1s. with terminals.

The new Clix "Continental" chassis-type valve-holders.

Reserve Your Presentation Copy of "Newnes' Everyman's Wireless Book" Now! See pages 890 and 891.

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.

NEW STATION IDENTIFICATION CHART

NOW that the Lucerne plan is in operation almost every station has a new position on your tuning dial. For making re-identification a simple matter Messrs. A. C. Cossor have issued a new Station Identification Chart, giving the new wavelengths, frequencies, and power of British and foreign stations; space is also provided for recording the new dial readings. Copies of the chart are available from radio dealers or from Messrs. A. C. Cossor, Highbury Grove, London, N.5, for 2d. post free.

NEW COSSOR BOOKLET ON CLASS B AMPLIFICATION

TO those readers who are users of battery receivers, Messrs. A. C. Cossor's book B.21 on Class B amplification will be of special interest. This is a particularly useful little book for the constructor who, hitherto, has been restricted to the small output of a power valve. It tells him how to incorporate a Class B valve in his receiver to obtain output comparable with that of a mains receiver. Several circuits are given, together with advice on how this latest form of output may be most successfully used, and added to suitable existing receivers.

Certain precautions may have to be taken and refinements added to ensure satisfactory results, and this book clearly explains what these additions are, and how they are best utilized. A copy of the booklet is available free to readers of PRACTICAL WIRELESS on application to Messrs. A. C. Cossor, Ltd., of Highbury, N.5.

HIVAC DRIVER+B VALVE

THE latest addition to the Hivac series of high quality low-priced valves for battery sets is the Hivac+B. This valve combines in one bulb two separate systems operating respectively as Driver and Class B output. This latest development in design, which gives added efficiency, reduction in cost, and simplifies wiring, is the result of extensive experimental work in the Hivac laboratories. The new valve is of particularly robust construction, and embodies mica spacers, and filament suspension springs, the anodes, grids, and filaments being housed between a side supporting framework. Interested constructors should write for a copy of the Driver+B leaflet, giving full particulars, prices, and characteristic curves, to The High Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1.

LISSEN PRODUCTS

A VERY extensive range of their popular components is given in a well-illustrated folder recently issued by Lissen, Ltd. Full particulars of the new Lissen iron-cored coils are, of course, included, and these coils have iron-dust cores, thus permitting very efficient coils of very small dimensions to be manufactured. Litz wire is used, and every strand is carefully insulated from the others until it reaches the point where it is soldered to the terminal. There are several types of these coils available, suitable either for aerial coils, band-pass, tuned-anode circuits, tuned-grid circuits, and windings are provided for reaction. Amongst the other components listed are the Lissen superhet three-ganged coil unit, dual and four-range coils, variable and fixed condensers, valve-holders, switches, chokes, potentiometers, wire-wound resistances, and the popular Lissen H.T. eliminators. Transformers, loud-speakers, and balanced armature units are also listed, together with the new Lissen permanent-magnet moving-coil loud-speaker. This high-class instrument is fitted with a universal transformer, and is suitable for use with either power valves, pentode valves, Class B. or Q.P.-P. circuits. There are also the Lissen Needle Armature Pick-up, valve adaptor, panel brackets, and plugs and sockets. Copies of the folder can be obtained from Lissen, Ltd., Lissenium Works, Worple Road, Isleworth, Middlesex.

IMPRESSIONS ON THE WAX.

(*Continued from page 930*).

son and his orchestra on *B*6436, will make this record extremely popular, whilst there is a good comedy version of *Two Can't Sit on a Three-Piece Suite* by the same band, coupled with *What's the Use of it Now?* on *H.M.V. B*6435. There are several good records by famous American bands, including Paul Whiteman and his Orchestra, but hot rhythm fans will be interested to know that Cab Calloway and his Cotton Club Orchestra are now recording exclusively for "His Master's Voice" and present as their first disc *Evenin'* and *Harlem Hospitality* on *B*6437. This band is due to make its first London appearance early in March.

THE BEGINNER'S SUPPLEMENT

(*Continued from page 916*)

panel should then be marked with the chosen ranges in the same order as those shown in the pictorial view of the finished meter (Fig. 5). This will ensure that your switch positions will agree with the wiring of the resistances.

Using the Meter

Having completed the assembly, a few notes on the method of using the meter may be of some assistance. The left-hand switch is, of course, the voltage selector, and the right-hand switch the milliamp selector. The bottom stud of the "volt" switch is marked m.a., and the pointer should always be set to this when milliamp readings are required. Similarly, when the meter is required for measuring volts, the milliamp switch must be set in the *volts* position. In this position with the "volts" switch set at m.a., the meter will naturally be set for the lowest range of milliamps, the adjustment of the "volts" switch to any other point setting the meter for the voltage range indicated. This, then, completes the multi-range meter, and if reasonable care has been taken in its construction, you should now have an accurate 7-range instrument at your disposal. There is no reason why you should not modify the design suggested if you consider that such a course would be more convenient. For instance, if you are artistically inclined you could make a neat paper scale giving both the volt and milliamp readings. So long as you follow the instructions dealing with the making of the shunts and the selection of the resistances explicitly, then you can be sure that results will be satisfactory.

Series Resistance for:—	FULL SCALE READING IN MILLIAMPS				
	0–2	0–3	0–4	0–5	0–6
0–2v.	1,000	—	—	—	—
0–3v.	—	1,000	—	—	500
0–4v.	—	—	1,000	—	—
0–5v.	—	—	—	1,000	—
0–9v.	—	3,000	—	—	—
0–10v.	5,000	—	—	2,000	—
0–12v.	—	—	3,000	—	2,000
0–150v.	—	50,000	—	30,000	—
0–160v.	—	—	40,000	—	—
0–180v.	—	—	—	—	30,000
0–200v.	100,000	—	—	—	—

SOUTHERN RADIO'S Bargains.—Set manufacturer's guaranteed surplus.

VARIABLE Condensers.—Lotus 3-gang 0.0005, 12/6; Lotus 2-gang, 0.0005, 8/6; Lotus Dyblock single, 0.0005, 4/9 (list 9/6); all these condensers are complete with dials, escutcheons, knobs, fully screened with trimmers, and boxed; Hydra block condensers, 16 mfd. (2+2+8+2+1+1), 1,000v. D.C., 7/- each; 20 mfd. (2+2+2+2+2+2+2+1+1+1+1), 1,500v. D.C., with terminals, 11/6; 10 mfd. (2+2+2+2+1+1), 7/3; Dubilier 4 mfd. (2+1+1), 1,000v. D.C., 2/9; 4.5 mfd. (2.25+2.25), 3/-; fixed 4 mfd., 2/3; 2 mfd., 1/6; 1 mfd., 1/-.

SPEAKERS.—Permanent magnet moving coil, 7in. cone, 28/- (list 49/6); 21/- (list 39/6); D.C. mains, energised for all voltages, 9in. cone, 21/- (list 42/-); 16/6 (list 32/6); Magnavox, model 154, 17/6; Blue Spot, 100U, 13/6 (list 39/6); 66K, complete in cabinet, 16/- (list 42/6); G.E.C. Stork, complete in magnificent cabinet, 19/6 (list £3/15); Celestion P.P.M. Soundex Permanent Magnet, 17/6 (list 27/6); all speakers are new, in original cartons.

PICK-UPS.—B.T.H. Senior 1934 model, with volume control, 28/6 (list 37/6); Blue Spot, model "88," with volume control, 26/- (list 63/-); Marconi No. 19 (1934), 26/- (list 32/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor "A" 3-valve, screen-grid kits, with cabinet and moving-coil speaker, less valves, £3/7/6; with valves, £4/10 (list £8/7/6); Ready Radio S.T. 400 kits, all specified components by Scott Taggart, £2/19/6 (list £4/17/6); Osram Music Magnet Four, complete with 4 Mazda valves, £4/19/6 (list £10/5); all kits new, in original sealed cartons.

MISCELLANEOUS Items.—Pifco All-in-One Radiometers, 9/3 (list 12/6); Ferrocart coils, G1, G2, G3, 31/6 (list 37/6); S.T. 500 coils, 5/6 per pair; Hellesen's 8 mfd. electrolytic condensers, 2/9 each; Westinghouse metal rectifiers, H.T. 6, 7, 8, 9/3 each; Radiophone volume controls, with switch, 3/- (list 10/6); Amplion loud-speaker units, 2/3 (list 12/6); Ferranti choke, 20 henry 60 m.a., 6/9 each; Kolster Brandes gramophone motors, dual, for A/C or clockwork, complete with turntable and all accessories, 110/250 volt, 25/- each (list 63/-); all new and guaranteed.

MAINS Transformers and Chokes.—Please send for complete list; specials can be supplied within 3 days of order.

ALL Transformers and Chokes Guaranteed for 12 months.

ALL Goods Guaranteed and Sent Carriage Paid.

BRANCHES at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle St., W.C.2; 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.

PEARL and PEARL, 190, Bishopsgate, London, E.C.2. All the following bargains guaranteed new goods. Cash or C.O.D., carriage paid.

LEWCOS Frame Aerial eliminates outdoor aerial and increases selectivity. List price 27/6, our price 9/6.

EDISWAN 2-volt non-spill accumulators, 80 ampere hours. Over-all measurements, height, 6¼in., width 3¼in., depth 3¼in.—7/6.

REGENTONE Pentode 2-valve A.C. all-electric receiver, complete with valves. Original price £6/10/0—our price £2/19/6.

LINCOLN STEWART D.C. Eliminator, 25 m.a., 4 tappings, list price 32/6, our price 16/6.

THE "Lincoln Super" Permanent Magnet Moving-Coil Loudspeaker, all purpose universal tapped transformer for Q.P.P., Class B Pentode, Power, and Super-Power output. Will carry 3 watts undistorted output. List price 42/-. Our price 19/6.

FORMO 2 mfd. Mansbridge Condensers, tested at 800 volts D.C. Our price 1/11.

SLEKTUN dual range screened coils, 200-550 met., 800-2,100 met. Every coil complete with wiring diagram. List price 6/6, our price 2/11.

SLEKTUN H.F. Coils for use with above dual range aerial coils. List price 6/6, our price 2/11.

K.B. D.C. "Pup," self-contained, simple, safe, and trouble-free. The K.B. 2-valve D.C. "Pup" is an excellent and reliable mains-operated receiver. List price £7/10/0, our price £3/12/6.

SURPLUS H.M.V. 3-gang .0005 mfd. Variable Condensers with drum drive, beautifully made in one piece to avoid backlash. To clear, 7/6.

T.C.C. 10.5 mfd. block condenser, working voltage 250 D.C. tapped for 8 different values, price 3/11.

STOCK of Telsen Major Chassis. This is a super bargain and is available while stock lasts. Usually 10/6, our price 3/3.

PEARL and PEARL. All above bargains sent cash or C.O.D., carriage paid. 190, Bishopsgate, London, E.C.2.

REPAIRS to Loud Speakers, 4/-; Blue-Spots, 5/-; Transformers, 4/-; Moving Coils and Eliminators Quoted for. All repairs remagnetised free. Guaranteed. Discount for trade. Clerkenwell 0009. S. C. Mason, 44, East Road, N.1.

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.

RAD-AUTO-GRAM buy Modern Second-Hand Components for Cash.—39, Tulketh St., Southport.

BIRMINGHAM RADIOMARTS Manufacturers' Bankrupt Stocks; post free over 6/-, otherwise 6d. New list stamp.

RADIOMART.—Limited quantity Philco Heavy Duty Class "B" Driver Transformers—boxed—2/9.

RADIOMART.—British Radiophone 27/6. Straight 3-gang standard dust-cover and trimmers 12/6.

RADIOMART.—Polar 1934 Superhet Monodial 3-gang, front section 110 kc/s, fully screened with trimmers 12/6.

RADIOMART.—British Radiophone 7/6, wirewound logarithmic potentiometers with mains switch 10,000 ohms, ditto 5,000. Heavy duty no switch, either type 2/-.

RADIOMART.—Marconiphone solid Walnut 535. Radiogram Cabinets, real quality 45/- carriage forward.

RADIOMART.—Wearite transformers 300/300, 250/250, HT8. HT9, all with 2CT.LT's., not stripped types, 10/6.

RADIOMART.—Metvick 35/- super transformers 250/250, 4v.2 amps., 4 v. up to 5a., fitted terminals 12/6, 110v. or 230v. 25 cycles same price.

RADIOMART.—440v. electrolytics T.C.C. 8 mfd. aqueous 3/11, Hellesen ditto 3/3. Utility 2/6, mains switches 9d.

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