53 College

MORE ABOUT THE CATKINS—By F. J. CAMM

Practical Wireless

3D.

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BUILDING THE "DOUBLE DIODE TRIODE" 3

Also in this issue:

AUTOMATIC VOLUME CONTROL.

CHOOSING A CHOKE.

A SHORT-WAVE TWO-VALVER.

WIRING EFFICIENCY.

THE AMATEUR TRANSMITTER'S LICENCE,

Etc., Etc.

THE PAPER WITH THE WORLD-WIDE CIRCULATION!

Practical Wireless

EDITOR:
Vol. II. No. 38 || F. J. CAMM || June 10th, 1933
Technical Staff:
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.
W. J. Delaney, Frank Preston, F.R.A., W. B. Richardson

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 for the greatest number of languages comprised in one transmission. The Acts 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 midday.

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 lecture 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 studios 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 custom. Shortly before a transmission is due the announcer puts out the official call and with a view to facilitating the tuning-in of the broadcast, verbally gives out a succession of numbers such as *trois cents, trois-cent-et-un, 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.

ALWAYS FIRST!

The following incomplete list indicates that in really important matters we are ALWAYS FIRST! Hence the Leading Position we Now Occupy.

1. The *first and only* paper to specify only those components used by the designer—NOT SEVERAL ALTERNATIVES.
2. The *first and only* paper to GUARANTEE RECEIVERS described in its pages to perform as claimed, and to give free advice to every builder until they do.
3. The *first and only* paper to answer all readers' queries FREE OF CHARGE, promptly and reliably, and without onerous restrictions.
4. The *first* paper regularly to feature PRACTICAL HINTS and tips by readers for the benefit of other readers.
5. The *first* paper to describe the construction of a CLASS B UNIT OR ADAPTOR.
6. The *first* paper to describe a PUSH-PULL DETECTOR receiver.
7. The *first* paper to deal in a practical manner with WIRELESS AND THE CAR.
8. The *first* paper to describe a VARIABLE-MU H.F. UNIT.
9. The *first* paper to standardize the modern sub-baseboard system of wiring
10. The *first* paper to deal with a lightweight portable using Class B amplification.
11. The *first* paper to deal with a TWO-PENTODE TWO-VALVER.
12. The *first* paper to deal with the HEXODE VALVE.
13. The *first* paper to deal with CATHODE CONTROL.
14. The *first* paper to deal with REMOTE TUNING CONTROL.
15. THE *FIRST* PAPER TO DEAL WITH ? ? ? . . . See **NEXT WEEK'S ISSUE.**

Additionally, innumerable new components have been introduced to the constructor for the first time through our pages. Watch THIS List Increase!

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 Vosnesensk, 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 relays, 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 *Ecôle 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-

ROUND the WORLD of WIRELESS (Continued)

ing to the stations concerned, in four separate categories. Exclusive wavelengths will only be allotted to National high power transmitters. Smaller National stations in groups of two or more may be compelled to share a wavelength. The common wavelengths (*ondes communes*) will be classified under two headings, namely, International (1) on which several stations of a power not more than 2 kilowatts will operate, and, providing there is but a small deviation during working hours from the allotted nominal channel; International (2) a series of international common wavelengths destined to transmitters of which the power does not exceed 200 watts.

Make a Note of It

AFTER June 1st last, in the interval of the Heilsberg programmes listeners no longer heard the two bell signal to which they have hitherto been accustomed; it was replaced by something more elaborate. An abbreviated version of an old East Prussian song (*Wild flutet der See*) is now used to identify the transmitter to its home and foreign audiences.

Radio Tessin

THE wavelength of the new Swiss transmitter has not yet been fixed. Tests made on 678.7 m. have been suspended as interference was caused with the shipping band. Experiments are now being carried out on 720 and 750 metres, but it is quite possible that a totally different channel may be allotted to this station.

For the Short-wavers

FOR the broadcast of its National and other programmes the German *Reichsfunk* now disposes of four short-wave transmitters which work according to the following time schedule. From B.S.T. 13.55 until 22.30 the Königswusterhausen entertainments are also taken by DJB on 19.73 m.; from 16.00 to midnight (24.00) DJD on 25.51 m. is brought into operation. DJA, the station with which we have been so familiar on 31.38 m., comes into action at 23.00 and stays on the air until about 0.300. DJC on 49.83 m. possesses an aerial directional to America and transmits special programmes from 01.00-03.00 daily.

Dutch Short-wave Transmitter

PCJ, Hilversum, which closed down in October, 1931, has not resumed its broadcasts, but in its place PHI, a neighbouring station at Huizen on the borders of the Zuider Zee, is working on 16.88 m. (17,775 kc/s), on Mondays and Thursdays between B.S.T. 13.00 and 15.00, and on Saturdays and Sundays with an extended transmission. An alternative channel is that of 25.57 metres (11,730 kc/s) which may be used during the winter months. The broadcasts, which are strictly of a non-political character, are mainly destined to the Dutch East and West Indies, but are being well received in most quarters of the world. The announcer is one of the most versatile linguists on the

INTERESTING and TOPICAL PARAGRAPHS

air, as he speaks Dutch, English, German, French, Italian, Spanish and Portuguese fluently. Many of these languages are used in the broadcasts.

A LESSON *via* RADIO

A demonstration for teachers and University students of a broadcast lesson in geography being given at Cookridge Street Baths, Leeds. The radio apparatus is seen on the left.

Radio Galicia

FRENCH listeners report the reception of broadcasts from an apparently new transmitter installed at Santiago on the North-western corner of the Iberic peninsula. Its call letters are EAJ4. The transmissions have only been heard in the later evening hours, as it works on a wavelength of 368.1 metres common to Bolzano (Italy) and Helsinki (Finland). Moreover, its signals are not strong, the power being given as 200 watts (aerial). It would appear to be run by a local association of wireless amateurs.

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 in direct radio communication with the base 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 for 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 only 150 miles from the English capital and, although its power is less than 1½ 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 *Marseillaise*; the National Anthem is not curtailed but given in its entirety.

Latinizing 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, fading, lay-out, buzzer, shunt, bandpass*, and so on can be frequently heard. Some, on the other hand, have been adapted; a loud-speaker is a *haut parleur*, a literal translation. On the other hand, *un coquetel* is a poor adaptation of cocktail; in programmes *un coquetel musical* is an *olla podrida* of popular melodies.

Hungarian Railway Radio Service

WITH a view to popularizing the new listening equipments on Hungarian trains, 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.

SOLVE THIS!

Problem No. 38

Jackson's set had suddenly taken leave of its senses. The London transmission was proceeding when suddenly, with a faint click, the music ceased. He walked across to the set and found the valves still burning, and upon rotating the tuning dial the station was again heard, only this time it was eight or nine degrees higher up the scale. The condenser was left at this point, and the programme continued uninterrupted for an hour or so, when with another click it vanished, to be found once more at the correct point on the scale. This occurred for several days, and then Jackson found the cause. What do you think it was? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes Problem No. 38. Do not enclose any other correspondence with your solution.

SOLUTION TO PROBLEM No. 37

Robinson overlooked the fact that the inductance was increased by using the iron core, and consequently the particular coil he used tuned to a wavelength of between 600 and 1,000 metres, with the result that none of the ordinary stations were audible.

The following three readers received books in connection with Problem No. 36.

S. Dover, 37, N.W. Terrace, Netherfield, Nottingham; H. S. Francis, 179, Nelson Street, Norwich, Norfolk; I. Lowder, Forest, Pontardulais, Swansea, Glam.

A SHORT-WAVE TWO VALVER

It is Explained in this Article how an Efficient, though Simple, Two-Valve Short-Wave Receiver can Easily be Made.

A Special Set for the DX Enthusiast

By FRANK PRESTON, F.R.A.

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 does it respond to atmospherics, 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, Nairobi, Bucharest, Rabat (Morocco), Rio de Janeiro, Tegucigalpa (Honduras), Pittsburgh (U.S.A.) and Vancouver—without question they span the whole world.

(Continued overleaf)

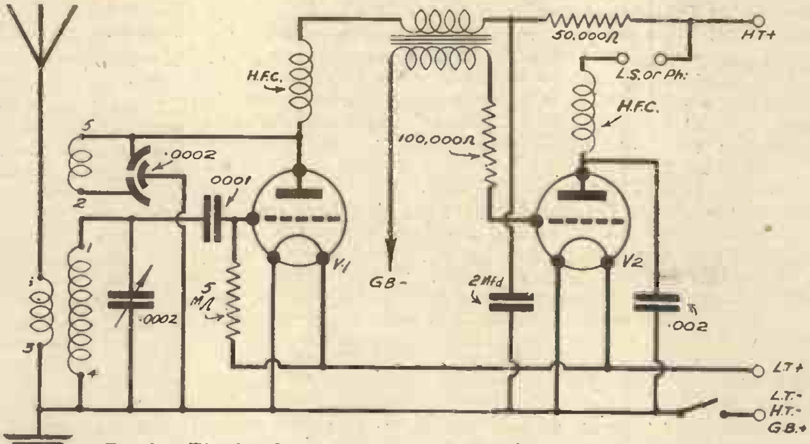


Fig. 1.—The 2-valve circuit recommended for a simple short-wave set.

Simplicity of wiring is the keynote!

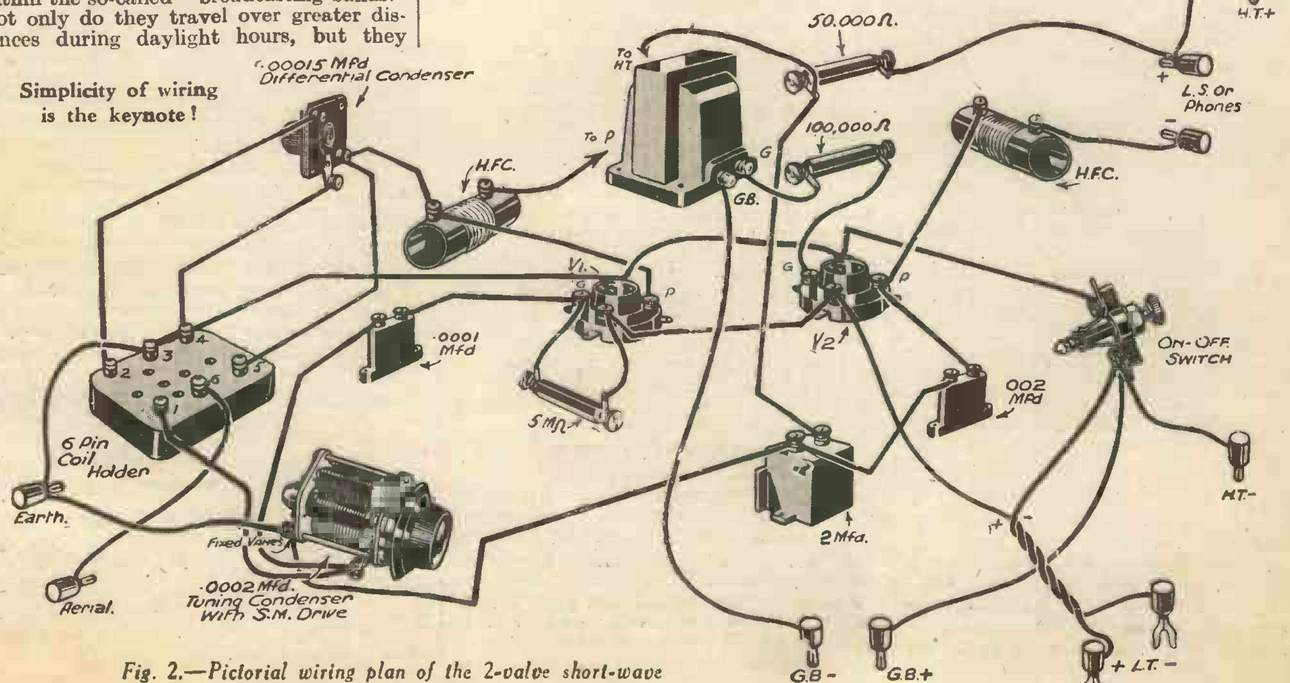


Fig. 2.—Pictorial wiring plan of the 2-valve short-wave receiver described.

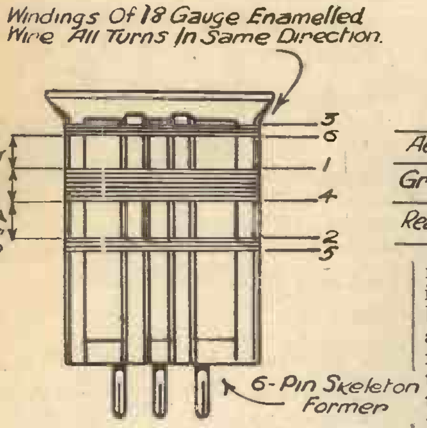
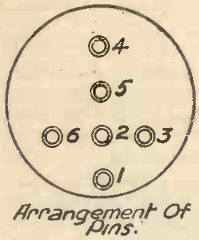


Fig. 3.—Details of the 6-pin tuning coils



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Short Waves Are For The Enthusiast

I am not going to say that round-the-world short-wave reception is the thing for the listener who is merely intent upon hearing a good programme of music, or a talk, but for the real enthusiast who enjoys DX reception for its own sake there is nothing like a short-wave set. There is ever a spice of adventure and a little uncertainty as to whether New Zealand, India or Ecuador will be heard at best strength, or whether one will receive the transmissions of an amateur in the wilds of Africa or broadcasting station in New York.

A few years ago the number of powerful stations regularly working on short-waves was small, but at the present time there are at least seventy transmitters sending out more or less regular programmes on wavelengths between 18 and 50 metres. In addition to these, however, there are literally thousands of amateurs who make constant use of short-waves in "working" with their brethren at the ends of the earth.

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 principally toward an outfit of the latter type. In passing, however, I would mention than 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 single-valver to a multi-valve superheterodyne, and all of them can be depended upon to provide endless entertainment. When only one valve is employed the user is necessarily tied down to the use of 'phones, whilst a superheterodyne, though being extraordinarily efficient, is a comparatively costly instrument. I suggest a compromise between the two extremes in the form of a two-valver having a detector and low-frequency amplifying stage. Such a set in the hands of a keen amateur will bring in the whole world on 'phones, and will make possible loudspeaker reception of more powerful signals.

	15-30	25-60	W/L METRES.
Aerial	3	4	TURNS
Grid	4	6	" "
Reaction	4	5	" "

A Good Two-valve Circuit

A circuit diagram of the type of set recommended is shown in Fig. 1, where it can be seen that the arrangement is almost identical with that of a similar type of broadcast receiver. The chief difference lies in the component values, but there are one or two "extras" which are included to simplify the operation ; these latter are shown in heavy lines so that they will be more readily noticed.

On glancing over the circuit we see that the tuner has a separate aerial winding which makes the set suitable for use on any kind of aerial. The detector valve operates on the leaky grid principle, the grid condenser and leak being of .0001 mfd. and 5 megohms respectively. Reaction is applied through a winding on the tuner and a differential condenser. Coupling between detector and L.F. valves is by means of a transformer, and the anode circuit of the first valve includes a decoupling resistance and condenser. Notice that a 100,000 ohm fixed resistance is joined between the grid of the second valve and the transformer secondary; this, in conjunction with the H.F. choke, prevents the leakage of high frequency currents into the second valve. To prevent hand-capacity effects which might be caused by H.F. currents picked up in the 'phone or speaker leads a second choke is wired between the anode of the power valve and one "L.S." terminal. Still further to help in this respect a .002 mfd. by-pass condenser is connected from the anode to earth.

Making the Set

Rather than give full constructional details for a particular instrument using this circuit I shall merely offer suggestions for its "interpretation" so that you may experiment yourself and probably make use of a number of parts which happen to be in the "junk box."

A pictorial wiring plan is given in Fig. 2 and this will help you to follow the connections. In practice the components will be laid out on a panel and baseboard in the same order as you would arrange the corresponding ones of a broadcast set. Care should be taken that the six-pin coil-holder is placed near to the first valve-holder and tuning condenser, so that the wires between these three components may be kept as short as possible. Both H.F. chokes should be near to the anode terminals of the valve holders to which they are connected, and should be at right angles to each other. It is also advisable to keep the L.F. transformer 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 fixed 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 .0002 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 reaction, 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 ; the 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 passing 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 ¾in. diameter tube of paxolin 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 course, suitable 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

(*Continued on page 420.*)

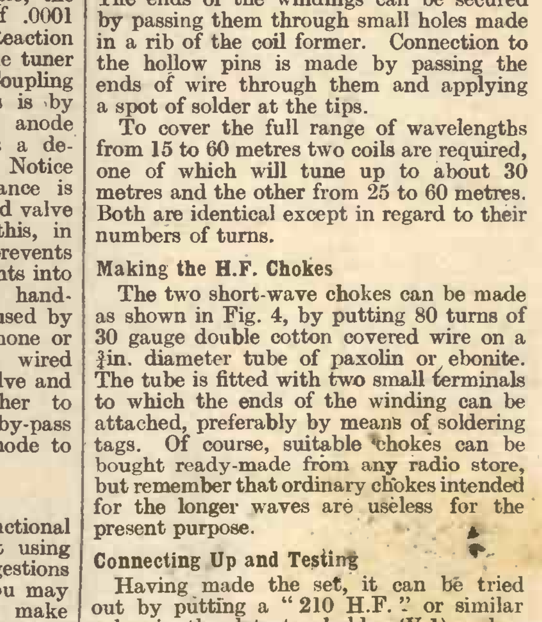

Fig. 4.—Showing how the H.F. chokes are made.

AUTOMATIC Volume Control & Your Set

FIRST ARTICLE

A Few of the Simpler Methods of Providing A.V.C. are Here Described

ONE of the most far-reaching radio developments of recent times has been the evolution and perfection of automatic volume control. Although the system is not as yet very widely employed in receivers on sale in this country it has become almost standardized in America and I do not think it is a very wild prophecy to predict that A.V.C. will be a strong feature of all the better-class receivers during 1934.

For the benefit of those readers who are not quite in touch with the progress that has been made during the last few months it should be explained that it is the object of automatic volume control to bring in every station, which is normally well received, at the same volume level. An incidental, though by no means insignificant, advantage of A.V.C., however, is that it goes a long way towards the elimination of fading.

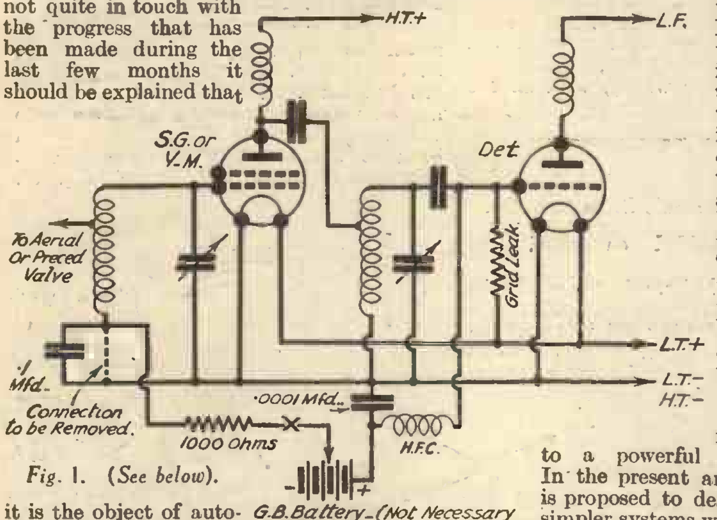

Fig. 1. (See below).

Only a short time ago this latest development would have appeared incredible, and even fantastic, but it has been tested and proved so thoroughly that it is quickly being relegated to the commonplace. It is, nevertheless, highly interesting and well worthy of trial, so I will try to explain how it can easily be added to existing receivers. Perhaps I ought to say that A.V.C. can never be of value in a comparatively insensitive set because it *does not increase* the strength of distant transmissions, but acts only by virtue of its ability to *reduce* the volume from the nearer and more powerful ones.

How it Works.

This will more easily be understood by considering how the system functions. 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 only 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, .0001 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.

(To be continued)

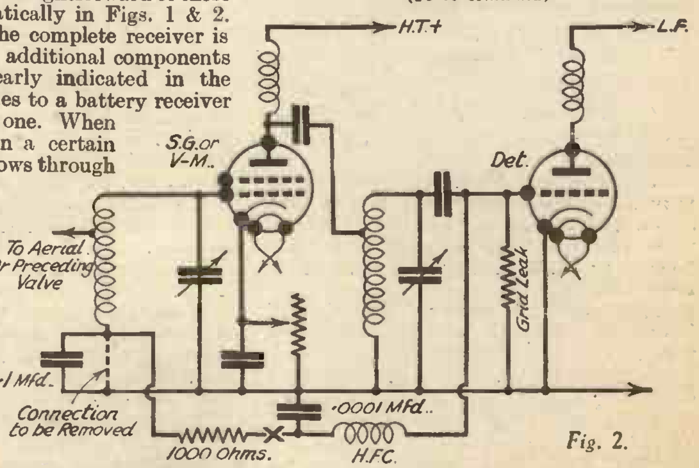

Fig. 2.

Figs. 1 and 2.—These two diagrams show the easiest, though not always best, method of providing automatic volume control. Circuit (1) applies to a battery set, and (2) to a mains set.

WIRING EFFICIENCY

How to Make the Connections in a Wireless Receiver in a Workmanlike Manner.

By A. V. D. HORT

THE arrangement of the wiring connections of a receiver and the method of securing them in position are second 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.

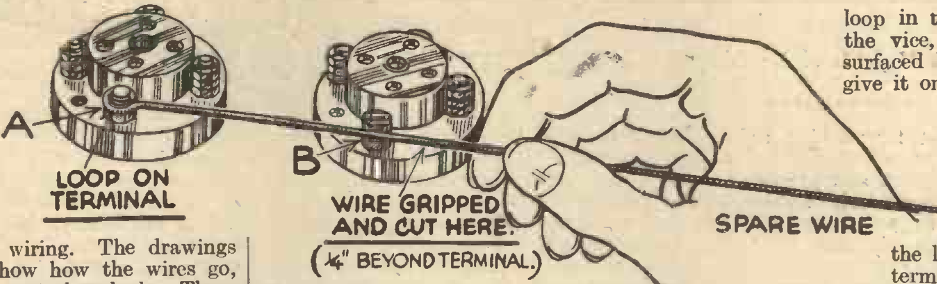

Fig. 1.—Measuring length of connecting wire.

Then comes the wiring. The drawings and photographs show how the wires go, and very nice and neat they look. There is more in it than mere 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.

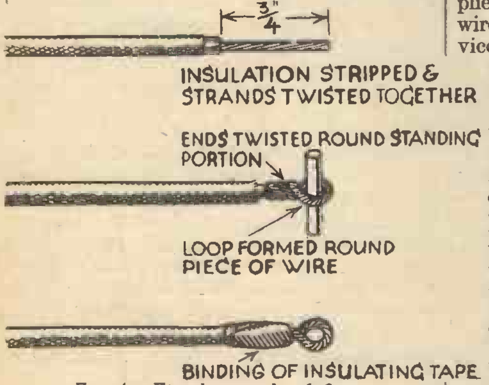

Fig. 4—Finishing ends of flex.

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 right 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 pliers. Ordinary side-cutting wireman's pliers will do for the whole job. If you are doubtful of your skill with a soldering iron, and prefer to put loops at the ends of the wires to fit on the terminals, you cannot do better than equip yourself with 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. Glazite fills the bill here. Let us assume that you have a bundle of 2ft. lengths by you, and that the receiver is ready for wiring, with all the components assembled on panel and baseboard.

Fig. 2.—How loops should lie on terminals.

Take a length of wire, grip one end in the vice, take hold of the other end with your pliers, and pull steadily till you feel the wire "give" just a trifle. If you have no vice, twist the far end of the wire round some object which is really secure. You will waste a bit of wire this way, so choose a nail or a hook, or something equally small, so that you waste as little as possible. In any case, you must straighten the wire before you start work.

Now your wire really is straight. Handle it with care. No bends can be permitted in it now except the right-angled ones which you are going to make.

Procedure in Wiring

Start on the wires which come closest to the baseboard of the receiver. These will include the L.T. circuit to the valve filaments. Fig. 1 shows two valveholders of a receiver, to illustrate the procedure in wiring. Bare ½in. of one end of a straightened length of wire by unwinding the insulation and cutting it off close to the wire with a pair of scissors. Form a loop on this wire and slip it over terminal A, laying the wire along beside terminal B. The loop should be of such a size that it just drops easily on to the terminal. Grip the wire with your finger and thumb about ¼in. beyond terminal B, lift it away, and cut it close to your fingers. Strip the insulation for ½in. at this end of the piece, and form your second loop, in the opposite direction to the first. Twist one or other of the loops if necessary, till they lie in the same plane. The link should now fit exactly over the two terminals. Lay each loop in turn on the anvil of the vice, or on any smooth-surfaced block of metal, and give it one blow with a hammer. This will flatten the loops, allowing 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 screwing down the terminal head tends to tighten the loop round the shank (Fig. 2).

Sub-baseboard Connections

If there are any wires which pass underneath 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).

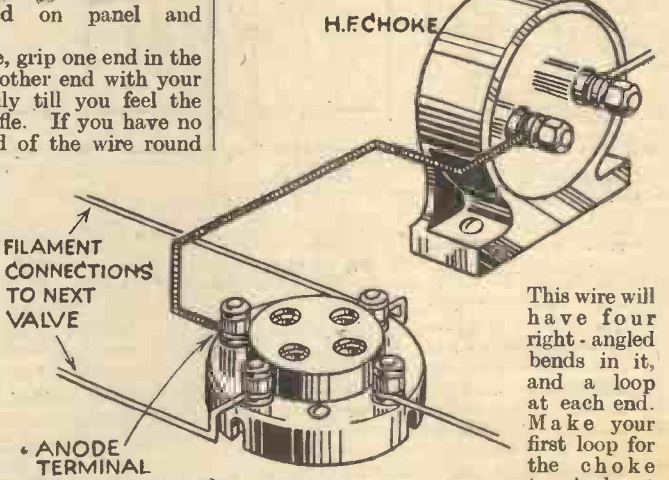

Fig. 3—Wiring a choke to the anode terminal of a valveholder.

This wire will have four right-angled bends in it, and a loop at each end. Make your 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 ¼in. beyond the anode terminal of the valve. Again in 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 end level again, and, finally, leave ½in. for the loop, cut the wire, and form the loop. Before putting the wire in place, true up the bends; 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 432.)

HOW TO OBTAIN AN—

Amateur Transmitter's Licence

An Informative Article Dealing with the Necessary Formalities

By G. H. WRAY, F.C.S.

PROBABLY the majority of readers find that wireless reception, with its associated problems, provides sufficient interest to satisfy them without investigating the possibilities of experimentation in the field of wireless transmitting, but there are also, no doubt, many advanced readers who have felt 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 in wireless 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 that 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 this question 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 sending 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 satisfy the Postmaster-General, by undergoing 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 Telephony for the examination, for which a fee of 5s. is payable.

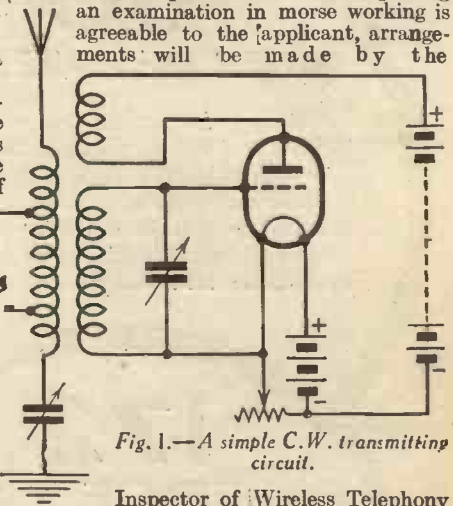

Fig. 1.—A simple C.W. transmitting circuit.

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 151.1 metres, 42.7 to 41.24 metres, and 21.38 to 20.88 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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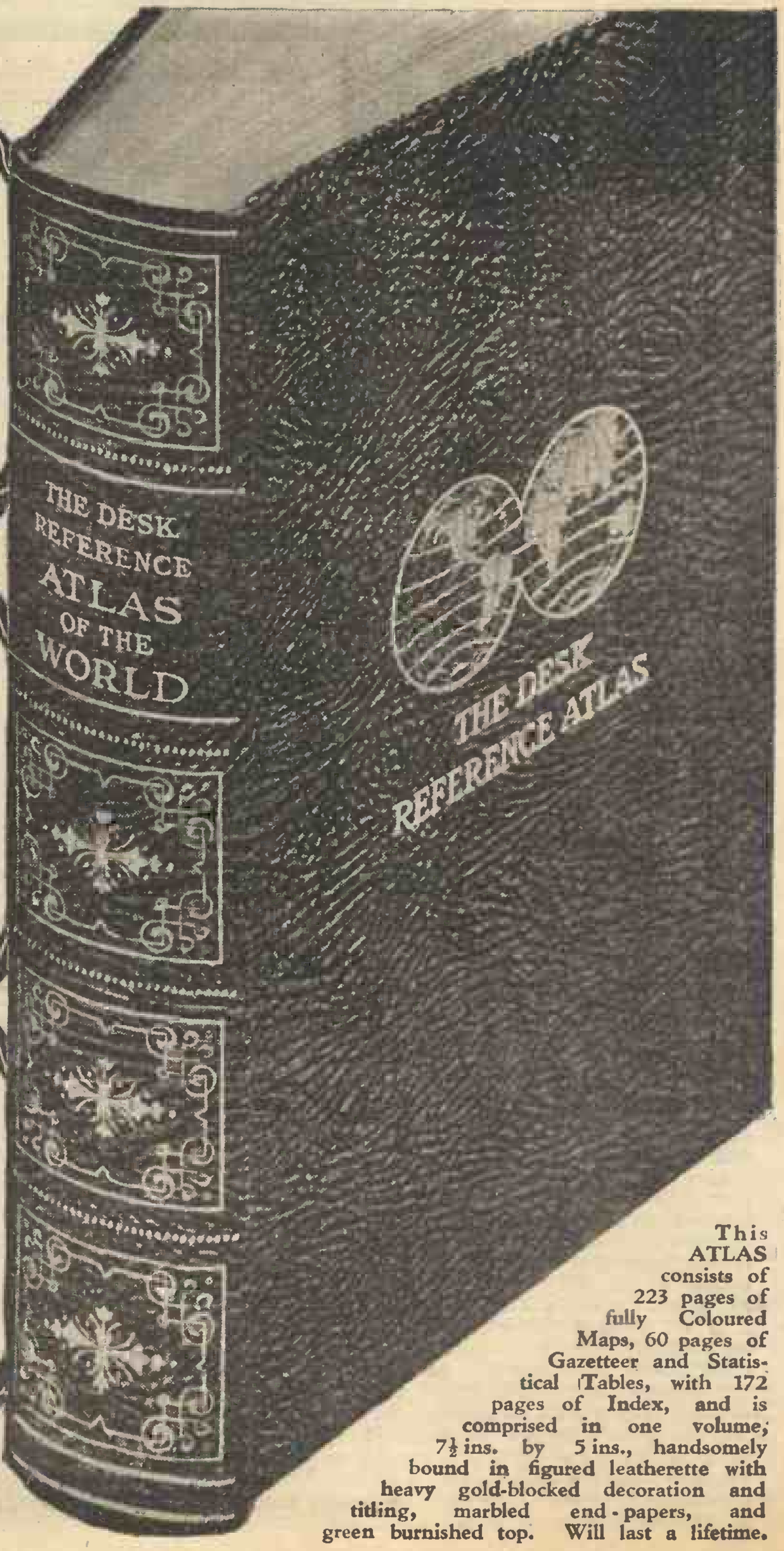

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By
H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

PART II.

CHOOSING A CHOKE

Points to Note Concerning the Selection and Use of L.F. and H.F. Chokes

THERE are at least five uses to which low-frequency chokes may be put in radio receiving apparatus. The most familiar, and that for which there is no substitute whatsoever, is in the smoothing circuit of a high-tension supply unit—"battery eliminator" or "power-pack," as it is variously termed. In a power unit operating on alternating current mains, the rectifier, whether of the valve or metal type, gives an output which is certainly a direct current, so far as being uni-directional is concerned, but which is, in its present form, totally unfit for use as the high-tension supply because it is fluctuating in value, carrying a ripple corresponding to twice the frequency of the A.C. supply, and also ripples of higher frequency.

Similarly, a supply drawn from direct current mains is far from steady as regards voltage, for it suffers from ripple also, and in many districts where direct current mains are available, it is more difficult to eliminate the ripple than to smooth the output of the average A.C. rectifier.

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 C_1 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 C_1. A further condenser, C_2, is also shunted across the supply at the other end of the choke, and has the effect of still further smoothing.

A single smoothing choke of suitable design, with two reservoir condensers—usually of 4 mfd. capacity—is in 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 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 disastrous shorts if the loud-speaker or extension leads are accidentally earthed.

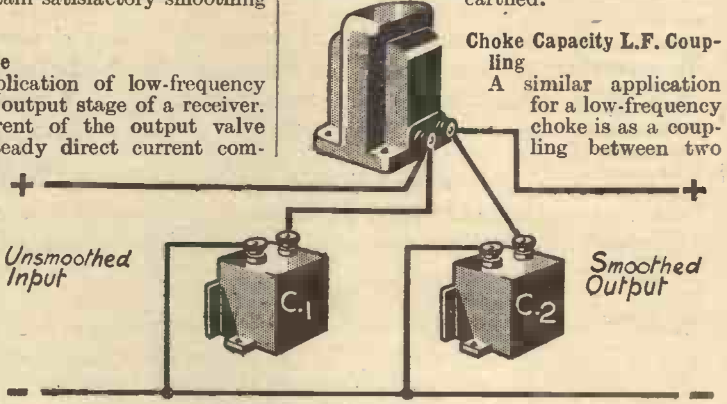


Fig. 1.—A smoothing circuit.

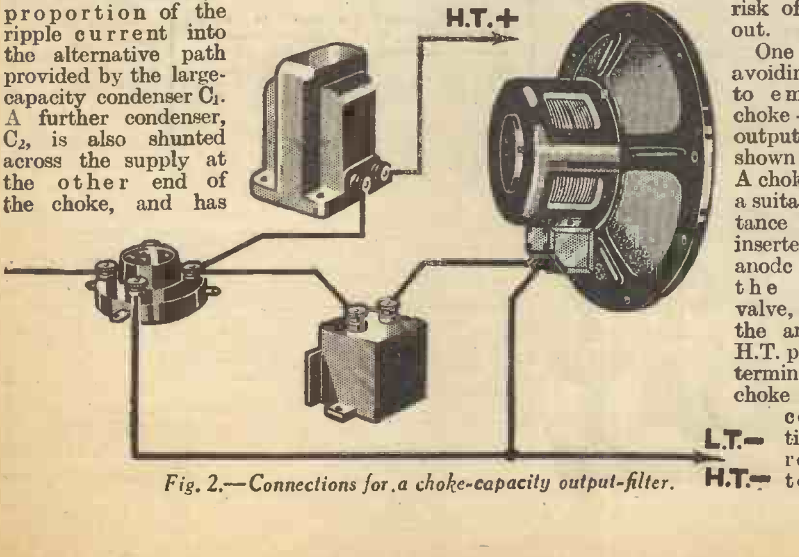


Fig. 2.—Connections for a choke-capacity output-filter.

Choke Capacity L.F. Coupling

A similar application for a low-frequency choke is as a coupling between two audio-frequency valves. The connections are shown in Fig. 3, and are identical with the somewhat better-known resistance-capacity coupling. It has an advantage over R.C.C., however, in that as the choke is of comparatively low resistance, the drop in anode voltage in the coupling device is comparatively small.

It is perhaps not so well known as it should be, that a low-frequency choke can be employed in place of a decoupling resistance in situations where it is desired to keep the voltage drop in the decoupling arrangements as low as possible. The action of a decoupling choke is exactly the same as that of the smoothing choke in a high-tension supply unit and it can, in effect, be considered as an extension of the smoothing system. Another use for a choke is in place of a grid-leak in resistance-capacity couplings where, for any reason, it is desired to keep the resistance of the grid circuit low.

H.F. and L.F. Choke Differences

The design of low-frequency chokes differs from that of radio-frequency chokes in several particulars. In the first place, in order to achieve the necessary high impedance at the comparatively low (audio) frequencies, a much higher inductance is necessary. Inductances of 15 to 30 henries are usually specified for output chokes, and somewhat larger values, up to 50 henries, for smoothing. In order to achieve the necessary high inductance, low-frequency chokes are wound on iron cores built up from a number of laminated sheets, similar

(Continued on page 420)

CHOOSING A CHOKE (contd. from p. 418)

to those forming the cores of low-frequency transformers.

Such a 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 serious.

Another point of difference is that low-frequency chokes usually have to carry much heavier currents than radio-frequency 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 certain particulars, but to help readers the practical values are reproduced here :—

Purpose.	*Inductance.*	*D.C. Res.*	*Current.*
L.F. Coupling	15/20 henries	500/800	15/30 m.A.
Power Grid Coupling	100/300 „	1000/2000	5/10 m.A.
General Purpose	20/30 „	300/500	30/60 m.A.
Output Filter	20/60 „	200/500	20/60 m.A.
Pentode Output	30/60 „	500/1000	20/60 m.A.
Mains Smoothing	30/60 „	200/500	20/80 m.A.

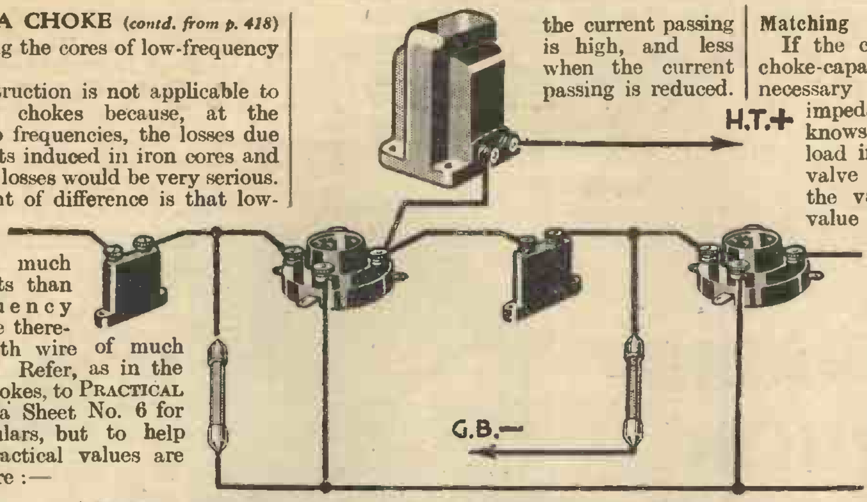


Fig. 3.—Showing the connections for choke-capacity L.F. coupling.

Selection

We must now consider what points affect the selection of a low-frequency choke. Obviously, the first consideration must be to see that the choke has the correct inductance—the figure specified by the designer of the set. Next, it is important to ascertain that the rated inductance is obtained when the choke is carrying the full load current of the circuit. This is, of course, a matter of design. The inductance of the choke depends upon the number of turns, the size of the coil, the size of the core, and the current carried. If the core is not of sufficient section, the iron may become magnetically saturated at, or even before, full load. If the steady, direct current component is sufficient to saturate the core, the alternating current component will not be able to produce the alterations in magnetic strength required, and the effective inductance will drop. The correct specification for a low-frequency choke, therefore, is that it shall be of a given inductance at a given current. All good makes of choke are rated in this way by the manufacturers.

The resistance of the choke is the next point to receive attention, especially in the case of smoothing chokes. If such a choke has a somewhat high resistance, a fairly big voltage drop will develop across it, and this voltage drop will be high when the current passing is high, and less when the current passing is reduced. Three effects will follow : first, the drop in voltage due to the choke's resistance will reduce the anode voltage available for the various valves ; second, the voltage regulation of the supply unit will be poor ; and third, the receiver will be more prone to low-frequency oscillation, hum, and motor-boating because the resistance of the smoothing choke will be common to the anode circuits of all the valves.

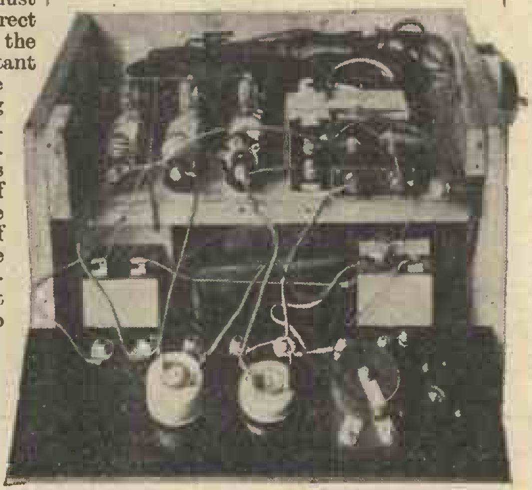


Fig. 4.—An example of a home-made H.T. eliminator in which the choice of correct L.F. chokes plays an important part. Note the three large open ones.

Matching

If the choke is intended for use in a choke-capacity output filter, it may be necessary to obtain a tapped choke for impedance matching. Every listener knows that the impedance of the load in the anode circuit of an output valve must bear a certain relation to the valve impedance, and the best value of load impedance is usually quoted by valve manufacturers for each type of output valve. If the impedance of your loud-speaker is not the correct value to form the optimum load for your output valve, you must adjust matters by employing either an output transformer of appropriate ratio, or a tapped choke. A tapped choke may be considered as a kind of transformer (auto-transformer is the technical name) in which the whole or a part of the choke winding acts as the transformer primary, while a part or the whole of the winding functions as the secondary. Tapped chokes giving a variety of different ratios 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 purchaser will naturally see that the general finish is good, and will attend to such matters as convenient and accessible fixing lugs or feet, and solid terminals or soldering tags. Insulation is an important matter, particularly in smoothing and output chokes, and must be designed to withstand the full voltage to which the component is likely to be subjected.

It is sometimes necessary, especially in the case of chokes which are to be incorporated in the receiver proper, to shield the component magnetically, in order to prevent stray magnetic fields from the choke inducing hum in other parts of the circuit. Shrouded chokes are encased in a metal case, and this case should be connected to earth by the terminal provided. Shrouding is not so important in smoothing chokes embodied in supply units installed some little distance from the receiver proper.

Loose laminations often produce a very annoying form of hum—or even buzzing—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.P.2" in holder V.2. 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 attach great importance to the last three words, for otherwise you will be disappointed in the results—or lack of them—obtained. If it is remembered that a station can be tuned in *and out again* in 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 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.

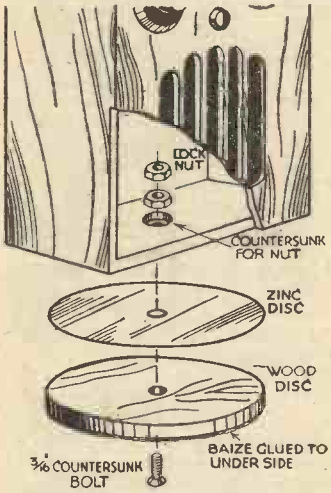
In all cases it will be found better to do the preliminary tuning with 'phones, switching over to the loud-speaker only after a loud signal has been tuned in.

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 Zeesen 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. Once the set has been "got going" you will find that signals from somewhere or other are to be heard practically all day long. A list, with times of working, power, etc., of all the principal short-wave stations in regular operation was given in an excellent "Data Sheet," presented with PRACTICAL WIRELESS dated April 8th, 1933.

READERS' WRINKLES — The HALF-GUINEA Page

A Cheap Turn-table

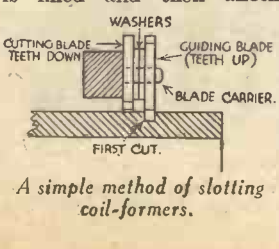
HAVING made a self-contained transportable set from a circuit given in No. 19 of PRACTICAL WIRELESS, I needed a turntable so as to obtain the full advantage of directional properties of the frame aerial. The total cost of the one I made was about twopence! For a penny I obtained a circular piece of wood cut out of a baffle-board, and having its diameter about ½in. more than 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 baize, glued underneath the turn-table removes all risk of scratching the furniture.—M. D. G. (Hampstead).



Showing the parts for making a cheap turn-table.

Slotting Ribbed Coil-formers

WHEN winding bare wire short-wave coils on 6 or 8 ribbed formers, difficulty is found in equally spacing the turns if 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.*, 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).



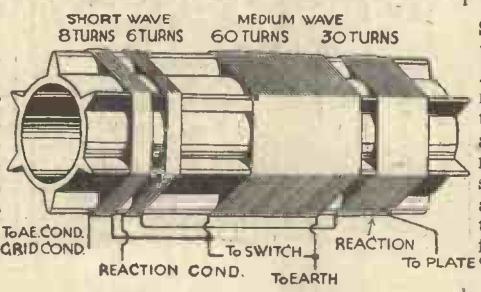
A simple method of slotting coil-formers.

THAT DODGE OF YOURS!

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

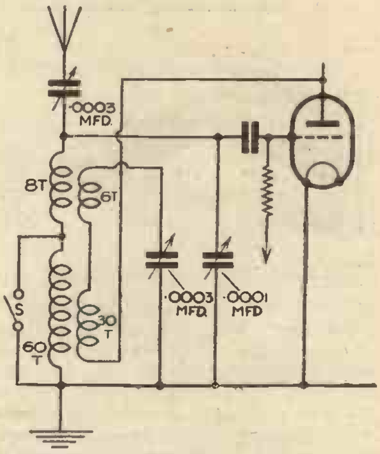
Making a Dual-range Coil

A COIL covering the most interesting portion of the short-wave band as well as 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 primarily intended for short-wave work with provision for receiving the local or regionals the rather narrow medium-wave range did not greatly matter. This can, of course, be varied to suit individual requirements. On the short-wave band many interesting transmissions will be found in the 34–18 m. range including most of the commercial telephone transmitters, and better received broadcast stations.



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

The construction of the coil is very simple, a ribbed ebonite former 6in. long being used. It is desirable to have this of small diameter as in this way the fields of the coils are kept small and interaction between the medium and short-wave windings prevented. In the original, the wire used was enamelled, but d.c.c. may also be employed. Particulars of windings are given in the diagram, but these may be altered to suit individual needs. An ordinary 2-pole switch is used for wave changing, 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 alternatively, an all-wave choke may be employed.—R. T. WARD (Exmouth).



Circuit for the dual-range coil.

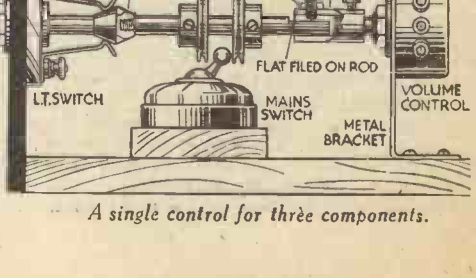
Single-knob Control

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 1in. 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)



A single control for three components.

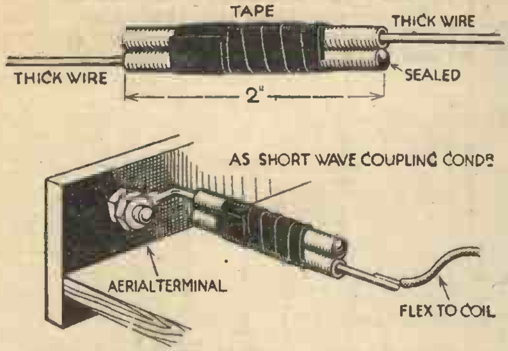
RADIO WRINKLES

(Continued from previous page.)

mains switch will be in the "off" position; when pulled out they are both "on." Turning the knob round works the volume control.—R. G. MARSHALL (Oakengates, Shropshire).

Midget Neutralizing Condensers

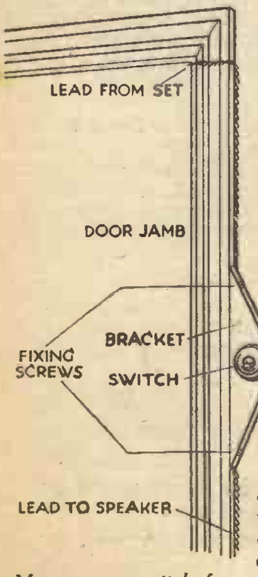
MIDGET adjustable condensers of small capacity—extremely useful for balancing circuits, neutralizing output valves, antenna coupling in short-wave receivers, etc.—can be made for next to nothing from odd lengths of systoflex and copper wire. The condensers consist of two 2in. lengths of systoflex, into 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 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).



Method of making small neutralizing condensers.

A Handy Switch Bracket

WHEN an additional loud-speaker is used 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 very 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 ⅜in. or ½in. in thickness—to the shape shown in the accompanying sketch. After staining or painting the wood the switch can be mounted on it and the necessary leads connected through holes behind the switch. The bracket can then be secured by means of two screws to the edge of the beading around the door jamb, as shown. In the majority of cases, the beading stands out about 1in. away from the wall, leaving ample room for the leads behind the bracket.—H. WEARING (Plymouth).

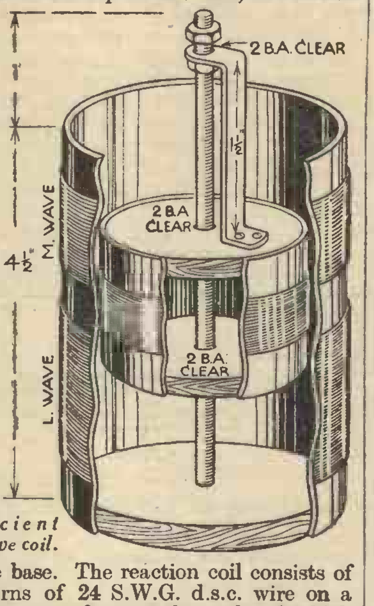


Mounting a switch for an extra loud-speaker.

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.

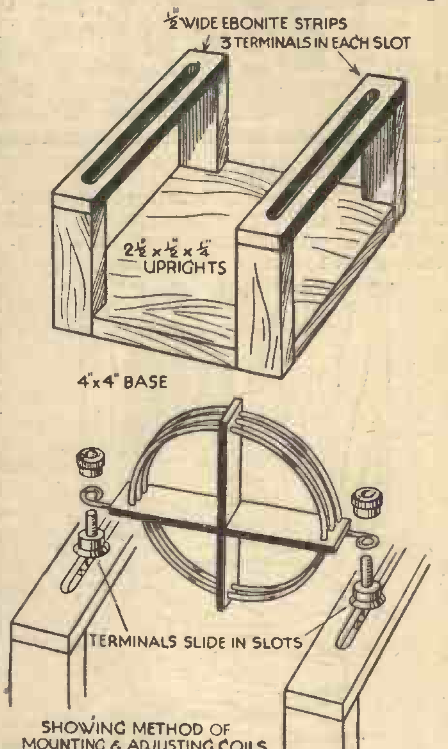
The following arrangement will be found to overcome this difficulty and, as can be seen from the accompanying sketch, the construction is perfectly simple. The coil is a single layer wound on a 3in. diameter paxolin former, with forty turns of 24 S.W.G., d.s.c. wire for the medium-wave band and 150 turns 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 into the base. The reaction coil consists of fifty turns of 24 S.W.G. d.s.c. wire on a 2¼in. diameter former, the ends of which have a wood disc fitted inside, a 2 B.A. clearance hole 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 studding, 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).



An efficient dual-wave coil.

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, 2½in. by ½in. by ½in.; two pieces of ebonite, 4in. by ½in.; 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. TREND (Upper Norwood).



Mounting short-wave coils.

A Short-wave H.F. Choke

A NEAT short-wave choke that can be suspended in the wiring of a set can be made as follows: Cut the former out of three pieces of 3-16in. ebonite to the dimensions given in Fig. 1. Assemble the three pieces, as in Fig. 2, and tie them together with thread. Fix a 6 B.A. terminal in each hole, with a soldering tag, solder some 36 d.s.c. to one tag and begin the winding. When the winding is well advanced, the thread can be removed, the turns of wire holding the former together. Finish the winding and solder the end of the wire to the second tag.—J. R. JONES (Cambridge).

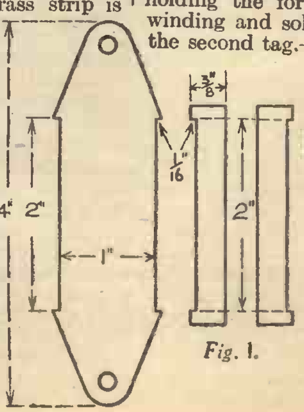


Fig. 1.

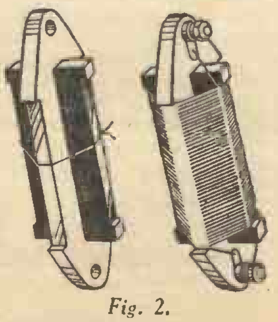


Fig. 2.

Making short-wave chokes.

BUILDING DOUBLE-I THREE

IT will be noticed from the photographs reproduced this week that the baseboard of this receiver has been covered with metallized 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 aluminium 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 16in. 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 1in.-bit being used for the 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 thoroughly coat the paper side with some adhesive. When well covered, place it on top of the baseboard and smooth it out so as to leave no wrinkles or blisters. Allow it to dry thoroughly, watching that it does not curl up at the edges. A good plan is to clamp strips of wood along the edges whilst it is drying. When perfectly dry cut through the holes made for the valve-holders with a sharp pen-knife and trim the foil to the edges of the holes. In order to make quite certain that there is no risk of short-circuits on the seven-pin valve-holder, the foil round this one should be cut back for about ⅛in. beyond the edge of the hole. With a sharp instrument find the holes at the edges of the foil and pierce these, afterwards screwing on the side runners. To avoid the screws cutting through the foil a fairly large washer should be inserted under the screw head. When the runners are firmly attached the valve-holders may be fitted, and then the baseboard turned over so that the sub-baseboard components may be attached. The thickness of the valve-holders will prevent the foil from coming into contact with the surface of the work-bench and the foil will not, therefore, get torn. All the components may be mounted on the back of the baseboard, and when firmly attached, the wiring may be commenced.

The Wiring

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 half-way, 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.

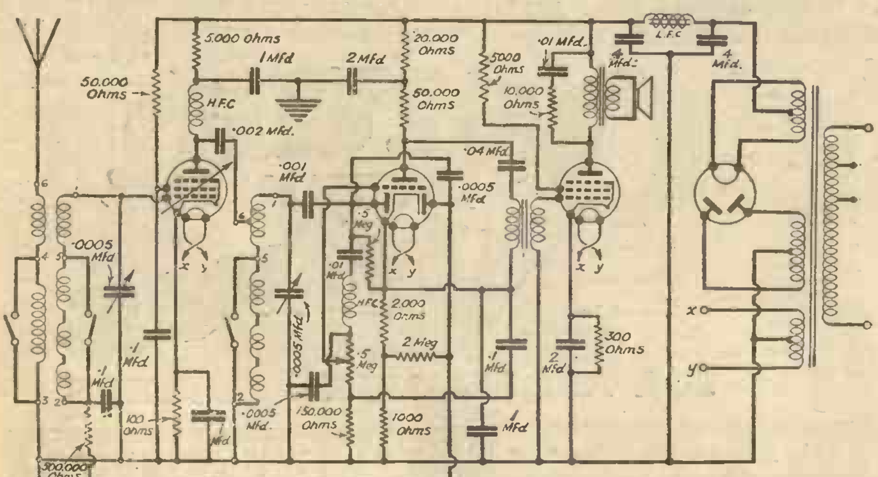
Mounting the Coils, etc.

Now turn the baseboard up the correct way and position the coils, variable condenser assembly, mains transformer, etc. When these are accurately aligned, pierce 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 ⅜in., and, consequently, if you drill through the baseboard there will be insuffi-

An attractive look

A FULL-SIZE BLUEPRIN MAY BE OBTAINED F

The sub-baseboard



Theoretical circuit of the Double-Diode-Triode Three.

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.

FOR LIST OF COMPONENTS SEE PAGE 440.

...ng set!

...cient thread projecting to permit of the attachment of the locking nut. To overcome this, the mounting bridge is used, but if you do not feel competent to carry out this little bit of metal work, the baseboard may be drilled with two ⅜in. holes to take the fixing thread, and then the underside of the baseboard should be recessed by cutting away two or three layers of the plywood. In addition it will be necessary to drill two small holes to take the leads 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 6⅜in. long by 1½in. wide. The central horizontal portion is 2⅝in. long, and the upright portions are 1¼in. The small turn-over for attachment to the baseboard is ⅝in. The two holes for the condensers are 1½in. apart, and the condensers should be attached to this mounting before screwing to the baseboard. 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.

...T OF THIS RECEIVER ...OR 1/-, POST FREE.

... components.

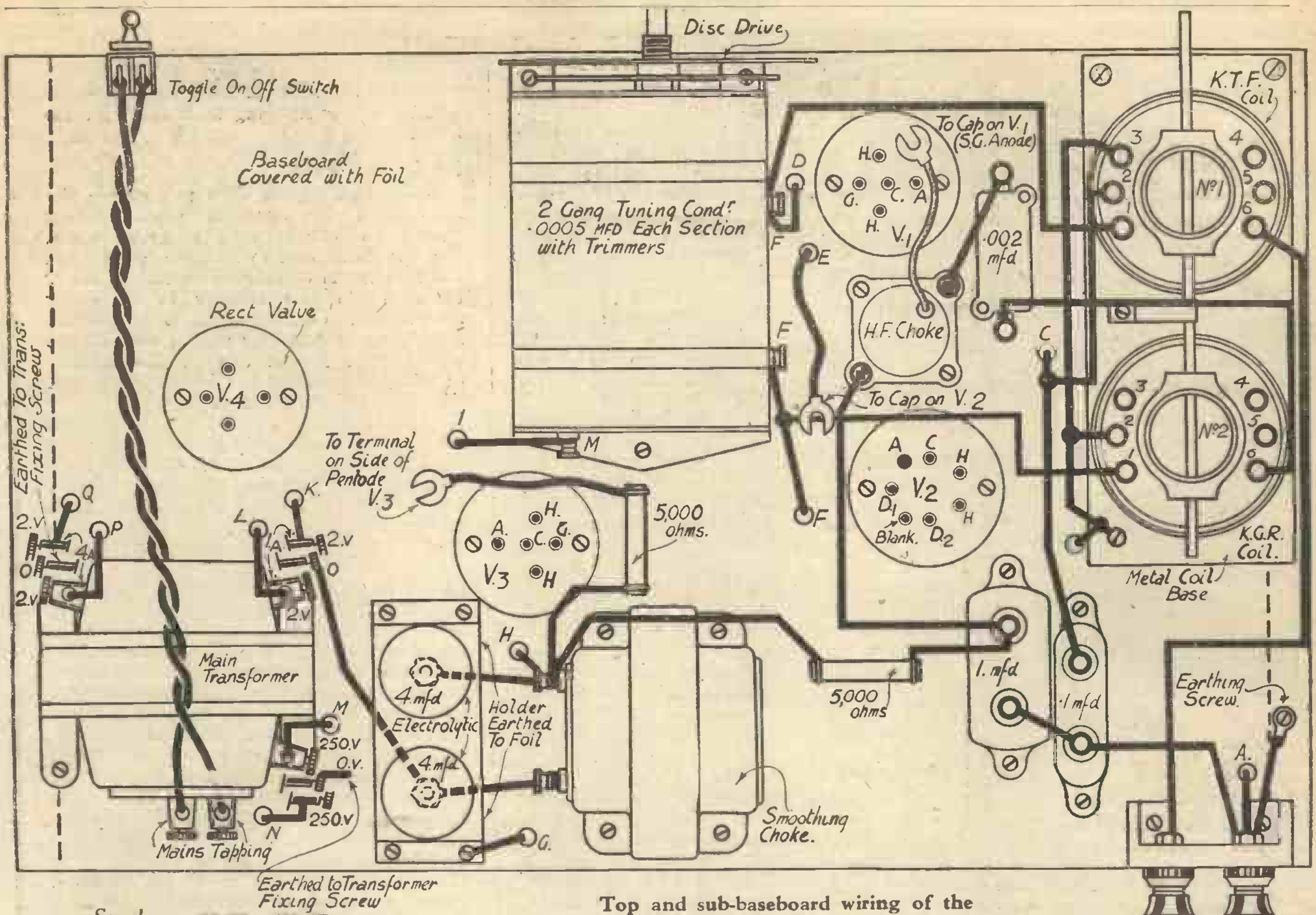
Completing the Wiring

Now bring through the various leads from the underside of the baseboard, noting that in one or two cases earth returns 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 case 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 held over until next week, when they 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.

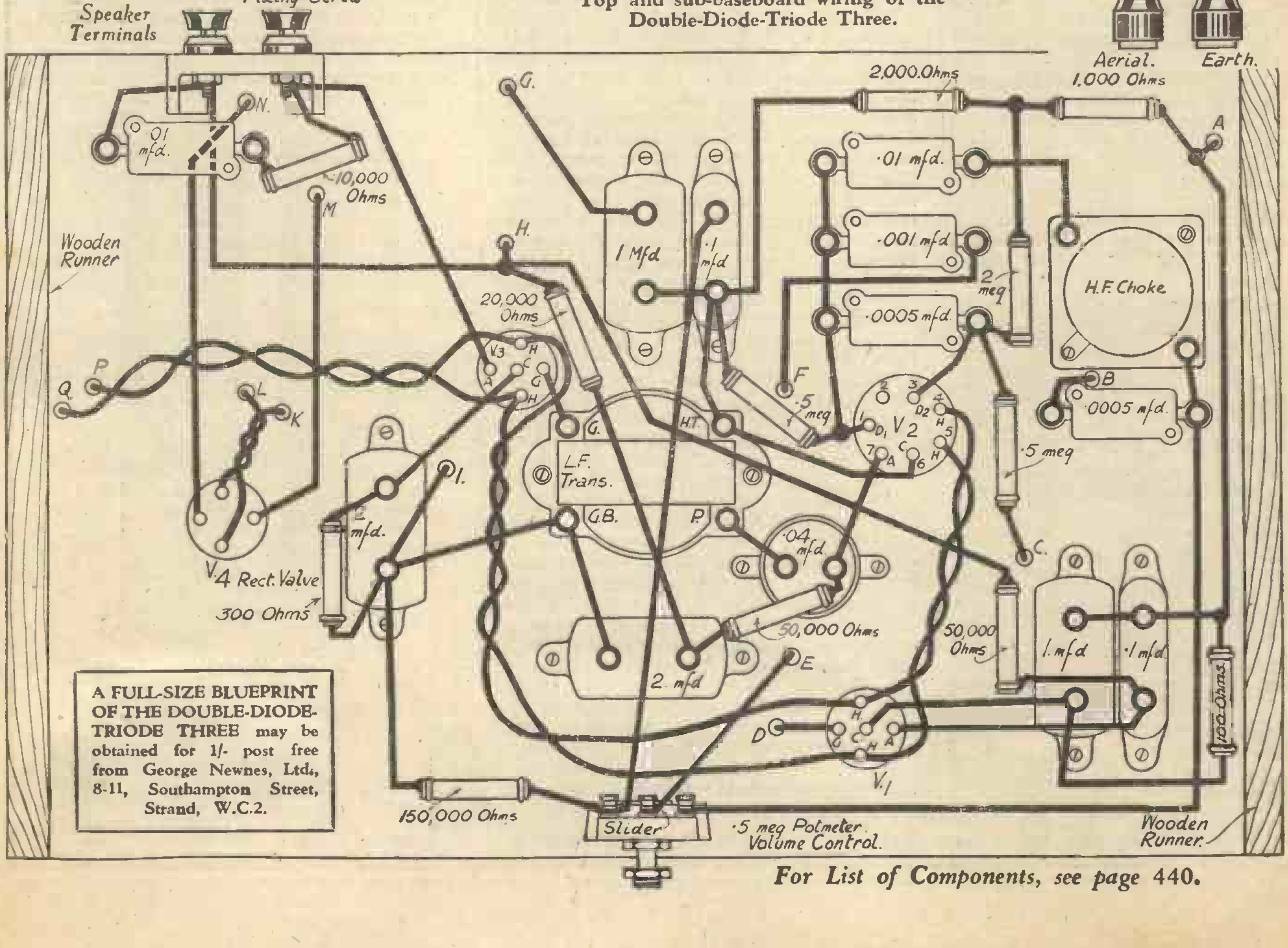
Spacing the Wiring

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.



Top and sub-baseboard wiring of the Double-Diode-Triode Three.



A FULL-SIZE BLUEPRINT OF THE DOUBLE-DIODE-TRIODE THREE may be obtained for 1/- post free from George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

For List of Components, see page 440.

The Beginner's Supplement

THE EASY ROAD TO RADIO

Conducted by F.J. CAMM

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.

The most familiar form of ebonite to the radio enthusiast is the sheet ebonite used for panels. It is also used for making coil-formers, coil-holders, etc., but to nothing like the extent to which it was formally, it having in recent years been gradually replaced by the cheaper and more easily moulded bakelite.

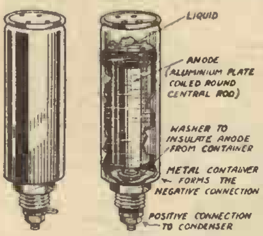


Fig. 1.—Electrolytic condenser and (right) cut away to show construction.

Electrode

Generally speaking this term refers to any of the component parts of a valve, battery, vacuum tube, or similar apparatus by which the electric current enters or leaves. For instance, in a wireless valve all the various "business" parts such as the anode, grid, or filament are called electrodes. In a primary cell or in an accumulator the plates are the electrodes. A positive electrode is also called an *anode* and a negative electrode a *cathode.*

Electrolyte

The liquid in a primary cell or accumulator. The liquid in an electrolytic condenser, and in the cells used for electroplating 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 certain salts or acids on which the action of the cell depends.

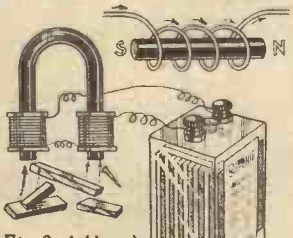


Fig. 2. (Above), a bar of iron can be magnetized by passing an electric current round it. (Below), a simple horseshoe electro-magnet.

THE BEGINNER'S A B C OF WIRELESS TERMS (*Continued*)

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 coiled 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. This film acts as the dielectric of the condenser while the anode and the liquid form the two plates. Since the film is very thin so the capacity of the condenser is comparitively large. The type illustrated is of the "wet" variety. There are also so-called dry or unspillable versions.

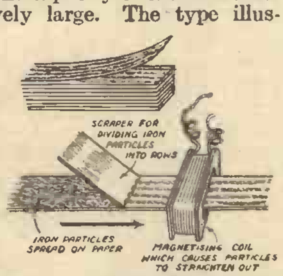


Fig. 3.—Diagram illustrating how Ferrocart is made.

Electro-magnet

If a coil of wire is passed round an iron rod as in the upper illustration, Fig. 2, and an electric current passed through the wire the iron becomes magnetized and will pick up small pieces or filings of iron. 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 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 causes electrons to be driven off into space until they strike the anode (See also *VALVE.*)

Eliminator

See *MAINS UNIT*

E.M.F.

Electro-motive-force, that is to say the pressure or *voltage* of an electric current.

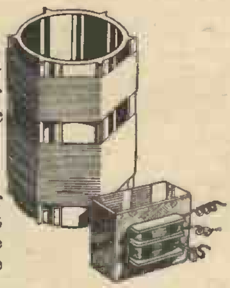


Fig. 4.—A Ferrocart coil is as efficient as an ordinary type of coil many times its size.

Ether

Wireless power like heat and light is considered to be transmitted in the form of waves. Naturally they must be waves of *something* and, since they do not seem to be composed of any material substance such as air or water (wireless waves will travel through a vacuum), they are assumed to be wave motions in a subtle medium which scientists call the *ether.* This is supposed to pervade everything and to be present everywhere.

Farad

The unit of capacity. In wireless this unit is too large for practical purposes so we use the *micro-farad* which is a millionth of a farad. See also *CAPACITY.*

Ferrocart

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 tuning coil can be increased by using an iron bobbin or "core" as it is called on which to wind the wire. In fact, this principle is extensively used in the

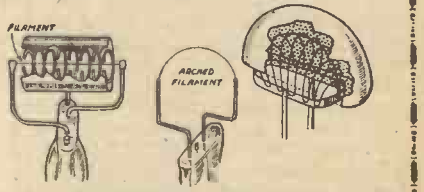


Fig. 5.—Early straight valve filaments and the later arched filament. Note peculiarly shaped grid and anode used with the latter.

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 the losses are those caused by little currents of electricity which circle round inside the iron itself and so waste power. These are called *eddy currents*. In the Ferrocart core this 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

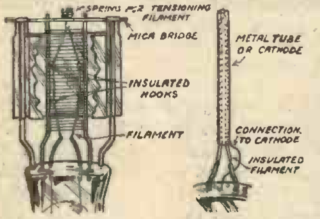


Fig. 6.—Two examples of modern filaments. (Left), as used in a battery valve. (Right), in a mains valve.

are built up to form the core in the manner shown in the upper illustration in Fig. 3. To reduce eddy currents to the 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

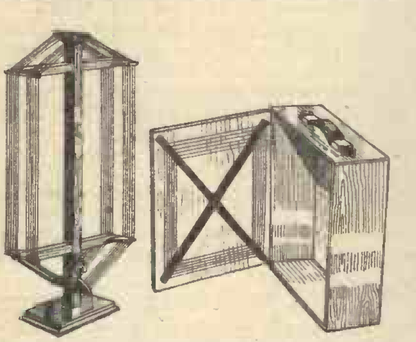


Fig. 7.—Two forms of frame aerial. That shown on the right is wound on the inside of the door of a portable receiver.

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 drooped on to the grid and caused a short circuit. The arched 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 on the left a sectioned view of a modern Cossor valve for battery use. The filament is here supported at no less than seven different points, thus assuring 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 quite 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 tuning coil, which, 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 it rises to its maximum value in one direction, then falls to zero again and finally rises to its maximum 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 20,000, 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. 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'Arsonval, 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 is the further will it turn. Attached to the suspension wire

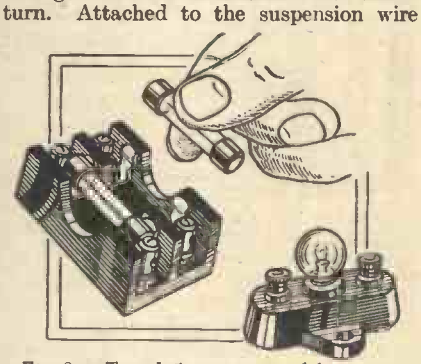


Fig. 8.—Two different types of fuses; on the left is a double fuse.

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 the coil turns, at the same time turning the mirror and causing the beam of light to be 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.

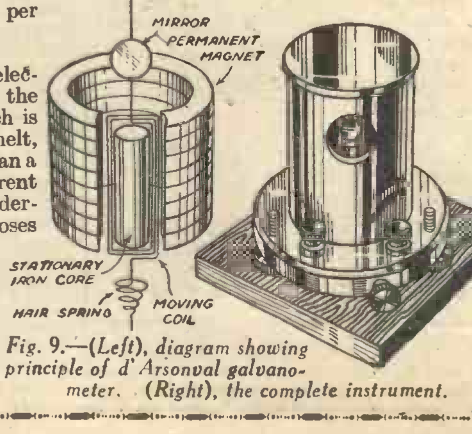
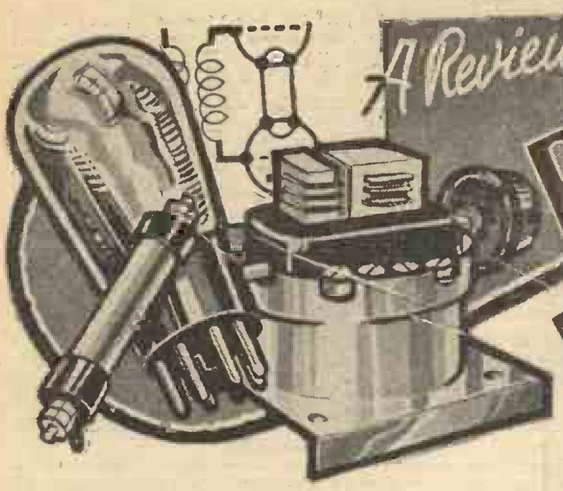


Fig. 9.—(Left), diagram showing principle of d'Arsonval galvanometer. (Right), the complete instrument.



A Review of RECENT RADIO DEVELOPMENTS

In this Article the Author Summarizes the Developments which Have Taken Place in Receiver Design During the Past Few Months. Among These are Automatic Volume Control, Quiet A.V.C., Q.P.-P., Class "B" Amplification, Introduction of "Cold" and Other New Valves, and Iron-Core Tuning Coils.

By FRANK PRESTON, F.R.A.

(Concluded from p. 320, May 20th issue.)

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.1, and is applied to the V.-M. valves through the decoupling resistance R.2. The audio-frequency output from the rectifier is also taken from R.1 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 provisions. 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 milliwatts 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" to such an extent that constructors begin to expect it to do the impossible. The fact is that a pair of valves connected in quiescent push-pull will give as much amplification as two transformer-coupled power valves, *but with about one quarter as much H.T. current.*

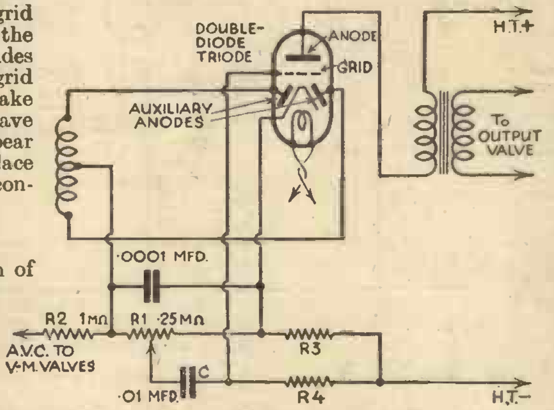


Fig. 5.—A double-diode-triode used as detector, A.V.C. and L.F. amplifier.

The circuit of a typical Q.P.-P. amplifier using two high-amplification small power valves is shown in Fig. 7. Actually, 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 more anode current, the 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 2 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 G.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

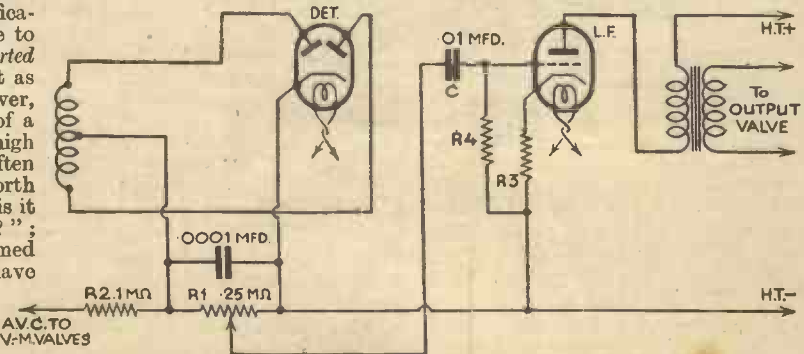


Fig. 6.—The equivalent circuit of Fig. 5, where separate valves are used for detection and L.F. amplification.

(Continued overleaf)

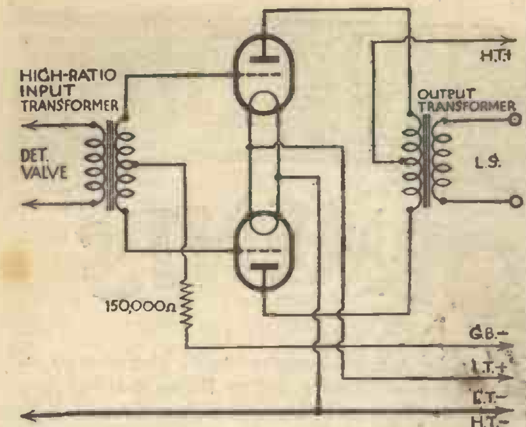


Fig. 7.—The circuit of a Q.P.-P. amplifier using two high-amplification triodes.

(Continued from previous page)

produces distortion due to the voltage drop across the transformer secondary; in "Class B," however, this difficulty is overcome 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.

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 our coils were not so efficient as they might be, but no better method of construction could be found. The coils had to contain a comparatively great length of wire to enable them to tune over the necessary wavelength ranges, and unless the wire were of heavy gauge it must necessarily introduce resistance losses—and the complementary condition of inselectivity. It was obvious that the only way to reduce the amount of wire without lowering the inductance was to employ iron instead of the "air" core. But iron in solid or laminated form introduces eddy current and other losses which are even greater than those caused by the windings. It remained for Hans Vogt to produce a core material, which he called Ferrocart, and which consists of very fine particles of iron contained in solid insulating substance. This was found to 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 hitherto produced. In addition, they are of smaller dimensions than other coils, and thus assist in reducing the overall size of 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 not yet 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!

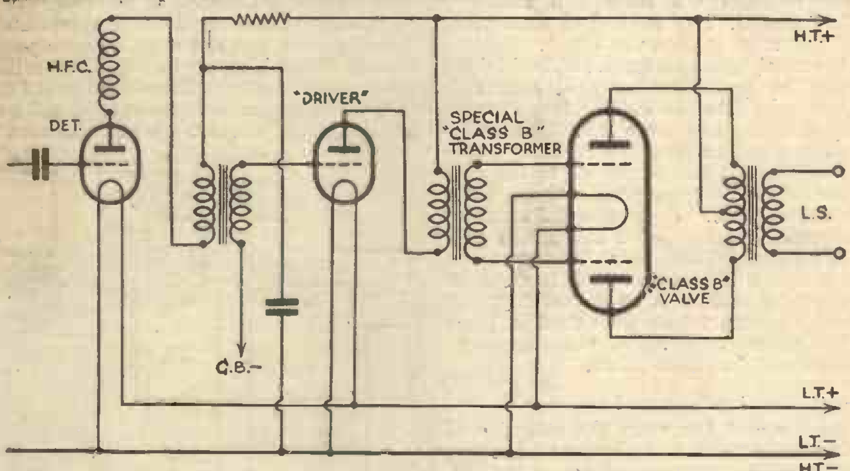


Fig. 8.—The arrangement of a "Class B" amplifier. Note the special valve and input transformer.

WIRING EFFICIENCY

(Continued from page 414.)

neat and precise. You could measure the distances required and mark them off on the wire. The method described, however, is simpler, in that the receiver itself is used as the measuring instrument to adjust each wire to its exact position. Follow the same procedure with every wire which you put in, finishing up with the long ones from the baseboard to the panel.

A Hint

One word of warning. You need not have the valves and coils in place all the time while you are doing the wiring. When you come to the wires which run close past them, put them in their sockets. Otherwise you may find later on that you have placed a wire just where a detachable component fits in. Leave enough space to enable you to remove valves or coils without disturbing the wiring.

Flex Leads

A final word about flexible wires. You would be very ill-advised to use flex for the general wiring of the receiver. The positions of the lengths, especially the longer ones, would 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.

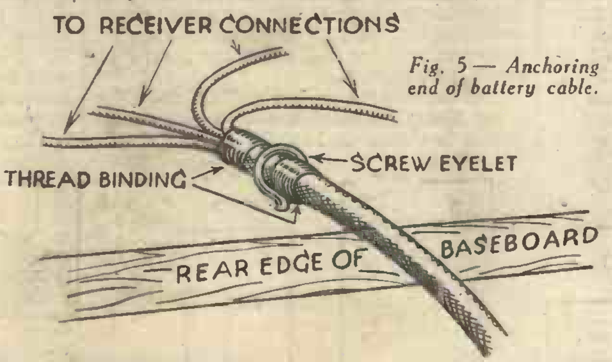


Fig. 5 — Anchoring end of battery cable.

Securing the Ends

Fig. 4 shows a satisfactory way of securing the ends. Remove the insulation carefully for ¾in., twist the strands together with your fingers, taking care not to omit any strands, and form a loop round a piece of wire of the size of the terminal shank, twisting the free end round the standing part of the wire. A scrap of adhesive insulating tape wrapped tightly over the neck of the loop, sealing the end of the insulation, will complete a workmanlike job.

If you use a battery cable, from which leads radiate to various parts of the receiver, do not rely on the individual terminals to hold the whole cable secure. Pass the main cable through a screw eyelet (Fig. 5) at the point where it enters the receiver, and tie it to the eyelet with a turn or two of stout thread. An accidental pull on the cable will then neither break the connections nor damage the components.

Use Soldering Tags

Should you prefer to solder your connections instead of making loops as described, see first that every component and terminal is fitted with well-tinned soldering tags. Then go round the receiver, bending the wires as already described, omitting the loops, of course, and the extra bit of wire necessary to form them, merely stripping ¼in. of insulation at each end of each connecting wire. Make all the necessary bends in a wire before soldering either end in position. It is far simpler to make neat bends when you have the whole wire in your hands.

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 :

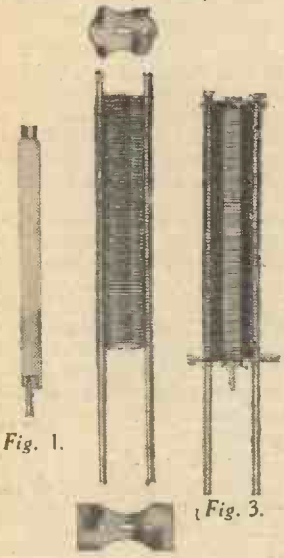


Fig. 1. Fig. 2. Fig. 3.

1. Almost unbreakable, owing to metal construction and interlocked electrodes.
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. Smaller 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, heater 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.

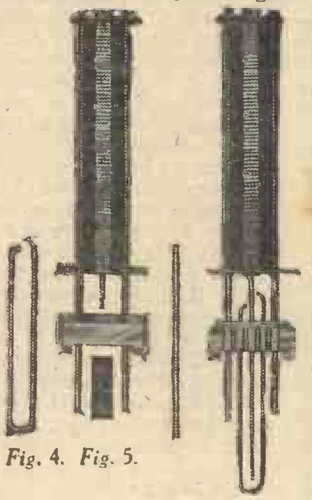


Fig. 4. Fig. 5. Fig. 6.

(To be concluded next week.—Ed.)

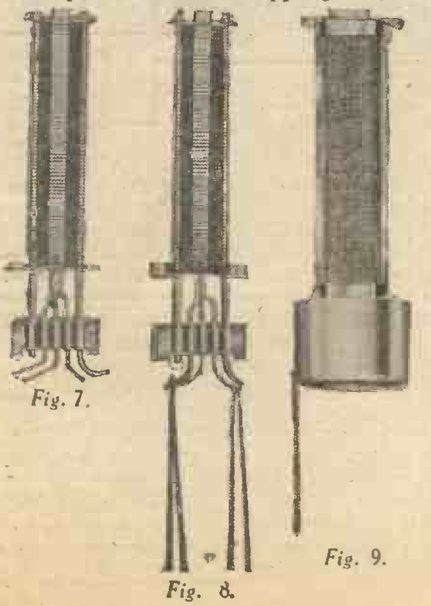


Fig. 7. Fig. 8. Fig. 9.

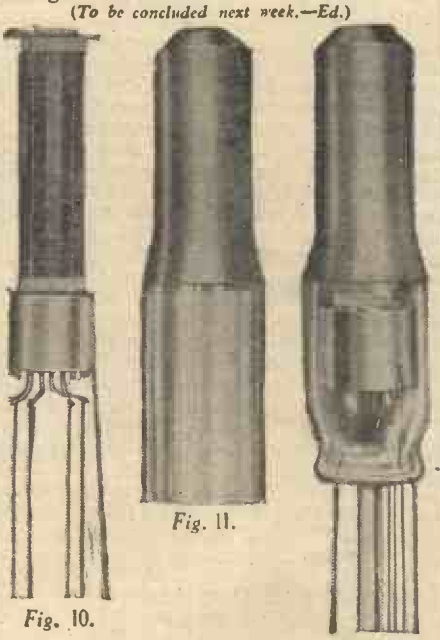


Fig. 10. Fig. 11. Fig. 12.

These illustrations show twelve progressive operations in the assembly of the new Catkin valve.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

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 radio relay systems. This "wired wireless," as it is called, is 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 leave the set free for the 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, and the advent of a new system of wiring, both convenient and cheap, will do much to popularize this form of listening. The disadvantage of being able to listen to only the station that the organizers decide is, however, a real one, and those responsible are finding out, like the B.B.C. before them, that there are very few houses in which two people will agree as to what constitutes an ideal programme. Still, if we had a set capable of receiving a thousand stations I do not suppose we would find an ideal programme.

Freak Radio

A MAN in a hospital in the Antipodes put a pair of headphones on his head and stuck the wires into the earth. He immediately received a broadcasting programme, although he had no set of any sort. Now he is hard at work trying to tempt the gods further by getting the programme on the loud-speaker so that his fellow patients will have the benefit of more or less free wireless. I make no attempt to give an explanation of this, even though I believe I can remember reports of similar phenomenon in this country, but there are just two questions I should like to ask. Firstly, how on earth did he come to stick 'phone tags in the earth ?—and is he liable to a licence fee for setting up a receiving "station"?

Faulty Resistances

IN common with other electrical apparatus, wireless components have a nasty habit of wearing out or breaking down. If the constructor responsible is worthy of the name he can generally make up a makeshift job so as to keep the programme running (this is following the general assumption that wireless sets fail suddenly only when special programmes are being broadcast), and a common breakdown often occurs in the various resistances to be found in the set. Sometimes, in certain positions, the resistance can be short-circuited, and any subsequent instability cured by lowering the H.T. voltage or similar palliatives, but this is only to be recommended when the resistances that are faulty are those placed in the H.T. leads. In the case of bias-resistances, from which automatic grid-bias is obtained in all-mains sets, a faulty resistance can be eliminated by substituting an ordinary grid-bias battery, and thus reverting to battery bias. In this case it is usually enough to connect up the battery in the same way as the resistance was, so long as this was in the cathode circuit originally. The cathode, you will know, is equivalent to the filament in a battery valve, and the grid-bias positive should be connected to it. The correct valve of grid-bias negative should be connected to earth, and this can be accomplished by attaching the G.B.— lead to the chassis or metal panel, or other convenient earthed point.

Kelvin Lecture

THE annual Kelvin lecture has just been delivered, and the subject dealt with wireless waves and how they travel through the ether. The lecturer, Sir Frank Smith, succeeded in interesting his audience to a man, which in itself was a difficult task, for although all of them were electricians many of them knew less about the mysteries of radio than many amateurs. You may have found out yourselves that many practising electricians, although capable enough in their own sphere, have a very elementary knowledge of the rudiments of radio. Even so, Sir Frank, intrigued all his hearers with the simple and concise lecture he delivered, and he referred to the way in which the theorists believed that two-way working with the other side of the world was practically impossible, even if all the power generated by the Niagara Falls could be radiated from the aerial. He related, what is now common knowledge, how the amateur transmitters, working on short waves, were able to circuit the globe with barely sufficient power to light an electric lamp, and from that point he discussed the way in which wireless waves travel, the Heaviside layer, and the cause of fading. Incidentally, I have seen fading attributed to sun spots, the phase of the moon and the weather, and who shall say which is right or wrong? The peculiar part of it seems to be that until somebody invented the various causes of fading this complaint was not half so bad as it is now.

Searching for Short-wavers

AS one would expect at this time of the year, the short-wave stations all over the world are coming in very well indeed. On the 19-metre band (which seems to be best of all at the time of writing) W2XAD, Schenectady; W8XK, Pittsburgh and W2XE, New Jersey can be brought in at good speaker strength on a Det.-2L.F. receiver between about 4 o'clock in the afternoon and midnight. Radio Coloniale and Zeesen are, of course, easily received whenever they are working. Another station on the 19-metre band which is worth trying for is (never mind the name) Kemikawod-Cho-Chiba-Ken, Tokio. The time of working is from 10 a.m. to noon, and it can be received under fairly good conditions.

On the 31-metre band W3XAU. Philadelphia; W1XAZ, Springfield; W3XAF, Schenectady; and PRBA, Rio de Janeiro are not difficult to find between about 9 p.m. and 2 a.m. Another good station on the same waveband is VK2ME, Sydney, which can generally be brought in fairly well between 6 and 8 a.m., and also from 6 to 9 p.m.

The 49-metre stations, although perhaps rather "steadier" than the others, have not been coming over with quite so much punch. Nevertheless, W3XAL, Bound Brook; W3XAU, Philadelphia; W4XB, Miami and W9XF, Chicago, have all been heard after 11 p.m., whilst ZL2ZX, Wellington (N.Z.); ZTJ, Johannesburg and VQ7LO, Nairobi are fairly reliable stations between about 3 and 6 p.m.

An S.-W. Tip

BY the way, here is a good tip for improving the sensitiveness of any short-wave set; use an A.C. valve of the "HL" or "L" type as detector. Its heater can be supplied with current from an ordinary 4-volt accumulator, and although it will take about 1 ampere, the extra L.T. consumption will be more than compensated for by the improvement in reception. Very little alteration will be required to the set. If it is a single valver all that need be done is to replace the present valve-holder by one of the 5-pin type and join together the cathode and negative filament terminals. The same modification is also suitable in a multi-valve set if ordinary 4-volt valves can be used in the amplifying stages. Otherwise the wiring must be altered as shown in Fig. 1 so that 4 volts are applied to detector valve and only 2 volts to the others.

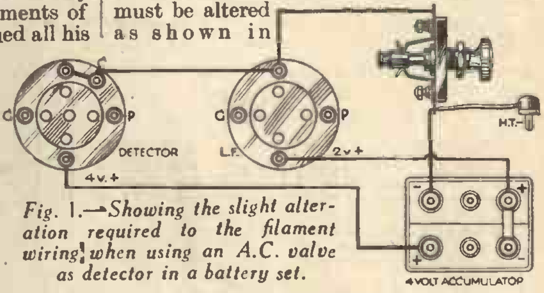


Fig. 1.—Showing the slight alteration required to the filament wiring when using an A.C. valve as detector in a battery set.

Just try this idea if you can; you will find it well worth while, since the A.C. valve makes an efficient regenerative detector.

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 loud-speaker in the Radiopax Four described in these pages recently. The Varley Output Transchoke 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. The loud-speaker which was specified should be joined to the terminals marked 1.5 to 1, and these 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.

Trimming.

Owing to the smallness of the trimming adjusting nuts some readers have appeared uncertain just which were the trimmers. Fig. 2 is a plan view of the receiver and the three small circles running down the centre of the print are the trimmers. They are almost above, and just to the right of the fixed condenser which is screwed at the side of the seven-pin valve-holder. They are made so small as there is really hardly any need to touch them, and the matching of the complete unit is practically sufficient for normal requirements. The wiring and the aerial earth system will however, vary 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.

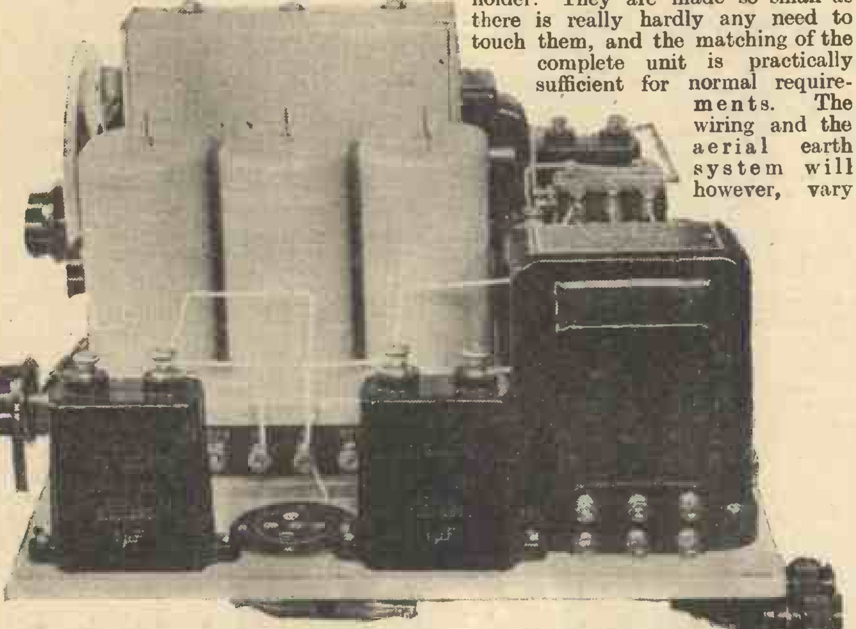


Fig. 1.—This illustration clearly shows the Varley output choke and its six terminals.

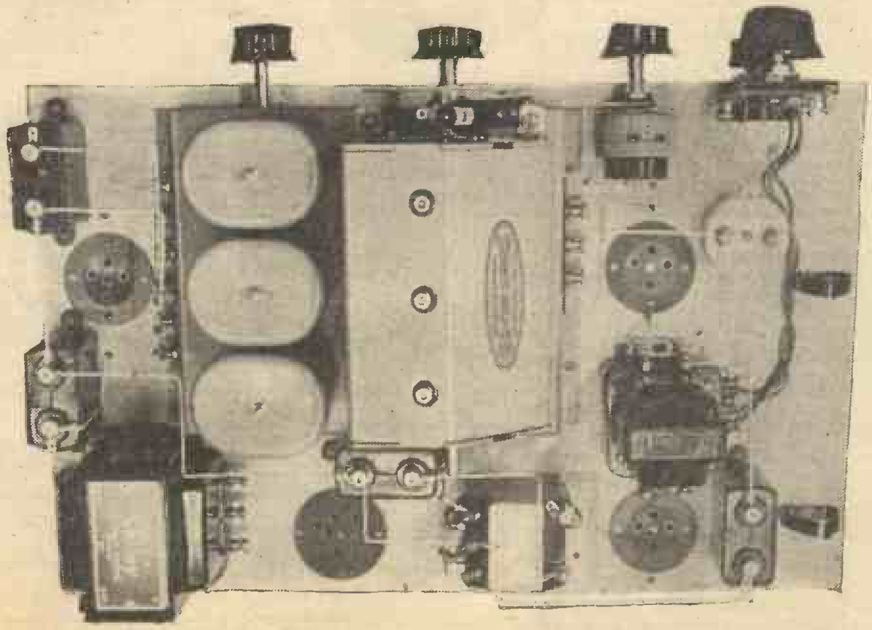
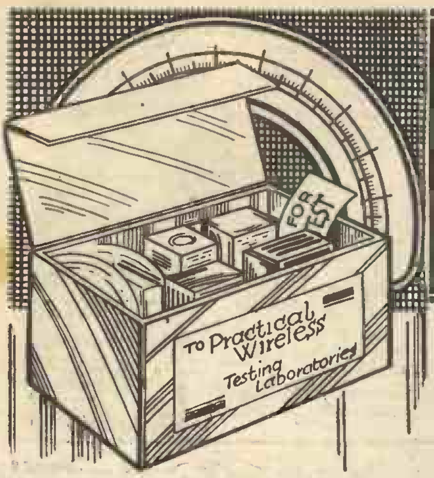


Fig. 2.—Plan view of the Radiopax Class B Four.



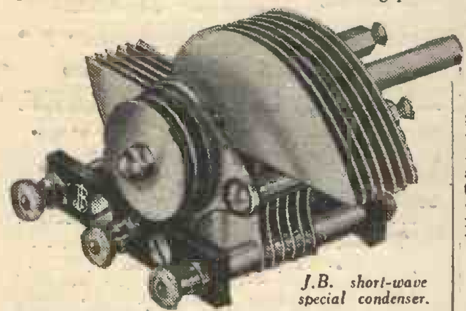
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

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



J.B. short-wave special condenser.

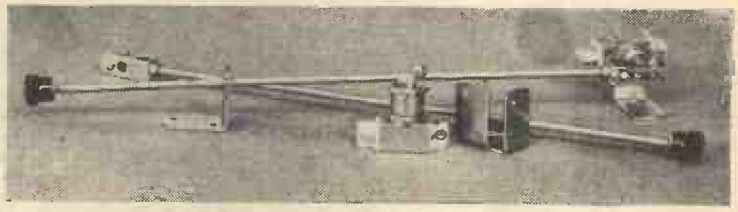
is a source of trouble, and even when using a pig-tail, the rubbing of adjacent turns causes noises which may prevent the accurate tuning-in of a station. Messrs. Jackson Bros. have produced the condenser shown above which is ideal for short-wave receivers, and there is very little that can be found wrong with it. The pig-tail connection is of covered wire, and to prevent inductive effects it is sandwiched between two brass discs. It must therefore always take up the same position as the dial is rotated. It is built up with brass vanes and spindle, and the insulation is carried out with good quality ebonite. Two terminals are provided for connection to the fixed vanes and two also for the moving vanes, so that wiring may be kept conveniently short. In place of the customary one-hole fixing attachment, three screws are employed on this type of condenser, and this ensures that it will not work loose in use and be a source of further trouble. It is a really high-class component and is obtainable in five values, .00005, .0001, .00015, .0002 and .00025. The price for any model is 5s. 9d.

TUNGSRAM UNIVERSAL VALVES

OWING to the great diversity of different mains voltages and periodicity which are available in this country, there is a great difficulty in standardising receivers. In addition, should one move from one town to another, there is a great possibility that the receiver which you are now using will be of no use in the new situation. The Universal Valve, which is a commonplace 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 a 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 .18 amps. (irrespective of the number of valves used) the barretter maintaining the current constant within limits of 2½ per cent. to mains voltage variations of 15-20 per cent. These valves are now being manufactured by the Tungsram Company, and we hope to give more details concerning them at an early date.

BLUE SPOT LOUD-SPEAKERS

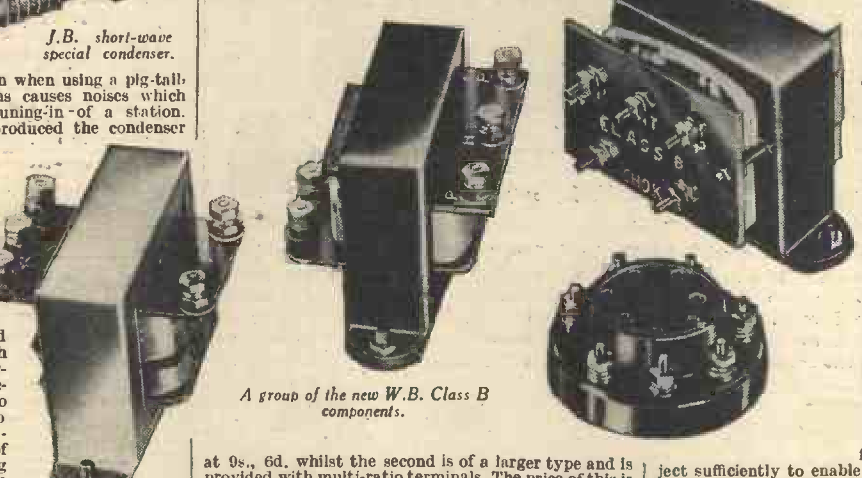
THE Blue Spot Company have had a number of requests to supply their very popular 29 P.M. Moving Coil Speaker (Cabinet version Model 22 P.M.) less the transformer, when the speaker is used for an extension model. This particularly applies, of course, in the case of sets which have Class B output and already incorporate a transformer. They are therefore supplying both these models less transformer; the 29 P.M. Chassis less transformer is 27s. 6d. retail, the Cabinet Model 22 P.M., less transformer, is 40s. retail.



British Radiophone switches, with extension operating rods.

NEW WHITELEY ELECTRICAL CLASS B COMPONENTS

FOUR new W.B. components are illustrated below and these are intended for the Class B type of amplifier. They are driver transformers, output transformers, output chokes, and 7-pin valveholder. On the left is a driver transformer, and this is manufactured in two types, one for inclusion in the anode circuit of small power valves and priced



A group of the new W.B. Class B components.

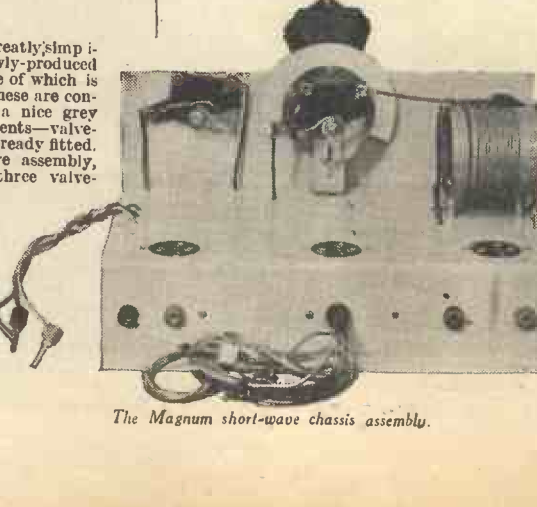
at 9s. 6d. whilst the second is of a larger type and is provided with multi-ratio terminals. The price of this is 12s. 6d. The output transformer is intended for low-resistance speech coils (or loud-speakers) only, and is priced at 7s. 6d. The output choke shown on the right, of the group is tapped to provide three different ratios, 1-1, 1.4-1 and 2-1. This costs 10s. 6d. Actual models have not yet been received by us, but as soon as we are able to test them we shall give a full report with characteristics.

MAGNUM CHASSIS ASSEMBLY

THE construction of a receiver is greatly simplified by using one of the newly-produced Burne-Jones chassis assemblies, one of which is shown at the foot of this page. These are constructed of steel, cellulosed with a nice grey finish, and the principal components—valveholders, coil, condenser, etc., are already fitted. The model shown is a short-wave assembly, fitted with short-wave coil, and three valveholders. Terminals are fitted to the rear of the chassis and only a few components and some wire are needed to complete the assembly of a really-efficient short-wave receiver. A special Q.P.P. model, a super-het model, and a class B model are also obtainable. The Class B model costs 15. 6d., and the remaining models will vary, of course, according to the particular components which are employed.

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 across the receiver or else have fitted it at the back of the cabinet where it is almost ungetatable. 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 baseboard and yet be controlled from the panel. 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 any convenient point on the baseboard and the rod passes through a hole in this bracket which prevents any unnecessary side play, etc. A small hole in the panel or cabinet front permits the rod to project sufficiently to enable the small ebonite knob to be fitted, when the operating of the switch is carried out by simply pulling or pushing the knob.



The Magnum short-wave chassis assembly.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents.

The Finest Weekly.

SIR,—I beg to acknowledge receipt of the "Wireless Constructor's Encyclopædia," 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 thirteen weeks.—H. ADAMS (Leeds).

A Jersey Reader's Thanks

SIR,—I have been studying wireless for the past six months, and, thanks to PRACTICAL WIRELESS, I have made two sets, which work excellently.

I received my "Wireless Constructor's Encyclopædia" recently, and I can assure you that it is a mine of instructive information for both amateur and professional alike. Wishing PRACTICAL WIRELESS every success.—W. J. BULLEN (St. Helier, Jersey).

"A Mine of Information"

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia," and wish to thank you most sincerely for such a mine of information. It really *is* a practical gift to wireless enthusiasts. I am delighted with it, and lose no opportunity of showing it to my wireless friends. The contents are so clearly explained that it is a great help to amateurs like myself. PRACTICAL WIRELESS is great, and I wish it every success.—A. WHEELER (Bristol).

"A Splendid Book"

SIR,—I wish to express my thanks for my copy of the "Wireless Constructor's Encyclopædia," which I received quite safely. It is a splendid book, and I am very pleased with it. Also, I should like to thank you for PRACTICAL WIRELESS, which I am taking regularly.—F. C. SMITH (Shrewsbury).

"Second to None"

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia," and my thanks are due to you for the production of such a practical book. I am sure it should have a position second to none in any constructor's library.—E. BRANNAN (Barnsley).

A Scottish Reader's Thanks

SIR,—The presentation copy of the "Wireless Constructor's Encyclopædia" received safely a few days ago. I am quite delighted with it. It contains a mine of useful information to every wireless enthusiast. I am only a raw amateur, and I have spent quite a moderate sum on books relating to radio, but I find the information in the Encyclopædia much easier to understand. In conclusion, I desire to thank you for such a magnificent bargain, and wish PRACTICAL WIRELESS every success.—DAVID SMITH (Strathaven).

A "Book of Practical Wireless Information"

SIR,—Many thanks for my copy of the "Wireless Constructor's Encyclopædia." 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

SIR,—May I express my appreciation of the "Wireless Constructor's Encyclopædia," 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).

CUT THIS OUT EACH WEEK

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 is always the outside casing.

—THAT the value of a variable condenser may be modified by inserting mica or 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" recently described in an article on Wireless and the Car in these pages are now obtainable commercially.

—THAT a copper disc stood beneath the telephone often proves very effective as an aerial.

—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 manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

FOR THE FIRST RELIABLE INFORMATION READ "PRACTICAL WIRELESS"

NEW IRON-CORE TUNING COILS

THE VARLEY NICORE AND THE WRIGHT AND WEAIRE NUCLEON

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 (incidentally, 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, many years, long before the days of Radio, and so 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 Tuned 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" wave-band switches are provided and, as instancing how small these coils actually are, it may be mentioned that the switchgear is by far the largest part of the assembly.

The new Varley Nicore tuning coils; they are available as single, double, and triple-gang units.

NEW WRIGHT AND WEAIRE IRON-CORE TUNING COILS

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 Nucleon, 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 8s. 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. In future the set of three Ferrocart coils will be available, on base-plate, at 37s. 6d.

FOR STOP PRESS NEWS SEE PAGE 440!

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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

DIFFERENTIAL REACTION CONDENSER

"I am at present building a receiver in which a condenser is specified for reaction purposes and this is of the differential pattern. I must admit that I am not quite familiar with this component, but as only one set of plates is joined to the reaction winding, and the other set of plates is joined to earth, it seems to me that this latter could be dispensed with, and an ordinary reaction used instead. I have got one of the latter and should like to know whether it is essential to use the differential type."—(E. N. G., Wroxham.)

It is true that one set of fixed plates is joined to earth, but it is this connection which gives the value to the differential type of condenser. If you examine the circuit from the anode of the detector valve, you will see that when the reaction condenser is at zero there is no capacity from anode to earth. As the reaction is increased the capacity to earth is also increased. For efficient rectification some value of capacity must be joined from anode to earth, and this should remain more or less constant. The great advantage of the differential condenser is, therefore, that the capacity to earth always remains constant, as the moving vanes enter one set of plates in equal proportions to the amount they leave the other set of plates. If you do not wish to use this type of condenser you must fix a fixed condenser from anode to earth, but the smoothness of reaction will obviously not be quite the same.

LIGHTNING AND THE AERIAL

"I have a rather elderly lady living with me, and since I have erected an outside aerial, she has evidenced great anxiety upon the approach of the recent black thunder clouds. She is convinced that there is danger, and likens my aerial to an ordinary lightning arrester. After a week or so of her continual remarks I am beginning to experience some doubt myself, and should therefore be glad to receive your assurance that there is, in fact, little risk from the ordinary outdoor aerial."—(L. A. W., Leeds.)

The risks of an aerial being struck by lightning are very remote, and whilst it is true that cases do appear in the newspapers after every storm, there is no need to worry. In an area thickly covered with aerials, the good conductivity to earth of the numerous aerial-earth systems, will enable the electric charge in the air to leak away and thus offer a protection as lightning is prevented from taking place. In a case where a solitary aerial is erected in a high position, clear of trees, buildings, etc., there may be a risk of a particularly heavy charge being carried to earth via the receiver and so damaging it. The risk is so small, however, that it should be ignored and you should not worry. If a storm breaks over your district, it is, of course, in the interests of everyone, safer to earth the aerial until the storm has passed.

IMPROVING THE LOUDSPEAKER

"My loud-speaker is a commercial one of very recent make—in fact less than six months old. It was supposed to be perfect. After a few nights I decided to experiment, and found that by sticking pieces of paper at different spots round the cone I have improved the reproduction. Does this signify that the speaker was imperfect in the first place? I do not want to feel that I have bought a bad article in these hard times."—(T. V., Llandudno.)

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 resonances 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 bass. 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 look to your receiver before condemning a modern loudspeaker of reputable make.

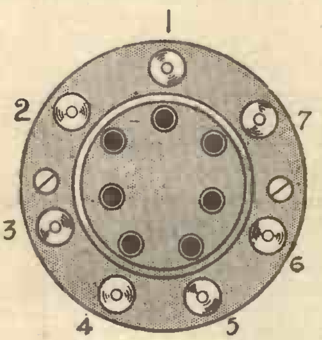
DATA SHEET No. 38.

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

SEVEN-PIN VALVEHOLDER CONNECTIONS

In view of the fact that the Double-Diode-Triode and the Double-Diode-Pentode valves have now appeared, it is thought desirable to state the connections which are required to the valve-holders for these valves. A table has already been given, but for the benefit of new readers, and to save referring back to this table it is now given again with the additions.

Type of Valve	Numbering on holder							Terminal on top of valve.
	1	2	3	4	5	6	7	
Class B .. .. (Battery heated)	G2	G1	A1	F	F	—	A2	—
Single Diode Tetrode (Indirectly heated)	—	G1	G2	H	H	C	D	A
Double Diode Triode (Indirectly Heated)	D1	—	D2	H	H	C	A	G
Double Diode Tetrode (Indirectly Heated)	D1	G1	D2	H	H	C	G2	A
Double Diode Pentode (Indirectly Heated)	D1	G1	D2	H	H	C	G2	A
L.F Pentode (Indirectly Heated) ..	—	G1	G2	H	H	C	A	—



The illustration is of the valve-holder.

THE NEUTRODYNE

"After using a simple detector receiver for the past few years I have decided to make up a set to bring in foreigners. Unfortunately I am limited in the cash I have to spare, and I have no S.G. valves in my collection. Can I use neutrodyne H.F. stages, or are they absolutely obsolete? Why has this form of H.F. fallen away in these days? I should like to have your remarks."—(R. S., Stockwell.)

The neutrodyne is quite an efficient arrangement, provided it can be accurately carried out. Unfortunately, it is restricted in range, and although a set could be built up, and accurately neutralised on say 250 metres, it is quite possible that at 600 metres it would be unstable. Switching from long to medium waves is therefore out of the question, and provided you are content to use the medium waveband only, you could build up a set of this type, but you will no doubt find that the set will be accurately neutralised at say the minimum wavelength and will have a slight reaction effect at the other end of the scale.

TWIN AERIALS

"I am trying to fit up two sets so that I can use the television transmissions. My difficulty is in getting sufficient signal strength for one of the transmissions. My mains home set is used for vision, and I have this joined to the aerial. I have built a three valve mains set for sound, but the Midland is so weak that I cannot hear it on an indoor aerial. I thought of fitting another outdoor aerial, but hesitate to erect it in case of interaction. Do you think it would work? If not, can you suggest how to get this station loud for the purpose?—(T. B., Hastings.)

It would be possible to erect another aerial, provided it did not run parallel with your present one, but there should be no need to do so. If your present receiver employs an aperiodic aerial coil, and the same form of tuning is used in the receiver you intend to use for the reception of sound, you may join the two sets to the single aerial. The sound set should be joined to the aerial lead-in in the ordinary way, but the earth terminal should be joined to the aerial terminal of the vision set, and the earth terminal of the latter joined to earth in the usual manner. An alternative method is to join the two aerial coils in parallel, or to join a single coil between aerial and earth, and to couple this to both of your receivers. If the receivers employ gang tuning, some readjustment will be necessary.

HOW LOUD?

"Several receivers have been published in your excellent paper during the past few months, and they all seemed to have a fairly hefty output valve. I only use a small set at the moment, but have been waiting until a design appears which I think will fulfil my requirements. I should like to know what you consider the maximum volume of which a home receiver should be capable. I notice that the Pentode valve delivers 2 watts. Is this the value that I should aim at? I am not keen on entertaining the neighbours, but I want pure music when I do eventually build up a set."—(W. H., Northampton.)

If you are keen on getting really high-class musical reproduction at a volume sufficient to prove entertaining in the average living room, you require an output of at least 5 watts. A two-watt output valve delivers a fairly good volume, but on the heavier musical passages, and for certain types of music it fails to deliver "body" and there is a certain amount of distortion unless the input is kept fairly low. A 5 watt output, however, operated so that the volume is at room strength will deliver really high quality, and provided the components used and the circuit which is chosen, are of the right sort, you will find that the quality will be practically as good as it is possible to obtain reproduction by radio.

FREE ADVICE BUREAU
COUPON

This coupon is available until June 17th, 1933, and must be attached to all letters containing queries.
PRACTICAL WIRELESS, 10/6/33.

Catalogues Received

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

BELLING-LEE TERMINALS

TWO small booklets are to hand from Belling-Lee, Ltd., one dealing with their well-known terminals and connectors and the other with the Belling-Lee "Unit" Pick-up. Full instructions for mounting and working this high-class component are given in the booklet, a copy of which can be obtained from the above firm at Cambridge Arterial Road, Enfield, Middlesex.

THE MORSE ALPHABET

LEARNING the Morse code is by no means easy by ordinary methods, but by using the "Ready" Method of Memorising Morse the whole alphabet can be memorised permanently in from five to ten minutes. The code signs are embodied in the actual formation of the ordinary letters in a striking manner, which enables the Morse signs to be easily visualised. Full particulars are printed on a thick card folder, which can be obtained for sixpence from the Agents, Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4.

FERRANTI CONSTRUCTOR'S CLASS 'B' FOUR RECEIVER.

AN addition to the already popular Ferranti home-constructor's charts has now been made and this time it takes the form of a neat Band Pass Four valver employing Class B in the output stage. This is the First Edition of the 1933 Model and gives every phase of the construction with fully dimensioned drawings. The circuit is of the usual Band Pass Aerial circuit with Screen Grid valve, grid leak detector transformer coupled to the driver valve, which is in turn coupled to the Class B valve. The total price of the receiver (without valves, H.T., L.T. and grid bias batteries or cabinet) is £11 10s. 0½d. Copies of the folder are obtainable from Messrs. Ferranti, Hollinwood, Lancs. Please forward a 1½d. stamp when writing to Messrs. Ferranti for this folder.

STOP PRESS NEWS!

AT the moment of going to press several new components and new devices have been brought to our notice, and in accordance with our policy of being first to introduce the latest components to our readers, we hasten to give advance notes regarding them. More detailed information will be given later.

SOUND SALES "ALL-VALVE" TRANSFORMER.

THE driver transformer for use with Class B valves requires a definite resistance in the secondary windings, and also must be matched with regard to the associated driver valve. At the moment the Cossor valve requires one ratio, whilst the Mullard and Mazda valves require different ratios. The problem of accurately matching a Class B valve depends, therefore, upon the component which is in use. When a valve is changed the transformer also would require changing. Messrs. Sound Sales have carefully studied this question, and from the characteristics of the available Class B valves have produced a driver transformer with a tapped primary which enables it to be used with any present (or future) Class B valve and at the same time gives the correct ratio and D.C. secondary resistance. The charge is 1/- more than the original model, namely, 10/-, and it will obviously find great popularity in view of its valuable use to the home-constructor.

NEW R.I. TRANSFORMER MOULDING.

THE original unshrouded L.F. components of Messrs. Radio Instruments will, in future, be housed in a neat bakelite casing, and we shall show an illustration of this new casing in next week's issue.

NEW R. AND A. CLASS B SPEAKER

THE Type B "Challenger" loud-speaker, manufactured by Messrs. Reproducers and Amplifiers, Ltd., is listed at the same price as the standard model, viz., 35s., and the transformer with which it is fitted has been wound for a plate to plate load of 15,000 ohms approximately, and is therefore suitable for all types of Class B valves now on the market. Since the "Challenger" was first reviewed by us considerable improvements have been effected in its construction, amongst which are: improved magnet forged of 15 per cent. cobalt steel with a flux density of 6,800 lines per square centimetre, patented dust excluding felt washer, improved cone suspension, whilst by an ingenious method of wool packing it is now practically impossible for metallic grit or dust to enter the speech coil gap. The "Challenger" is now obtainable in four different models of the permanent magnet class, all listed at 35s., viz.: (1) Standard Model, fitted with three-ratio transformer having tappings of 10, 33 and 52 to 1; (2) Model B, as detailed above; (3) Model Q, with a transformer specially wound for quiescent push-pull operation for valves with an approximate load of 15,000 ohms plate to plate; (4) Model P, specially designed for operation as an extension unit with commercial receivers which require a speech coil impedance of between 1.2 and 5.5 ohms.

RADIO CLUBS & SOCIETIES

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

SLADE RADIO

A lecture, entitled "Radio Frequency Rectification," was given by Mr. G. F. Clarke at the last meeting of this Society. Stating that he would deal with an old problem from a new point of view, he proceeded to describe radiation and efficiency. Passing on to sound waves and modulation, also conversion of H.F. modulated waves into audio frequency, he gave details of measurement of H.F. current. Various types of detectors, including the Westector, and their associated circuits were described, after which followed distortion and harmonics. After dealing with De-modulation and Miller effects, pentode detectors, reaction and couplings, the unusually interesting lecture was brought to a close. Anyone interested is invited to write to the Hon. Sec. for details of the Society. Address: 110, Hillaries Road, Gravelly Hill, Birmingham.

THE CATFORD AND DISTRICT RADIO SOCIETY

The Catford and District Radio and Television Society held their final meeting for the season on Thursday, May 25th, when the members of the Society had the pleasure of hearing how true radio reproduction can sound. The speaker, Mr. Marlow, first of all gave a historic survey of the development of loud-speakers and incidentally demonstrated some of the very early types. He said the present demand was for a small loud-speaker that gave good results under bad conditions. After this came the description of dual speakers. Various technicalities of these speakers were discussed which proved the interest that the members had in this subject. Dr. Bannounah, the Society's Treasurer, provided the radio set, gramophone, and records for the evening and this home-constructed outfit played a very important part in the success of the evening. The Society have had a very successful season and are now closing down until September when they hope to start again in real earnest. All interested are invited to write to the Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23, who will be pleased to send particulars of membership for the coming season.

INTERNATIONAL SHORT WAVE CLUB

On May 26th a very interesting talk on the "Atomic Theory and Ionisation" was given by Mr. A. W. George English. This was followed by a lecture on "Class B Amplification" given by Mr. R. Poliakoff. Members were greatly interested in this subject and also in a demonstrating receiver which incorporated "Class B Amplification."—A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16.

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

(*See page* 424)

One Polar Uniknob .0005 mfd. Condenser.
One pair Colvern Coils, Types K.T.F. and K.G.R.
One Graham Farish H.M.S. Choke.
One Wearite H.F.P.A. H.F. Choke.
One Igranic T.24.B. L.F. Transformer.
One Wearite T.21.A. Mains Transformer.
Thirteen Graham Farish Ohmite Resistances (one each 100, 300, 1,000, 2,000, 10,000, 20,000, 150,000 and two each 5,000, 50,000 and 500,000 ohms.)
One Graham Farish 2 megohm Grid Leak.
Three Dubilier .1 mfd. fixed condensers, Type B.B.
Three Dubilier 1 mfd. fixed Condensers, Type B.B.
Two Dubilier 2 mfd. fixed Condensers, Type B.B.
Two Dubilier 4 mfd. Electrolytic Condensers.
One Dubilier .002 Fixed Condenser, Type 670.
One Dubilier .001 Fixed Condenser, Type 670.
Two Dubilier .0005 Fixed Condensers, Type 670.
One Dubilier .04 Fixed Condenser, Type 9200.
Two Dubilier .01 Fixed Condensers, Type 670.
Two Clix 5-pin Chassis-mounting Valveholders.
One Clix 7-pin Chassis-mounting Valveholder.
One Clix 4-pin Chassis-mounting Valveholder.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B terminals Aerial, Earth, L.S. + and L.S. —.
One R. & A. Challenger Moving-coil Loud-speaker.
One Carrington Cabinet.
One Watmel .5 megohm Volume Control.
One Lissen Mains Smoothing Choke.
One Ferranti VPT.4 Valve.
One Ferranti H.4.D. Valve.
One Mazda A.C./Pen Valve.
One Mazda UU2 Valve.
One Sheet Konductite.
One Bulgin On-Off Toggle Switch, Type S.80.
Two coils Glazite, flex, bayonet plug, etc.
Aerial and Earth Equipment:—
Pressland Cop.
Tin of Filt.

ADVERTISEMENT INDEX

Broadcast Query Corner

1. Write *legibly*, in ink. Give your full name and address.
2. State type of receiver used, and whether transmission was heard on headphones or on loud-speaker.
3. State approximate wavelength or frequency to which receiver was tuned, or, alternatively, state *between* which two stations (of which you have the condenser readings) the transmission was picked up.
4. Give date and time when broadcast was heard. Do not forget to add whether *a.m.* or *p.m.*
5. Give details of programme received, and, if you can, some indication regarding the language, if heard.
6. State whether and what call was given and/or kind of interval signal (metronome, musical box bells, etc.) between items.

Replies to Broadcast Queries

G. L. WILLIAMS (Straits Settlements): Cannot trace from condenser readings; you do not say whether "80" represents metres or condenser dial readings; some estimate of wavelength should be given. We cannot trace a transmission of *Faust* in any European programme. C. O. G. (Sheffield): WIXAL, Boston (Mass.), on 25.45 m., relaying WEEI. MARK 2 (Canterbury): G5SN, N. W. Skinner, 296, London Road, Westcliff, Southend-on-Sea. DA DI DA (Port Glasgow): G6MN, E. R. Martin, Castlemount, Worksop, Notts.; G6NU, W. E. Nutton, 42, Richmond Road, Gillingham, Kent; G2IP, C. J. Reed, 184, Henleaze Road, Bristol, Somersetshire. G5GD, D. G. Sainsbury, Bishampton, Pershore, Worcestershire; G2DD and G6WU, regret, cannot trace; write to R.S.G.B., 53, Victoria Street, S.W.1. F8SY, Henri Brodin, 78, rue Gorge de Loup, Lyon 5e, (Rhone). PAOMU, G. J. Meijer, Koningstraat, 82, Apeldoorn, Holland; PAOOE, F. Bennik, Jr., Breelaan, 14, Bergen (Holland); PAOFB, J. Adama, Waalsdorperlaan, 42, The Hague; POAKB, K. J. Asselberg, Burgemeester Kerstenlaan, 8, Breda. PAOAM. G. H. van Vliet, Ridderstr. 40–A, Rotterdam.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Radio Pictures

P. W. Gift Stamp No. 37

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