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(P.R.47)
ROUND the WORLD of WIRELESS

The Record Multi-lingual Broadcast

When the Vatican transmitter on June 4th concluded its broadcast of a Pontifical Ceremony relayed from St. Peter’s, Rome, it secured the record of a Pontifical Ceremony relayed from St. Peter’s, Rome, it secured the record of the Apostles on the occasion of the Whitsun Holydays were read in thirty-five different languages. The broadcast was carried out on 19.84 m. between 11.0 a.m. and midafternoon.

Italy’s Most Up-to-date School

The Industrial School at Cremona possesses one of the most modern receiving stations with which any similar institution has been equipped. From his private office the Head is able to listen to seven hundred scholars throughout the establishment, speech being broadcast through forty-eight loud-speakers in the class rooms. All educational courses from the Italian studies are relayed during the day; according to their subjects they are taken by different class rooms. It is perhaps the most up-to-date educational establishment in Europe.

Eiffel Tower Remains Conservative

Notwithstanding the fact that so many European broadcasting stations have adopted distinctive opening and interval signals, the Eiffel Tower, one of the earliest to broadcast, retains its original chimes. Shortly before a transmission is due the announcer puts out the official call and with a view to facilitating the turning-in of the broadcast, verbally gives out a succession of numbers such as trois cents, trois-cent-età, trois-cent-deux and so on. This preliminary warning may last from one to two minutes, when the call is repeated.

World-wide Broadcast

When the King opens the Economic Conference on June 12th his speech will be relayed to almost every country in the world, barring, perhaps, Japan and China. The transmission will be carried out by the Post Office authorities working in co-operation with foreign administrations from the Geological Museum, where the address is delivered. His Majesty’s voice will be conveyed through the new International Telephone Exchange at Faraday House to a number of lines, feeding in turn the B.B.C. network, including the Empire broadcasting stations, the Post Office system at Rugby for relay to the Empire and ships at sea, and the international submarine cables for the benefit of continental capitals.

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11. The first paper to deal with REMOTE TUNING CONTROL.
12. The first paper to deal with the HEXODE VALVE.
13. The first paper to deal with the CATHODE CONTROL.
14. The first paper to deal with a TWO-PENTODE UNIT.
15. The first paper to deal with a two-valve TWIN-VALVE.

New Russian Transmitter

In the intervals of North Regional broadcasts owners of multi-valve receivers may hear from time to time strains of music or foreign speech; these emanate from the new high-power transmitter which the Soviet Union has erected at Ivano Vosnesenki, and which has been carrying out tests on 483 m. (621.1 kilocycles) with a power of some 40 kilowatts (aerial).

The Watch on the Rhine

The new interval signal adopted by Frankfurt-am-Main and its relay points Cassel and Treves, comprises a few notes of the famous Wacht am Rhein, a song which, during the Great War, was no less popular with the Germans than the Hymn of Hate! To Replace Paris PTT

With a view to carrying out the Ferrié plan in its entirety the French State has decided, notwithstanding the purchase of Radio Paris, to erect a 120-kilowatt PTT transmitter at Villebon-sur-Yvette, some 13 miles distant from the French capital. The building of this new station has been entrusted to French manufacturers, and work is to be started without delay, as it is desired to bring the station into operation at the beginning of next year. The present station worked by the Ecole Supérieure has had its power raised to 7 kilowatts, and will continue to broadcast until the new transmitter is finished on 447.1 metres.

Broadcast to South Africa

The King will perform the opening ceremony at South Africa House, Trafalgar Square, London, on June 25th. His speech will be broadcast to the South African Zone through one of the Daventry Empire stations, and may also, it is hoped, be heard by British listeners to the National or Regional programmes.

European Statistics

According to the International Broadcasting Union the increase in the number of registered wireless receivers in Europe amounted in 1932 to nearly two millions, or approximately eight million individual listeners. This increase, taking place as it did at a period of crisis, surpassed by nearly two-and-a-quarter millions that of 1929, the last year of prosperity since the war. We have by no means reached anywhere near saturation point.

The New Lucerne Plan

Although at this juncture it is impossible to forecast the wavelength plan which may be elaborated at Lucerne, it is possible to state that the allocation of channels will be made accord
The French station which is heard immediately above the tuning of London National is Lille PTT. This transmitter, situated in the North of France, is approximately 100 miles from the English capital and, although its power is less than 11 kilowatts the signals are well heard in many parts of Great Britain. Lille announces itself as “Radio PTT du Nord à Lille” as the station is in the French State broadcasting system. It’s opening and closing call is usually followed by a gramophone record. Most French studios now close down with the playing of the Marsellesse and the National Anthem is not curtailed but given in its entirety.

Radio and Mount Everest
The work of the Mount Everest Expedition has been considerably assisted by the fact that two of the camps have been directly linked with the station at Darjeeling. One of the stations is situated at the foot of the Rongbuk Glacier from which the ascent to the summit of Mount Everest is to be attempted. All equipment and the installation of a combined transmitter and receiver had to be conveyed by carriers from Darjeeling, and the convoy was greatly hampered by storms. Unfavourable weather conditions at the outset made radio messages almost impossible, but when they improved, three-way communication was established and greatly assisted towards the success of the undertaking.

Lille and London National
The French station which is heard immediately above the tuning of London National is Lille PTT. This transmitter, situated in the North of France, is approximately 100 miles from the English capital and, although its power is less than 11 kilowatts the signals are well heard in many parts of Great Britain. Lille announces itself as “Radio PTT du Nord à Lille,” as the station is in the French State broadcasting system. Its opening and closing call is usually followed by a gramophone record. Most French studios now close down with the playing of the Marsellesse, and the National Anthem is not curtailed but given in its entirety.

Latinate Foreign Words
Although the French are doing their utmost to find equivalents for English radio words, they have succeeded in doing so in very few instances, and the French fans’ radio jargon contains most of the terms—curiously mispronounced it is true—familiar to our ears. In their radio talks such words as midget, fuzzy, lay-out, buzzes, shout, bendpass, and so on can be frequently heard. Some, on the other hand, have been adopted, a loud-speaker is a haut-parleur, a literal translation. On the other hand, un coupelé is a poor adaptation of cocktail; in programmes un coupelé musical is an olla podrida of popular melodies.

Hungarian Railway Radio Service
With a view to popularizing the new listening services to the Magyars, the Budapest transmitter broadcasts a special concert daily at 9.15 a.m. G.M.T. for the benefit of passengers travelling by the Budapest-Vienna express.
THE summer months are notorious for presenting innumerable difficulties to the normal reception of long-distance stations. As a result, the DX enthusiast is debarred from getting the maximum enjoyment from his hobby during the light weather. Conditions are such that the signals from medium and long wave stations do not travel nearly so well as they do in winter time and thus if they are to be well received over distances of more than 200 miles or so a rather specially sensitive receiver is required. But even the best set that can be designed, with little regard to cost, cannot entirely overcome the difficulty because the more sensitive it is made, the more readily do it respond to atmospheric disturbances, which are, of course, of frequent occurrence during the warmer months of the year.

It is a happy coincidence, however, that short waves, below 50 metres or so, behave in an entirely opposite manner to those within the so-called "broadcasting bands." Not only do they travel over greater distances during daylight hours, but they are affected to a much lesser extent by atmospheric disturbances. In fact, it is often found that when the "grinding" and "crashing" noises are intolerable on, say, 400 metres, they can scarcely be heard on 40 metres.

All this points clearly to the conclusion that if DX work is to be carried on at this time of year, it must be done through the medium of short waves. Very fortunately, the simplest and least expensive kind of apparatus is all that is necessary for world-wide short-wave reception. Anyone who has not spent half an hour at the controls of a good short-waver cannot possibly imagine the thrills which the set can give. No matter what hour of the day it happens to be, the listener can be assured of picking up signals from two or three continents, and with a bit of luck it is by no means impossible to log every continent of the world in the space of twenty-four hours. There are stations galore working on the wavelengths between 15 and 50 metres and these are so far-flung as Tokio, Wellington (N.Z.), Kuala Lumpur (Malay States), Calcutta, Bucharest, Rabat (Morocco), Rio de Janeiro, Tegucigalpa (Honduras), Pittsburgh (U.S.A.) and Vancouver—without question they span the whole world.

(Continued overleaf)
What is the Best Type of S.W. Receiver?

The question which now arises is, how can the amateur of limited means take part in the great game of short-wave reception? There are two distinct ways; one is to make an adaptor or converter which can be used with the existing broadcast receiver, and another is to build an entirely new set specially for the job. It might be that the former method is rather less costly, but the self-contained short-wave set has much in its favour. There is no need to connect and disconnect it every time a change is to be made from one waveband to another, it is more adaptable for experimental purposes, and it can be used at the same time as the normal receiver in supplying entertainment to the non-technical members of the household. For these reasons I shall direct my remarks primarily towards an outfit of the latter type. In passing, however, I would mention that an excellent adaptor will shortly be published in Practical Wireless.

Available Circuits

There are many circuits available to the constructor of a short-wave set, from a simple but nevertheless fairly well away from the tuning circuit components and from the chokes.

Choice of Components

What about the choice of components? For best results, all those except the transformer, fixed condensers and resistances should be special ones designed essentially for short-wave use, but for a start you can try ordinary ones which are on hand, changing them later as your experiments progress. This remark does not apply to the coils and H.F. chokes, but it will be explained later how these can easily be made at home. The 0.002 mfd. tuning condenser must be of the air dielectric type—a bakelite one is useless for short waves—and should be fitted with a good slow-motion drive. A bakelite condenser can be used for tuning, but if an air-dielectric one is available it will be better.

Although definite values are assigned to all fixed condensers and resistances there is no reason why these should rigidly be adhered to; the figures given will serve as a guide.

The Coils

The coil connections shown are correct for the "Eddystone" 6-pin coils, which may be bought ready-made if required. On the other hand a pair of coils can easily be made as shown in the sketch of Fig. 3. Skeleton 6-pin formers are used, and these are wound with 18 gauge enamelled wire. Two turns are slightly spaced in the aerial and grid windings, but those for the reaction winding are placed side by side. The ends of the windings can be secured by passing them through small holes made in a rib of the coil former. Connection to the hollow pins is made by placing the ends of wire through them and applying a spot of solder at the tips.

To cover the full range of wavelengths, from 15 to 60 metres two coils are required, one of which will tune up to about 30 metres and the other from 25 to 60 metres. Both are identical except in regard to their numbers of turns.

Making the H.F. Chokes

The two short-wave chokes can be made as shown in Fig. 4, by putting 80 turns of 30 gauge double cotton covered wire on a pin, diameter to the point or ebonite. The tube is fitted with two small terminals to which the ends of the winding can be attached, preferably by means of soldering tags of ebonite. Chokes can be bought ready-made from any radio store, but remember that ordinary chokes intended for the longer waves are useless for the present purpose.

Connecting Up and Testing

Having made the set, it can be tried out by putting a "210 H.F." or similar valve in the detector holder (V.1) and a
A Few of the Simpler Methods of Providing A.V.C.

The primary idea is that strong signals are made automatically to reduce the amount of amplification afforded by the high frequency amplifying valve or valves. We know that the amplification of a variable-mu, or even an ordinary screened-grid valve can be reduced by applying more negative bias to its grid. We also know that the signal voltage passed on to the grid of the detector valve is proportional to the strength of the signal tuned in. Putting two and two together, as it were, it is not difficult to imagine that the extra voltage applied to the detector by a powerful signal might be fed back to the high frequency valves as additional bias, which would reduce the amount of amplification that they can give. The net result would be that the H.F. amplification would be reduced in proportion to the strength of the signal. This is, of course, precisely the action that is required and it forms the basis of automatic volume control. There are many ways of obtaining the desired effect, but, unfortunately, most of them are rather complicated and can hardly be satisfactorily applied to a powerful mains receiver.

In the present article, however, it is proposed to deal only with the simpler systems which can be tried in practically any receiver of standard type having one or more S.G. or V.-M. valves.

The Simplest Method of A.V.C.

The first and most straightforward of these is shown diagrammatically in Figs. 1 & 2. Only a portion of the complete receiver is represented and the additional components and wiring are clearly indicated in the sketch. Fig. 1 applies to a battery receiver and Fig. 2 to a mains one. When a signal is tuned in a certain amount of current flows through the detector grid leak and causes a voltage drop to occur across it, making the detector grid negative. The more powerful the signal is the heavier is the current flowing through the leak, and thus the greater is the voltage developed. As you are no doubt aware, this is the principle underlying the operation of a grid-leak detector. Well, then, it only remains to feed back the voltage drop produced by the grid leak to the grid of a preceding H.F. valve. This is done by taking a connection from the grid end of the leak to the "bottom" of the tuning coil connected in the grid circuit of an H.F. valve. To prevent instability an H.F. choke, 0.001 mfd. by-pass condenser, decoupling resistance and 1 mfd. condenser are inserted in the "return" lead. In the case of a battery variable-mu valve it is also better to include a grid-bias battery so that a suitable minimum value of bias can be applied to the high-frequency valve.

As mentioned before, the methods illustrated in Figure 1 can be used even with a set having only a single high frequency stage, but they are much more effective when two amplifying valves come before the detector. The control may then be applied to the first valve only, or to both; grid bias for the second is taken from the point marked X, through another 1,000 ohm decoupling resistance. Precisely the same idea holds good when the set is a superheterodyne, and in that case the A.V.C. will be applied to the intermediate frequency amplifying stages. Actually, this particularly simple arrangement is very effective with a superhet, since the signal voltage handed on to the detector is fairly great in this type of receiver.

In using this method in an existing set the only very important point to watch is that the extra H.F. choke should be mounted as near as possible to the detector valve-holder and should be arranged at right angles to any other unshielded chokes or coils that happen to be within six inches or so.

Fig. 1. (See below.)
THE arrangement of the wiring connections of a receiver and the method of securing them in position are of secondary importance only in importance to the disposition of the component parts. If you build from a published design, the lay-out of the components is done for you, and all that you need to do is to follow the drawings and instructions in order to make an exact replica of the original.

Then comes the wiring. The drawings and photographs show how the wires go, and very nice and neat they look. There is a reason for this in its neatness, too. The wires are so arranged that they take the shortest route from point to point, while, at the same time, they are well spaced apart. Though there may be several bends in a long wire, the straight parts are like ruled lines, and the bends are true right-angles. As a result, the receiver practically provides its own circuit diagram, which it would not do if the wires followed kinked and erratic paths. More than this, the connections being rigid and spaced well apart, no unsuspected interactions are likely to be set up between them.

This is a trouble which is prone to appear in the H.F. portions of a circuit in particular, if the wires are placed haphazard. The capacity between adjacent wires makes them in effect tiny condensers, so that the H.F. currents can take paths which should not be open to them at all.

Tools to Use

In a well-wired receiver, if you want to vary the circuit arrangement, or if a fault arises, you will be able to get at the real wires at once, without needing to trace your way through a tangled skein of connections.

It is quite easy to make a "professional" job of the wiring. You will need a pair of round-nosed pliers as well. There is a special type made for the job, with stepped jaws to bend loops of various sizes, but the ordinary plain pattern will serve quite well.

For the wire itself, soft tinned copper, 16 s.w.g., is the best. Glaze it first for extra life. Lay it on the terminals. Before putting the wire in place, true up the bends; the bends should be of such a size that it just drops on the terminal head without having to be bent. This will make it closer to your fingers. Grip it here with finger and thumb and bring it to the terminal, put the wire along beside terminal B. Make the loop immediately under the level of the terminal. Grip the wire firmly, with the loops, the terminal heads to hold them firmly, with the largest area of contact. Note that the loops are put on the terminals in such a way that they are not open to the terminals for the whole job. This will flatten the loops, allowing the terminal heads to hold them tightly, with the largest area of contact. Note that the loops are put on the terminals in such a way that they are not open to the terminals for the whole job. This will flatten the loops, allowing the terminal heads to hold them tightly, with the largest area of contact.

Sub-baseboard Connections

If there are any wires which pass under the baseboard, put in these also at an early stage. Now look at the photographs of the receiver which you are making, and see which wires come next above those which you have completed. Take as an example the wire from the anode of a valve-holder to a H.F. choke (Fig. 3).

This will have four right-angled bends in it, and a loop at each end. Make the first loop for the choke terminal, put the wire in place on the terminal, and see where your first bend will come to pass the wire clear of the corner of the choke. Grip it here with finger and thumb, lift it off, and make the bend. Put it back, and note the point for the next bend. This time, the hinge point is at the anode terminal of the valve. The level of the valve is marked on position, to mark the bend bringing the wire down to the level of the terminal. Next, the bend directly underneath the last one, to bring the bend down to the level of the terminal. Before putting the wire in place, true up the bend; the wire should then fit exactly on the terminals.

This process takes longer to describe than to carry out in practice. It does need patience, but the result is a job which is

(Continued on page 412.)
PROBABLY the majority of readers find that wireless reception, with its associated problems, provides sufficient interest to satisfy them without investigating the possibilities for experimentation in the field of wireless transmitting, but there are also, no doubt, many "amateurs" who have the desire to extend their activities beyond the confines of ordinary reception by taking up the sending or transmitting side of wireless, with a view to obtaining a Post Office licence to install and work an amateur transmitting station.

Under the Wireless Telegraph Act of 1904–1926, the Postmaster-General’s authority must be obtained before any apparatus for wireless, either for transmission or reception, may be installed or worked. In order to obtain the necessary licence, a form of application must first be obtained from the Engineer-in-Chief, General Post Office, London. The more important of the questions contained in the application form are: Particulars of any previous experience in working transmitting apparatus, and of any certificates of proficiency which the applicant may hold. Speed at which the morse code can be sent or received by the applicant. General outline of the nature and object of the experiments which it is desired to carry out with the transmitting apparatus. Particulars of the apparatus to be used, together with circuit diagrams. Source of power to be used for transmission purposes. Frequency and character of waves to be transmitted, and type and dimensions of the aerial to be employed.

If the applicant is under twenty-one years of age, the application must be countersigned by his parent or guardian, in whose name the licence, if granted, will be issued. Each application for a licence is judged upon its merits, and care should, therefore, be taken to provide answers as definite and comprehensive as possible to the questions asked, especially in the case of applicants calling for a general outline of the nature and object of the experiments which it is desired to conduct. It is not sufficient to answer "I am interested," by stating that it is intended to conduct experiments with wireless transmitting apparatus. Some definite line of research or investigation must be indicated.

If the form of application is completed in a sufficiently explicit and convincing manner, there is little doubt that the licence will be issued to the applicant, irrespective of whether he has any knowledge of the morse code. A licence to use transmitting apparatus with a radiating aerial is not usually granted to beginners, and if the applicant comes within this category he will probably receive a reply to his application to the effect that the Postmaster-General is advised that the use of a radiating aerial is not necessary for the experiments which the applicant has in view. It would probably be pointed out that the use of such apparatus with an "artificial" aerial, in conjunction with suitable detecting or measuring instruments, should prove sufficient, and that accordingly the Postmaster-General authorizes the applicant to use transmitting apparatus with an "artificial" aerial, with the stipulation that the apparatus shall not be connected with a radiating aerial. A call sign is also allotted for the use of the station, and a licence fee of 10s. is payable yearly.

An "artificial" aerial is defined as a closed, non-earthed oscillatory circuit possessing inductance, capacity and resistance, and functioning in the place of the usual aerial-earth system. It must be as nearly non-radiating as possible. The inductance should be in one piece and of small dimensions, as distinct from an inductance of large dimensions such as a frame aerial, and the maximum area formed by the turns of the inductance must not exceed 3 sq. ft.

The circuit arrangement of a continuous wave transmitter in its most simple form is shown, connected with a "radiating" aerial, in the diagram Fig. 1, from which it will be seen that the general layout bears a close resemblance to that of an ordinary one-valve receiving set.

When the amateur has served what might be termed his probationary period with sending apparatus connected with an "artificial" aerial, during which time he has acquired adequate knowledge of the operation of his apparatus, and an operating speed in the morse code of at least twelve words per minute, he may probably consider that the progress of his experimental work would be assisted by the use of a radiating aerial. With an artificial aerial the range of reception of the transmitter is approximately the four walls of one’s house, but connection to a radiating aerial makes it possible to communicate and work experimentally with other amateur transmitters, both at home and abroad.

Application for authority to use a radiating aerial should be made to the Engineer-in-Chief, G.P.O., together with the reason why, in the opinion of the applicant, the use of a radiating aerial is necessary for the further progress of his experiments. If a sufficiently good case is made out, the desired permission will usually be granted. Before such permission becomes effective, however, it will be necessary for the applicant to satisfactorily undergo an examination, as to his qualifications in morse working. Morse qualifications are necessary even where wireless telephony only is proposed, in order that the amateur working the station may be able to understand instructions addressed to him in the morse code by Government or Commercial Stations. An amateur who does not possess the necessary knowledge of morse may, however, under certain circumstances be permitted to employ a qualified wireless operator to take charge of the transmitting apparatus. If the issuing of a permit conditional to passing an examination in morse working is agreeable to the applicant, arrangements will be made by the Inspector of Wireless Telegraphy for the examination, for which a fee of 5s. is payable.

If a licence to use a radiating aerial is granted, the fees payable are 30s. for the first year, and 20s. for each subsequent year. These fees apply only to stations where the power for transmission purposes does not exceed 10 watts. For more powerful stations higher fees are charged. Ten watts is the usual power for amateur stations. The character of the waves transmitted is confined to continuous wave and telephony, spark transmission being prohibited.

Transmitting is ordinarily limited to the following wavelength bands: 173.4 to 101.1 metres, 42.7 to 41.24 metres, and 21.38 to 20.58 metres, and the amateur must ensure that the apparatus is as accurately tuned as possible to the particular frequency within these authorized wavelength bands.
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Points to Note Concerning the Selection and Use of L.F. and H.F. Chokes

The effect of still further smoothing.

A single smoothing choke of suitable design, with two reservoir condensers—usually of 4 mfd. capacity—is most cases sufficient for smoothing the output from a full-wave rectifier valve operated on normal commercial A.C. systems, and also for smoothing a supply taken from some D.C. mains. In many instances, however, it is found necessary to add another choke and condenser to obtain satisfactory smoothing on D.C. mains.

The Output Stage

The next application of low-frequency chokes is in the output stage of a receiver. The anode current of the output valve consists of a steady direct current component, and also an alternating current component corresponding to the audio-frequency output power which will ultimately operate the loud-speaker. It is, of course, possible to pass the whole anode current through the speaker winding, and in many cases the loud-speaker will operate quite satisfactorily, providing its impedance is correctly matched to that of the output valve. But then the direct current portion of the anode current will pass through the winding as well as the alternating current component, and will have the effect of heating it up. This may not be of importance in the case of a small output valve, but the mean anode current of many large output valves is fairly heavy—a matter of 30 milliamperes or more, and may be greater than the speech coil can carry continuously without overheating or even the risk of burning out.

One way of avoiding this is to employ a choke-capacity output-filter, as shown in Fig. 2. A choke, having a suitable inductance value, is inserted in the anode circuit of the output valve, between the anode and H.T. positive terminal. The choke has a comparatively low resistance to the direct current portion of the anode current, but the audio-frequency portion is choked back and takes the easier path through the condenser C to the loud-speaker, and thence to the H.T. terminal. An additional advantage of this system is that, as the speaker winding is entirely isolated by the condenser C from the high-tension voltage, there is no risk of shock or dangerous shorts if the loud-speaker or extension leads are accidentally earthed.

Choke Capacity L.F. Coupling

A similar application for a low-frequency choke is as a coupling between

Unsmoothed Input

+ Unsmoothed Input

Smoothened Output

Fig. 1.—A smoothing circuit.

Smoothing Circuits

The method of removing ripple is the same in either case—the use of a smoothing circuit, as indicated in Fig. 1. Here, the two terminals marked “input” are those connected either to the output of the rectifier, or the direct current mains (when the condenser C1 is really unnecessary), so that a “ripply” voltage exists across these two points, and any current flowing in a circuit attached thereto will be subject to similar fluctuations. But a low-frequency choke is connected in series with the circuit, and, by virtue of the impedance it offers to current fluctuations, shunts a very large proportion of the ripple current into the alternative path provided by the large-capacity condenser C1. A further condenser, C2, is also shunted across the supply at the other end of the choke, and has

Fig. 2.—Connections for a choke-capacity output-filter.
BETTER RADIO RECEPTION

Be a critic for once. Switch on your Set and listen—listen critically. Is the bass rich and full—is the treble brilliant, clear cut? Can you get the volume you want? And will it bring in the stations it used to?

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2-VOLT TYPES

<table>
<thead>
<tr>
<th>Type</th>
<th>Filament Amps</th>
<th>Anode Volts</th>
<th>Imped Amp</th>
<th>Mutual Conductance</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>*215 S.G.</td>
<td>-15</td>
<td>120-150</td>
<td>300,000</td>
<td>1-10</td>
<td>16/6</td>
</tr>
<tr>
<td>*225 S.G.</td>
<td>2</td>
<td>120-150</td>
<td>200,000</td>
<td>1-60</td>
<td>16/6</td>
</tr>
<tr>
<td>*200 V.S.G.</td>
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<td>120-150</td>
<td>110,000</td>
<td>1-6</td>
<td>16/6</td>
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<tr>
<td>210 R.C.</td>
<td>1</td>
<td>75-150</td>
<td>50,000</td>
<td>0-6</td>
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<td>5,000</td>
<td>1-10</td>
<td>7/1</td>
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<tr>
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<td>75-150</td>
<td>15,000</td>
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<td>7/1</td>
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<tr>
<td>210 DET.</td>
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<td>13,000</td>
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<tr>
<td>210 L.F.</td>
<td>1</td>
<td>75-150</td>
<td>10,000</td>
<td>1-4</td>
<td>7/1</td>
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<tr>
<td>215 P.</td>
<td>-15</td>
<td>75-150</td>
<td>4,000</td>
<td>2-25</td>
<td>8/9</td>
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<tr>
<td>220 P.</td>
<td>2</td>
<td>75-150</td>
<td>4,000</td>
<td>2-25</td>
<td>8/9</td>
</tr>
<tr>
<td>220 P.A.</td>
<td>-2</td>
<td>100-150</td>
<td>4,000</td>
<td>4-00</td>
<td>8/9</td>
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<tr>
<td>230 X.P.</td>
<td>3</td>
<td>100-150</td>
<td>3,000</td>
<td>6-5</td>
<td>12/1</td>
</tr>
<tr>
<td>230 P.T.</td>
<td>-3</td>
<td>100-150</td>
<td>—</td>
<td>2-0</td>
<td>17/6</td>
</tr>
<tr>
<td>220 H.P.T.</td>
<td>-7</td>
<td>100-150</td>
<td>—</td>
<td>2-5</td>
<td>17/6</td>
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<tr>
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<td>100-150</td>
<td>—</td>
<td>2-5</td>
<td>17/6</td>
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<td>75-100</td>
<td>27,000</td>
<td>0-19</td>
<td>20/1</td>
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<tr>
<td>240 B.</td>
<td>-6</td>
<td>120-150</td>
<td>CLASS A</td>
<td>—</td>
<td>14/1</td>
</tr>
</tbody>
</table>

* These Valves are available with or without Metallic Bulbs.

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Please send me free of charge, a copy of the 40-page Cossor Valve and Wireless Book B.17.

Name
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Pei C. 10/0/33.
CHOOSING A CHOKE (contd. from p. 418)
to those forming the cores of low-frequency transformers. 
Some construction is not applicable to high-frequency chokes because, at 
the enormous radio frequencies, the losses due to eddy currents induced in iron cores and
other magnetic losses would be very severe.
Another point of difference is that low-
frequency chokes usually have to carry much heavier currents than
radio-fre quency chokes, and are therefore wound with wire of much
heavier gauge. Refer, as in the case of H.F. chokes, to PRACTICAL
WIRELESS Data Sheet No. 6 for

fore wound with wire of much
heavier currents than
have to carry much
frequency
to eddy currents induced in iron cores and
enormous radio frequencies, the losses due
transformers.

Selection

Mains Smoothing
Pentode Output
Output Filter
Power Grid Coupling
L.IP. Coupling

reproduced here:-

readers the practical values are
of certain particulars, but to help
radio-frequency
way by the manufacturers.

good makes of choke are rated in this
specification for a low-frequency choke,
to produce the alterations in magnetic
saturate the coil, the size of the core, and the
upon the number of turns, the size of
the inductance of the choke depends
This is, of course, a matter of design.

Obviously, the
first
point to receive attention, especially
the purchaser will

Note the three large open ones.

the method of manipulation will be
almost the same as that which applies to
the power-valve and H.T. voltage in use.
The method of manipulation will be
about a quarter of a degree of the tuning
about to occur in

the current passing is high, and less when the current
is reduced.

PRACTICAL WIRELESS
June 10th, 1933

the current passing is high, and less when the current
is reduced.

H.T.+

G.B.-

Fig. 3.—Showing the connections for
choke-capacity L.F. coupling.

Three effects will follow: first, the
drop in voltage due to the choke’s
resistance will reduce the anode
current available for the various
values—the figurespecified by the
supply unit will be poor; and third,

the whole or a part of the
transmitter primary, while a
part or the whole of the winding functions
as a transformer. Tapped chokes give
a variety of different ratios that can be obtained,
as well as centre-tapped chokes for
push-pull, quiescent push-pull, and class “B”
circuits.

Concerning the mechanical design of
low-frequency chokes there is really not
much to be said. The
the correct setting is that which produces
a faint “rushing” sound in the speaker
or phones.

in all cases it will be found better to do
the tuning and reaction controls must
be adjusted
impe d ances.

Every listener

about a quarter of a degree of the tuning
dial, you will at once appreciate the need
for careful operation of the tuning condenser.
Reaction adjustment is nearly as critical,
and whilst “searching” the set should be
be kept just “off” the oscillation point.
All except the most powerful signals
will be missed entirely if the reaction condenser
is set either too far “in” or too far “out”;
the correct setting is that which produces
a faint “rushing” sound in the speaker
or phones.

In all cases it will be found better to do
the preliminary tuning with ‘phones,
switching over to the loud-speaker only
after a loud signal has been tuned in.

Just one final word. If you do not
succeed in tuning in any stations on one
wavelength range, try the other. Reception
conditions on various wavelengths change
from hour to hour, and whilst the 20-metre
band might not be productive of strong
signals at one time, conditions will probably
be just the reverse on the 31 metre range.
Perhaps the best time for a preliminary
trial is between 1 and 5 p.m., when Zeeseen
is to be heard on 19.73 metres. After
2 p.m. you will probably also pick up
Pittsburgh (W8XK) on 19.72 metres and.

Bound Brook (W3XAL) on 16.87 metres.

Loose windings often produce a very
annoying form of hum—due to magnetic
stresses, and I have known cases when this hum was so bad
as to be audible as a most unpleasant
background to even fairly big volume
reproduction, and was often mistaken for
actual circuit hum.

SHORT-WAVE TWO-VALVER
(Continued from page 412)

high amplification power valve, such as a
“220 P.A.,” “P.M. 2A” or “L.F.2”
in high tension V.V. A high tension
voltage of 100 or more will give best results, and
the grid-bias plug should be given a voltage
appropriate to the power-valve and H.T.
voltage in use.
The method of manipulation will be
almost the same as that which applies to
any Det. L.F. broadcast receiver, except
that the tuning and reaction controls must
be adjusted much more slowly. You should
attain each great importance to the last three
words, for otherwise you will be dis-
appointed in the results—or lack of them—
obtained. If it is remembered that a
station can be tuned in and out over in

A Cheap Turn-table

HAVING made a self-contained transportable set from a circuit given in No. 19 of Practical Wireless, I needed a turntable so as to obtain the full advantage of the directional properties of the frame aerial.

The total cost of the one I made was about twentyfivepence. For a penny I obtained a circular piece of wood cut out of a baffle-board, and having its diameter about two and a half times the depth of my cabinet. For another penny I purchased a 3-16in. bolt and two nuts. I then bored a hole to take the bolt, without binding, through both the bottom of the cabinet and through the centre of the wooden disc, and between the two rubbing surfaces of wood I put a sheet of zinc to reduce friction. The first nut I let into the bottom of the cabinet—on the inside, of course—the second nut acting as a lock-nut. A piece of balse, glued underneath the turn-table removes all risk of scratching the furniture.—M. D. G. (Hampstead).

Setting Ribbed Coil-formers

WHEN winding bare wire short-wave coils on 6 or 8 ribbed formers, difficulty is found in equally spacing the turns as the ribs are not slotted. This somewhat tedious operation can be simplified as follows. First mark and cut with a hack-saw the first groove right round the former. Then slack off the saw frame and leaving the first blade in the frame, slip two small washers over the studs on which the blade is fixed and then another blade, but reversed, i.e., with the toothless side towards the work, as shown in the sketch. Tighten up the frame, rest the reversed blade in the cut already made and proceed with the work—the washers between the blades ensuring even spacing and the blade even depth of cut.—W. ANDERSON (Wolverhampton).

Making a Dual-range Coil

A COIL covering the most interesting portion of the short-wave band as well as a quite a large range on the medium waves can easily be constructed at little cost. The one here described was wound to tune from about 400-300 metres and 34 to 18 metres with a .0001 mfd. condenser in parallel. If a larger variable condenser is used, say, .00025 mfd. a greater range can be obtained, but tuning becomes more critical on the short waves. As the coil was employed, say, .00025 mfd. a greater range can be obtained, but tuning becomes more

A dual-range coil for the short and medium wavebands.

and should be mounted as close to the coil as possible. In nearly all cases it will be found that a short-wave choke will give smooth reaction on the medium waves, but if this is not the case a 10,000 ohm spaghetti in series with it, or alternately an all-wave choke may be employed.—R. T. WARD (Exmouth).

Single-knob Control

IN keeping with the modern tendency of reducing control knobs on a wireless receiver to a minimum, I have devised the switching arrangement shown in the accompanying illustration. It will be noticed that one knob controls three separate components. First obtain a suitable length of metal-rod; thread one end to fit the bulb of the L.T. switch, and then fit two toy pulley wheels to engage with the "dolly" of the mains switch, as shown. A flat must be filed at the other end of the rod, about 1 in. long. This flat part operates the adaptor fixed on the volume control spindle.

A grub screw on the adaptor is screwed down until the rod will slide freely but not turn round in the adaptor. The screw is then locked in that position by the locknut. The assembly completed, a few adjustments may be necessary according to the design of the components used. When knob is pushed in both the L.T. switch and the

(Continued overleaf)
Midget Neutralizing Condensers

MIDGET adjustable condensers of small capacity—extremely useful for balancing circuits, neutralizing output valves, antenna coupling in short-wave receivers, etc.—can be made for next to nothing from odd lengths of systoflex and copper wire. The condensers consist of two 2in. lengths of systoflex, into which are inserted 3in. lengths of stiff copper wire. One end of each tube is sealed with sealing-wax or Chatterton's compound. The two tubes are laid parallel (as shown in the accompanying sketch) and wrapped firmly together with insulating tape. Variation of capacity is effected by sliding the wires in or out of their respective sheaths. For connecting purposes a loop may be formed, on one wire, and a length of flex soldered to the other, or short lengths of flex soldered to both. If desired, the condensers may be made in 3in. or 4in. lengths to give a higher capacity.—F. Gough (Ellesmere).

A Handy Switch Bracket

When an additional loud-speaker is needed in a separate room it is not always desirable that it should function simultaneously with the main speaker, which consequently necessitates some form of switching arrangement being installed in the vicinity of the extra loud-speaker. There is often a difficulty in finding a suitable position to place a switch for this purpose. A very simple method of mounting same is to cut a small piece of wood—about 1in. on a side—out of the door jamb, and use these discs so that the three 2 B.A. clearance holes being drilled through the centre of each. A piece of brass strip is bent to shape and drilled as shown, and screwed to one of these discs so that the three 2 B.A. clearance holes are in alignment. The reaction coil assembly is slipped over the studs, a nut being screwed on before the brass bracket so that the coil is suspended by the nut, a second nut following after the bracket to lock its position. It will be seen that by adjusting the nuts the coil is raised or lowered, and a reaction setting will remain constant over the entire scale of both wave bands.—E. L. Nimmo (Merton Park).

Short-wave Coil Unit

A SHORT-WAVE coil unit, as shown in the accompanying sketches, can be made up in a few minutes from scrap material. It possesses advantages, especially for the experimenter, in that each individual coil is easily interchangeable, and all are adjustable. The diagram is self-explanatory, and the materials required are: one piece of hardwood, 4in. by 4in.; four wooden uprights, 2in. by 1in.; two pieces of ebonite, 4in. by 1in.; six terminals, and a quantity of 16 S.W.G. bare wire. The terminals are mounted three in each slot, one pair for each coil.—F. C. Femand (Upper Norwood).

An Efficient Dual-wave Coil

PROBABLY the majority of amateurs have found that whereas reaction is freely obtained on the medium-wave section of a dual-wave coil, the coupling has to be considerably increased to reach the oscillation point on the long-wave band. The result, in the case of the majority of receivers, commercial sets included, is that on switching over from long to medium waves the set bursts into oscillation.

The following arrangement will be found to overcome this difficulty and, as can be seen from the accompanying sketch, the construction is perfectly simple. The coil is a simple layer wound on a 3in. diameter ebonite former, with forty turns of 24 S.W.G., d.s.c. wire for the medium-wave band, and 150 turns of 31 S.W.G. d.s.c. wire for the long-wave band. A wood disc is cut to fit inside one end to form a base, so that the coil can be mounted vertically, and a length of 2 B.A. studding, sufficient to project about 1in. above the top of the coil, is screwed through holes behind the switch. The bracket can then be secured by means of two screws to the edge of the bracket, as shown. In the majority of cases, the base stands out about 1in. away from the wall, leaving ample room for the leads behind the bracket.—H. Wearing (Plymouth).

An Efficient Dual-wave Coil

The condensers consist of two 2in. lengths of systoflex, into which are inserted 3in. lengths of stiff copper wire. One end of each tube is sealed with sealing-wax or Chatterton's compound. The two tubes are laid parallel (as shown in the diagram) and wrapped firmly together with insulating tape. Variation of capacity is effected by sliding the wires in or out of their respective sheaths. For connecting purposes a loop may be formed, on one wire, and a length of flex soldered to the other, or short lengths of flex soldered to both. If desired, the condensers may be made in 3in. or 4in. lengths to give a higher capacity.—F. Gough (Ellesmere).

A Handy Switch Bracket

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Short-wave Coil Unit

A SHOR-TWAVE coil unit, as shown in the accompanying sketches, can be made up in a few minutes from scrap material. It possesses advantages, especially for the experimenter, in that each individual coil is easily interchangeable, and all are adjustable. The diagram is self-explanatory, and the materials required are: one piece of hardwood, 4in. by 4in.; four wooden uprights, 2in. by 1in.; two pieces of ebonite, 4in. by 1in.; six terminals, and a quantity of 16 S.W.G. bare wire. The terminals are mounted three in each slot, one pair for each coil.—F. C. Femand (Upper Norwood).

An Efficient Dual-wave Coil

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A study of the diagram reveals at once the advantages of the OSRAM "CATKIN" VALVE assembly over the previous method. The increasing accuracy in the use of valves demands an increasing accuracy in performance, and therefore increasing precision in construction. The "Catkin" construction permits a greater uniformity in production than was possible with the equivalent glass types, and so allows for a greatly improved performance in the set.

By using OSRAM "CATKIN" VALVES you are definitely assured of—

1. **FREEDOM FROM BREAKAGE.**
2. **HIGHEST UNIFORM PERFORMANCE.**
3. **NO BACKGROUND NOISES.**
4. **SMALLER SIZE.**
5. **PERFECT SHIELDING.**
6. **ABSOLUTE RELIABILITY.**

**Osram (CATKIN) Valves**

*Made in England*

Covered by World Patents

FOR A.C. MAINS RECEIVERS

**THE VALVE WITH THE IRON CONSTITUTION**

It will be noticed from the photographs reproduced this week that the baseboard of this receiver has been covered with metalized paper. There are two reasons for this. First, earth return leads are simplified by its use, and, secondly, it helps to prevent instability which might arise due to coupling between certain parts of the circuit. The actual material used in the original receiver was Konductite, a material which consists of paper upon which aluminum foil is deposited. It is extremely simple to work, a pair of scissors cutting it as easily as ordinary paper. In commencing the construction, the first part of the work is the baseboard preparation. This is cut from five-ply 10in. by 10in. The side runners are 10in. by 3in. Smooth up the baseboard, and arrange the components as shown in the wiring diagram, and make quite certain that sufficient room is left at the rear edge of the baseboard to accommodate the metal bracket which holds the two electrolytic condensers. When every component is correctly placed, make a pencil mark round each one, and also, using the four-pin Clix valve-holder, make a mark in the centre of each valve position. This may easily be done through the centre hole in this particular valve-holder, and it should be placed in each valve-holder position in turn, and the centre marked. Now remove all the components and place them on one side for the time being. Drill out each valve-holder clearance hole, a 1 in.-bit being used for this purpose. The hole for the seven-pin holder will then have to be slightly enlarged, an ordinary half-round file being easily employed for this purpose. Smooth the edges of the holes, and then place the side-runners in position and drill the holes for the fixing screws for these, but do not attach them yet.

Covering the Baseboard

The next part of the work should be carried out very carefully. Cut out a piece of Konductite exactly 16in. by 10in., and smooth it as easily as ordinary paper. In order to keep the appearance of the work intact, the surface of the work-bench and the foil will not, therefore, get torn. Allow the condenser assembly, mains transformer, etc. When these are accurately aligned, pierced through the screw holes and attach them in position. The two 4-mfd. electrolytic condensers must be mounted on a small metal bridge, or the baseboard must be recessed to accommodate them. It will be noticed that the majority of the wiring is carried out on this side of the baseboard, and this greatly simplifies the construction. Only very few wires go through the board, and this saves a lot of time and trouble which usually occurs when the base has to be continually turned one way and then the other. The Ohmite resistances are held in place with the ordinary Glazite which is used for wiring-up, and they should be left until last in order to avoid untidiness which will occur if they are put in here and there, and have to be continually moved. The flexible leads for the heater windings should be inserted first of all, and the two leads from the valve-holder V3 to the mains transformer will, of course, be left until last. When all the main wiring is finished the positions of the holes through which leads pass must be marked and drilled from the bottom. In order to keep the appearance of the finished receiver nice and clean it is preferable to drill these holes only halfway, and then to use a fine pointed tool to continue the hole to the metal foil. The baseboard may then be turned over, and the hole finished from the top. This will save splitting and tearing the paper.

Mounting the Coils, etc.

Now turn the baseboard up the correct way and position the coils, variable condenser assembly, mains transformer, etc. When these are accurately aligned, pierced through the screw holes and attach them in position. The two 4-mfd. electrolytic condensers must be mounted on a small metal bridge, or the baseboard must be recessed to accommodate them. It will be noticed that the length of thread which is provided on these condensers is only about 1 in., and, consequently, if you drill through the baseboard there will be insuffi-
THE DIODE-TRIODE

The First Steps in the Construction of this New Three-valve Set which Employs Automatic Volume Control.

By the "Practical Wireless" Technical Staff.

from the mains smoothing choke for subsequent connections to the positive tag of the condenser. The negative connection will automatically be made to the casing through contact with the metal foil. The bridge upon which the condensers are mounted is cut from a strip of aluminium or brass 6in. long, by 11in. wide. The central horizontal portion is 21in. long, and the upright portions are 11in. The small turn-over for attachment to the board is 1in. The two holes for the condensers are 31in. apart, and the condensers should be attached to this mounting before screwing to the board. Attach two short Glazite wires to the small terminals underneath the condensers and cut these long enough to reach the terminals on the Smoothing Choke. Bend the necessary loops in the ends of these leads, and then screw down the mount, as shown in the wiring diagram.

Completing the Wiring

Now bring through the various leads from the underside of the cabinet, noting that these leads are made to fixing screws. One lead is attached to the fixing screw for the electrolytic condenser mounting just made, whilst another lead is brought from a 2-mfd. condenser on the underside to the terminal on the rear of the condenser chassis. The coil base is attached with four screws, one of them being used as a combined earthing terminal for the coils and is then joined to the .0005-mfd. fixed condenser underneath. Two further components have now to be wired into position, and these are the on-off switch and the volume control potentiometer. These are attached to the front of the cabinet, and as it is awkward (in fact, almost impossible) to attach these first and then complete the wiring, they must be connected up and then inserted into the holes in the cabinet with the wires already attached. They should therefore be put into their approximate position, and the requisite lengths of wire cut off. In the ease of the switch, two lengths of flex of approximately the right length will be sufficient as the flex may sag in this part of the receiver without any ill-effects. The volume control, however, must be more accurately adjusted, and it will be found that the Glazite is almost strong enough to enable this to remain in position without any mounting. When the wiring is finished it is preferable to try out the receiver before inserting it in its cabinet, and the instructions for this part of the work will be best left until next week, when these can be dealt with more fully. Until these appear, carefully check over all wires, as a short-circuit in a mains receiver is not easily rectified, and may result in serious damage. No fuses are used as there should be no need for them, but as prevention is always better than cure, it is preferable to utilize the time between completion and the appearance of operating instructions in carefully checking connections, joints, etc., and making quite certain that everything is in order for the first test.

Spacing the Wiring

A wiring diagram does not enable the constructor to ascertain what spacing should be left between adjacent wires, and the photographs which are taken when the receiver is completed do not in many cases enable this spacing to be easily ascertained. Consequently, it is possible sometimes to correctly wire a set and yet obtain poor results due to the manner in which the wiring has been carried out. The illustrations given on this page show the receiver after the wiring has been commenced, and it will be seen just what leads should be fitted first. (For the sake of avoiding confusion the heater leads, which are of twisted flex, have been omitted, but as mentioned above, they should be put in place before any of the Glazite is fitted. The subsequent wires should be put in by the aid of the wiring diagram, but at all points where wires cross try and arrange that the angle is as acute as possible. Where convenient, this should be a right-angle, but if this is not possible, bend it so that it takes a path nearly so, and also leave as wide a space between the adjacent wires as possible. Although there is only the one high-frequency stage in this receiver, it is possible to upset its performance by interaction between the wiring, but if the above points are borne in mind when the construction is being carried out there will be little likelihood of trouble being experienced. There are certain modifications which may be made in the value of some of the resistances on the automatic volume control side of this circuit, but they will be dealt with fully when describing the operation of the receiver next week.

The method of mounting the electrolytic condensers.
A FULL-SIZE BLUEPRINT OF THE DOUBLE-DIODE-TRIODE THREE may be obtained for 1½ post free from George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

For List of Components, see page 440.
Ebonite
An insulating substance made by heating together a mixture of rubber and sulphur. It is a hard, black material, but capable of being pressed or rolled into various shapes at the high temperatures used in its manufacture. It will take a very high polish.

Fig. 2. (Above). Ebonite coil-formers, coil-holders, etc., fixed in position by means of a silk cord. (Below) A simple coil of ebonite tubing.

Electrolyte
The liquid in a primary cell or accumulator. The liquid in an electrolytic condenser, and in the cells used for electrolyzing, is also called the electrolyte. Although we say "liquid" it is possible to have electrolytes in the form of paste or jelly as in the familiar "dry" cells of H.T. and grid-bias batteries or in some unspillable accumulators. However, the fact remains that it is the aqueous content of the paste or jelly which enables it to work. To produce a really dry electrolyte is impossible since it is the combination of water with the electrolytes which constitutes an electric current. In the ordinary way some conducting path such as a metal wire is needed for the movement of electrons but under suitable conditions it is possible to make them fly off into space. Such conditions exist in a valve. Here the heat of the filament or cathode is sufficient to drive off any jelly or water with which it is in contact. In the case of static electricity this is a hard, black material, but capable of being pressed or rolled easily moulded bakelite.

Electrolytic Condenser
A type of condenser which is of relatively large capacity for small bulk. It is entirely different from the usual type of fixed condenser. A typical example is shown in Fig. 1. It is something like a small primary cell. It has an outer metal case containing a liquid (the electrolyte) and a centre metal plate coated round a metal rod. This central electrode is insulated from the case. The condenser does not work as such until an electric current is passed through it in one direction only. A very thin film of insulating substance is then formed over the centre plate or anode. Since the film is very thin so the capacity of the condenser is comparatively large. The type illustrated is of the "wet" variety. There are also so-called dry or unspillable versions.

Electro-magnet
The name of a recently introduced material which is used in the place of air as the core of tuning coils. It is a well known fact that the inductance of a coil is as efficient as an iron bobbin or "core" as it is called on the electric-magnet principle. This principle is used in countless electrical devices such as electro-magnets for lifting iron and steel, relays, cut-outs, and some kinds of electric motors. One of the greatest advantages of an electro-magnet are that it loses its magnetism as soon as the current is switched off. An easily made electro-magnet in a practical form is also shown in Fig. 2. It consists of a soft iron staple wound with two coils of insulated copper wire mounted on bobbins. On passing an electric current through the coils as shown the iron becomes temporarily magnetized and will attract iron, steel, or nickel objects very strongly.

Electron
A particle of negative electricity. It is the flow of electrons which constitutes the electric current. In the ordinary way some conducting path such as a metal wire is needed for the movement of electrons but under suitable conditions it is possible to make them fly off into space. Such conditions exist in a valve. Here the heat of the filament or cathode is sufficient to drive off any jelly or water with which it is in contact. In the case of static electricity this is a hard, black material, but capable of being pressed or rolled easily moulded bakelite.
construction of chokes, transformers, etc., used in low-frequency circuits. Unfortunately however, in the high-frequency circuits of a receiver (of which the tuning coils are part), iron cores introduce certain losses which entirely nullify their advantages. Chief amongst these losses are those caused by little currents of electricity which circle round inside the iron itself and so waste power. The earth from which the Ferrocarril core is overcome by using small filings of iron instead of a solid rod or bar and sticking them on to strips of specially prepared paper. These strips are built up to form the core in the manner shown in the upper illustration in Fig. 3. To reduce eddy currents to a very minimum the filings are not simply spread on the paper strip but are scraped into rows as shown in the same illustration. Again each particle in the rows is made to point in the same direction. This is accomplished by passing the strip through a strong magnetic field produced by an energized coil.

Filament

The filament in a valve is very similar to that used in an ordinary electric lamp. There is one important difference, however. The valve filament is coated with a special substance which enables it to give off a large number of electrons at a temperature far below that needed to give the same emission from an uncoated one. Modern valve filaments are heated only sufficiently to make them glow a very dull red. Figs. 5 and 6 show some of the changes which have been made in the design of filaments during the past ten or twelve years. The early form shown in Fig. 5 was liable to sag when in use and alter the characteristics of the valve. In extreme cases it dropped on to the grid and caused a dead current. The filament shown on the right was developed by the Cossor people to overcome this. The specially shaped grid and anode necessitated by this somewhat unorthodox filament are shown on the right.

Fig. 6 shows one of a sectioned view of a modern Cossor valve for battery use. The filament is here supported at no less than seven points thus ensuring perfect alignment and freedom from microphonic troubles. The peculiar looking thing on the right is the filament arrangement used in a mains valve. In this case the filament is designated a heater, since it heats a narrow surrounding tube known as the cathode. Any slight variations in the heat of the filament caused by fluctuations in the mains current are not passed on to the cathode since this is much heavier than the filament and therefore retains the heat better. In this way mains hum (which is caused by fluctuations in the mains current) is avoided.

Frame Aerial

A small aerial usually wound round some form of wooden frame. It is not connected up in the same way as an ordinary aerial, since it takes the place of both aerial and aerial tuning coil. In fact, it may be looked upon as a large type of transformer, by virtue of its size, is able to pick up sufficient energy without using any other form of pick-up. A frame aerial is very rarely as efficient as the more orthodox type, but it is, of course, the only type which can be employed in a portable set. Most frame aerials have strongly directional properties, that is to say, they are most efficient when pointing towards the station being received. They are least sensitive when at right-angles to the direction from which the signals are coming. See also Aerial.

Frequency

The frequency of an alternating current is the number of complete cycles it passes through in a second. An alternating current travels first in one direction and then in the other, that is to say, from zero to its maximum value in one direction, then falls to zero again to its maximum value in the opposite direction. On returning once more to zero it is said to have passed through one cycle. It is the number of such cycles which are completed in one second which is called the frequency. With low-frequency currents this may be anything up to 10,000, while in the case of high-frequency currents, as are set up in the aerial circuit of a receiver, the alternations backwards and forwards take place millions of times per second.

Fuse

A protective device included in electrical circuits. It usually takes the form of a thin piece of wire which is made of such metal that it will melt and so break the circuit if more than a predetermined amount of current passes. Fuses are used to a considerable extent in wireless for such purposes as protecting valve filaments from an accidental increase in current due to a short circuit or some mishap within the receiver, and for protecting receivers operated from the mains current. With the fuses used for these purposes the fuse wire is usually enclosed in a glass bulb or tube. Both these types are shown in Fig. 8, as also are the holders employed. It will be noticed that in both cases the fuse itself is readily detachable either by lifting it from a pair of clips or unscrewing it like an electric torch bulb. In this way replacements can be made in a minimum of time.

Galvanometer

A sensitive instrument for detecting the presence of an electric current and also for determining its direction. One well-known type, the d'Arsenval, is illustrated in Fig. 9. The diagram on the left shows the principle on which it works. A small rectangular shaped coil of wire is suspended by a thin phosphor bronze wire between the poles of a permanent magnet. The coil is able to swing round as it hangs from the wire, and is connected to two terminals on the base of the instrument through the wire itself and through a hair-spring at the bottom. On passing a small electric current through the coil it tends to turn round at right angles to the position in which it is shown on the diagram. The stronger the current the further will it turn. Attached to the suspension wire is a small mirror, and as the wire twists so the mirror moves round as well. To use the instrument a beam of light is shone on the mirror and reflects back on to a scale. When a current is passed through the instrument and a beam of light is shone on the mirror and reflects back on to a scale. When a current is passed through the instrument and a beam of light is deflected. The amount of the deflection is shown on the scale. The advantage of the mirror is that it enables a beam of light to be used as a pointer which, of course, has no weight, and thus overcomes the chief drawback of the ordinary type of pointer or needle.
June 10th, 1933

PRACTICAL WIRELESS

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63 complete with Class "B" valve ready for use. Ask for leaflet Warrants.

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To prevent interaction a screen is placed between the main and auxiliary anodes. The method of connecting this new valve is shown in Fig. 5.

Automatic grid bias for A.V.C. is obtained across the potentiometer grid leak R.I. and is applied to the V.M. valve through the decoupling resistance R.2. The audio-frequency output from the rectifier is also taken from R.I. and passed on to the grid of the L.F. amplifying portion through the grid condenser C. Resistance R.3 provides automatic grid bias, and R.4 is the grid leak, for the L.F. amplifier. So as to make the circuit a little easier to follow I have re-drawn it in Fig. 6, as it would appear if two separate valves were used in place of the more complicated, but more convenient, double-diode-triode.

Q.P.-P.
For the past few years the attention of set designers (and manufacturers) has been directed towards all-mains receivers to the great detriment of the battery user. That this has been a mistake is clearly shown by the large numbers of mains receivers which have recently been thrown on the market at "cut" prices—the result of over-production. It is now realised that the call for more efficient and powerful battery sets is louder than ever before, and there is little doubt that the demand will be even greater in the near future. Until very recently the great objection to battery sets has been in respect to their inability to provide more than a relatively small volume of reproduction in return for an economical supply of high tension current. This has been effectively swept away with the development of quiescent push-pull amplification by which it is possible to obtain as much undistorted volume from a battery set as from a mains-operated receiver, and for the expenditure of a very modest amount of high tension current. We are often asked, "Is Q.P.-P. worth while?" "Will it last, or is it merely a passing fancy?" "Does it do all that is claimed for it?" Frankly, I have answered all these questions in the affirmative, but with certain reservations. For example, the advantages of Q.P.-P. would be wasted if it were used with an antiquated or badly-designed set; similarly, they could not be appreciated if the speaker was not a good moving-coil capable of handling up to, say, 2,000 milli-watts of signal energy. There is no doubt that Q.P.-P., or some development of it, will last for a long time provided it is not "boosted".

This diagram reveals very little, because it is the way it is operated that is all-important. The input transformer is of high step-up ratio (about 9-1) and thus supplies a large signal voltage to the grids of the valves used in Q.P.-P. These valves receive a heavy negative grid bias so that they normally pass a very small amount of H.T. current. But when a signal is tuned-in the positive halves of the rectified signal voltages reduce the steady negative bias and so cause the valves to pass on a voltage and an increase in current being proportional to the strength of the received signal. Since one end of the transformer is always negative whilst the other is positive, the valves work "in turns," so that at any instant one valve might be passing as much as 10 milliamps whilst the other takes only 3 milliamps. The average current consumption is consequently small and depends entirely on the volume required. Thus one has the satisfaction of getting value for money—if volume is reduced, current consumption is also cut down.

A fairly average current consumption over a period of "full-volume" listening works out at something like 6 milliamps.

"Class B"
Another method of L.F. amplification which is developing alongside Q.P.-P. and which has similar aims is known as "Class B." The name is American, but the system is in reality a modified form of push-pull. Instead of two separate valves, however, only one is used, but this is a "twin" having a single filament, two grids, and two anodes enclosed in the same glass bulb. The essential difference between a "Class B" valve and ordinary ones is that the former is of high impedance so that, although it is worked at a zero O.B. voltage, it passes only a very low anode current. Since the normal grid voltage is zero it becomes positive on the application of a signal and thus there is a flow of current in the grid circuit. It is well-known that in the ordinary course of events grid current
Positions of the lengths, especially the longer, would be very ill-advised to use for the general wiring of the receiver. Flex Leads should not be sufficiently controllable to make a sound job. You will, however, have some flex connections to make, such as battery leads. Make a neat job of the ends of the leads, and they will be less likely to come adrift from the terminals.

Ferrocart Coils

Perhaps one of the greatest advances which has been made during the last few months has been in respect to tuning coil design. It has been known for a long time that in time they will revolutionize our work in the field. While it is true that in time they will revolutionize our work in the field, it is far simpler to use Ferrocart coils as they have the combined advantages of both air and iron, for it had practically no eddy current losses and increased the inductance to such an extent that only a fraction of the number of turns were required for any given coil size.

The net result, is that Ferrocart coils are definitely more selective than any others. To use them for the connections between the detector and the receiver and, in consequence, the lengths of the connecting wires.

Permeability Tuning

In spite of their essentially rather high price there is little doubt that "iron core" coils will eventually become standardized in some form or other. I think that in time they will revolutionize our tuning circuits since, by so arranging the core that it can be withdrawn from the winding, it will be possible to tune more efficiently without the aid of variable condensers. But that is for the future; permeability tuning (as it would be called) is certainly an accomplished fact, although it might be by the time these words are in print. Who knows?

"PRACTICAL WIRELESS" still leads the way as you will see from next week's issue!

WIRING EFFICIENCY

(Continued from page 414.)

It has now become quite common by using a special step-down input transformer having a very low resistance secondary. Thus, although grid current does flow, it produces a negligible voltage drop. To compensate for the step-down effect of the transformer an extra valve, called a "driver," must be included between the detector and output stages. The usual circuit arrangement for a "Class B" amplifier is shown in Fig. 8. Special valves and transformers for this form of amplification are already on the market and the system can be adopted with every satisfaction.

Fig. 7.—The circuit of a Q.P.-P. amplifier using two high-amplification triodes.

Fig. 8.—The arrangement of a "Class B" amplifier. Note the special valve and input transformer.

Flex Leads

A final word about flexible wires. You would be very ill-advised to use these for the general wiring of the receiver. The positions of the lengths, especially the longer, are likely to come adrift from the terminals. Therefore, it is better to use Ferrocart coils in the connections between the detector and the receiver and, in consequence, the lengths of the connecting wires.
More About Catkin Valves—2

(Continued from page 383, June 3rd issue).

By F. J. CAMM

LAST week we gave preliminary details of the new unbreakable metal-mains valves which have been produced jointly by The General Electric Co., Ltd., and the Marconi Osram Valve Co., Ltd. I have under test a receiver with these new valves incorporated, and as soon as my tests are completed the information will be passed along to my readers.

The following is a brief summary of its advantages:

1. Almost unbreakable, owing to metal construction and interlocked electrode system.
2. Great uniformity, due to extreme accuracy of electrode alignment, steel and mica pinch, straight support wires, few welds.
3. Increased reliability, as anode in direct contact with air promotes cooler running, thus less chance of gases or water vapour being set free.
4. Less microphonic, owing to rigidity and rubber mounting.
5. Solid metal shield gives better screening than metallising on glass bulb.
6. Small size, hence more compact sets, great saving in storage space.
7. Base cannot work loose or come off.
8. Easy transit. Carton one quarter to one-sixth size of present types, can be sent by post with no special packing.

The perfection of the copper-glass joint for mass production has made it possible to place the anode in direct contact with air.

By promoting this more efficient radiation of heat the whole electrode system operates at a lower temperature than in a glass valve, and any tendency for occluded gases or water vapour to be set free in the vacuum is greatly lessened.

The cathode, henter and grid or grids are built up as a unit in an entirely new manner. In the normal valve the electrode supports are held by a glass "pinch" which forms the foundation of the whole electrode system. This pinch, although in most respects quite satisfactory, is liable to distortion and inaccuracy, as well as introducing a number of welds and bends into the supporting wires. The Marconi "Catkin" pinch consists of a pressed steel clip with mica insulation, which cannot distort or shift; it is proportioned in such a manner as to eliminate all bends in the electrode supports, and so contributes again to greater accuracy and strength.

(To be concluded next week.—Ed.)
Wired Wireless

I see that a British firm of cable makers have become the first in the field with a special cable and cable-connecting device for use in "wired wireless," as it is called, proving very popular for people who do not care to be bothered with a set of their own, and the imaginary troubles that they believe to follow in the wake, but I am afraid readers of Practical Wireless would find little appeal in such a system in their own homes. Of course, wireless on tap for the people in the house who want to listen to something would be no substitute for a radio fan to experiment with, and the fact that the radio receiver could be regularly dismantled without affecting the other members of the household is a commendation in itself. Seriously, though, wired wireless is becoming a boon to large numbers of people. The advent of a new system of wiring, both convenient and cheap, will do much to popularize this form of listening.

Faulty Resistances

In common with other electrical apparatus, wireless components have a nasty habit of failing out of order in radio fans, and as a result of a common breakdown often found in the various resistances to be found in the set. Sometimes, in certain positions, the resistance can be short-circuited, and any subsequent instability caused by lowering the H.T. voltage or similar palliatives, but this is only to be recommended when the resistances that are faulty are those listed in the set. Sometimes, in certain positions: the assumption that wireless sets fail suddenly is generally made.

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The Radiopax Class "B" Four

Some Further Notes Regarding the Correct Adjustment of this Receiver

SOME little doubt seems to have arisen regarding the correct connections for the loudspeaker in the Radiopax Four described in these pages recently. The Varley Output Trans choke is provided with six output terminals, and these are clearly shown in the photograph reproduced below (Fig. 1). On the top of the choke will be found three different ratio markings, 1.5 to 1; 2 to 1; and 2.5 to 1.

![Fig. 1.-This illustration clearly shows the Varley output choke and its six terminals.](image1)

The loud-speaker which was specified should be joined to the terminals marked 1.5 to 1, and there are the two left-hand terminals shown in the illustration. The central pair are for the 2 to 1 ratio, and those on the right are for the 2.5 to 1 ratio. On the different makes of receiver and the little extra which is obtainable when correctly matched is naturally worth while. There is no necessity in this receiver to alter the adjustment for long waves, as the matching holds over the entire range.

![Fig. 2.—Plan view of the Radiopax Class B Four.](image2)
The Magnum short-wave chassis assembly.

**Facts and Figures**

Components Tested in our Laboratory

**BY THE PRACTICAL WIRELESS TECHNICAL STAFF**

**BRITISH RADIOPHONE SWITCHES**

We have already mentioned that the British Radiophone Company are now manufacturing the majority of ordinary wireless parts, instead of specialising in variable condensers. The small toggle switch used in mains apparatus is one of the lines which we have received and these are very well finished. They are of the 3 amp. type, very robust and possessing a very definite action. The majority of constructors have, no doubt, at one time or another experienced, difficulty in mounting such a switch in a position on the panel which would prevent the mains leads running right through the receiver or box, have fitted it at the back of the cabinet where it is almost unattainable. The apparatus shown at the top of the page will prove invaluable to the constructor, as it enables the switch to be mounted at the rear of a chassis and yet be controlled from the front.

As may be seen a small bracket is provided to accommodate the switch, which is fitted by the normal one-hole fixing arrangement. The long rod is then attached to the dolly and held in position by the small nut and bolt. A second bracket is mounted at a convenient point on the board and the rod passes through a hole in this bracket which permits all unnecessary side play, etc. A small hole is drilled in the panel or cabinet front permits the rod to protrude sufficiently to enable the switch to be turned to the rear, when the operation of the switch is carried out by simply pulling or pushing the knob. The apparatus shown at the top of the page will prove invaluable to the constructor, as it enables the switch to be mounted at the rear of a chassis and yet be controlled from the front.

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**A CROSS OF THE NEW W.B. CLASS B COMPONENTS.**

The universal valley, which is a component on the Continent, solves this difficulty, as it may be used easily on either A.C. or D.C. mains. This is carried out by utilizing a 20-volt heater (including 20-volt type of valve as rectifier and barretter) and the heater circuit is joined right across the mains, without the intervention of a mains transformer. The whole filament circuit passes 16 amp. (irrespective of the number of valves used) the barretter maintaining the current constant within limits of 24 per cent., to mains voltage variations of 15-20 per cent. These valves are now being manufactured by the Tungram Company, and we hope to give more details concerning them at an early date.

**J.B. SHORT-WAVE SPECIAL CONDENSER.**

The difficulties of tuning on the short waves are very great indeed, and apart from the actual range covered in each degree of a condenser dial there is the question of noise. The contact at the moving plates is a source of trouble, and even when using a pig-tail, the rubbing of adjacent turns causes noises which may prevent the accurate tuning-in of a station.

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**TUNGSTEN UNIVERSAL VALVES.**

With the great diversity of different mains voltages and periodicity which are available in this country, there is a great difficulty in standardising the customary one-hole fixing arrangement. The long rod is then attached to the dolly and held in position by the small nut and bolt. A second bracket is mounted at a convenient point on the board and the rod passes through a hole in this bracket which permits all unnecessary side play, etc. A small hole is drilled in the panel or cabinet front permits the rod to protrude sufficiently to enable the switch to be turned to the rear, when the operation of the switch is carried out by simply pulling or pushing the knob.
The Finest Weekly.

Sr,—I beg to acknowledge receipt of the "Wireless Constructor’s Encyclopaedia," with which I am more than delighted. Such a volume is easily worth three or four times the amount it has cost me, and I hope to continue taking the finest weekly for thirteen years rather than merely weekly for thirteen weeks.—H. Adams (Leeds).

A Jersey Reader’s Thanks

Sr,—I have been studying wireless for the past six months, and, thanks to PRACTICAL WIRELESS, I have made two sets, which I am more than delighted.

A “Book of Practical Wireless Information”

Sr.—Many thanks for my copy of the "Wireless Constructor’s Encyclopaedia." Although I have had very little time to have more than a look through it was quite enough to see what an interesting book of practical wireless information it is. I am sure it will be fully appreciated by all readers of PRACTICAL WIRELESS who have taken advantage of your offer.—W. McLoughlin (Radford).

A Bradford Reader’s Appreciation

Sr.—May I express my appreciation of the "Wireless Constructor’s Encyclopaedia," which I have received safely? In my twenty-five years’ experience as a Wireless amateur I have not seen such a helpful book before, and it should be of very great value to the thousands of wireless amateurs who have not been fortunate enough to receive the mathematical and scientific training so useful in the pursuit of their hobby. Again, sir, my congratulations and best wishes for your future efforts.—J. C. Hall (Bradford).

DO YOU KNOW?

—THAT an electrolytic condenser must be joined in circuit in the correct manner, and that its two terminals are positive and negative.

—THAT the negative terminals of this type of condenser are always the outside casing of the unit.

—THAT the value of a variable condenser may be modified by inserting slips of good dry paper between the vanes.

—THAT the on-off switch in a battery receiver is the most frequent source of trouble, and should therefore be periodically examined.

—THAT the suppressors usually described in an article on Wireless and the Car in these pages are now obtainable commercially.

—THAT a copper disk placed beneath the telephone often proves very effective as an earth.

—THAT the aerial should not run close to telephone wires owing to the trouble caused by induction.

—THAT the new metal valves should not be placed near a tuning coil or H.F. choke if the latter is unscreened.

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 unextracted copy, every effort will be made to return it to the writer. If a printed address envelope is enclosed, all correspondence intended for the Editor should be addressed: "The Editor, PRACTICAL WIRELESS, George, Na Fean, Ltd., 6-11, Southampton Street, Strand, W.C.2.

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

FOR RELIABLE INFORMATION READ "PRACTICAL WIRELESS"
FOR nearly seven years "Varley" have been conducting intensive experiments on the use of powdered iron for the cores of coils. As far back as 1926 Varley produced in their laboratory some constant inductance chokes with iron powdered cores (accidentally, it was the research work on these chokes which proved the technique of the air-gap in chokes with laminated cores). Now Varley are about to release the new Varley NICORE coils which they consider will prove the biggest advance in radio tuning since the introduction of the famous Square Peak Coils two years ago. As has already been explained in these pages, the main difficulty hitherto with Radio-frequency coils has been to get cores which, while considerably increasing the inductance of a coil, avoid the great loss at high frequencies due to eddy currents. To reduce these disturbing eddy currents to a minimum it was essential that the magnetic material finally chosen should have high initial permeability. Another pitfall, that Varley are peculiarly fitted to avoid, is the winding technicalities. The design and winding of NICORE Coils are a totally different affair from that of air core coils; owing to the high permeability of the core the coils are very small indeed and the winding is consequently an extremely delicate job involving quite unusual skill. But Varley have specialised in precise winding for many years, long before the days of Radio, and are able to produce the NICORE Coils with complete consistency and dead accuracy. These coils, above all, are CONSISTENT—that has been the great aim in the whole research work and, indeed, the additional research work thereby necessitated revealed an even greater efficiency than was at first thought possible. Selectivity, so important an essential in modern radio reception, is a maximum with these coils and has to be experienced to be fully appreciated.

The 'coils will be marketed as Aerial or Transformed Grid, with Reaction, and H.F. Intervalve Transformer with Reaction, each at 10s. 6d. or with both medium and long-wave bands accommodated in a very small, neat and compact assembly (screened against the remote possibility of interaction) at 33s., the set of three ganged together. Self-contained "Varley" waveband switches are provided and, as instance how small these coils actually are it may be mentioned that the switchgear is by far the largest part of the assembly.

WE understand that Messrs. Wright and Weaire are shortly producing tuning coils employing the iron-core principle. The material of which the core is made is known as Varlex, and is a product of the Standard Telephone Company. These coils will be available in two different types—open core tuning coils for simple aerial coils, and closed core coils for matching purposes in multi-stage receivers, etc. The price of the open core coils has provisionally been fixed at 9s. 6d., whilst the closed core coils will probably cost 12s. 6d. No further details are yet available, but as soon as samples have been received they will be tested and reported upon in these columns.

PRICE REDUCTION FOR FERROCART COILS

The original iron-core tuning coils which appeared on the English market were manufactured by Messrs. Colvern from the patents of Herr Hans Vogt, of Germany. The coils proved immensely popular and the only apparent drawback for many constructors was the price, which was originally 50s. for the set of three. The demand has steadily increased, however, and the General Electric Company are now undertaking the manufacture of this coil in England with the result that Messrs. Colvern are happy to be able to announce a substantial reduction in price. The 'coils will be marketed as single, double, and triple-gang units. The price of the open core coils employing the core principle. The material of which the core is made is known as Nucleon, and is a product of the General Electric Company. These coils will be available in three different types—open core tuning coils for simple aerial coils, and closed core coils for matching purposes in multi-stage receivers, etc. The price of the open core coils has provisionally been fixed at 9s. 6d., whilst the closed core coils will probably cost 12s. 6d. No further details are yet available, but as soon as samples have been received they will be tested and reported upon in these columns.

OFF THE BEATEN TRACK

on the edge of beyond above the world the Mount Everest Expedition are relying upon—

FULL O'POWER RADIO BATTERIES

you too will appreciate their sterling qualities

BUY "Full O'Power" by SIEMENS

AND THEY COST NO MORE THAN ORDINARY BATTERIES

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SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Quneric Service is intended only for the solution of problems or difficulties arising from the construction of receivers, and is not intended for the solution of problems or difficulties arising from the construction of transmitters. It is restricted to questions arising out of our pages, or on general wireless matters.

(1) Supply circuit diagrams of complete sets of the questions.
(2) Suggest alterations or modifications of your own invention.
(3) Suggest alterations or modifications to commercial receivers.
(4) Make your queries clear 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. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Nye & Co., Ltd., 8-11, Southampton St., Strand, London, W.C.2.

The fact that the response is altered (we do not say improved) by sticking pieces of paper on the cone is due to the fact that the resistances in the speaker are altered. The speaker may, however, have been a really excellent one in its original condition, and it may quite possibly have been your receiver which was at fault. Your speaker may have a slightly compensating resonance in the bass for instance, and you may have a receiver which is particularly lacking in this. The additional thickness of the cone occasioned by the extra pieces of paper may have reduced the upper response and thereby made the bass seem louder. We think it would be better first to fit some resistors to your receiver in the hope of eliminating a modern loud-speaker of reputable make.

DIFFERENTIAL REACTION CONDENSER

I have got one of the latter type of condenser you must fix a fixed condenser from anode to plates.

The great difference in the value of the differential pattern.

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SEVEN-PIN VALVEHOLDER CONNECTIONS

The neutrodyne is quite an efficient arrangement, provided it can be accurately carried out. Unfor- tunately, it is restricted to 250 ohm sets and it is quite possible that a 600 ohm set could be built up, and accurately neutralised on say 250 ohms. This is a matter of just a single connection to the neutralising box.

Double Diode

Tetrode

Pentode (Indirectly Heated)

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I am trying to fit up two sets so that I can use the television transmissions. My difficulty is in getting sufficient input strength for one of the transmissions. My mains home set is used for vision, and I have this system which is sent must bear the name

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BELLENTREE TERMINALS
Two small booklets are to hand from Belling-Lee, Ltd., one containing the well-known terminals and connections and the other with the Belling-Lee " Knot " patent, from which working drawings can be obtained for the many types that are in use.

THE BELLING-LEE CONSTRUCTOR'S CLASS ' B ' FOUR-RECEIVER.
A new addition to the already popular Ferranti home-constructor's range is announced. The " Challenger " is now obtainable in the and is of the usual Band Pass aerial circuit with screen grid valve, grid leak detector transformer and the other with the Belling-Lee " Knot " patent, from which working drawings can be obtained for the many types that are in use.

LIST OF COMPONENTS FOR THE DOUBLE-DIODE-TRIODE THREE.

The constructor's charts has now been made and this is the First Edition of 1933 Model and gives every phase of the construction with fully dimensioned drawings. The method is of the usual Band Pass aerial circuit with screen grid valve, grid leak detector transformer and the other with the Belling-Lee " Knot " patent, from which working drawings can be obtained for the many types that are in use.

Two Dubilier A.01 Fixed Condensers, Type 9670.
Two Dubilier B.01 Fixed Condensers, Type 760.
Two Dubilier 0.1 Fixed Condensers, Type 9627.
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PRACTICAL WIRELESS BOOKS

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By RALPH STRANGER
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A comprehensive work that everybody can understand. Specially written for the "man in the street," it covers the whole subject of wireless reception. 816 pages.
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Yet again a Radio Expert chooses the famous R. & A. 'Challenger.' The designer of the 'Double Diode Three' realises that no other similar instrument can equal the 'Challenger' for true reproduction of speech and orchestral music. The 'Double Diode Three' must have the most modern Reproducer if its capabilities are to be fully exploited. The 'Challenger' embodies the very latest developments and gives a realism in reproduction that completely satisfies the most critical listener.

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Complete with 3 ratio Transformer

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TYPE 'B' for Class B Amplification.
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Write to-day for fully-illustrated Catalogue No. J.1231 of complete new range of Igranic Quality Components.

Igranic Electric Co., Ltd.,

IGRANIC COMPONENTS WILL BE THE MAKING OF YOUR SET