MAKING L.F. TRANSFORMERS

Practical Wireless

9D EVERY MONTH

Editor F. J. CAMM

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Practical Wireless
and PRACTICAL TELEVISION
EVERY MONTH
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COMMENTS OF THE MONTH BY THE EDITOR

Government Speakers on the Air

WE do not think that anyone has a greater audience than Mr. Winston Churchill when he broadcasts, as we think all too infrequently. By his forthrightness and candour he carries the listener with him. He is frank and open; he tells us the good news and the bad news, and at the same time he is inspiring. Apart from his summary of the war situation, his fine rhetoric and command of choice English are sparkling and stimulating literary diapasons. Although Mr. Churchill is a politician all listeners eagerly look forward to his broadcasts.

We cannot pay this compliment to all political speakers who are given the freedom of the air. A recent example to which many of our readers have taken exception is the broadcast of Sir Stafford Cripps, whose views we are certain are quite sincere. But we pertinently ask whether the war is the right time to promote advanced political beliefs. We have first to win the war, and unless we win it all of these views for the halcyon Utopia, for which most of us hope, will be jejune and plantigrade, for Hitler will impose as he has done in Germany our political creed and germanify our life. No doubt Kingsway would be changed to Königstrasse. Had Sir Stafford Cripps confined his broadcast to an appeal to everyone to make further efforts no exception could be taken, for his experiences in Russia have given him first-hand knowledge of the forces arrayed against us. We strongly object to the advancement of political creeds during the war. It is not so many years ago since the views of Sir Stafford Cripps were unpalatable to his party. His sojourn in Russia and India does not, in our view, entitle him to presume that views which were unpalatable a few years ago may be more palatable now. Political creeds are not our concern. We are, however, closely concerned with the use of the ether as a form of entertainment and dissemination of news, not views.

We do not think that the B.B.C. should permit tendencious broadcasts, and we equally disagree with programme time being occupied by the views of university lecturers announced to the world as experts and economic advisers. The economic advice which they have given so far has been unsound. Germany, we were told in the early days of the war, would soon be short of oil and aluminium and steel. The advisers did not take into consideration the fact that Germany planned her war knowing full well the materials she required for it, and planned to conquer the the countries which supplied those materials. University lecturers live in a world of textbooks. They do not base their opinions upon the possibilities outside textbooks. It is misleading for such hypothetical views to be broadcast as inexorable facts, that we merely have to await the passage of a certain period of time for Germany to throw up the sponge, because they have run out of a particular commodity. It is, indeed, patent to all now that the economic advice given to the Government has been based on false premises. Events have not proved that any of the advice was based on accurate foundations.

During the war, therefore, it is our considered view that, apart from the Premier, who must be allowed to say what he likes, for he is in possession of all of the facts, other political speakers if they are allowed to broadcast at all should be made to confine their remarks to non-controversial and non-political subjects.

Slight Drop in Licences

IT is an astonishing thing that according to the Post-master-General's figures the number of radio licences held from 1937 shows a gradual increase up to 1939, but the more surprising fact is that whereas in 1939 the number of licences held was 8,947,570, in 1940 the number had only dropped to 8,904,177, and in 1941 to 8,625,579. This, in spite of the vast numbers who have left their homes and have joined the Services. Of course, when a man joins the Army he leaves his family behind, who still wish to operate a wireless receiver, but now that more and more women are being conscripted and are being "directed" to jobs outside their home town, the figures for the current year may show a steeper decline.

Our Free Advice Service

WILL readers bear in mind the fact that we make no charge for answering technical queries. While our advice is free, however, we do not expect to pay to give it, which is another way of saying that many readers are taking advantage of our Free Advice Bureau, and omitting to enclose the stamped and addressed envelope. Some, indeed, do not even enclose the query coupon from the current issue. In future, therefore, queries which are unaccompanied by a stamped and addressed envelope will be answered through the columns of this journal only, provided that the coupon from the current issue is enclosed. Letters which are not accompanied by a query coupon will be ignored. Our service is intended to apply to readers of the paper, and in these days of staff shortage it is even more necessary that attention should be confined to those readers. Letters which are accompanied by a stamped and addressed envelope without a coupon will remain in abeyance until the coupon is supplied.

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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.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

ROUND THE WORLD OF WIRELESS

Licence Figures

IN answer to a question in the House of Commons recently regarding the number of radio licences issued for each year from and including 1937 onwards, the Postmaster-General quoted the following figures: 1937, 8,480,822; 1938, 8,908,366; 1939, 8,947,570; 1940, 8,904,177; 1941, 8,625,579.

Utility Radio Sets Being Considered

IN Parliament recently Mr. Dalton, President of the Board of Trade, stated that some 125,000 wireless sets for the civilian population are in process of manufacture. He added that the most economical results would be achieved by completing these sets rather than embarking at this stage on the production of utility sets. This, however, was under consideration.

Television Relay System

AN extension o: the radio-relay system of television between cities, which is already working between New York and Philadelphia, is planned by executives of four American television companies. It is proposed to erect a station in Washington and to link it with Philadelphia.

U.S. Television

THE result of the conference of the United States Federal Communications Commission to decide the fate of television for the duration of the war is being anxiously awaited in America. Television is being used by the New York civil defence organisations for the purpose of training personnel.

Listening by Order

BY a decree recently published in Germany the personnel of public establishments must at once suspend all service to customers and remain silent during the transmission of German and Italian bulletins and special announcements.

Canadian Broadcast News Service

IN a recent address Major W. E. Gladstone Murray, General Manager of the Canadian Broadcasting Corporation, deplored the lack of a high-power short-wave station for the dissemination of Canadian news. In reviewing the growth of the Corporation, Major Murray said that it had increased its effective coverage from 48.8 per cent. of the population in 1936 to 90.5 per cent. in 1940. Coverage was poorest in the Cariboo Valley of British Columbia.

A.T.S. Girls Fitting Tank Radio

OWING to the shortage of wireless mechanics girls in the A.T.S. who show aptitude for the work, are receiving special training for radio work, and some have already begun work on fitting radio equipment in Valentine and Matilda tanks for the Middle East.

Croaking Radio

A KENT A.A. unit, when investigating interference in radio reception, found a frog in their portable set.

Sheila Borrett Back

SHEILA COX, who, as Sheila Borrett, was the first woman anno cer, has rejoined the B.B.C. announcing staff.

Tunnel Aerial

IT is reported that for some time American owners of car radio receivers have complained of signals fading out when the car is passing under bridges or is in a tunnel. Now a vehicular tunnel, near Pittsburgh, has been equipped with an "outside aerial," with a lead carried on insulators inside the whole length of the tunnel, and good reception is obtained.

Radio-Paris Wrecked

ACCORDING to a recent report from Vichy the pylons carrying the aerials of the Radio-Paris broadcasting station at Allouis, near Bourges, 130 miles south of Paris, have been blown up with dynamite, by saboteurs. One of the huge pylons, as it fell, destroyed part of the station buildings. Well known to listeners on the long waves before the present war, Radio-Paris was one of the most powerful transmitting stations in the world.

If B.B.C. Programmes are Cut

MR. DALTON, President of the Board of Trade, recently stated in a Parliamentary reply: "If the B.B.C. Home and Forces programmes were closed down at 10.30 p.m., and listeners then turned off their lighting and went to bed, 250,000 tons of coal might be saved during the winter months." Mr. Dalton is, of course, a theorist.

U.S. Broadcast Defence Programmes

A SERIES of programmes titled "Bombs Over Cincinnati?" has become a weekly feature broadcast from four of the five broadcasting stations in Cincinnati. Written, directed, produced and recorded through the facilities of station WLW, the programmes are sponsored by the Hamilton County Council for Civilian Defence in an effort to acquaint local citizens with the possibility of the community being subjected to a bombing raid.

A group of A.T.S. girls, being trained as wireless operators, are here seen receiving instruction in an open-air class.

Television Producer Joins R.A.A.F.

B.B.C. Television producer, Harry Pringle, an Australian, has joined the Royal Australian Air Force.

B.B.C. Mobile Recording Units

AUTHENTICITY is keynote of B.B.C. recordings, and future generations will have the advantage of hearing what actually happened on specific occasions. Touring extensively war-time Britain, B.B.C. has eleven "Mobile Recording Units." These camouflaged armour-plated cars contain gear for making gramophone records.

Calling British Forces in Malta

LISTENERS with relatives serving in Malta are asked to send their messages to the B.B.C. in the form of a lyric, to be sung to any well-known tune or popular air from grand opera to swing. This novel suggestion was made by an Army sergeant just returned from the fortress. Alick Hayes, who produces "Calling British Forces in Malta" every Sunday evening, has adopted it.

Sergeant Newmark, the soldier from Malta, launched the lyric programmes when he sent a message to his friends in "B" Company of a famous regiment now stationed in the island, to the tune of "Roll Out the Barrel."

Listeners are asked to address their lyrics to "Malta Lyric Messages, B.B.C., Broadcasting House, London, W.1." Nat Allen and his Backroom Boys will play the chosen airs.

Great favourites in the Malta programmes are Ronnie Shiner, that congenial cockney, and the "three-minute padre," who is always gonged when he overstays his time limit.

"Workers' Playtime" Programme

"WORKERS' PLAYTIME," the popular programme for war workers, started as an experiment by the B.B.C. for a few weeks last year, reached its first anniversary on May 30th when a special programme was broadcast from the London area.

It was John Watt's idea in May, 1941, that the B.B.C. should go to workers who could not come to B.B.C. studios to see and hear performances by famous artists. Three times a week for the past year the B.B.C. has taken companies of first-class artists to entertain the men and women in all parts of the kingdom producing the "tools of war" in Britain. These variety programmes have been broadcast to the world from modern stages in huge canteens of up-to-date factories, from rough huts on mountain sides and from almost every type of factory in Britain.

U.S. Broadcasts for Men in Services

SOLDIERS, sailors and marines of the United States Armed Forces, particularly those stationed in the Canal Zone, and at other places in the world within the reach of WLWO's Latin American beam, are having an opportunity to hear some of the finest entertainment ever broadcast by a United States radio station. Two programmes especially designed for U.S. military and naval men are "Command Performance" and the newly inaugurated "Baseball Interviews."

"Command Performance" brings entertainment to service men outside of the United States, and it is broadcast each Sunday evening at 9.15 p.m., featuring the greatest names in U.S. radio. Fred Allen, Robert Benchley, Kate Smith and Fred Waring were among the first microphone personalities to make their appearance on "Command Performance," and the producers eagerly await the wishes of the men of the U.S. Armed Forces so that their own favourites may be featured on coming programmes. WLWO broadcasts "Command Performance" on 9,590 kilocycles, 31.3 metres, and the time, as stated before, is 9.15 p.m. E.W.T.

Music While You Work

MANY North-Country brass bands, dance bands and orchestras, etc., are helping to increase war production. They make this contribution to the nation's war effort in the "Music While You Work" series, which is broadcast twice each day to war factories throughout the length and breadth of the land. In a recent "Music While You Work" programme—on May 11th—the band of the East Yorkshire Regiment, conducted by Patrick Purcell, gave a morning broadcast in the series.

Girl students at Wellesley College, Mass., U.S.A., are to have their own radio station, and our illustration shows Ruth Nagle, who will be in charge of drama.

Three Million Factory Listeners

NEARLY 5,000 factories throughout the country are now taking these twice-daily programmes, and more than 140 bands, etc., have contributed to "Music While You Work," since the series began in June, 1940. It is estimated that more than three million workers in factories hear the programme, but the total listening public is nearer 6,500,000. The importance attached by factory managements to these programmes, which are played to their workpeople, is indicated by the correspondence received by the B.B.C. One firm stated some time ago: "When, owing to a breakdown, no music was received, production dropped 13 per cent. When music was re-introduced, not only was normal production regained, but output increased by 5 per cent."

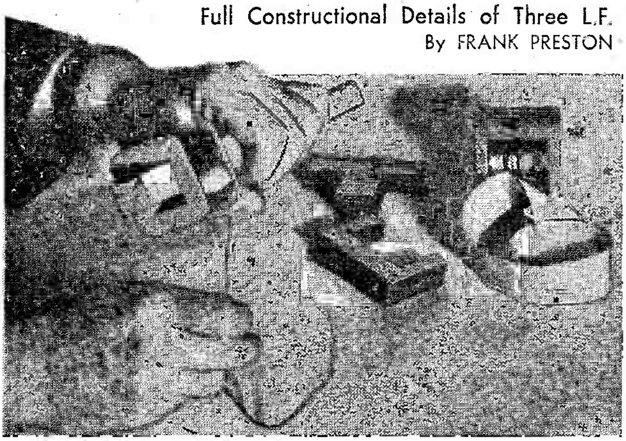
Fees for Music in Factories

ACCORDING to a recent report, the B.B.C. "Music While You Work" programmes, which are amplified by loudspeakers to war workers, have attracted the attention of the Performing Right Society, which collects fees for music composers for presentation of their works. A director of one firm to which the society applied for fees has written a letter to the Press in which he states: "It would be a brake on the national effort if manufacturers are penalised for alleviating monotonous hours at the work bench by diffusing music broadcast for the purpose. The society has already collected fees from the B.B.C." Mr. C. F. James, general manager of the Performing Right Society, has stated that the fees were equivalent to 1d. per employee per annum for one hour's music a day.

LOW-FREQUENCY TRANSFORMERS

Full Constructional Details of Three L.F. Transformers are Given in This Article

By FRANK PRESTON



A convenient holder for the winding spool is a square stick which fits tightly within the spool. In this illustration a length of rubber-covered flex has been soldered to the end of the wire, the joint being covered with insulating tape. In the rear at the right is a transformer wound on a sectioned spool.

AS most readers are aware, a low-frequency transformer is described according to the step-up ratio between the primary and secondary. In practice, it is the turns ratio which is used as an index of the step-up ratio. Thus, if there were 1,000 turns on the primary and 5,000 on the secondary, it would be stated that the transformer had a ratio of one to five.

Gauge of Wire

Although very fine wire could safely be used for the winding—in view of the extremely small amount of D.C. to be carried—it is usually far better for the constructor to avoid gauges finer than about 40 s.w.g. Wires of finer gauge are extremely thin and fragile, so that they are easily broken when winding. Besides this, the counting of turns becomes particularly tedious if a winder of some kind is not available. Some more-experienced constructors will probably use a lathe for winding, setting this to run at very low speed and, perhaps, fitting a counter on the headstock. This is by no means essential if we stick to cores of fairly large dimensions; if an attempt were made to use very small core stampings a larger number of turns would be required (the position is closely related to that which exists with regard to the number of turns per volt with power transformers) and they would be difficult to deal with.

Constructional Data

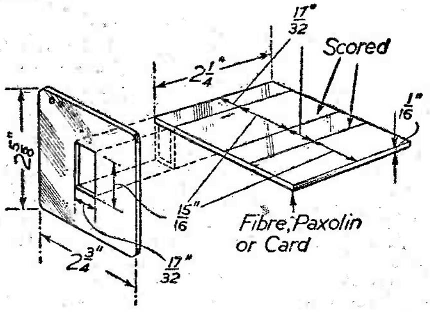
For most purposes a transformer with a nominal step-up ratio of about one to five is perfectly suitable. Using the gauge of wire and core size which will be suggested, a transformer wound to this ratio is suitable for use in a series-fed circuit in practically any type of set. The primary, wound with 38 s.w.g. enamelled wire, will easily carry up to 50 mA, which is, of course, far more than the anode current of a detector or intermediate L.F. valve.

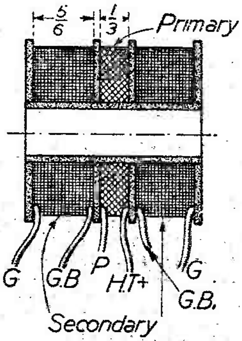
Using a core consisting of three dozen No. 4 Stalloy stampings an excellent transformer can be made by using a primary winding comprising 2,000 turns of 38-gauge enamelled wire, and a secondary consisting of 10,000 turns of 40-gauge enamelled wire. The winding spool could be made by following the details given in Fig. 1, the cross section of the core being $^{15}/_{16}$in. by approximately $^{17}/_{32}$in. Actually, it will be satisfactory to make the spool to fit a core slightly over ½in. thick, and then to fill it with stampings after winding.

It is customary when making transformers of this type to place the two windings one over the other, simply insulating the two—and also insulating between every few layers of each winding—with oiled silk, empire tape or waxed paper. The general idea is shown in Fig. 4, which represents a long section through the spool. First the end cheeks are drilled and fitted tightly, on the rectangular-sectioned tube, and then the bobbin is wound with insulating tape, empire tape or oiled silk. This smoothes over the sharp corners besides helping to give additional support to the end cheeks.

Insulation

The primary is then wound, a layer of insulation such as waxed paper being placed after approximately 1,000 turns. On completion of the full 2,000 turns, the end connecting lead of rubber-covered flex is soldered, the joint being covered with sealing wax or a slip of waxed paper, and the lead brought out either through a hole in a cheek or led up the inside of one of the cheeks. The primary must then be covered with at least one layer of insulation, the tape or oiled silk being allowed to bend up against the insides of the cheeks at the ends; this is to guard against any secondary turns slipping past it and, possibly, touching any primary turns.





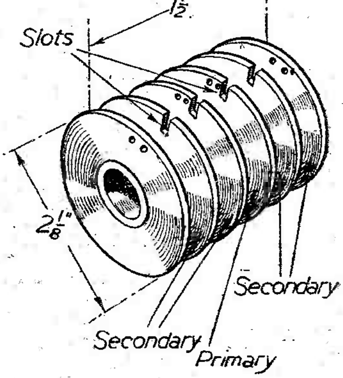
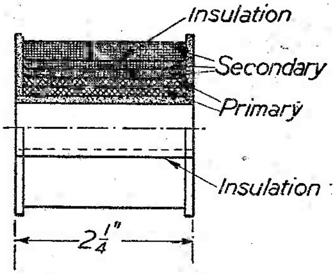


Fig. 1.—(Above) The dimensions and constructional details of a suitable bobbin. Fig. 2.—(Centre) Showing the location of the primary and secondary windings and connections for a push-pull circuit. Fig. 3.—(Right) A tubular bobbin suitable for small cores.



The insulating material between winding layers should be used as shown here.

A similar procedure is followed in winding the secondary, which is divided into three or four sections by means of layers of insulation. The end of the winding is finished as with the other transformers described, and the whole of the outside of the spool well covered with insulating tape.

Leads and Connections

Although not previously mentioned, it is clearly important that a note should be made of the four leads from the primary and secondary windings. One simple method is to use pieces of flex of different colours for the ends of the windings, another is to paint spots of colour on the flex connecting leads, and a third is to stick pieces of adhesive paper to the flex leads, marking these I.P., O.P., I.S. and O.S. to represent: inside primary, outside primary, inside secondary and outside secondary respectively. When connecting the transformer I.P. goes to the anode, O.P. to H.T.+, I.S. to earth or G.B., and O.S. to grid.

The method of fitting the core stampings and core clamps is precisely the same as for mains transformers.

More Compact

A somewhat more compact transformer, and one that is perhaps rather easier to make, can be built by using as core, about three dozen pairs of No. 5 Stalloy stampings. The cross section of the winding limb of these is $\frac{3}{4}$in. by rather more than $\frac{1}{2}$in., so it is convenient to use a tubular winding spool. This is shown in Fig. 3, and the inside diameter of the tube should be $^{13}/_{16}$in. For convenience, however, we should use any convenient paxolin, presspahn or cardboard tube with an inside diameter between $\frac{3}{4}$in. and about $\frac{7}{8}$in.; if the tube were on the small side it would be necessary to use fewer stampings; if it were a full $\frac{7}{8}$in. in diameter, we should have to use rather more than three dozen stampings or else pack the tube with a strip of cardboard to wedge the core tightly into the former.

It will be seen that six cheeks in all are fitted to the central tube. These should be $2\frac{1}{8}$in. in overall diameter, and must have a central hole of such a size that the cheeks will fit tightly on to the tube. There is a pair of small anchor holes in each of the two end cheeks, whilst small slots are cut or sawn in the others to permit of the wire being taken from one to the other.

This time the primary should consist of 3,000 turns 46 s.w.g. enamelled wire, this being placed in the central slot. For the secondary use 12,000 turns of 40 s.w.g. enamelled wire equally divided between the other slots; 3,000 turns in each, in other words. When winding it will be advisable to fill all except one winding section with string to prevent the cheeks from being displaced. Wind the primary first, dividing the total winding into about three parts with insulation. Then wind the secondary, starting from one end of the spool and winding all four remaining sections. The wire can be passed right across the top of the insulated primary from the second to the fourth section. The number of turns mentioned will give a ratio of one to four; a one-to-five ratio can be obtained by using 15,000 turns on the secondary, dividing these between the four sections.

This form of spool and method of winding have certain advantages over the method previously described. The principal advantage is that the secondary winding, being fairly well split up, has a lower self-capacity than when wound by the method first described. Insulation between primary and secondary is also inclined to be superior. There is the further advantage that it is always easier to wind a spool of circular section than one which is rectangular.

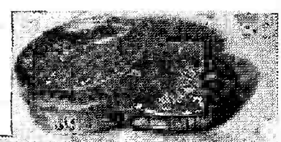
Push-pull Details

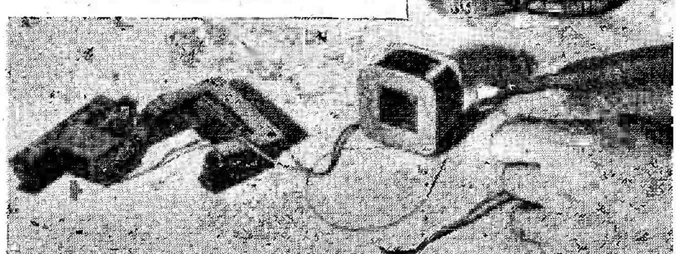
A push-pull transformer can be made by following the same general procedure as that already explained. The core should, for preference, consist of three dozen pairs of No. 4 Stalloy stampings, and the spool should be made of rectangular cross section to fit them. Four cheeks are required, these being the same size as shown on Fig. 1. Arrange the cheeks as shown in Fig. 2, and wind the primary in the centre section. This should consist of 2,000 turns of 38-gauge enamelled wire. For a one-to-five ratio transformer, the complete secondary should consist of 20,000 turns of 40-gauge enamelled wire. This is wound as two separate windings, each of 10,000 turns. The method of connecting the ends of the windings is shown in Fig. 2, where it is assumed that all windings are in the same direction, as they should be. In many cases the two G.B. leads from the secondary would be joined together to act as a centre tap, but it is frequently an advantage to employ separate connections for these, especially in a battery set.

Separate secondary windings have much in their favour, as they allow the individual valves in a push-pull output stage to have their grid-bias adjusted independently, thus ensuring equal anode current consumption and more accurate matching.

The winding details given above are intended for P.P. input transformers used in normal Class A circuits, i.e., where each valve is operating on a straight portion of its characteristic curve. For Class A-B, Class B or Q.P.P. it is essential to use transformers specifically designed for such circuits, as the turns ratio differs a great deal and the secondary windings have to possess certain characteristics to render them suitable for the power input requirements of the methods mentioned.

With unscreened L.F. transformers, a certain amount of care must be taken to prevent interaction in locating them with respect to other components. This applies in particular to mains-operated receivers or amplifiers, as, in addition to interaction between components, there is always present the possibility of wires carrying raw A.C. creating a field which would affect the L.F. transformer windings to the extent of introducing hum.





Soldering a length of flexible wire to the end of the winding. The joint thus formed must be covered with insulating material.

The Valve as a Rectifier

A.C. and D.C. : The Function of a Valve Rectifier : Half- and Full-wave Rectification

BEFORE one can consider using alternating current supplies for the purpose of providing the necessary high tension for a receiver or an amplifier, it is essential to arrange some means whereby the alternating current can be "rectified" so that a steady current, flowing in one direction only—*direct current*—is obtained.

The process is known as "rectification," and in this article it refers to alternating currents of low frequency—

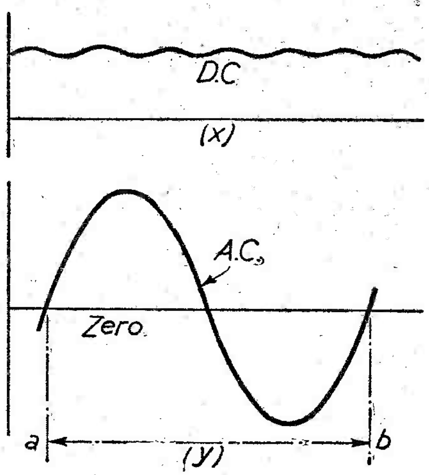


Fig. 1.—*Graphical representation of a D.C. and an A.C. supply.*

the standard frequency of commercial supplies in this country being 50 cycles per second—and not, as in the case of rectification or detection in a wireless receiver, to alternating currents of radio or high frequency.

When dealing with batteries or D.C. supplies, the potential can be considered to be steady, while the polarity is always constant, one side of the circuit being negative and the other side positive. With A.C., however, the state of affairs is very different, as the polarity alternates between a positive and negative maximum value.

It is possible to represent the difference between the two supplies graphically, and "x," Fig. 1, indicates the wave form of a direct current, while "y" shows that produced by an alternating supply, the change in polarity being clearly indicated. The distance between the two points "a" and "b" represents a complete cycle, during which the current passes from zero to positive maximum, back to zero and on to negative maximum, finally completing the cycle by returning to zero. This cycle is repeated very frequently, and it is the number of times per second that it takes place which determines the periodicity or frequency of the current.

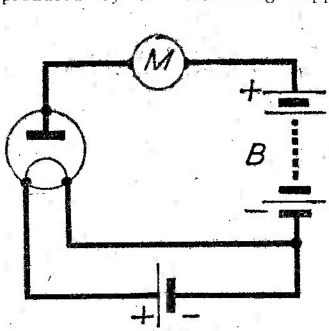


Fig. 2.—The basic circuit of a valv rectifier.

If the two curves are given a little consideration, it will be appreciated that to obtain the required results the alternating current has to be stopped from flowing in alternate directions, i.e., above and below the zero line; therefore, various methods have been devised to do this, but in this article we are only concerned with the thermionic valve as a rectifier.

The Valve Rectifier

The original thermionic valve (Fleming) employed two electrodes only (diode valve), a filament and an anode, as indicated in Fig. 2. For its operation it depended on the filament, when heated, emitting electrons which passed across the intervening space to the anode, providing the anode was maintained at a positive potential, with respect to the filament. The flow of electrons constitutes an electric current, and the milliammeter M will indicate its presence.

The rectifying valve of to-day is fundamentally the same, though, of course, vast improvements have been made as regards design, construction and efficiency.

The modern rectifying valve can be of the directly or indirectly heated type; it can be fitted with one or two anodes for half- or full-wave rectification, while larger electrodes are employed to allow the necessary output and life to be obtained.

The main considerations in design are the reduction of voltage drop across the valve, perfect insulation, and a filament which is capable of giving a generous emission without excessive loss of life. The placing of the anode in relation to the filament is very important, as this has a direct bearing on the voltage drop.

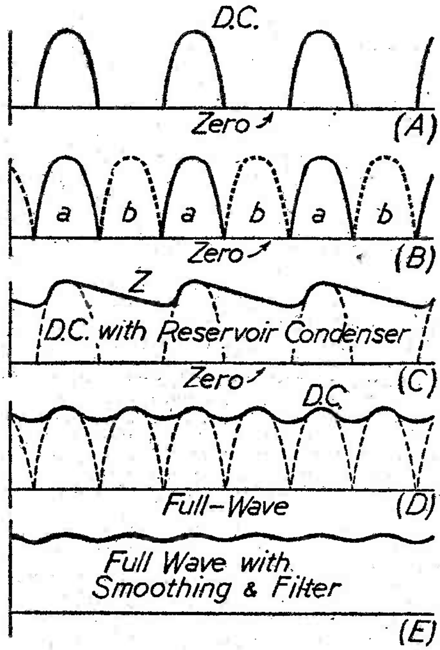


Fig. 3.—Shows, in a graphical manner, the effects of rectification of an A.C. supply, and the smoothing circuits.

Operation

Referring again to Fig. 2. If the battery "B" is replaced with a source of alternating current, it follows that the anode will be alternately positive and negative; therefore, in view of the previous remarks concerning the Fleming valve, it also follows that current will flow only during the positive half-cycle, i.e., when the anode is positive. During the negative half-cycle, no current flow will take place, so what really happens is: a *unidirectional* current is set up, *but* it is of a *pulsating* nature due to the time between successive positive half-waves.

This can best be understood by examining Fig. 3, in which curve "A" shows the wave form of the rectified output, and it will be appreciated—by comparison with "x," Fig. 1—that the D.C. thus produced is still far from perfect.

The system described deals with only half of the A.C. wave, it being the most simple method possible, and it is usually known as half-wave rectification.

Full-wave Rectification

If two half-wave rectifiers are connected as shown in Fig. 4 it will be possible to utilise the complete A.C. cycle and obtain a greatly improved output wave form.

The source of alternating current is obtained from the mains via the transformer "T," which can be so designed that the voltage output of the secondary windings is greater or less than the actual mains supply.

The secondary "S" is provided with a tapping at its dead electrical centre, and it is essential that the voltage across "s" and "s.l." is equal to twice the voltage required by the anode of each rectifier, thus giving between "c.t." and "s" and "c.t." and "s.l." a voltage equal to that required by each valve.

When the secondary is positive at "s," current will flow through the rectifier "R," but "R1" will be inoperative. As soon, however, as the polarity of the secondary changes, "s.l." will become positive and the current flow will be through rectifier "R1," while "R" will cease, as that end of the winding is then negative.

By adopting this method, and it is the one most widely used, both half-cycles of the A.C. wave are rectified, and the resultant output is considerably smoother or, in other words, the big gaps between the pulses "A," Fig. 3, have been filled in, as shown by "B" of the same diagram, by the rectification of the additional half-wave.

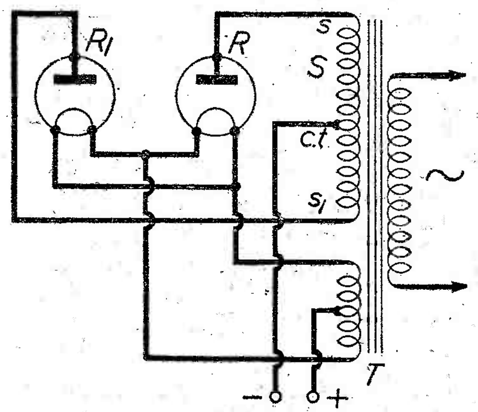


Fig. 4.—Method of using two half-wave rectifiers to obtain an improved output wave form.

It is not usual, for average amateur work, to use two separate half-wave rectifying valves to obtain full-wave rectification, as full-wave rectifying valves, containing two sets of electrodes within one bulb, are standard products of the various valve manufacturers.

Smoothing

It has been agreed that the outputs obtained so far are still far from perfect and quite unsuitable to feed the anodes of the valves in a receiver or an amplifier, therefore some smoothing arrangements must be employed.

For simplicity's sake, consider the half-wave output first. Quite a high degree of smoothing can be obtained by simply connecting a suitable fixed condenser across the output. In fact, such an arrangement also has a marked effect on the output voltage, tending to raise the value; therefore, although the capacity is not exactingly critical, it is advisable to follow the rectifier makers' specification. If the condenser has too high a value, damage can be caused to the rectifier by excessive charging currents, while, on the other hand, if the capacity is too small, the condenser will discharge its load too quickly or too much before it receives the next charge, thus producing a pronounced ripple.

If the curve "C," (Fig. 3) is examined, the general effect of the condenser can be seen. During the positive half-cycles the condenser receives a charge which is discharged, or partially so, during the following negative half-cycles, thus, as the curve shows, filling in, so to speak, the gaps between the pulses or peaks, the part "z" being condenser voltage.

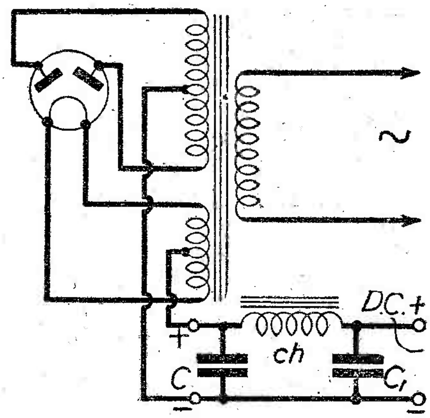


Fig. 5.—Full-wave valve rectifier circuit, complete with smoothing choke and condensers.

For the average amateur working voltages, a capacity of 4mfds. is quite satisfactory, but it will be found that half-wave rectification requires more smoothing than full-wave.

The unevenness of curve "C" is due, to a great extent, to the presence of "ripple" voltages superimposed on the direct current, and if such are allowed to remain it is highly probable that pronounced "hum" will be experienced, so a simple filter circuit has to be embodied to remove all traces of them. A good L.F. choke and another fixed condenser are all that is necessary, at least, in the majority of cases, and they are introduced into the circuit as shown in Fig. 5, which shows the complete full-wave rectifier arrangement.

With the output of the full-wave circuit, the condenser smoothing has an even greater effect than in the previous case, the resultant curve being shown as "D" (Fig. 3), where it will be seen that the output is no longer a series of heavy pulses, but a fairly steady supply.

The filter circuit is still, however, essential, and its effect can be seen by examining the curve "E" (Fig. 3), which represents a reasonably good D.C. supply.

The choke "Ch," Fig 5, should have an inductance of at least 20 to 25 henries when carrying the maximum current output of the rectifier concerned, while "C1" should be 4 mfd. to 6 mfd., and, for safety's sake, it is advisable to see that it is made for a "working" voltage of, say, 50 per cent. higher than the rectified output.

Economise on Power–2

Eliminating Unnecessary Valves. Modifying the Detector Stage. Using an Economiser Circuit

By L. O. SPARKS

HAVING completed the examination of the batteries and all external connections, consideration should be given to the circuit specification. For the purpose of illustrating the points to be dealt with, let us assume that the receiver incorporates four valves arranged in the following manner: One stage of H.F. amplification feeding a triode detector, the latter being resistance-capacity coupled to an L.F. valve, which passes on the signal to the output pentode by means of a low ratio L.F. transformer. A valve sequence of this nature would normally provide reasonable sensitivity and ample L.F. amplification—even when receiving a weak signal from a distant transmitter.

An average high-tension current consumption for circuits in this class would be in the region of 15 mA.s, but it is highly probable that many individual sets would register figures nearer, say, 18 to 20 mA.s. These would represent heavy loads on the usual dry H.T. battery, and, unless a super-capacity type was used, it would not —even in pre-war days—be a very economical proposition. Under present conditions such current consumption is likely to cause the set owner a certain amount of worry over upkeep and battery replacements; therefore, the most reasonable procedure to adopt is to take the steps necessary to reduce the current load on the battery and thus help conserve supplies.

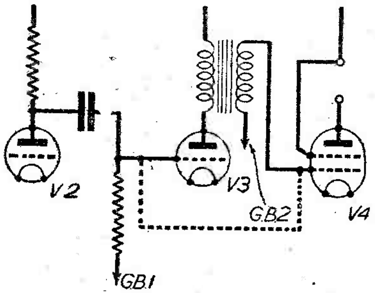


Fig. 1.— The slight alteration necessary to cut out the L.F. stage.

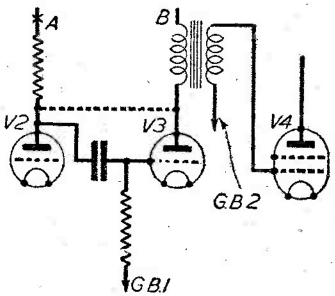


Fig. 2.— Using the L.F. transformer to couple V2-V4, to increase the gain.

Reducing Current Consumption

Current consumption can be reduced in many ways; before taking hasty, drastic measures—which, in the long run, might not achieve the desired results, plus satisfactory reception—it is best to analyse the complete circuit to determine which stage is doing the least work in proportion to its H.T. consumption. To take the circuit under consideration, it will be reasonable to say that the H.F. stage is taking $2\frac{1}{2}$ mA.s, the detector $1\frac{1}{2}$ mA.s, the L.F. 5 mA.s and the output pentode 10 mA.s, making a total of 19 mA.s. These figures show that the last two valves are the most extravagant; the output valve is essential—more about that later—but, can one say the same about the L.F. stage?

As mentioned last month, the output power can be reduced considerably without the listener appreciating any change, so it is safe to assume that the L.F. valve can go. This does not mean that components and wiring should be ripped out, in fact, it is quite unnecessary to adopt such drastic steps for any of the suggested modifications. The part of the circuit concerned is shown in Fig. 1, in which the broken lines indicate the new wiring required to cut out the L.F. valve marked V3. The connection from the secondary of the L.F. transformer to the grid of the pentode should be removed and the valve (V3) withdrawn from its holder. The output from V2 will then be fed into the pentode, and it will be necessary to adjust the value of G.B.1 to suit that valve; the connection G.B.2 can be removed from the G.B. battery as it is no longer required.

This slight alteration will have a very appreciable effect on the H.T. consumption; the loss in volume—so far as the British transmissions are concerned—is not likely to be sufficient to mar the entertainment value of the programmes. There are, of course, bound to be exceptions to this statement; certain localities are worse than others for general reception; therefore, it is up to individual listeners to apply the various ideas given in this article to determine which is most suited to their conditions.

An alternative to the above alteration, for those who wish to get slightly more power than the new three-valve circuit is capable of giving, is shown in Fig. 2. This allows the transformer to be used as the coupling between V2 and V4 in place of the resistance-capacity unit, thus providing an increase in amplification. Remove V3 as before; leave the transformer secondary connected to the grid of V4 and G.B.2 in the G.B. battery. Break the H.T. feed to the anode resistance of V2 at the point marked "A," and connect the anode terminals on the valve holders of V2 and V3 together. G.B.1 can be withdrawn from the G.B. battery. The transformer primary is now in the anode circuit of the detector (V2), so that electrode will receive a greater H.T. voltage than before, owing to the lower resistance of the primary compared with the anode resistor. This may upset the reaction operation, and it would be advisable to use a separate H.T. lead to point "B" so that the voltage can be adjusted to suit the detector stage, and, incidentally, allow the most economical value to be selected.

The H.F. Stage

In many districts an H.F. stage is not really necessary;

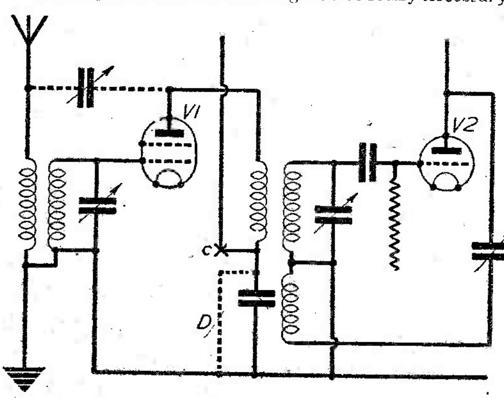


Fig. 3.— Cutting out the H.F. stage is a simple matter, if reference is made to this diagram and the text

a little attention to the aerial and the use of an aerial series condenser—variable for preference—will do a great deal towards improving signal strength and selectivity when the H.F. stage is removed. A simple test will show whether the H.F. valve is absolutely essential (bearing in mind economy of H.T. current) and the modifications are shown in Fig. 3.

If the H.F. coupling is of the transformer type, remove the H.F. valve (V1), and the H.T. lead to the primary at the point marked "C." Short-circuit the fixed condenser "D" to earth and connect the aerial to the connection, which is normally joined to the top of the H.F. valve, via a small variable condenser having a maximum value of, say, .0001 mfds. These alterations cut out the aerial tuned circuit and the H.F. valve, therefore, tuning will be flatter but this can be improved by the careful use of the aerial series condenser. If the H.F. coupling is "tuned-grid," as shown in Fig. 4, the following procedure should be adopted. Remove the valve, break the H.T. feed to the H.F. choke at the point "F," and connect the aerial to the side of the coupling condenser marked "E," making sure that the top-cap connection to the H.F. valve does not touch any earthed parts of the circuit. If selectivity is not good enough, replace the fixed coupling condenser by a variable one, as suggested for the first example.

These tests should be carried out over a reasonable period, as it is not fair to judge the results until one has got used to the modified circuit and results.

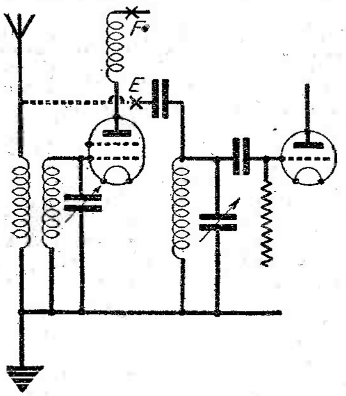


Fig. 4.—The alterations necessary for a "tuned-grid" H.F. stage.

The Detector Stage

Assuming that the H.F. valve can be cut out of circuit, it can be used in the detector position with advantage, especially in those districts requiring that little extra efficiency from the modified circuit. The use of an S.G. or H.F. pentode valve in the detector position results in a much greater amplification being obtained than when a normal triode is used. Selectivity is also better, therefore, when dispensing with the H.F. stage it is well worth while to make the slight modifications necessary to allow the valve to be used in the detector position.

If the valve is of the four-pin type, the wiring alterations are: Remove, from the anode terminal of the detector valveholder, all existing connections, and arrange them so that they can be taken—by means of a short length of flexible insulated wire—to the top cap of the S.G. valve when it is in its new position. To the now vacant terminal on the valveholder connect one side of a .1 mfd. fixed condenser and a length of flexible wire long enough to reach the H.T. battery. The other side of the fixed condenser is then connected to the negative filament terminal, as shown in Fig. 5. The free end of the flexible lead is inserted in the 24 or 36 volt socket of the H.T. battery, but tests should be made to determine the most efficient value, keeping it as low as possible consistent with good results. Should the H.F. valve be fitted with a seven-pin base, it will be necessary to replace the existing detector valveholder with one of the seven-pin type, and connect it as shown by the diagram on the right of Fig. 5. To avoid purchase, or if it is difficult to obtain a required part, the holder used in the H.F. stage could, of course, be utilised.

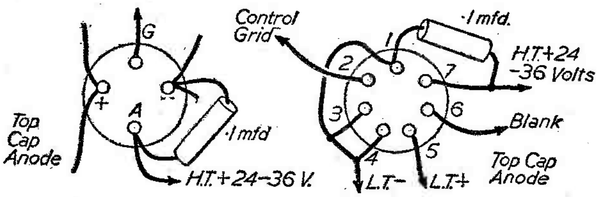


Fig. 5.—The valve-holder connections—plan view of holders—for an S.G. detector stage.

The Output Stage

So far, no mention has been made of the valve which has the heaviest current consumption, namely, the output pentode. The H.T. current consumption of the two-volt power and pentode valves normally obtainable varies over quite a wide range of values, and, some of those coming within the super class, can impose a heavy drain on an H.T. battery. The majority of single-valve output stages operate on what can be termed Class A conditions, which means that the *maximum* anode current is flowing the *whole time*—irrespective of the strength of signal being handled. This can be considered —in the light of current economy—as most unsatisfactory, especially when one thinks of the periods during which the valve is not doing any work, i.e., during silent parts of the programme, or when very soft passages are being received. By utilising Class B and Q.P.P. systems of operation, the anode current consumption varies with the strength of the signal being handled, and during idle moments the quiescent current value is only a *fraction* of the *maximum*.

It is possible to achieve results very similar to those mentioned above by incorporating a system developed by the makers of the Westinghouse Metal Rectifiers, which uses one of their type W.6 rectifiers. The recommended circuit is shown in Fig. 6, and the principle of operation is as follows.

A small portion of the L.F. output is tapped off and rectified, the D.C. voltage thus obtained being used to bias the output valve according to the power which it is

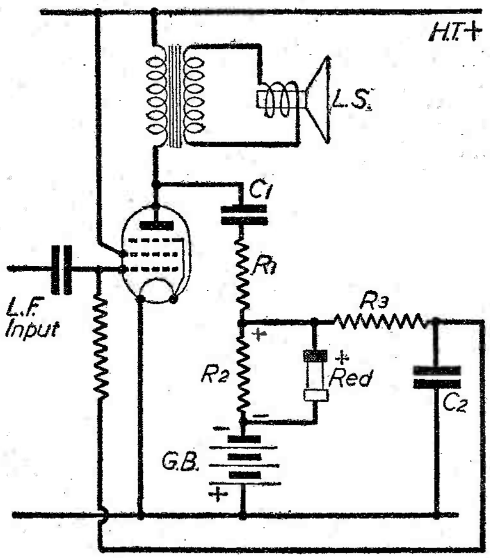


Fig. 6.—The economiser circuit recommended by the makers of the Westinghouse metal rectifiers.

called upon to handle. An important point to note is that no grid-current flows, therefore there is *no need* to use a *special* driver valve or L.F. transformer preceding the output stage.

The grid-bias must be increased above its usual value, to reduce the standing or quiescent current of the valve to quite a low value, this being in keeping with Class B and Q.P.P. operation.

When a signal reaches the grid, the rectifying action of the Westector allows a D.C. voltage to be built up across the resistor R2, the upper end being positive. As it is this point to which the grid-bias lead from the valve is taken, the bias actually applied to the valve will be the *resultant* of the voltage from the G.B. battery *and* the rectified voltage across R2.

The effect, therefore, is that when a powerful signal is applied to the grid, the high value of grid-bias from the G.B. battery is automatically *reduced* to a value sufficient to allow the signal at that instant to be handled without distortion. The system is most satisfactory, provided adequate precautions are taken to prevent the grid-bias value changing at low frequency, and thus ensure that no L.F. reaction is produced between the anode and grid circuits. In the circuit shown, the filter formed by the condenser C2 and the resistor R3 takes care of this by keeping the grid-bias at a frequency lower than the lowest low-frequency signal likely to be handled. By virtue of the complete action of this economiser circuit, the quiescent value of the anode current consumption is kept at a *very low figure*, and even when a signal is received by the valve the grid-bias adjusts itself, so to speak, so that the anode current is not allowed to rise *above that value necessary* for satisfactory reproduction. The overall effect is a considerable saving in current consumption and, likewise, the life of the battery.

The makers of the Westector have prepared a useful table showing relative operating data and values for R1 for the types of battery output valves most widely used, and part of it is reproduced below.

Valve	Battery Volts	R1 ohms	Quies. Current mA.	Peak Current mA.	Output mW.
Pen.220A ..	150	100,000	2.0	20	1,100
Pen.220A ..	120	100,000	1.3	16	700
220 P.T. ..	120	100,000	1.3	16	640
Pen.220, 220 HPT, P.T.2	150	150,000	1.6	10	500
P.220A, P.2	150	20,000	2.0	14	300
P.220, L.P.2, 220 P.A.	150	60,000	0.75	5.5	150

Formulæ and Their Applications–1

Formulae are Useless Unless They Can be Applied. Elementary Items are Important. Some Practical Examples.

It is becoming increasingly evident, more so than during any other period in the history of the amateur radio movement, that technical qualifications are essential, and that it is now no longer good enough for amateurs and, in particular, alleged radio service men who try to cover up their totally inadequate knowledge of the subject by the fraudulent use of the title radio engineer, to apply "hit-and-miss" and "rule-of-thumb" methods to a subject which so obviously calls for an intelligent understanding—if only elementary—of its principles.

So many of the thousands of radio enthusiasts, who have responded so splendidly to the appeals from the three Services for radio men, realised when they started their radio training that they did not know as much about their hobby or trade as they had assumed. Radio in the Services naturally calls for special training, but apart from the apparatus and equipment peculiar to Service needs, a recruit possessing a reasonably sound theoretical knowledge of radio has a distinct advantage over others, and is able to make more rapid progress with the training.

It is not intended to convey the impression that "technical qualifications" imply some predetermined fixed standard. The expression is too loose and has too great a field of application for it to be tied down to some rigid quantity of knowledge. The actual limits or requirements are governed by the class of work being considered; speaking in a general sense, one might classify the various spheres of radio activities under headings such as these: Those requiring pure theory; specialised theoretical knowledge; a sound knowledge of theory plus production experience, and, finally, a good understanding of the theory combined with extensive practical ability and a wide knowledge of commercial receivers and allied equipment.

In this article it is only natural that we are primarily concerned with the amateur constructor, the experimenter, and those who have in mind entering the radio industry, and, during the present time, one of the branches of the Service.

To cover these various sections, therefore, especially in an article for general application, it is only possible to touch on the elementary items, which, after all, form the foundation of the knowledge one hopes to acquire. If, as in all other matters, the foundation is shoddy or skimped, the whole structure will be shaky, and—in the case under consideration—the student will reach a point where he will regret his failure to appreciate the true value of those simple elementary rules, laws and formulæ which he passed over too quickly in his eagerness to reach the more advanced and, possibly, more interesting stages.

Ohm's Law

In view of the above, no apology is necessary for starting with one of the fundamental but elementary Laws connected with the relationship between Current, I, Voltage, E, and Resistance, R.

The Law states that $I=\frac{E}{R}$, but from this two other equations can be derived, namely, $R=\frac{E}{I}$ and $E=IR$. The units for these three equations—which apply only to *direct current*, are amperes for the current, volts for E and ohms for resistance, R.

Examples:

(1) An E.M.F. (voltage) of 500 volts is applied to a circuit having a resistance of 250 ohms. What current will flow in the circuit?

$$I=\frac{E}{R}=\frac{500}{250}=2 \text{ amps.}$$

(2) The current flowing in a circuit is 4 amps.; the applied E.M.F. is 1,000 volts. What is the resistance of the circuit?

$$R=\frac{E}{I}=\frac{1{,}000}{4}=250 \text{ ohms.}$$

(3) A resistance of 400 ohms is inserted in a circuit; the current measured is ½ amp. What is the applied E.M.F.?

$$E=I\times R=\tfrac{1}{2}\times 400=\frac{1}{2}\times\frac{400}{1}=\frac{400}{2}=200 \text{ volts.}$$

These simple examples can be cross-checked by using equations 1, 2 and 3 to each of them.

With radio work, one is usually more concerned with milliamps, i.e., a milliampere is one-thousandth of an ampere (1/1,000), therefore, when applying any of the above to circuits involving milliamps (mA.s) it is necessary to express the current as a fraction or, better still, decimal part of an ampere, or multiply or divide by 1,000, as shown below.

When current is expressed in mA.s:

$$I=\frac{E\times 1{,}000}{R};\quad R=\frac{E\times 1{,}000}{I};\quad E=\frac{I\times R}{1{,}000}$$

Typical Applications

What value bias resistor is required to provide 30 volts bias, if the anode current of the valve is 20 mA.s?

Solution.—Apply equation No. 2 with E representing the bias voltage required.

A resistor has to be inserted in series with the positive H.T. lead to reduce the voltage of 350 volts to 200 volts. The H.T. current flowing is 45 mA.s. Determine value of resistor.

Solution.—Apply No. 2 with E, representing the voltage to be dropped, i.e., 350 volts—200 volts.

An anode decoupling resistor is inserted in series with the load resistor of a resistance-capacity coupled valve. The anode current is 5 mA.s; the resistor has a value of 20,000 ohms. What voltage will be dropped across it?

Solution.—Apply equation No. 3.

The chief point to remember in any of the applications is what units are used for the current measurements, amperes or milliamperes.

Wattage

Electrical power (D.C.) is the product of the E.M.F and current, and can, therefore, be written:

(Watts) $W=I\times E$. The units being the same as for Ohm's Law. Now we have seen that $E=IR$, therefore, W also equals

$IR\times I$ or I^2R.

Now, $I=\frac{E}{R}$, and, likewise, $E=\frac{E}{R}\times R$

Therefore, W must also $=\frac{E}{R}\times\frac{E}{R}\times R$, or $\frac{E^2}{R^2}\times R$

$\therefore\ W=\frac{E^2}{R}$

These arrangements allow one to determine the wattage dissipated across a resistor when the current and resistor values are known, or if the voltage across a resistor and the current flowing through it are known. The last equation given will find application in such cases when the known values are those of the resistor and the applied voltage across it.

Occasions arise to determine the voltage and current in circuits about which only the wattage and resistance values are known. For these the equations

$E=\sqrt{WR}$ and $I=\sqrt{\frac{W}{R}}$ can be applied.

Examples.—A mains voltage dropping resistor in an A.C./D.C. set has a value of 650 ohms. The current flowing through it is 0.2 amps. What wattage will be dissipated?

Solution.—$W = I^2R = 0.2 \times 0.2\times 650=0.04\times 650=26$ watts.

An anode resistor produces a voltage drop of 50 volts when a current of 2.5 mA.s is flowing. What must be the wattage rating minimum of the resistor?

Solution. — $W = EI = 50 \times 0.0025=0.125$ watts.

If in the above question the resistor had a value of 20,000 ohms and still produced a voltage drop of 50 volts but the current value was unknown, how would the wattage be determined?

Solution.—Applying $W=\frac{E^2}{R}$ we get $W=\frac{50^2}{20{,}000}=\frac{2{,}500}{20{,}000}$

$=\frac{5}{40}=\frac{1}{8}=0.125$ watts.

If a circuit containing a load resistance of 10,000 ohms dissipates a wattage of 5 watts, what are the values of the current and voltage?

Solution.—Applying $E=\sqrt{WR}$ we get

$E=\sqrt{5\times 10{,}000}=\sqrt{50{,}000}=$(approximately) 224 volts.

$I=\sqrt{\frac{W}{R}}=\sqrt{\frac{5}{10{,}000}}=$(approximately) 0.0224 amps.$=22.4$ mA.s.

These figures can be cross-checked by applying $W=IE$ in which case we get: $.0224\times 224=5.0176$ watts, a value sufficiently accurate for an example of the application of the formula.

For those who might experience any difficulty with "squares" and "square roots," etc., the series, "A Refresher Course in Mathematics," by the Editor, will prove invaluable, as it deals with all such matters in a most explicit manner.

Series; Parallel and Series-parallel

Resistors connected in series: The resultant value is equal to the sum of the individual resistors.

$R=R1+R2+R3+R4$ . . . .

The same rule applies to *cells* (batteries) in series and *inductances* in series.

Resistors in parallel.—The resultant value is expressed thus: The *reciprocal* of the resultant value is equal to the sum of *reciprocals* of individual resistors.

$$\frac{1}{R}=\frac{1}{R1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}\ \ldots\ldots\ldots$$

The same rule applies to *inductances* in parallel, and *condensers* in *series*.

Cells in parallel.—The resultant value is that of one cell.

Condensers in parallel.—The resultant value is equal to the sum of the individual condensers.

$C=C1+C2+C3+C4$ . . . .

(To be continued)

The apparatus used for recording concerts, etc. for oversea troops. A new form of entertainment inaugurated by the R.A.O.C. band, and arranged through ENSA.

Mounting Extension Speakers

Some Practical and Pleasing Ideas for Improving the Appearance and Efficiency of External Loudspeakers

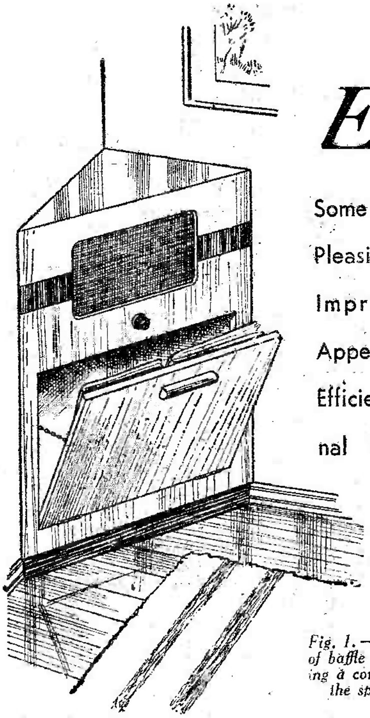


Fig. 1.—This cabinet type of baffle is ideal for utilising a corner in a room for the speaker location.

DURING the last year or so, the use of extension speakers has become increasingly popular, and we receive many queries concerning suitable wiring, output circuits and speakers. These items have been covered in a comprehensive manner by articles which have appeared in past issues, but there is one item which has not received a great deal of consideration, and it is hoped that this article will provide the information which experience and requests indicate is sorely needed.

Many constructors still devote a lot of time and labour to the wiring of the extension points; quite a number will go to a lot of trouble to devise some system of remote control or switching, but the majority appear to neglect—or, at least, give very little thought to—the actual location and mounting of the speaker. In many instances, a small square of 5-ply—unstained or polished—is used and, apart from the loss of a wide range of frequency response, the general idea is not to be encouraged, as it is bound to detract from the decorative scheme of the room in which it is used.

While admitting that it is not now so easy to obtain all that one might wish for to complete extension speaker installations, the illustrations show that it is not a difficult or expensive matter to construct simple arrangements which will improve the efficiency and appearance of the unit, without using materials of which the supply is restricted.

Plaque Types

Where space or the lack of a suitable cabinet enforces the use of a plain baffle-board, the ideas depicted by Fig. 2 can be utilised to good advantage. Instead of adhering to the usual square shape, much can be done to reduce the apparent size of the board by cutting it to an octagonal, hexagonal or even circular shape. It will be found that this procedure makes the appearance of the baffle more pleasing to the eye and, therefore, allows one to use a much larger baffle area without it appearing too bulky. Plywood is scarce; it is possible that odd pieces of timber might have to be used to make up the required size. It may happen that the surface of the material is not suitable for staining or polishing, in fact, its condition might be such that in normal times one would not think of using it. The suggested designs shown in Fig. 2 take these items into account, and it will be seen how, by the use of a small amount of ordinary hessian fabric, it is possible to transform a very ordinary piece of board into an article which, while serving its original purpose, possesses a pleasing finish which will harmonise with the general furnishing and decorative scheme of the room.

The hessian can be obtained in various colours, and the beading and cross-bars can be stained or enamelled in tints to suit individual tastes and colour schemes. The design shown is but one of many which can be employed, and if a little time is spent drawing out ideas to link up with the shape of baffle-board selected, it is surprising what pleasing results can be obtained and what a refreshing change they will make to the old orthodox square-shaped stained board.

The small rubber buffers are worthy of note. They not only protect the wall covering, but prevent the possibility of chatter between the edge of the board and the wall.

Fire-screen Types

The design shown in Fig. 3 is, basically, the same as Fig. 2 as regards materials used, but it is of larger proportions and fitted with feet to allow it to stand on the hearth of a fireplace. If a little care is taken with the making and assembly of the simple woodwork and with the selection of the colour scheme, a very useful piece of furniture—serving the dual purpose of speaker-baffle and fire-screen—will be obtained. The fact that it will normally rest on the hearth allows a generous baffle area to be used, and if stout board, or five-ply with neat bracers fitted to the back, is used, the tonal response from the speaker will be most satisfactory. The use of bracers or stiffening pieces is usually

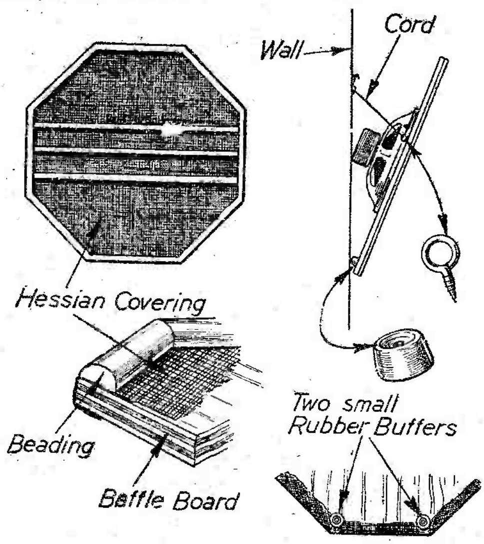


Fig. 2.—Where space is limited, the plaque type of baffle will prove most useful. This is but one of many suitable designs.

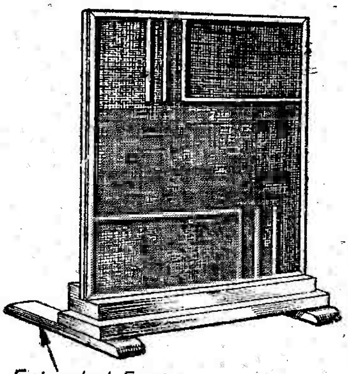


Fig. 3.—A suggested design for a fire-screen baffle. An idea having much to recommend it.

desirable with large areas of five-ply, to reduce the possibility of unwanted resonances.

Flush Speaker Mounting

The effect of a cut-out circular opening and an ornamental fret is often spoiled by the exposed cut edges becoming coated with dust. It is not an easy matter to keep these clean—even by using a small brush—as there is always the risk of damaging the material backing the fret. The method shown in Fig. 4 is one which is now widely adopted by many set manufacturers; it not only eliminates exposed edges, but it also provides a very fine flush or smooth finish to the front of the cabinet. It involves a little extra work, but the resultant effect compensates for that, therefore, in general, it has much to recommend it.

The circular hole should be at least 2ins. greater in diameter than the normal speaker opening. A ring has then to be cut out of wood, preferably five-ply, its inner opening being that required for the speaker, and its outer diameter being equivalent to the circular opening cut in the baffle board. The method of mounting the speaker and fixing the silk is apparent from the diagram, the only word of warning necessary being—keep the silk or fabric taut and free from wrinkles. The inset shows how a baffle can be housed in a set of shelves, such as those often found in the corner of a room.

Corner Cabinets

In many rooms, especially where space is a consideration, good effects can be obtained by housing the speaker in a simple cabinet, as shown in Fig. 1. As it is purely an extension point, and as no set has to be concealed, the bottom half of the cabinet can be utilised in many ways according to the requirements and ingenuity of the constructor.

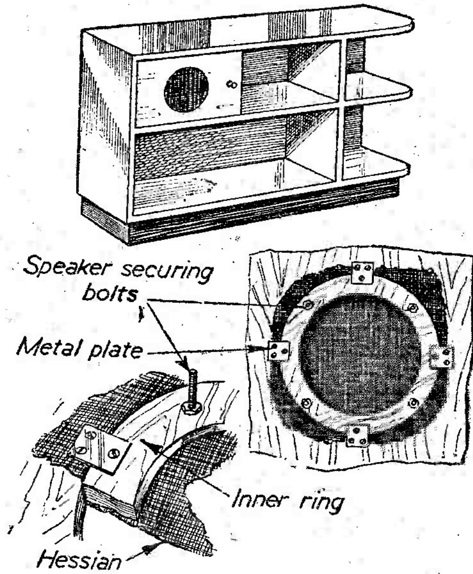


Fig. 4.—A neat and effective way of housing the speaker in a set of shelves—the flush mounting method adding greatly to the finish and appearance.

B.B.C. HANDBOOK FOR 1942

"THIS is the British Broadcasting Corporation."

Not only in this country, but throughout the world, these words, broadcast every quarter of an hour just before Big Ben in the Overseas Services, are the signal for action, says the "B.B.C. Handbook, 1942," which is now on sale. News and programme services from Britain are re-broadcast over five continents, and in a hundred distant control rooms, in New Zealand, or New York, Barbados or Fiji, operators wait for this network cue to switch over for the next programme. Within 20 seconds their transmitters are connected and another link has been forged in a world-wide chain of understanding and co-operation.

This extension of re-broadcasting is part of the 1941 development which the handbook reviews in detail. Many illustrations are given of outstanding broadcasting events, as well as information on all B.B.C. services.

Fresh impetus was given during 1941 to British broadcasting by a substantial increase in transmitter strength to existing services to Europe, to the Empire, to North and South America and to the Near East, thus enabling the B.B.C. to carry the voice of Britain to new listeners throughout the world. At the beginning of 1941 the Corporation was broadcasting in 32 Empire and foreign languages for 145 hours a week, but when the year ended this had increased to 40 languages with a weekly total of 231 broadcasting hours, and there has since been a further marked increase.

Programmes in English to the Empire and United States were broadcast for 21 hours a day; programmes to Central and Western Europe and the Central Mediterranean for 20 hours a day, and to the Near East and special Empire countries throughout the day, while South America was served for five hours a day and Spain, Portugal, the Balkans and Scandinavia for 19 hours.

The handbook reviews B.B.C. efforts in the field of political warfare, emphasising the use of radio as a weapon in the Near East where, in co-operation with diplomacy and the armed Forces, positive results were achieved in three cases last year.

Feature programmes were again proved to be the "striking force" of radio. A recurring theme in such programmes was the story of the resistance of the oppressed peoples of Europe. Epics of the sea and air like the *San Demetrio* and the "Battle of Britain" continued to reflect the spirit of Britons, while other features provided occasions for distraction from the war.

Sections of the handbook are devoted to Variety—the problem being to cater for listeners at home and for large numbers of men and women in the Services—and to Talks, Sunday Postscripts, Outside Broadcasting, Recorded Programmes and Group Listening. The handbook includes articles on Broadcasting by E. A. Harding, Director of Staff Training; Re-broadcasting and Exchange Broadcasting by Maurice Gorham, Director of the B.B.C.'s North American Service, and War-time Studies by Dr. F. W. Alexander, Head of the Programme Engineering Department.

The price of the "B.B.C. Handbook, 1942," is 2s. 6d. (2s. 10d. post free), and it may be obtained from the B.B.C. Publications Department, The Grammar School, Scarle Road, Wembley, Middlesex, or from any bookstall.

Radio Examination Papers—8

Another Series of "Test Yourself" Questions, With Answers Written by The Experimenters

1.—Permeability Tuning

THIS system depends upon a method of altering the resonant frequency of a tuning coil by variation of its effective inductance. It is known that the inductance of any air-core coil is increased if a ferrous core be inserted into it. It is also known that the inductance can be varied by so arranging the ferrous core that it may be moved into or out of the coil; this is done with certain chokes used for controlling equipment fed from A.C. The control corresponds to that provided by a variable resistance in a D.C. circuit.

The insertion of the iron into the core of the coil has the effect of reducing the "resistance to magnetism," or of increasing the permeability of the magnetic circuit. A method such as that described above is perfectly suitable when dealing with A.C. at frequencies up to 100 cycles or so, but it is totally unsuitable when the frequencies concerned are in the region of kilocycles or even megacycles. This is because a solid core of iron or iron alloy introduces serious losses due to the circulation of eddy currents in the metal. It should be explained that these eddy currents are circulating currents which only have the result of causing the development of heat; and if heat is developed power is required to provide it; this power is taken from the H.F. current passing through the winding.

For high-frequency tuning purposes, therefore, a different system must be used. This consists of making a core consisting of extremely small particles of iron or iron alloy, these being insulated one from another. The iron is mixed with a plastic compound, the whole being pressed or shaped under heat so that a solid block results.

A core made from this material is then arranged to slide into and out of an ordinary inductance coil. The inductance increases as the core is moved into the coil; and as the self-capacity remains practically unchanged the resonant frequency is reduced, in the same way as it would be if additional turns were put on the coil. Thus, the resonant frequency (or tuning) can be varied by movement of the core. One method of providing adjustment for the core is illustrated in Fig. 1.

SPECIMEN QUESTIONS

1.—*Explain the principles of permeability tuning.*
2.—*How can an A.C./D.C. receiver designed for 110-volt working be operated from a 220-volt mains supply?*
3.—*What advantages does variable-mu show over other methods of H.F. volume control?*
4.—*Draw a diagram to illustrate how decoupling is applied to the anode circuit of a battery-type detector valve. Explain briefly the action of the decoupling components.*
5.—*What are the chief differences between class B and Q.P.P. amplification?*
6.—*It is required to make a power transformer for operation from 230-volt, 50-cycle mains. If the Stalloy core stampings to be used provide a cross-sectional area of 1 sq. in. and if the number used is sufficient for a 100-watt transformer, find the number of turns required for: the primary; an H.T. secondary to give 250-0-250 volts, 100 mA; an L.T. secondary to give 6.3 volts, 3 amp.*

2.—Voltage Dropping

The simplest method of operating a 110-volt universal receiver from 220-volt mains is by inserting in one of the mains leads a 110-volt light bulb. Since the bulb must dissipate the same amount of power as does the set it would be necessary to know the power consumption of the set. This is generally indicated on sets of this type, and for "midget" receivers is normally about 30 watts. A bulb rated at 110 volts, 30 watts would thus meet the requirements. The method of connection is shown in Fig. 2.

If the power consumption of the set was not known, the current consumption would probably be stated. From this it would be an easy matter to find the resistance of the set, and therefore the additional resistance required to "break down" the supply voltage. From a knowledge of this resistance it would not be difficult to find a light bulb of suitable resistance —and it need not be of the 110-volt type, but of any other voltage rating provided that the resistance was correct. The resistance of any lamp bulb can be found quite easily by applying Ohm's Law. It is known that wattage is equal to I^2R (current, in amps., squared, times resistance) and that the current passed, in amps., is equal to the wattage divided by the voltage. Thus, a 60-watt, 220-volt bulb would pass .27 amp. Its resistance could be found from the formula already given or, more easily in this case, by dividing the voltage by the current; the answer is 806 ohms. Two such lamps in parallel would have a resistance of 403 ohms, which

(Continued on page 344)

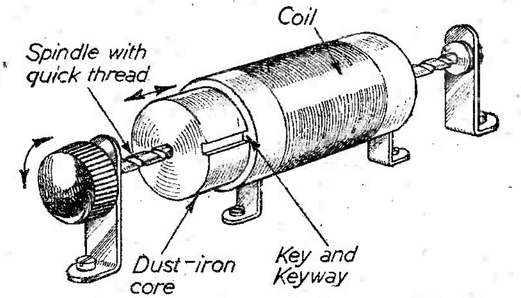


Fig. 1.—A possible form of construction for a permeability tuner. By turning the tuning knob the dust-iron core may be moved into or out of the coil, on the quick-thread spindle.

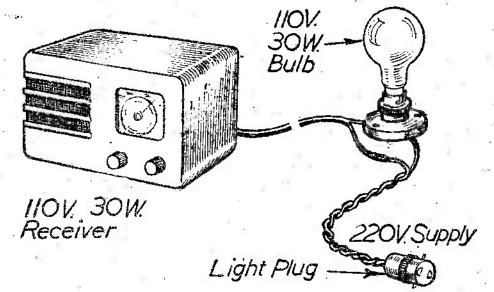


Fig. 2.—A method of operating a 110-volt, 30-watt "midget" receiver from 220-volt mains. Two 220-volt, 60-watt bulbs in parallel could be used in place of that shown.

is approximately correct for many of the 110-volt "midget" A.C./D.C. receivers.

When the set is to be operated from A.C. mains the best method would be to use a 2 : 1 step-down transformer, if one were available, with sufficient current output. Another method would be to employ an auto-transformer, which consists of a single winding having a tapping; in the present case a centre-tapping. It would be connected as shown in Fig. 3.

3.—Variable-mu Volume Control

One advantage which variable-mu control possesses is that increased selectivity is obtained as the volume is "turned down" by increasing the applied grid bias. This advantage is also shown, however, by controlling the screening grid voltage, although the gain in selectivity in this case is not quite so pronounced.

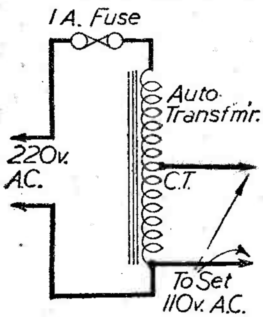


Fig. 3.—A convenient way of "breaking down" or stepping down an A.C. mains voltage.

Another great benefit is the use of variable-mu control which practically eliminates cross-modulation. This is a form of interference caused by a strong signal modulating a weaker signal to which the receiver is tuned. The strong signal may be sufficiently separated in frequency from the other to avoid adjacent-channel interference, but may act in the same manner as the oscillation produced by the H.F. oscillator of a superhet mixer stage. And if the H.F. valve were to act as a first detector a somewhat peculiar "intermediate frequency" would be produced. By increasing the bias to a variable-mu H.F. stage the valve is prevented from acting as a first detector and therefore the cross-modulation cannot occur.

4.—Decoupling

Fig. 4 shows the circuit of a detector valve with anode-circuit decoupling; the decoupling components are shown in heavy line. It will be seen that the decoupling resistor is connected between the anode load (transformer primary in this case) and H.T.+, and that the condenser is wired between the "transformer" end of the resistor and the earth line.

If these components were not incorporated there would be a danger of the audio-frequency output from the detector valve being developed across the H.T. supply, especially if this had a fairly high internal resistance. The result of that would be that the supply to the other valves would, in effect, be modulated by this audio-frequency voltage. That would give rise to distortion and that form of L.F. oscillation which is normally described as motor-boating, because the noise is similar to that made by the exhaust of a motor-boat engine: the "pop-pop-pop-pop" sound.

The effect of the decoupling resistance is to act as a "stopper" to the A.F. current, while the condenser provides a relatively easy path to earth; the reactance of a 2-mfd. fixed condenser at 1,000 cycles is only about 80 ohms. It is evident, therefore, that the condenser provides a much easier path than does the resistance, which normally has a value in the region of 25,000 ohms.

5.—Class B and Q.P.P.

Both of these forms of L.F. amplification can actually be described as class B, but whereas grid current is allowed to flow in the case of class B, it is definitely prevented from flowing in the case of Q.P.P.

Class B is a power-driven amplifier and must be fed from a driver valve, which is of the small-power type; this is to supply the current which passes to the grids of the double triode through the secondary of the class B push-pull transformer. Class B valves are usually operated without grid bias, although some types are so designed that they require a low bias—in the nature of 1.5 volts.

A Q.P.P. amplifier, which has two pentodes in push-pull, or a double-pentode with the two halves in push-pull, is a voltage amplifier. The two grids are heavily biased so that the pentodes pass little or no anode current until signal voltages are applied to them. But on the positive half-cycles of the signal the standing bias is counteracted by the positive signal voltage and anode current rises. The current passed on the application of a signal is proportional to the amplitude of the signal voltage.

In both systems the anode current passed by the valves (or the two halves of the double valve) is proportional to the applied signal voltage. If, therefore, the volume control is turned down the current consumption is reduced. The average anode current is quite small in relation to the output, since it falls when the modulation ceases, and also on quieter passages of music or speech.

6.—Transformer Design

On 50 cycles, and with Stalloy core stampings which provide a cross-sectional area of 1 sq. in., it is correct to allow 8 turns per volt for primary and all secondaries.

It will be seen that the total output from the required transformer is only about 70 watts, and therefore that the stampings specified will have an ample volume for this power, even if allowance is made for the losses between primary and secondary. If the transformer efficiency were 80 per cent. (an average figure) the total input would be under 80 watts.

Working on the figures given above it will be seen that 8 times 230, or 1,840 turns would be needed for the primary. For the H.T. secondary it would be necessary to wind 8 times 500, or 4,000 turns; there would be a centre tap at 2,000 turns.

For the L.T. secondary the correct number of turns would be 8 times 6.3, or about 50½ turns. Since the heater voltage required by 6.3-volt valves is not critical, it would be quite in order to wind either 50 or 51 turns.

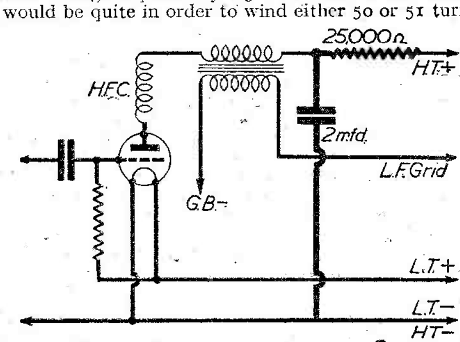
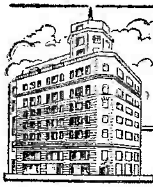


Fig. 4.—The decoupling condenser and resistance for the anode circuit of a detector valve are shown in heavy lines in this diagram.

To find the gauge of wire required for the secondaries it would be necessary to look up wire tables to see what gauges would carry the necessary current, at a current density of not more than 1,500 amps. per sq. in. The same method would be applied to the primary, after finding the current to be carried. This would be found by dividing the input wattage (say 80) by 230; it would be sufficiently accurate to give this as .25 amp.



ON YOUR WAVELENGTH

By THERMION

Brains Trust to be Rested

THE B.B.C. has announced that it will shortly "rest" the Brains Trust, and it is unlikely that Mr. Joad will be a member of it if, and when, it resumes. It has, I suppose, been one of the most publicised B.B.C. features in recent years, although why it should have been given the title of Brains Trust I do not know. I expatiated on the question of what is, and what is not brains, some months ago. I do not know whether my disquisition prompted the recent question on the same subject which the Brains Trust endeavoured to answer, and as modesty has always been one of my strong points I must not say that I still think that my definition is better than theirs! And now I have said it, much as the man who says "needless to say" always says what is needless to say. However, I reassert my opinion that if there is to be a Brains Trust so-called, its members should be changed from week to week, in the same way as the manager of a variety theatre changes its bill every week.

For (let us be frank about it), the Brains Trust is not really a Brains Trust. It does not answer real questions. The only questions it endeavours to answer are those in which the answerer can never be proved right or wrong. I, for one, refuse to acknowledge that the only people who can answer any questions set before them are the B.B. Rains Trust. Torrents of abuse upon me! However, whether the B.B.C. has reached the same conclusion as myself and many of my readers, or whether it feels that the members of the Brains Trust need a period of respite if their replies are not to degenerate into mere adumbrations, we shall never know.

Here is a comment by Timothy Shy from the *News Chronicle*:

To a reader who, devoured by obscene curiosity, asks us what we "really think" of the Brains Trust, we will relate a moral story concerning the great Jowett, Master of Balliol. A contemporary Brains Trust ace came up to Jowett once, giggling and smirking and devoured by the usual insane vanity, and said: "And what, Master, do you in Oxford think of us?" To which the great Jowett replied, after blowing his nose: "We do not think of you at all."

Our Roll of Merit

Readers on Active Service—Twenty-fourth List.

N. J. Wright (Bombdr., R.A.), Sandgate.
M. F. Blair (A.C.2, R.A.F.), Rochester.
J. G. Taylor (R.A.F.), Heacham.
D. W. Hewson (O/T R.N.), Skegness.
N. M. Trimmer (Corpl.), Farnborough.
A. G. Groves (Pte., R.A.O.C.), Loughton.
W. Lee (A.C.2, R.A.F.), Scotland.
J. H. T. Bragg (A.C.1, R.A.F.), Nottingham.
D. Stott (A.B., R.N.), Dartford.
W. Adams (A.C.1, R.A.F.), Aberdeenshire.
R. Pitt (Sgt., R.A.F.), Kidbrook.
G. Sole (Pte., R.A.S.C.).
F. C. Trew (A.C.1, R.A.F.), West Hartlepool.
D. H. Seaden (A.C., R.A.F.), Nth. Wales.
A. G. Tester (F/Sgt., R.A.F.), Bedfordshire.
W. G. Sansom (A.C.1, R.A.F.), Herts.
H. Pryce (Corpl., Field Ambulance), Louth.
D. Wood (R.A.F.), Ipswich.
D. R. Lovell (L.A.C., R.A.F.), Wimborne.
R. Speck (A.C.1, R.A.F.), Glasgow.

Great Minds Think Alike

AND now I must recount a dream. It was the post-war period, and the B.B.C. were in solemn conclave like politicians and industrialists on the new Post-war Order. The representative of the cryners stated that he wanted half the programme time, whilst the representative of the hot air merchants claimed the whole of the programme time in view of the vast sacrifices he had made during the war. His salary had been reduced from £19,643 4s. 9½d. to £19,543 4s. 9½d. He said that he had been promised this by the All High. To which the representative of the Drain Bust replied: "I made no such promise!"

Is the Brains Trust Unrehearsed?

I SHOULD like to know whether it is true that the members of the Brains Trust are not given time to think about answers to the questions put to them, and that their replies are spontaneous. By unrehearsed I mean: Are the members of the Brains Trust brought straight to the microphone, and the questions put to them? Do they have, say, a little lunch beforehand when the questions are outlined to give them an opportunity of framing useful replies? It seems to me that a little rehearsing is necessary if their answers are to be anything more than loquacious lollypops.

New B.B.C. Rules

SOME new B.B.C. rules are:

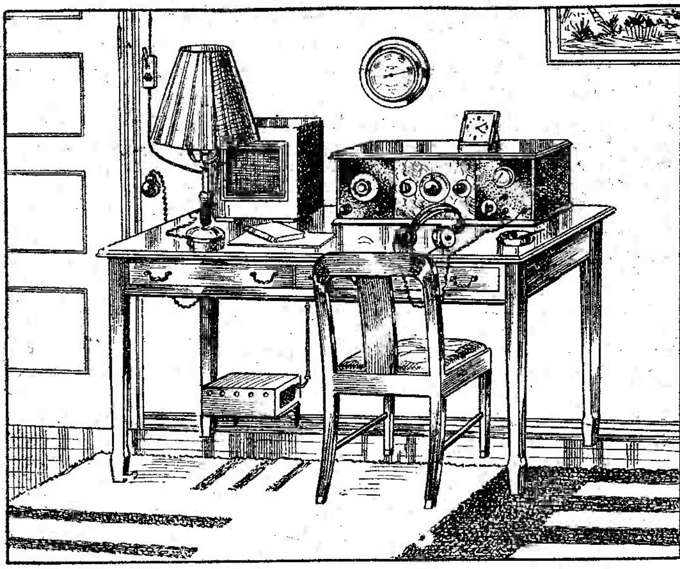
1. If the War Office, Admiralty or Air Ministry—or any other department, such as the Post Office—asks the B.B.C. to broadcast a talk by a serving member or official, no fee can be paid to the speaker.
2. If the B.B.C. asks a soldier, sailor, airman or civil servant to talk about his job, they pay only half the fee to the broadcaster. The War Office, Admiralty, Air Ministry, or appropriate Civil Service department, puts the rest of the fee into its own fund.
3. If the B.B.C. asks a soldier to talk about something other than his job, such as coal-mining, or asks a postman to talk about butterflies, not letters, it pays each individual the full fee.

Colour Codes

I HAVE never been able to discern the reason for the complicated cabalistic signs which are used to mark resistances and condensers. It is advantageous to mark multi leads for identification, but surely the value of a resistance or a condenser could be stamped on them, using the usual digits. Why should the body of a resistance be marked with one colour, the tip with another, and a dot or band on the body to indicate its resistance? To read the value one has to take the body colour first, then the tip colour, and then the dot. For example, a 25,000-ohm resistance would have a red body, a green tip, and an orange dot. It is stupid and unnecessary; the values could be stencilled on so that they could be read direct. I know that the Radio Component Federation some years ago approved this code, which must not only be costly to carry out in manufacture, but gives rise to serious mistakes. A number of firms tell me that few manufacturers have been able to train girls to identify colour codes, and resistances are dispatched of wrong values. It ought to be abolished, for it is a relic of the early days of radio, and the type of mentality which was in radio in those days. There is no point in trying to make the identification of a resistance value mysterious or clever.

Notes from an Amateur's Log-book

The Complete Rx: Practical Details of the Meter



An artist's impression of 2CHW's station

SINCE describing the construction of the two-valve L.F. amplifier, I have been busy fitting the three sections of the Rx into the cabinet, and making one or two final adjustments to the complete circuit and the individual units. It will be remembered that the original Rx was in the form of 0-v-1; to this was added the H.F. unit (March issue), making the valve sequence 1-v-1. Now that the amplifier has been added, the L.F. stage of the 0-v-1 arrangement has been removed, so the final layout is 1-v-2.

The three separate units fit into the cabinet perfectly, and the centre aluminium panel, flanked on each side by black-crackle finish of the H.F. and L.F. panels, gives the complete assembly a very smart appearance. The mains unit is now protected by a metal covering, and when it is on the shelf fitted to the skirting-board, it is out of the way and not at all conspicuous. The artist's impression of the full outfit—shown above—gives a good idea of how I have arranged things—but I must admit that the artist has made the table look more tidy and spruce than it is usually.

Connecting the Sections

The valve-holder, etc., of the original output stage is removed to allow the two-valve unit to fit into position. The anode resistor—fitted across the 'phone terminals of detector circuit—and the .01 mfd. coupling condenser are retained to provide the input to the new amplifier. The free side of the condenser is connected to the contact on the potentiometer, 1, so marked on the plan wiring diagram shown on page 302 (June issue). The next step was to connect the filament circuits right through, so that all four valves are fed by two leads from the accumulator. The H.T. positive lead from the amplifier is taken direct to the "Power" socket on the mains unit, and the lead supplying the positive H.T. to the detector is inserted in the "Detector" socket on the unit. The leads G.B.1 and G.B.2 are connected to 1½ volts and 4½ volts respectively on the G.B. battery.

The H.T. supplies to the H.F. stage need, perhaps, a little explanation. The theoretical circuit of this section, page 150 (March issue) shows a variable-mu arrangement, and the screening-grid fitted with its own H.T. lead. The wiring plan—page 151—shows the layout and wiring of the original unit which utilised a "straight" S.G. valve, and had potentiometer control for the H.T. to the screening-grid. Both circuits are perfectly correct, but the theoretical circuit is of the later H.F. stage, i.e., the one now in use. I hope this will clear up any misunderstanding that may have arisen. The wiring plan for the variable-mu circuit is shown in Fig. 1.

The H.T. positive lead 1 should be connected to the socket marked S.G. on the mains unit, but the anode of the H.F. valve receives its H.T.—via the coupling coil in the coil unit—from the socket marked H.F.

To couple the H.F. stage to the detector, the following connections and modifications are necessary. Remove the earth wire from the coupling-coil; connect the now vacant terminal to a lead of suitable length to reach the H.F. socket on the mains unit, and to one side of a .01 mfd. fixed condenser. The other side of this condenser is then connected to the earth terminal. The screened flexible wire from the top-cap of the H.F. valve is fastened to the original aerial terminal on the detector section assembly; the aerial lead-in must then be taken to the switch on the H.F. section, as indicated on the wiring plan. The earth wire can remain on its terminal.

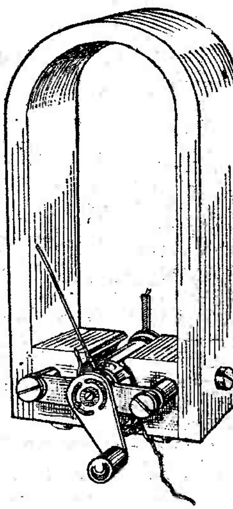


Fig. 2.—The meter movement after re-assembly.

Meter Construction

Since the first mention of the proposal to try to make a meter movement I have been examining all the various types which have come my way. The chief trouble I have experienced is overcoming the defects associated with designs which are most suited to amateur efforts, especially, as in my case, when tools are limited and the services of a lathe are not available. A great deal of time has been spent searching through the stock of those dealers who make a speciality of collecting all the bits and pieces—ranging from rusty screws to motor-cars—with the hope that I would unearth the parts I could not make and/or had not the time to make. So far the results have been most encouraging; I brought to light a unit which had long parted from its case and had suffered during that period a fair share of the rough handling and disrespect which appears to be the lot of those items coming under the heading of "junk." However, after a good deal of attention, which included dismantling, cleaning and the fitting of two new spiral springs and a temporary pointer, it was reassembled and given an initial test. Its general design is as shown in Fig. 2. The elongated "U"-shaped magnet is 5ins. x 2⅝ins., the thickness of the metal being 1in. x ⅜in. At the open end of the "U" two shaped pole-pieces are fitted to the magnet arms by means of screws which pass through the latter into the pole-pieces.

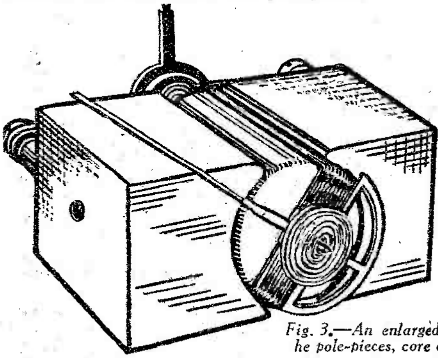


Fig. 3.—An enlarged view o' he pole-pieces, core and coil.

Into the circular space thus formed a solid iron cylinder is fitted, its diameter being approximately ¼in. less than that of the circle bounded by the curved faces of the pole-pieces. The cylinder is a fixture; it is held in position by a distance piece and a cross member—both brass—the latter being screwed to the bottom, when the magnet is in the position shown in the diagram, of the pole-pieces. The edges of the screws are just visible in the drawing, one each side of the zero adjusting arm. The object of this cylinder or core can be likened to that of the core inside the speech-coil former of a M.C. speaker, the concentration of the lines of magnetic flux. The importance of this small element was brought home to me when some initial experiments were being undertaken, using a simple shaped magnet—practically identical with that shown in Fig. 1, page 260 (May issue))which I obtained from an old toy electric motor. The results were not too satisfactory; the movement was insensitive, very irregular and far from dead-beat. The obvious conclusions were that the lines of force were concentrated chiefly straight across the tips of the poles of the magnet and that the coil did not, therefore, pass through a magnetic field of reasonably uniform density. The results were loss of sensitivity and uneven scale deflections, plus a swinging pointer, i.e., not dead-beat. The latter, by the way, was due to the fact that I had used a very light wooden former on which to mount and pivot the coil, thus losing the damping characteristic of a metal former.

The coil is rectangular in shape; its dimensions are such that, when in position, it is free to rotate round the metal core in the small circular channel between the core and the pole-pieces. The winding is carried on an aluminium former, which has small pivoting points of brass or phosphor bronze fixed to the short members of the rectangle. The associated bearings are mounted on strips of hard insulating material or non-ferrous metal—the latter being insulated from the magnet and pole-pieces—which are fixed across the front and rear of the assembly. One of the strips—the front one—is seen in Fig. 2. To ensure the pointer returning to its zero setting when no current is flowing in the coil, a hair-spring is fastened to the coil former and a small arm on the bearing strip. The arm must be so arranged that it can be used to vary the tension of the spring, thus allowing the zero position of the coil and likewise the pointer to coincide with the zero mark on the scale. Better regulation is provided by two springs, one at each pivoting point of the coil, as this helps to correct any variation in spring tension due to temperature changes. On no account must these hair-springs be made from steel; springy copper or brass foil is often quite satisfactory if it is cut to form a strip approximately 1/32in. in width, and rolled to form a flat coil around, say, a knitting needle.

The Movement Assembly

It is not possible, in this article, to give a complete set of dimensioned drawings, but it is hoped to be able to do so in the next issue, thus providing some concrete data on which those interested can base their work.

The drawing Fig. 3 does, however, give a very good idea of the essential features, as it depicts the two shaped pole-pieces, complete with core, coil, adjusting springs, bearing cross members and zero setting arm. The items likely to be most difficult to obtain are the two shaped pole-pieces. I can only suggest a continued search—such as that which I had to undertake—of dealers in surplus and junk materials. If one has the use of a lathe or drilling machine, or can enlist the aid of someone who has, it would be possible to shape a piece of iron to the overall rectangular area of the two pole-pieces when placed together, and then drill in the centre a hole having the required diameter. The material could then be cut in half, across the diameter of the circular hole and at right angles to the long sides of the rectangular, and the final shape obtained by filing.

When dealing with any assembly work involving magnets so much depends on actual magnet used, i.e., what holes might be drilled in it, etc., as it is out of the question for the average constructor to drill or shape magnets owing to the hardness of the material and the risk of destroying its magnetism.

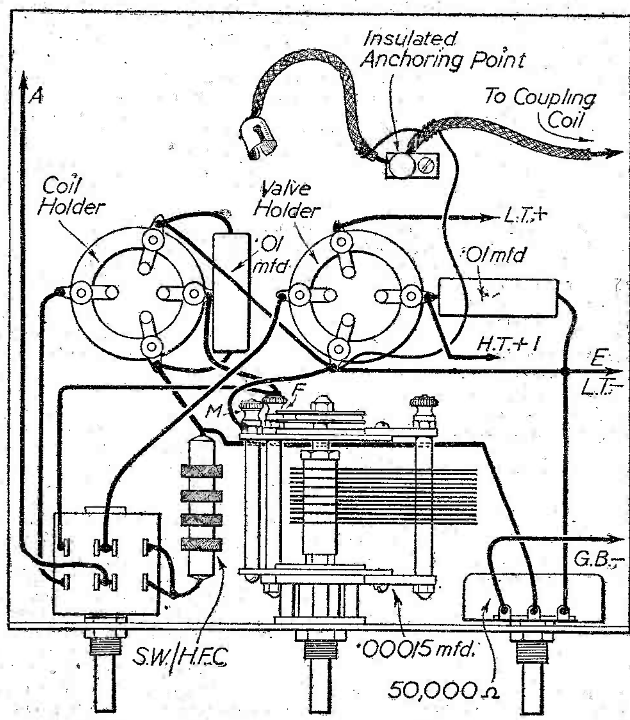


Fig. 1.—The wiring plan of the H.F. unit for use with a variable-Mu valve.

A Service Engineer's Records

Details of Some Minor Faults and the Remedies That Were Applied

Altered Valve Connections

A MAINS superhet which was brought into the workshop a few days ago presented some unusual problems until a number of tests had been made. It should be first explained that the receiver was of a cheap and unbranded type which had been bought just over a year ago. The complaint made by the owner was that, although reception had been fairly good for some time, the set had suddenly become "dead." On test it was found to behave as though one of the L.F. stages was not operating.

There was a faint mains "hum" in the speaker, but not a suggestion of signals, nor could anything be heard from the speaker when a pick-up was connected to the pick-up terminals. Voltages were checked at the valve-holder sockets, and were correct. Octal valves were fitted, and since replacements were not immediately available the question of replacing either the double-diode-triode or the output pentode was ruled out.

The valves were taken out of the receiver to be tested, and each one proved to be in good condition. They were therefore replaced—and then the receiver operated correctly! This seemed somewhat mysterious, and it was obviously desirable to find what had previously been the cause of trouble. Possibly a valve had been making bad contact with its holder; and the double-diode-triode—or at least the triode section of that valve—was suspected.

This valve was therefore again removed from its holder and the pins examined for cleanliness. They were quite clean, so attention was directed to the holder. Its sockets also appeared to be clean, but were treated with a trace of carbon tetrachloride on a pipe cleaner. And just as the valve was to be replaced in its holder the cause of trouble was found. In addition to the keyway used to locate the pins there was another partly-formed keyway which had apparently been formed by pressing the valve into the holder. Thus, it was fairly certain that the valve had at first been incorrectly fitted; there was sufficient proof of this when the owner later agreed that he had removed the valves when "spring-cleaning" the set.

Great care should always be taken that valves with octode bases are fitted properly, although a mistake could not possibly be made if the holder were a good one. Those fitted in the set in question were of inferior quality, the top plate being of very thin and fairly soft paxolin. It was fortunate that the valve had not been replaced in such a way that the H.T. voltage was across the heater.

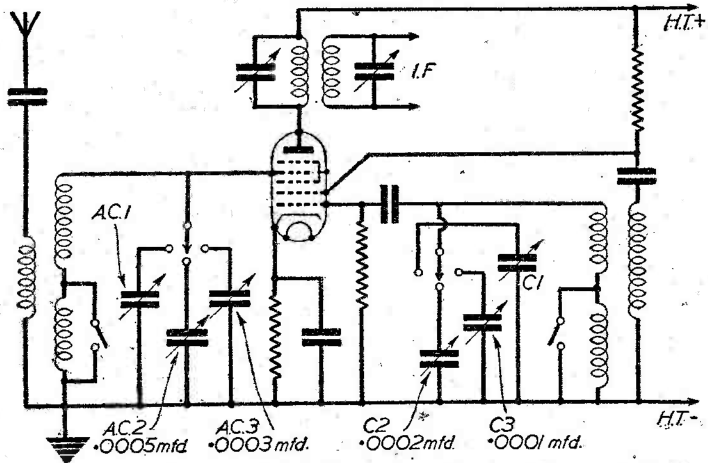
There is a moral here for home-constructors: use only good-quality valve holders.

Inferior Reproduction With M.C. Speaker

A NUMBER of sets now coming in for repair are old models which have been brought back into use due to the difficulty in obtaining new ones. We were called upon to test a battery set of this type recently. It was a portable with built-in moving-iron speaker. Hoping to improve reproduction the owner had connected a moving-coil speaker in place of the old one previously in use. He was surprised to find that reproduction was a good deal worse with the M.C. speaker, in spite of the fact that this speaker worked quite well on another set.

There was no question of incorrect matching, because the M.C. speaker had a variable-ratio transformer, of which every combination of tappings had been tried.

This "fault" was easily corrected, because we had often run across it before. A new high-tension battery at once put matters right, and reproduction on the moving-coil was satisfactory. Had a tapped grid-bias battery been in use it may have been sufficient to tap down the G.B. voltage, but the set had automatic bias so this was impracticable. We did make provision for G.B. variation, however, by replacing the 500 ohm bias resistor with a variable resistor of the same value. Normally, this would not be recommended, but now that it is necessary to economise in H.T. batteries the change was justified because the old battery can be kept in service after its voltage has fallen to as little as 60 per cent. of the original figure.



How a two-gang, three-way switch can be used to provide automatic tuning to "Home" and "Forces" wavelengths in a typical superhet.

"All-dry" Valves

WE have recently had a fair amount of trouble with receivers fitted with 1.5-volt filament valves. Not because the valves are unsatisfactory, but because owners *will* insist on taking the filament supply from a two-volt accumulator. Very often the valves will withstand this bad treatment for a time, but after that signal strength, range and reproduction fall off considerably.

New valves of this pattern cannot readily be obtained—in fact, it is often just impossible to buy them. There are then only two alternatives: to fit new valve holders and re-wire them to take two-volt, four-pin valves, or by some means to "recondition" the old valves whose emission has fallen off very considerably. The first-mentioned method is probably best if the owner is competent to carry out the modification (which is not always easy because of the different characteristics of the two-volt counterparts), or if a competent service mechanic can be found—and most of those who come within this category are now in one of the Fighting Services.

If it is proposed to try the alternative, one method, to disconnect the H.T. battery and run the valves for a few hours on a 1.5 volt L.T. cell. A more "drastic" method is to "flash" the filaments. This consists of connecting one filament pin to the negative socket of an H.T. battery and then to flick a lead from a 30 volt tapping against the other filament pin. Neither of these methods is by any means infallible nor as effective as they were with some of the old-type battery valves. They can, however, be tried before finally discarding the valves.

Overheating of Output Valve

RE-READING the first of these notes brings to mind another fault which was investigated a few weeks ago. The set was a powerful A.C. model with push-pull output stage. Volume had fallen off to a certain extent and reproduction was not up to the original standard. Examination of the set while in operation showed that one of the push-pull valves was running extremely hot, while the other was almost cold. So much heat had been developed in the "hot" valve that the base had cracked.

Removal of the other valve from its holder had no effect, so it was evident that a single valve was handling the whole of the output. Both valves were tested and found to be O.K., so it was evident that there must be a bad connection to one of them. The valve-holder was suspected, but no fault could be found. And then it was discovered that there was a "dry" joint to the anode socket. When this joint was cleaned and re-made the fault was cleared.

Reduced Signal Strength

A "STRAIGHT" three-valve battery set had to be tested because it had suddenly ceased to bring in any stations other than those giving the "Home" and "Forces" programmes. Additionally, tuning had become very critical; so much so that the slightest movement of the tuning knob caused serious distortion, if the signal were not lost entirely.

First, a test was made by transferring the aerial lead to the anode terminal of the V.-M. high-frequency valve. This improved reception and flattened the tuning appreciably, even when full reaction was applied. The H.F. valve was suspected as being faulty, and replaced. This did not affect reception in the least, and suggested that the fault was in the input circuit to the H.F. valve, and the coil and its connections were checked; but without result.

Next, the aerial-series condenser was short-circuited, and that brought back full sensitivity, and made tuning *too* flat. So a new .0001 mfd. condenser was connected in parallel with that in the receiver. Reception was then perfectly normal, showing that the original condenser had developed an open circuit, which was proved by connecting an H.T. battery to its terminals and then attempting to discharge the condenser through the loud-speaker. There was not even a faint "click"—and there would have been a loud "plop" if the condenser had been charged by the battery.

"Two-Programme" Tuning

DURING the past year or so we have modified several receivers for "switched tuning" to the two British programmes. It is not necessary to employ a push-button system, and a three-way switch will suffice: on one position the normal tuning condenser is in circuit, while in the other two suitable pre-set condensers are connected to provide automatic tuning to the "Home" and "Forces" wavelengths.

The method is straightforward with a "straight" receiver, especially if there is only a single tuning circuit, but a little more care is required for a superhet. This is because a pre-set condenser must be provided for both the input and oscillator tuning circuits. This means that two three-way switches are required. Two "biscuits" of a five-way rotary switch provide the simplest means of arranging for this, and the connections are shown in the diagram.

It is the adjustment of the condensers which calls for care and the adoption of a correct procedure. First wire up the rotary switch-plate in the oscillator circuit to the condensers marked C.1, C.2 and C.3, as shown. The first of these is the oscillator section of the ganged tuning condenser, while .0002 mfd. pre-sets are used for the other two. If you use the lower wavelength "Forces" programme it will be better to use a .0001 mfd. pre-set condenser for C.3.

With the switch on C.1, tune in the "Home" programme n the normal manner. Then switch over to C.2; probably nothing will be heard, so the pre-set must be adjusted until the programme is heard again. Continue the adjustment until maximum signal strength is obtained. Go back to C.1 and tune in the "Forces" programme in the ordinary way. Then switch over to C.3, and repeat the process carried out on C.2.

The oscillator tuners are then correctly adjusted, so the input tuning condensers can be connected and set. Turn the ganged switch to C.2 and adjust A.C.2 until the "Home" programme is received at maximum strength. Turn to C.3 and adjust A.C.3 in the same way. If the receiver is fitted with a visual tuning indicator, this should be used when setting the pre-set condensers.

When the switch is in the first position the normal variable tuning condenser can be used in the ordinary way; the two other settings provide the automatic tuning.

SYNCHRONOUS TIME DELAY RELAY

LONDEX, LTD., Electrical Remote Control Engineers and Manufacturers, of 207, Anerley Road, London, S.E.20, have just issued a new list, No. 97, which illustrates and describes their new Synchronous Time Delay Relay PRL. The various models cover a time range of from 2 seconds to 28 days.

This type of relay is synchronously driven through easily interchangeable gearing, and is capable of switching up to 500 VA. Heavier loads up to 50 amperes can be dealt with by using the Londex Mercury Type Relay LQA in conjunction with the Time Delay Relay PRL.

Easy means are provided for adjusting the time settings. Six models cover between them a time range of from 2 seconds to 28 days.

Type PRL with cover removed.

PRIZE PROBLEMS

Problem No. 433

SMITH had had his four-valve A.C. receiver operating for some months, and he was very proud of the results. One night, however, the quality of reproduction went to pieces: violent distortion suddenly became evident, and, when Smith started to examine the set, he saw that the rectifier was showing signs of overload, and, before he could do anything, the reproduction spluttered and then ceased altogether. The rectifier then resumed normal appearances, but when Smith measured the voltages on the H.F. and det. stages, he found that they were exceptionally high. What was the original cause of the trouble?

Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 433 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, June 15th, 1942.

Solution to Problem No. 432

When Harris let the top-cap connection of the S.G. valve touch the metallising, a short-circuit across the H.T. positive line—via the H.F. choke—was produced, and the resultant heavy current burnt out the choke winding. This rendered the H.F. stage inoperative, and when the aerial was connected to the coupling condenser only the det. and output valves were handling the signal, thus the selectivity was poor owing to the absence of the tuned aerial circuit.

The three following readers successfully solved Problem No. 431, and books have accordingly been forwarded to them: J. Rae, 51, Kingshall Avenue, Aberdeen; F. Underwood, 310, Greenwood Avenue, Hanwell, W.7; G. R. Broberg, "Glenhurst," Thornhill Drive, Apperley Bridge, Nr. Bradford.

The Cathode-r

An Indispensable Part of Testing Eq.

By S. A.

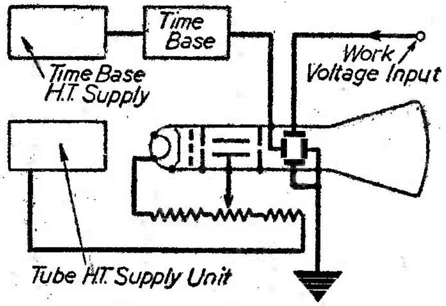


Fig. 1.—The component sections of a complete oscilloscope circuit.

Purpose of the Oscilloscope

THE cathode-ray oscilloscope has become an almost indispensable part of testing equipment, both to the laboratory, the workshop, and the servicing bench.

When an accurate graphical representation of a natural law, or any other type of qualitative information is required, the cathode-ray tube is the best and in most cases the only means that can satisfy the requirement completely.

Its applications are practically limitless; fault tracing, aligning of R.F. and I.F. circuit single response curves, hum tracing and ripple observation, value characteristics, wave-form observation, phase shift and modulation tests, use as R.F., A.F., and D.C. voltmeter, and the study of speech and music wave-forms, to name but a few.

An oscilloscope will give a graphical representation as a function of time of any effect which can be made to produce an equivalent electrical effect, that is, potential change irrespective of whether the initial effect is electrical or not. It is indispensable to the seriously minded radio engineer, a versatile instrument which can be constructed portably enough to make it invaluable for all outside inspection and repair work.

The following notes are written to give the user of the oscilloscope, and all those interested in its working, whether it is a commercial product or home constructed, an elementary insight into the operating principles of the instrument.

Lay-out and Units of the Oscilloscope

The complete oscilloscope consists of the cathode-ray tube, the power supply unit for the tube, the time base and its H.T. supply, and the amplifying stage for the input or work voltages. As shown in Fig. 1, it will be seen that the whole instrument can be split up into these units and dealt with one at a time, and the best order for doing this is to begin at the tube itself, working backwards through the tube supply and the time base unit to the amplifying stages. As these notes are purely of an elementary nature it will be appreciated that in the interests of clarity there may be slight deviations in the continuity of some of the explanations, but the order of the units as already given are retained as much as possible.

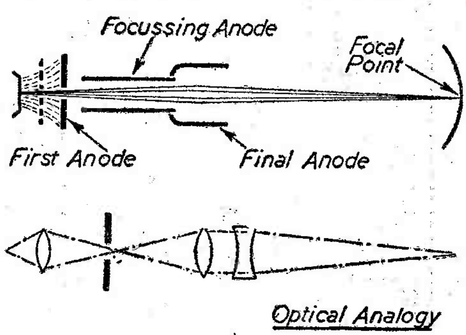


Fig. 3.—Showing the effect of the anodes on the electron beam in an electrical and optical sense.

Construction

The cathode-ray tube, as used in oscilloscope designs, is usually of the medium voltage type, with an accelerating potential in the region of 1,000 to 2,000 volts. The tube may be either hard, that is, high vacuum, or soft, containing a trace of gas to assist focusing. The latter are known as gas-focused tubes, and are not dealt with in this article at any length.

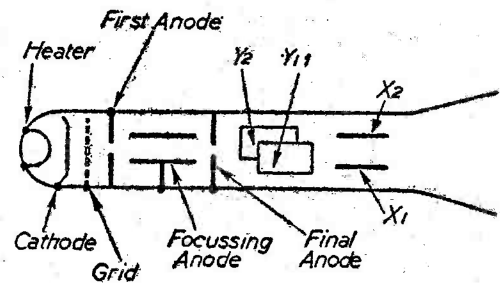


Fig. 2.—The electrode arrangement of a tube utilising the electrostatic focusing system.

High vacuum tubes using electrostatic deflection are the most popular types for use in the medium voltage class of oscilloscope.

With one or two exceptions the electrode construction of a cathode-ray tube corresponds to that of an ordinary valve, and much resembles an ordinary valve in its principle of working. Electrons are emitted from a heated cathode, pass through an electrode referred to as the grid, which operates in much the same way as the control grid of a triode valve in that its potential can either reduce or accelerate the electron stream, and are attracted to a system of electrodes known as anodes, which are supplied with various positive potentials of high tension. In Fig. 1 these various electrodes are shown in their relative positions, together with the two pairs of deflector plates, which come between the final anode and the fluorescent screen.

On the application of heater volts the cathode begins to emit electrons which are attracted along the length of the tube by the positive potentials on the accelerating anodes. The first anode is mounted a short distance above the cathode and usually takes the form of a small cup pierced in the centre by a hole a millimetre or so in diameter. The bulk of the electrons will, if no other arrangements are made, pass on to the anode in much the same way as in the case of a triode valve and create an anode current. This is known as the "beam" current. A certain proportion will, however, proceed

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'KNIGHT

through the small hole n the anode's centre and pass up the tube by reason of the velocity acquired from the anode potential.

Unless measures were taken the stream would impinge on the fluorescent screen and produce a large and irregular patch of fluorescent light due to the "spraying" out of the stream on its way up the tube. This would be due to the mutual repulsion of the electrons to one another during the length of their travel. In order to obtain a small, sharply defined spot, therefore, a means must be found for focusing the electron stream into a concentrated jet. In oscilloscopes there are two methods adopted for this purpose, gas focusing and electrostatic focusing, and of the two, electrostatic focusing is the most popular.

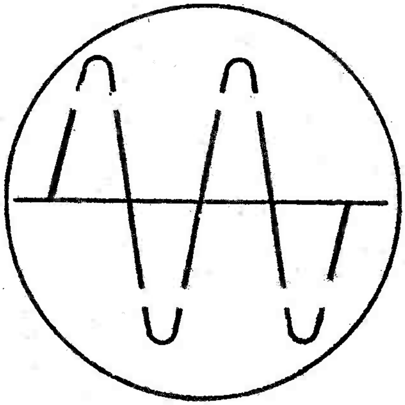


Fig. 5.—*The interrupted effect produced with wave-forms of high amplitude by Fig. 4.*

Gas Focusing

As mentioned earlier, one method of doing this is to insert a small quantity of gas into the tube before sealing

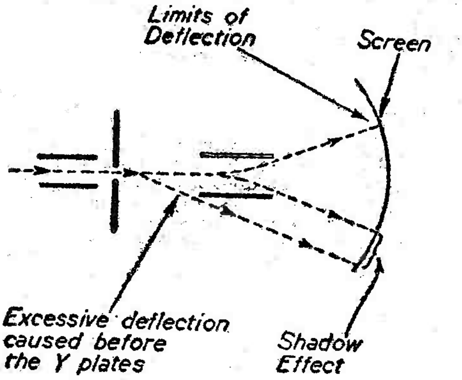


Fig. 4.—*Depicting the shadow effect due to the electron stream passing each side of the deflectors.*

it off, thereby making it "soft." The electrons on their journey up the tube collide with the gas molecules and ionise them by collision. A formation of ions is thus made to accompany the production of the electron beam, and compared with the high velocity of the electrons, these ions are slow moving and heavy. They are inclined, therefore, to remain in the path of the beam, creating a positive core, and thus neutralising the mutual repulsive force in any particular section of the stream where the number of positive ions is equal to the number of electrons.

An increase in the number of ions after this stage results in an attractive force on the electron flow, concentrating it in towards the axis and producing a sharply defined spot on the fluorescent screen.

Electrostatic Focusing

Turning now to electrostatic focusing, it will be found that with this system the tube is of the vacuum type, and the focusing electrodes consist of an arrangement of two or three anodes built into the interior of the tube (Fig. 2). These anodes perform a variety of functions; besides the purpose of supplying a control of focus they are used as accelerators to the electron beam, constraining it to follow a path which brings it into a fine focal point on the screen's surface. The electrode system and the path of the electrons is shown in Fig. 3, and it will be seen that up to the first anode the stream is widely divergent and of no particular formation. This is assuming that the grid is at cathode potential, and there is no repulsive effect acting on the electrons.

What happens after this depends more or less on the design of the tube, but, generally, the tendency of the beam which emerges from the hole in the first anode is to remain substantially parallel on its journey along the length of the second, or focusing, anode, until it comes within the field of the final anode. This electrode is maintained at the full tube positive high tension supply, and accelerates the electrons while altering the convergency of the beam. It is the second anode which is the important one, and is usually referred to as the focusing anode; in practice its potential is made adjustable, and is quite critical for accurate focusing.

Another way of looking at the action of these electrodes upon an electron stream is to consider the case analogous to the action of lenses on a beam of light, when the fields between the three anodes of the tube assembly can be regarded as three lenses with the second and third having the greatest effect on the focusing of the light. In cathode-ray technique this field of the subject is known as electronic optics.

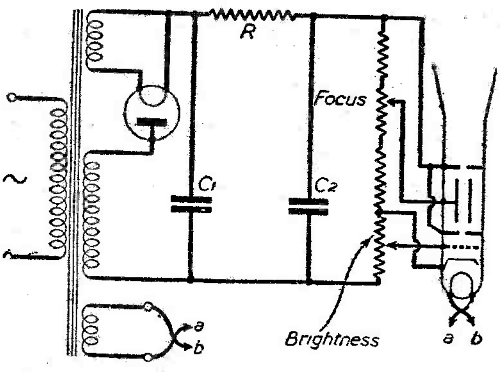


Fig. 6.—*A typical half-wave rectifier for use with an electrostatically focused tube.*

The brilliancy of the spot depends on the velocity of the beam when it reaches the fluorescent screen, which factor depends on the voltage present on the final anode. The second anode is maintained at a lower potential for the purpose of good focusing; while the first anode voltage is not particularly critical. It is usual in modern tubes to operate the first anode at the same potential as the third though a reduction in first anode voltage will generally have no more effect than a reduction in the brightness of the spot.

The grid which is inserted between the cathode and the first anode is usually maintained at a negative potential with respect to the cathode, and is used for controlling the density of the electron beam, and therefore the brilliance at the screen end. Electrons emitted by the cathode leave it with a certain initial velocity, but if the grid is made sufficiently negative they are compelled to fall back again, and none of them succeed in escaping to the field of the first anode. As in the case of an ordinary triode, as the negative potential on the grid is reduced, so more and more electrons are allowed to pass on their way to the anode until at equal potentials of grid and cathode the maximum flow is obtained and the spot is at its brightest. The grid of a cathode-ray tube as used in oscilloscopes is never run positive with respect to the cathode.

The Deflector Plates

There are two pairs of deflecting plates in the cathode-ray tube, and they are situated immediately beyond the final anode. One pair are used for horizontal deflection, and are designated the X plates, and one pair are used for vertical deflection and are designated the Y plates. The X plates are mounted vertically and the Y plates horizontally.

As the deflection of the beam depends on the potentials applied to the plates, tubes are said to have a particular deflection sensitivity, depending on the particular design of the tube. A typical example might be the expression 500/final anode volts mm. per volt. This means that if the anode volts are 1,000, then the deflection is 0.5 mm. per volt of potential difference between a pair of the plates, or, in other words, 20 volts would be required to move the spot a distance of 1 cm. (10 mm.). In some cases the sensitivity of the tube is given more directly, such as 35 volts per cm.

It does not follow that small diameter tubes necessarily require a smaller deflecting potential than larger ones. In all probability the sensitivity of a 2in. tube would be very much alike in both cases, due to the fact that the angle of deflection in the small tube would be no greater than that in the large tube. A smaller screen diameter is generally accompanied by a decrease in tube length, and the spacing of the deflector plates. As will be seen from Fig. 4, the limit of deflection is determined by the spacing of the deflectors and the distance from them to the fluorescent screen. Deflection beyond this limit causes a "shadow" of the particular plates to be cast on the screen, due to the electron stream passing on the outside of the deflectors as well as the inside. With wave-forms of high amplitude on the screen this causes an interrupted effect as shown in Fig. 5.

The one main defect with electrostatic deflection is, however, the defocusing effect which the plates exert on the electric beam. With tubes of screen diameter in the region of 6in. some 250-300 volts might be needed to give full deflection of the beam, which, in turn, is some 20 per cent. of the potential on the final anode. In most oscilloscopes and single deflecting circuits one of the plates is normally connected to this electrode, while the other has a potential which fluctuates several hundred volts above or below that of the final anode. The beam thus passes through a varying field which tends to upset its focus, especially when it approaches close to one of the plates. As a result, a time base sweep applied to one pair of the deflectors would be difficult to focus along the whole length of the line.

To overcome this trouble it is necessary to connect the deflector plates symmetrically with respect to the final anode, so that the mean potential with respect to the anode is zero. This can be arranged by a push-pull circuit arrangement so that when one plate of a pair swings positive the other swings negative by an equal amount. This will be dealt with later on.

Power Supplies

Methods of obtaining the power supplies for cathode-ray tubes are not unlike those used in ordinary receiver power pack circuits, except that the potentials are usually in the region of 1,000 to 2,000 volts, and full-wave rectification is seldom employed. The tube requires its maximum rated potential for the first and final anodes, a lower and adjustable potential for the focusing anode, and a supply for the heater.

Dealing with the latter first, most of the latest tubes use a similar arrangement to ordinary indirectly heated valves and have heaters rated at 4 volts A.C. or D.C. at a current of 1 to 2 amperes. Some tubes might be found with 2-volt heaters, but they are not so common. As in the case of radio valves, the heater supply is derived from a separate winding on the mains transformer and the cathode is strapped down, internally or externally, to one side of the heater lead. In large tubes, using upwards of 3,000 volts where, as is customary, the positive side of the H.T. supply is earthed, care must be taken to see that this winding is thoroughly insulated from the full supply, and a small separate transformer is sometimes advisable. Where the H.T. negative is earthed, however, the 4-volt winding may be taken from the time-base supply transformer.

Dealing now with the high voltage supply a basic circuit arrangement is shown in Fig. 6, which is for use with an electrostatically focused tube, and not for the gas-focused type. The latter's power supply is not quite so complicated, usually consisting of a simple half-wave rectifier with very little smoothing. The application of variable focus control does not enter into the design at all. As gas tubes are not being dealt with, however, it is not proposed to go into their power pack details.

Referring to Fig. 6, it will be seen that a typical half-wave rectifier system is employed, with a smoothing arrangement consisting of condensers C_1 and C_2 and resistance R. The condensers have a value of about .025 μF, and must be rated for the full voltage supply of the unit, while the resistance is generally of a value between 100,000 ohms. and 0.5 Megohms.

Potentiometer System

The potentiometer system, comprising two fixed resistors and the brilliance and focusing controls is arranged in values to give the correct potential to the various anodes, and its overall resistance is generally kept in the region of 2 Megohms. With this value the beam current of the tube is negligible in comparison with the current drawn by the potentiometer and the separate resistance values can be regarded as proportional to the voltages required.

It should be noticed in the figure that the smoothing resistance R is included in the positive lead. This is all right so long as it is the negative lead which is earthed, but in oscilloscopes designs, where the deflector plates have to be available for external connections, it is the positive side which is usually earthed, and therefore resistance R should be included in the negative lead.

A resistance is used for smoothing in these circuits because the current drawn is generally so low (2-3 mA) that the voltage across C_1 is nearly equal to the peak A.C. input and the ripple is consequently very small. The resistance also serves the purpose of limiting the current in the event of a short circuit across C_2 or a flash over between the tube electrodes.

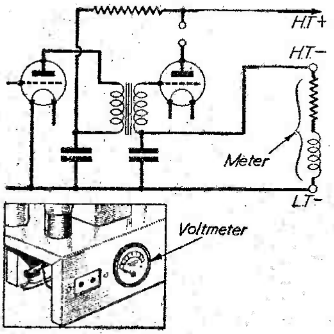
No charge remains on either C_1 or C_2 after switching off the supply because of the leakage path through the potentiometer network. For the purpose of safety a high resistance may, however, also be connected in parallel with C_2. This should have a value of some 10 Megohms, so that the current drain is of no consequence.

(To be continued.)

Practical Hints

Meter as Auto-Bias Resistance

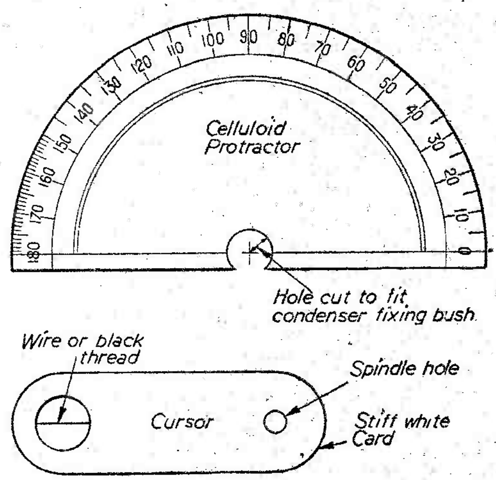
WHILE wiring up a set I found that the resistance I needed for the automatic grid-bias arrangement was 500 ohms. I had no resistance of this value in the junk-box, but I came across a cheap volt-meter the resistance of which I knew to be exactly 500 ohms. I accordingly wired this up as the resistance element of the automatic grid-bias, mounting the flush-type voltmeter on the side of the chassis. When the set was finished and switched on the volt-meter registered six volts, which was the calculated voltage. I now find that this volt-meter gives an excellent idea of the condition of the H.T. battery, since as its voltage falls so also does the grid-bias voltage. By a simple calculation I can tell how many volts are left in the H.T. battery, and thus am warned in good time to enable me to hunt up a new battery—by no means easy these days.—WM. NIMMONS (Belfast).



A novel method of using a meter as an auto-bias resistance.

A Simple Dial

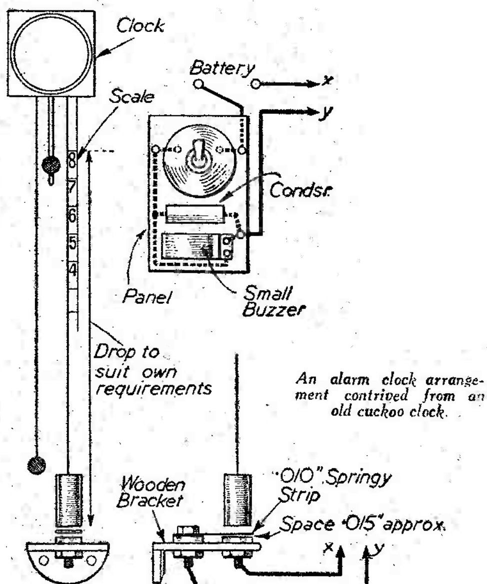
MANY reaction condensers are supplied with a very small knob. A simple dial for these condensers can be made from a celluloid protractor and a postcard. Cut a hole in the centre of the base-line to take the condenser fixing bush, and fit flush against the panel. Cut the postcard, as shown in sketch, and make two holes in the ends. One is for the condenser spindle, the other opening covers the degree readings on the dial. Fasten a piece of fuse wire or black thread across the back of this hole in line with the spindle hole. Stick this card on to the back of the original knob; and the dial is finished.—G. H. WHALEN (Warrington).



A useful dial made from a celluloid protractor.

A Novel Alarm Clock

I SUBMIT particulars of a novel alarm clock arrangement I have recently constructed, and which is shown in the accompanying illustrations. The distance the weight has to fall is nine hours, and this I have arranged solely to suit my family's requirements, as I need it to operate at 6 a.m. I have also especially fixed it at nine hours, so as to have a reminder when I switch on the radio at 9 p.m. to hear the news.



An alarm clock arrangement contrived from an old cuckoo clock.

When the weight reaches the contact the clock stops and the weight stands upright; the buzzer operates, and all I have to do is to put my hand out and switch off. The panel is fitted on the wall just at my side, and is stained and varnished to make it neat and the same colour as the bedstead. The timepiece is a small cuckoo clock, and is fitted in the living-room immediately underneath my bedroom.

I had occasion to break the alarm spring in the only alarm clock I had, and having difficulty to get another spring in these times, I was prompted to convert my small cuckoo clock, as described. The arrangement works very satisfactorily.—C. A. YARDLEY (Coventry).

BRITISH LONG DISTANCE LISTENERS' CLUB

WE have not devoted these pages solely to members' correspondence and details of their activities for some time, so this month we are handing over both pages to those of you who have sent in letters of general interest. Before doing this, however, we have one very important announcement to make. Fortunately it does not affect present members; to those who were thinking of joining our ranks, the news will not be good, as the statement we have to make is that no applications can now be considered for membership of the B.L.D.L.C. This does not mean that we have reached the limit. It is purely a temporary measure necessitated through the restricted supplies of PRACTICAL WIRELESS, and we hasten to assure those interested that the membership list will be opened again at the first possible opportunity.

Membership List Closed : Memories Section : Medium Wave Dx : A Problem

Correspondence

Now for the letters, the first of which comes from Member 3,830, R. Toase, of Cockerton, Darlington.

"I have been very interested in, shall I call it, the 'Memories Section' of the letters which have been published recently from 'the old hands,' in fact I have become so interested that I decided to contribute my little share towards it.

"My first interest in radio was in the days when Poldu, Cullercoats, and Le Havre were the listener's only interest, and then one only received weather and news items. No concerts.

"I think the old hands will remember those days: the days when the main components were variometers, home-made condensers, crystals, cat's whiskers and 'phones, and, if you were lucky enough to possess a valve, you could almost dispense with any other means of house lighting.

"The valves then generally used were mostly Dutch or Austrian, and a 4-volt valve would take anything from 4 to 9 volts or more on the filament.

"I have in my possession four of a series of books that were written by Sir Oliver Lodge, and they would cause considerable interest and, possibly, some amusement among the modern amateurs and DX'ers.

Dx'ing Trials

"My first attempt at DX'ing, as it is to-day, was made through the medium of a home-made 3-valve battery receiver (Det. 2LF), when the craze was for sitting till after midnight to try and receive any American stations. This meant very fine dial manipulation and concentration, at which I was pretty successful, my log book showing 14 entries of different stations in one session.

"For these operations, a good size table was needed to hold the equipment, and the log was made up by the glow from the valves.

"Some of the materials used in set construction were cocoa tins for condensers, slate for panels, bell wire and cardboard tube for coils.

"When valves eventually became popular, only triodes were obtainable; ebonite was bought by weight and some of it appeared to contain any ingredients to make it heavy. The first HF stages I used consisted of an H.F. triode valve, coil, and condenser and were enclosed by a mass of tin or copper screening, the building of which took months and then, maybe, more months before the results were satisfactory.

"I think I can say that I am a pretty old hand at radio, and I am still as much—if not more—interested than ever, and in the last 20 years I have only had one break and that during my Army career in this war. I was a member of 43rd Brigade Company, R.A.S.C., T.A., and was called up for service in August, 1939 and, later, when Radiolocation came into being, volunteered to take a mechanic's course.

"I was successful in the examinations and later contracted an illness, being discharged as unfit for military duty in November last.

"Since then I have been more or less a bed patient at my home.

"My reading matter is 95 per cent. radio and with me here are Practical Wireless Service Manual, The Wireless Engineer's Pocket Book, R.S.G.B. Handbook and supplement, The Admiralty Handbook, 'Coils, Chokes and Transformers,' and PRACTICAL WIRELESS.

"When I am able to work again I am thinking of taking up Radio Servicing as a means of livelihood, I am at present compiling my own book of data needed in Radio Servicing.

"In closing may I offer my best wishes to the Editor and staff of PRACTICAL WIRELESS for keeping the flag flying under the present conditions."

A very interesting letter, R.T., and we hope that it will not be long before you are able to take up the work you have in mind. To augment the data you are preparing, the Editor is sending you a copy of Wire and Wire Gauges, this being an award for the month's best letter of general interest. (Hon. Sec.)

Medium Wave Dx

IN response to the request we made for details of reception of Dx medium-wave transmissions, Member 7,204 (G. Fergus, of Newcastle) has sent n the following, which we hope will prove useful to those who are now working on this band.

"In response to your request for reports of medium-wave Dx, I am basing my first report on this subject. All of the following stations were heard during February on a 4-valve D.C. mains superhet of 1934 vintage, with an inverted L-type aerial. The times of reception were between 22.15 and 04.00 hrs. and 05.30 and 09.15 hrs. B.S.T.:

"246 m., Philadelphia (Columbia) WCAU; 270 m., New York (Independent) WNEW; 275 m., Baltimore (National), WBAL; 277 m., Hartford (National), WTIC; 282 m., Hamilton (Canadian), CBA; 294 m., Pittsburg (National), KDKA; 300 m., Boston (National), WBZ-WBZA; 341 m., New York (Columbia), WABC; 373 m., Schenectady (National), WJZ; 426 m., New York (Mutual), WOR; 454 m., New York (National), WEAF; 469 m., New York (National), WGY.

"The earliest station to come in was CBA, which came in at 22.30. The last station to fade out was WNEW, which remained until 09.15. Stations WHN and WNEW operate 24 hours a day.

"I hope that this information will be of use to other B.L.D.L.C. members.

"Finally, could you tell me of any past issue of PRACTICAL WIRELESS which contains constructional details of a good D.C. mains battery eliminator."

Many thanks, G.F., for the information. Regarding constructional details of a D.C. eliminator, we have not *published the constructional details, therefore we hope that the article on D.C. Mains Apparatus in the June issue will have been of some help.* (*Hon. Sec.*)

A Problem from York

MEMBER 7,167.—R. V. Goode, of York, submits a problem which he encountered during his activities. Fortunately, he also gives his solution, so those interested in diagnosing faults can compare their findings with those given by 7,167.

"Not having written yet as a member I wonder whether it will interest members to hear how I gained some very useful experience and had the importance of a certain component brought home to me.

"Some time ago, when I was fairly new to mains sets, I had an A.C./D.C. receiver for servicing, the owner of it describing the trouble as 'Sounding as if it had a plum in its mouth.' It recovered two or three times when I first had it on test, and I took the opportunity to note some of the voltage and current readings taken with my Model 90 Taylor meter. The set had an energised speaker, and I found this to be the most convenient point from which to take the readings, the following, though approximate, are typical (the mains being about 240 volt A.C.): H.T. voltage before the speaker field (smoothing choke) 240 volt, after same 200 volt; field current 95 mA. When the fault finally developed I again measured the current and voltages, finding that the H.T. current was now only 28 mA., while the H.T. voltage had dropped to 73 volts, rising to 120 volts when the speaker field winding was disconnected (i.e., no load) but with the 8 mfd. reservoir condenser still connected (I found out later that when this condenser was disconnected the voltage fell to 110 volts, although there was always 240 volts A.C. on the rectifier anodes). I thought the valve rectifier must have lost its emission, especially as when I removed the valve, though, of course, leaving its heater in circuit, and connected instead my Milnes Unit to its holder, the set worked well. After a lot of trouble I managed to get another valve rectifier of the special type required, but I found that it made not the slighest difference! What, then, was wrong? It could only be one thing. Replacing the electrolytic reservoir condenser with another cured the trouble, because the old one had simply dried up and so lost most of its capacitance. With the new condenser all the voltages were, of course, up again as before, and on no load (i.e., with just the reservoir condenser connected), instead of 120 volts as previously, it was now about 340 volts.

Deductions

"The following interesting facts emerge from the foregoing: A D.C. voltage reading of a little less than half the R.M.S. value on the anode is to be expected from a half-wave valve rectifier when the reservoir condenser is disconnected (e.g., with about 240 volt A.C. on the anode a D.C. reading of 110 volts is obtained, as in the above instance), while with the condenser, but no load, connected, the D.C. voltage obtained should be 1.4 times the R.M.S. value (e.g., the 340 volts mentioned above), because this latter is the A.C. peak voltage, and, as it is not being discharged by any load, the condenser will remain more or less at the highest voltage fed to it; this also shows why it is so necessary to use a condenser having a high peak-working voltage.

"If it had been the valve rectifier instead of the reservoir condenser that had been at fault, the voltages and currents would still have been low, but it would most probably have shown 340 volts on no load with, of course, the condenser connected.

"It will probably interest you to hear that Member 7,149 and I have contacted each other as we think we have a number of things in common. I have been wondering if you can give me the names and addresses of some members living in York?"

Here is one member in York who will be pleased to make contact, so we suggest that you get in touch with each other and we will forward details of others in the area at the first opportunity. The new member is G. R. Peacock No. 6,784, and his address is 34, Grange Garth, York.

Who Can Help?

YORKSHIRE members are well to the fore in the correspondence this month, and if it ever becomes a question of which county has the most members, it seems as though Yorkshire might be in the lead.

A new member, 7,172, A. B. White, of Bradford, is in doubt about a transmission he received on the 31.29 metre band, at 15-51-16.00 hrs. G.M.T. The station announcement was "Voice of Free India," "Voice of Ahdahadlin"?

A similar query comes from member 7,129, C. G. Cullen, of Abingdon, Berks, who received a transmission on the 31.92 metre band at 6.50 p.m. (G.M.T., B.S.T., or D.B.S.T.?), which announced "Radio Azazin"? "The Voice of Free India."

Other members who have identified these stations—though it would appear that they are the same—might care to send along such details as they may have.

Huddersfield, Yorks.—Any members around 15 years of age in this district are asked to contact No. 7,186, at 35, Carr Street Marsh, Huddersfield.

Wakefield, Yorks.—R. Haigh, who does not quote his membership number, sends us a sketch of his station, but, unfortunately, we are unable to include it in this issue. He describes his outfit thus:

"As our house is not fitted for electric light I have to take my power from dry batteries, and, as a result of this, I find the background noise practically non-existent, even on Dx.

"My aerial, which is an indoor one, consists of a single length of No. 26 enamelled copper wire, and goes once round the room in which my 'station' is housed. With this results are really surprising, and I prefer it to a 50ft. one outside.

"My Rx, which is of the 0-v-2 type, utilises plug-in coils, covering 10-150, 200-800, and 900-2,000 metres.

"I use a Mullard PM2HL as a detector, transformer coupled to a Mazda HL2, which in turn is transformer coupled to a Mazda P220A.

"An airplane dial facilitates tuning, and I pull in most of my stations with ample volume on the loud-speaker.

"So far I have logged WCRC, WNBI, WGEA, WGEO, WRCA, WRUL, Australia, Radio Saigon, Finland, Ankara, India, most of the D stations and several Italian stations, all on the L.S.

"May I say in closing that the cover change of PRACTICAL WIRELESS does not affect me in any way, as I always remove it and place the rest of the pages in a file."

WGEO Reception

MEMBER 8,040, of Kelso, Roxburghshire, who was asking on these pages last month for contacts, wants to know what has happened to WGEO—31.48 metres—as he has not been able to receive it during the last few weeks.

Havana Cuba

AN R.A.F. Service member, No. 7,208—E. Crowder—reports the reception of C.O.K., Havana Cuba, on, approximately, 28 metres between 12 noon and 12 midnight E.S.T. (*We assume he means English Summer Time and not Eastern Standard Time.—Hon. Sec.*) On March 31st, at 00.15 hrs., the signal strength at the receiving station in question—somewhere in England—was R4. The aerial in use was S.E. by S.

Morse Transmissions

FOR those wishing to improve their Morse receiving speed, details are given below of transmissions—in Morse—radiated from Post Office stations in the form of official News Bulletins.

Call signs and wavelengths used are:—

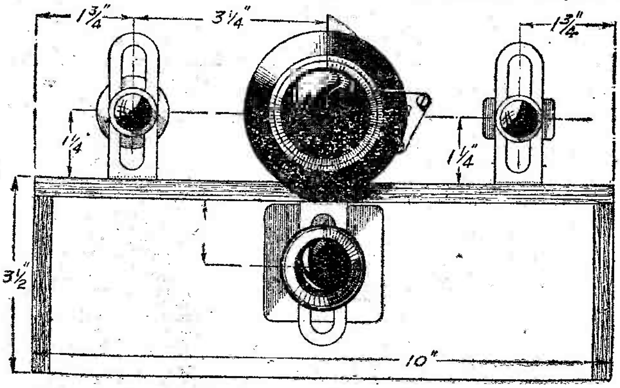
GIA, 15.27 m.; GAD, 15.40 m.; GBL, 20.47 m.; GID, 22.13 m.; GIH, 28.17 m.; GAY, 33.67 m.; G.B.R, 18.750 m.

The times (G.M.T.) of transmissions are: 09.30: GBR, GIA, GID, GIH; 12.00: GBR, GAD, GIA, GID; 16.00: GBR, GAD, GIA, GID; 19.30: GBR, GAY, GBL, GID; 23.30: GBR, GAY, GIH.

The Signet Two-valver

Main Constructional Details of a Beginner's Simple Broadcast Two-valver, Described on Blueprint No. P.W. 76

IN 1936 we described a simple two-valver which proved such a great success that we reprinted constructional details in our issue for September 24th, 1938. The demand for blueprints and back numbers of the journal in question has been so great that all the available issues have been sold out, and in response to the requests of many readers we are again reprinting particulars of the set, together with the list of components. Blueprints are still available. In the original specification a special trans-coupler was specified, but this is no longer on the market. Fortunately, however, a similar item is still listed in the Bulgin range, and is known as type L.F.10. This is similar in electrical and physical characteristics and may easily be used in the receiver. The only difference is in the marking of the terminals, and in place of the letters P, H.T.1, and H.T.2 on the original component, the Bulgin item is marked Anode, Low and High. These correspond respectively to the original markings, and thus in this receiver the anode terminal is connected to the point P on the blueprint and the H.T. lead is taken to terminal marked High.



Symmetrical layout of the controls can be secured by noting the dimensions shown here.

Circuit Details

The circuit is the well-tried detector-L.F. arrangement, a triode valve being used in the detector stage and an economy pentode in the output stage. A triode could be substituted for the pentode, but this would result in loss of volume, therefore the specified valve should be adhered to if possible. The coil is an efficient dual-range type, wave-changing being effected by means of an external three-point switch.

It is of the transformer type so that a high degree of selectivity can be obtained if the reaction condenser is judiciously operated. This coil works best with an outside aerial of approximately 40ft. If a longer aerial is used it will be advisable to connect a fixed condenser of approximately .0002 mfd. between the aerial lead and the aerial socket of the set. Reaction is provided by means of a differential reaction condenser, thereby ensuring an effective path to earth for the H.F. component at the anode of the detector valve.

Range

This simple little set can be relied upon to pick up medium-wave stations at a distance of approximately 100 miles when a reasonably efficient aerial is employed.

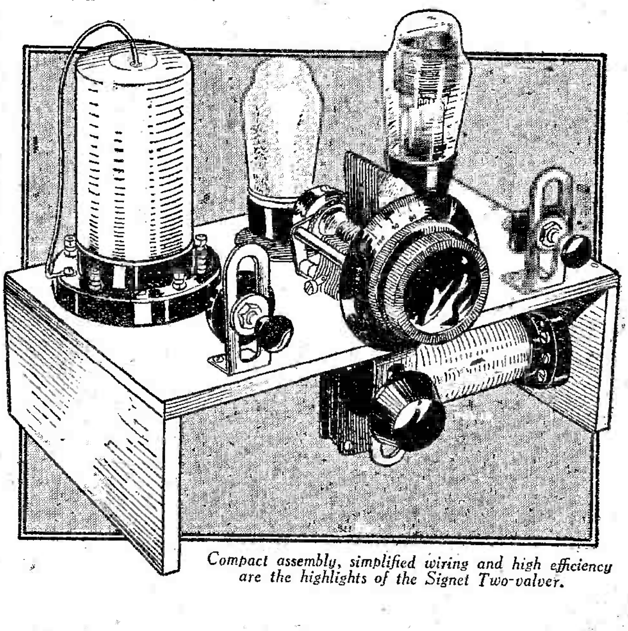
Construction

It will be noted that the receiver is ideal for the constructor who is attacking his first piece of constructional apparatus, and the lay-out has been arranged so that no possible difficulty can arise. The wiring diagram shows how the very few wires are placed in position, and provided that all connections are firmly made (either by making a neat loop for inclusion beneath the terminal head, or by soldering to connecting lugs) the receiver may be relied upon to offer many months of efficient service without risk of breakdown. When wiring the receiver, cross out each wire on the wiring diagram as its counterpart is placed in the receiver, and thereby avoid the risk of omitting one wire and dispose of all doubt as to whether any mistakes have been made.

The illustrations may be used as a guide in wiring, and every component required is clearly set out in the list of components. Existing conditions may make it impossible to obtain all the parts specified, therefore when selecting alternatives, see that they have the same values and are of reliable makes.

The Chassis

The chassis is constructed from 5-ply wood, to the dimensions shown on the blueprint. Holes will have to be drilled in order to accommodate the valveholders, the terminal socket strips and for the various connecting wires to pass through. There are nine of these, and a gimlet may be used for the purpose. Alternatively, a hole ⅛in. in diameter may



Compact assembly, simplified wiring and high efficiency are the highlights of the Signet Two-valver.

be drilled, but for the valve-holders a hole 1in. in diameter must be drilled. For the socket strips you can drill either a separate ¼in. hole for each projecting socket, or may cut a slot into which both sockets on each strip will pass. This is done by drilling two ¼in. holes separated by a space of 1in. and sawing away the intervening wood.

Before mounting the components one important factor must be stressed. The on-off switch is included in the L.T. positive lead and, consequently, if one is tempted to use an existing metal chassis, it must be insulated from the chassis which is common with the L.T. negative.

LIST OF COMPONENTS

One coil (C20) (Bulgin).
One .0005 mfd. condenser (1,046) (C1) (J.B.).
One .00025 mfd. reaction condenser (1,081) (C2) (J.B.).
One L.F. coupler Type L.F.10 (Bulgin).
One resistance: 1 meg., R1 (Erie).
One .0001 mfd. condenser (665) (C3) (Dubilier).
One switch (S36) (Bulgin).
One switch (S22) (Bulgin).
Two terminal strips, A.E. and L.S.
Two valveholders (one 4-pin, one 5-pin) (Clix).
Two valves: Cossor 210H.F., 220 H.P.T.
Five plugs: H.T.—, H.T.1, H.T.2, G.B.+, G.B.—.
Two spades: L.T.—, L.T.+.
Four component brackets.
Chassis, 10in. by 6in. by 3in.
One 100m/A microfuse and holder (Microfuse).
One speaker, Junior W.B.

Operating Instructions

Connect the aerial and earth leads to the two sockets marked A and E, and plug the leads from the loudspeaker into the loudspeaker sockets. The two L.T. leads should be joined to the positive (+) and negative (−) terminals on a 2-volt accumulator, and the H.T.− lead should be inserted in the negative socket on a 120-volt H.T. battery. The lead marked G.B.+ should be inserted into the positive socket of a 9-volt G.B. battery, and the lead marked G.B.− should be inserted into the 4.5-volt socket on this battery. Lead H.T.+2 should be inserted into the 120-volt socket on the H.T. battery and H.T.+1 should be plugged into the socket marked 99 volts, or somewhere near that value. Pull out both switches, and the receiver will then be in action on the medium waves, and before attempting to tune in a station rotate the reaction condenser in a clockwise direction with the main tuning condenser set at minimum (with the vanes "all out"). If the set goes into oscillation smoothly, as indicated by rushing sound in the speaker turning to a plop, turn the main tuning condenser with vanes all in, and again try the reaction condenser. The same thing should happen. Try this also on the long waves, that is, with the left-hand switch pushed in, and you should find that the reaction operates smoothly over the entire band. A modification of the voltage at H.T.+1 will vary the sensitivity and the smoothness of the reaction control, and a value should be used where a smooth build up is obtained on a station without a sudden plop, which indicates oscillation. If the H.T. voltage here is too low no reaction will be obtained. Stations are located by turning the main tuning condenser, and the strength is increased by the reaction condenser, but this should be used judiciously.

Aerial and Earth

With a simple receiver the best possible aerial should be employed, and this will be obtained when the aerial wire is erected as high above an earthed object as possible. Remember that a five-foot pole over a roof will only give an effective height of 5ft., and thus the aerial should, wherever possible, be placed so that it passes over clear ground, and as high as convenient. The earth also should be very efficient, and a buried metal plate, with the earth lead soldered to it, is generally the best. If you cannot get such an earth, or to do so means that a very long earth lead has to be adopted, then a main water pipe should be utilised, with the wire attached by means of a proper type of earthing clip.

Impressions on the Wax

Review of the Latest Gramophone Records

Columbia

ONE hundred ducats—about £50—was the sum Mozart received for his immortal opera, "Don Giovanni," which was first performed in Prague in 1787. The story of how the overture was completed only the night before the production is widely known, but there is another interesting fact connected with this opera, and that is that Mozart composed three extra numbers for when it was produced in Vienna. It is one of these: "Cruel One, Thou Hast Betrayed Me" (Mi tradi quell' alma ingrata) which Joan Hammond, accompanied by the Hallé Orchestra, conducted by Leslie Howard, records on *Columbia DX1075*. The aria expresses the rage of Donna Elvira, and Joan Hammond in her magnificent and thrilling rendering, has extracted—to the last detail—the full unrelentless fury of the betrayed woman.

Another outstanding recording in the classical releases is the Hallé Orchestra's performance of the Overture to "Die Fledermaus," the baton again being in the able hands of Leslie Howard. Although more than half a century has passed since Johann Strauss captivated Europe with this masterpiece of his, it can truly be said that it has lost none of its popularity and charm, and the Hallé Orchestra plays the Overture in the style the Waltz King intended it to be played—with exuberance and brilliant gaiety typical of the Viennese character and atmosphere of those days. The recording is on *Columbia DX1065*.

In the standard section, Isobel Baillie (soprano) has made some fine recordings of songs from the land of her birth—Scotland—on *Columbia DB2076*. These consist of "John Anderson My Jo," "I'm Ower Young to Marry Yet," and "Ca' the Yowes to the Knowes." Her voice has a radiant quality, and her rendering of these Scottish songs will appeal in particular to those north of the border.

Songs by Turner Layton at the piano are always popular, and his latest *Columbia* recording, *FB2781*, should not be missed by those who like the warm and sincere manner of presentation characteristic of this artist. "Say a Little Prayer" (introducing Schumann's "Traumerei") and "Bless This House" are the two numbers he has selected for this recording.

Members of the Monte Rey Friendship Circle will welcome the latest release of *Columbia FB2782* on which is recorded Monte singing—in his own inimitable style—"Your Hand in Mine" and "If You Were Beside Me." These are two very popular numbers, and the singer, accompanied by an orchestra, makes the most of their appeal.

The smooth, easy rhythm, always associated with Carroll Gibbons' piano playing, is, to me, pleasantly relaxing, and the two latest examples of Carroll's lazy fingers, "Solitude" and "Time on My Hands," provide ever-welcome restful music, and reveal the true skill and technique of this popular artist. The recordings are on *Columbia FB2785*.

Those who like their dance music in strict dance tempo will appreciate the new releases—*Columbia FB2790*, *FB2791* and *FB2792*—which record the rendering of "Greetings from You" and "When the Roses Bloom Again"; "Madelaine" and "Jim," and "To-morrow's Sunrise" and "Mandy is Two," by that ballroom music maestro, Victor Silvester.

Hawaiian enthusiasts have not been overlooked. Felix Mendelssohn and his Hawaiian Serenaders offer "La Cumparsa Cubanas" and "Lover Come Back to Me"—from "New Moon"—on *Columbia FB2783*.

An ever-popular trio, the Albert Sandler Trio, has recorded, on *Columbia DB2073*, "Baby Mine," one of the outstanding hit tunes from the film "Dumbo," and "My Paradise," from "Gangway."

Parlophone

RICHARD TAUBER is always refreshingly topical with his recordings, as exemplified by his choice of titles from the Jeanette Macdonald film "Smilin' Through." On *Parlophone RO20510*, he has recorded "Smilin' Through" and "A Little Love, A Little Kiss" and, needless to say, the singing—in English—is true to the standard for which this versatile artist is world famous. Other *Parlophone* recordings include "If I Could Paint a Memory" and "Lullaby to a Hero," *F1903*, by that trio who perform under the title "The Organ, The Dance Band and Me," namely, Billy Thorburn, H. Robinson Cleaver and—the vocalist—Julie Dawn; "Tin Pan Alley Medley—No. 43," *F1902*, by Ivor Moreton and Dave Kaye. Geraldo and his Orchestra have a couple of records—*Parlophone F1901* and *F1900* on which they have recorded "'Tis Autumn" and "Soft Shoe Shuffle" and "White Cliffs of Dover" and "Madelaine" respectively.

H.M.V.

HERE is a selection of the *H.M.V.* recent releases, all of them being in the *BD* series. "Day Dreaming" and "Flamingo," *H.M.V. BD1003*, and "I'll Always Remember" and "The Shrine of Saint Cecilia" on *BD1001*, are two for those enthusiasts of "Hutch" (Leslie A. Hutchinson).

Big-hearted Arthur Askey also has two new records, one—having piano accompaniment—*BD1002*, on which he records "The Flu-germ" and "The Ant," and the other, *BD1004*, having an orchestral accompaniment, "I Want a Banana" and "It's Spring Again." Duettists at a piano, in the form of Gaye and Nevard, offer "Day Dreaming" and "The Turn of the Tide" on *H.M.V. BD997*. A most pleasing combination of voices and piano.

Reginald Fort on his Giant Moller Concert Organ, records a fine selection from the music of the film "Dumbo" on *BD1000*. The title is "Dumbo" Selection and it occupies both side of the disc.

Here are five fine Dance Orchestra releases, *BD5743* being by The R.A.O.C. Blue Rockets Dance Orchestra, playing—with vocal refrain—"When It's Peace on Earth Again" and "Ma, I Miss Your Apple Pie," and *BD5745*, "We're The Couple In the Castle" and "Katy Did Katy Didn't." The other three are by Joe Loss and his Orchestra, which give us "Jim" and "The Mayflower" on *BD5740*; "The Shrine of Saint Cecilia" and "Greetings From You" on *BD5741*, and "I Don't Want to Walk Without You" and "Who'll Buy a Rose from Margareeta" on *BD5742*.

Decca

A RECORD I recommend to all of those who appreciate the works of Rachmaninoff, and the superb technique of Moura Lympany, is *Decca K1026*. This offers a brilliant recording of Moura Lympany at the piano, playing "No. 8 in C Minor (Op. 23, No. 7)," "No. 12 in C Major (Op. 32, No. 1)," "No. 7 in E Flat (Op. 23, No. 6)" and "No. 10 in E Flat (Op. 23, No. 9)," by Rachmaninoff.

In a very much lighter mood, there is "Charlie Kunz Piano Medley No. D 52" (with rhythm accompaniment) on *Decca F8100*. This consists of "Concerto for Two," "Russian Serenade," "What More can I Say," "The White Cliffs of Dover," "Green Eyes" and "Rose O'Day."

No record list would now be complete without Vera Lynn, and I have selected *Decca F8110* on which she records, with Mantovani and his Orchestra, "The White Cliffs of Dover" and "I'll be with You in Apple Blossom Time."

Old-time Sets

Further Notes on the Activities of Some of Our Readers in the Early Days of Radio

WE publish on this page a few more details of readers' activities in the early days of radio, submitted in response to Thermion's invitation in our May issue.

A Crystal Set: and Two-Valver

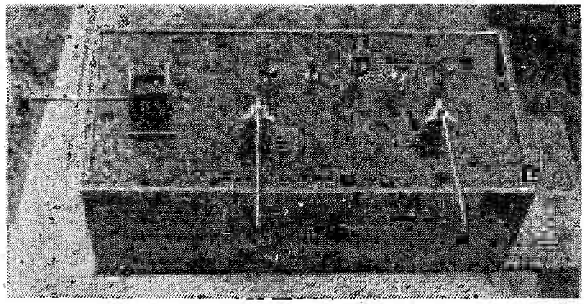
A. J. BUDD, of Harrow, describes his early activities as follows:

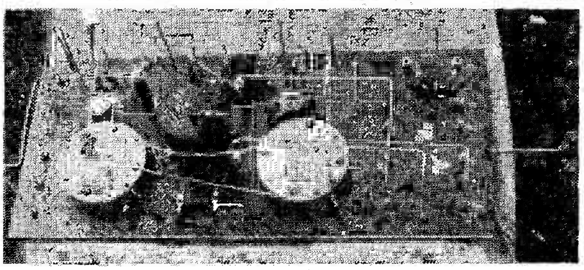
"Although I had been a keen and active model engineer for many years, and interested, in a general sense, in electricity, I did not take up wireless seriously until 1921.

"My first experimental and constructional efforts were, naturally, connected with crystal receivers, and I well remember the hours that I used to spend winding, mounting and testing the cumbersome solenoid coils which were part and parcel of the then popular crystal circuits. One of the accompanying illustrations shows one of my receivers; it was, in those days, considered a de luxe model, with its double sliders on the coil and the micrometer adjustment for the cat's whisker. In conjunction with this and other sets I made, I used a rather elaborate aerial system, consisting of twin wires, held apart by 6-ft. bamboo spreaders, a 30-ft. wooden mast, and all guys and halyards rigged in true Bristol fashion. The first thrill of receiving the signals from Eiffel Tower on the crystal set will never be forgotten.

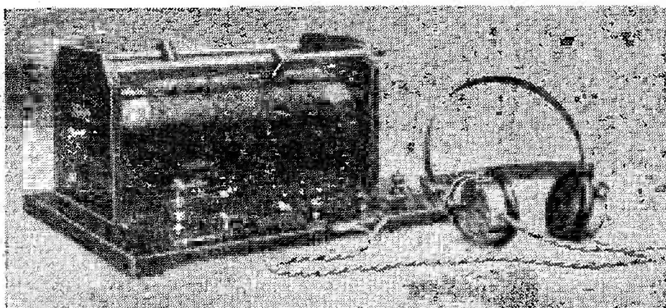
"The other illustration shows an early effort using valves. The circuit was of the Det. and L.F. type, aerial tuning being carried out—medium waves only—by means of the vario-coupler, complete with tappings, and a home-made variable condenser. This must have been about 1923, and I well remember the great excitement when I received with it, a broadcast programme — a concert—from 5IT, which was 80 miles from my station!

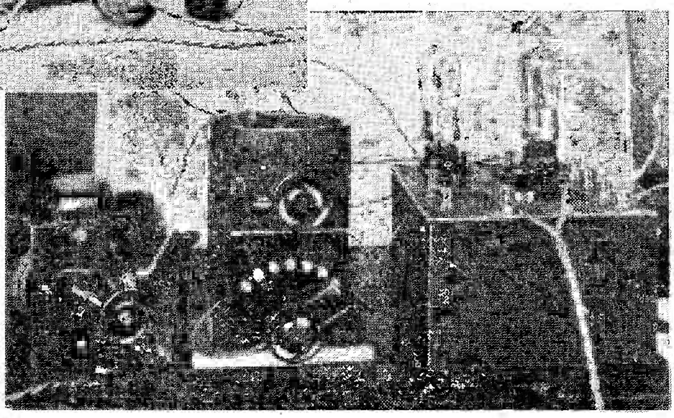
"For L.T. supply I used a 6-volt accumulator that nearly broke my back every time I had to move it; the H.T. was obtained from 18 flash-lamp batteries—that is, when the connections did not let me down. Those were the days!"





Two views of M. Joseph's receiver of 1924 vintage.





A. J. Budd's crystal receiver built about 1922 and (on the right) his two-valve set with vario-coupler tuner.

An Adaptable Receiver

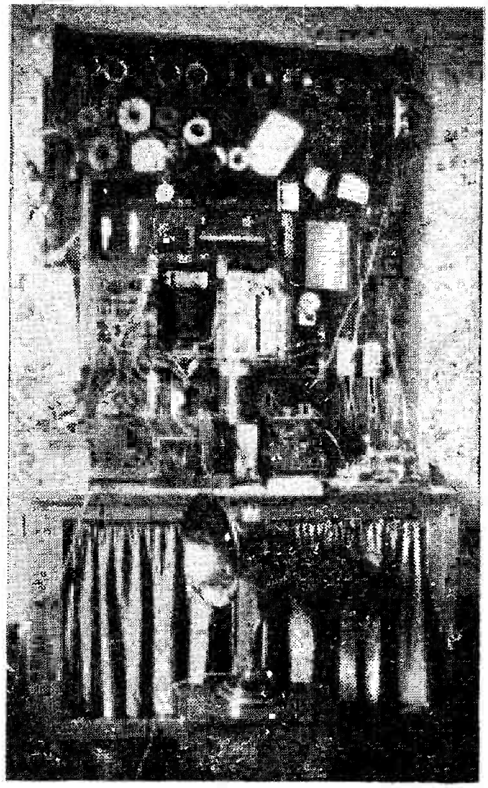
M. JOSEPH, of Wimbledon, writes concerning his early receiver:

"I enclose a couple of prints which show the exterior and interior of a 'very up-to-date' receiver of February, 1924, vintage. The numerous sockets allowed of the different components being connected up to form anything from a o-v-1 to a o-o-1. I used the best 'bits and pieces' that I could get then, but the set was not very good, though, I suppose, good enough for those times.

"You will observe the microstats controlling each valve's filaments, and the Bretwood grid leak, then quite *de rigueur.* This receiver has reposed in my junk box for many a year now, and I don't quite know what to do with the bits. I just keep them in case I might be short of some odd part or other."

A Neat Layout

C. R. NEVILLE, of Greenwich, sends the following short description of his early activities:



A corner of C. R. Neville's wireless den in 1925.

"Your article 'The Silent Sets' carried my mind back to those happy days of the reflex circuits. The component shortage did not deter our efforts in those days.

"I can remember winding an iron core transformer with 40 d.s.c. wire, after making a coil winder from an old Edison Bell phonograph machine, the type that played cylindrical records.

"Then we used to wind our honeycomb coils with the aid of a piece of broom handle with nails driven into it. I recall my first portable with frame aerial in the door and external speaker; it was so bulky that it required two to carry it. I took it on a tramcar one evening to see what its performance would be like. I often have a laugh when I recall the expression on the faces that peeped over the top of the evening papers when the Savoy Orpheans dance band burst forth with 'Three o'Clock in the Morning' from the brown paper parcel containing the speaker.

"We used to get some DX thrills even in those days. One night I picked up the B.B.C. experimental transmission for their new Glasgow transmitter. My RX was a one-valve reflex and I logged the transmission at R6-R7, at a time when atmospherics were bad.

"I enclose a photo taken in 1925, hoping it will be of interest to you."

A Refresher Course in Mathematics

By F. J. CAMM

(*Continued from page 322, June issue*)

Simple Equations

Further Examples in Division

$$a^2+2ab+b^2)\ a^3+3a^2b+3ab^2+b^3\ (a+b$$
$$a^3+2a^2b+ab^2$$
$$\overline{\quad a^2b+2ab^2+b^3}$$
$$a^2b+2ab^2+b^3$$
$$\overline{\qquad\qquad}$$

$$a+b)\ ax+ay-az+bx+by-bz\ (x+y-z$$
$$ax \qquad +bx$$
$$\overline{ay-az+by}$$
$$ay \qquad +by$$
$$\overline{-az-bz}$$
$$-az-bz$$
$$\overline{\qquad\qquad}$$

Brackets

Parts of an algebraic expression are often grouped by means of brackets ( ), and where brackets are used within a bracket, square brackets [ ] are used on the outside and the normal bracket within. Sometimes it is necessary also to use the brace $\{\ \}$. In other instances a line is placed over quantities, and this line has the same value as a bracket. Hence, $\overline{x+y}$ is the same as $(x+y)$, and $\overline{x+y}\times\overline{x-y}$ is the same as $(x+y)(x-y)$.

Example: $5x-(2a-3b)$. The expression means that we must subtract $2a-3b$ from $5x$.

When a minus sign precedes the bracket, it changes the sign of all terms within the bracket. The minus sign is equivalent to -1, and every term within the bracket is thus multiplied by -1. So, in the example given, $2a$ becomes $-2a$, and $-3b$ becomes $+3b$, and the complete expression now reads $5x-2a+3b$.

Further examples:

$$5x+(3a-4b+5c)=5x+3a-4b+5c$$
$$5x-(3a-4b+5c)=5x-3a+4b-5c$$

When multiple brackets are used, each form of bracket indicates that all terms between them must be considered as one quantity and therefore must be multiplied, divided, subtracted or added as a whole according to the signs which precede the terms. The positive sign outside a bracket does not affect the signs within.

Thus, to multiply $x+y$ by $a+b$ we write:

$$(x+y)(a+b)$$

If we wish to subtract a quantity from this, as $2d$, we write:

$$(x+y)(a+b)-2d$$

and if this quantity is to be multiplied by a further term, say $5x$, we write:

$$5x\{(x+y)(a+b)-2d\}$$

Further multiplication, addition, or subtraction brings in the use of square brackets. Thus:

$$2[5x\{(x+y)(a+b)-2a\}-n]$$

It is usual, in evaluating an expression of this sort, to remove the inner brackets first; thus:

$$2[5x\{ax+ay+bx+by-2a\}-n]$$

Here $x+y$ has been multiplied by $a+b$ to produce $ax+ay+bx+by$.

Next the braces; multiply $ax+ay+bx+by-2a$ by $5x$, producing:

$$5ax^2+5axy+5bx^2+5bxy-10ax$$

We now have:

$$2[5ax^2+5axy+5bx^2+5bxy-10ax-n]$$

and multiplying that by 2 produces:

$$10ax^2+10axy+10bx^2+10bxy-20ax-2n.$$

Further Examples

Add: $2a+4b+3c+8d$, $a+b-c-d$, $18a-3b+3c-4d$, and $6b+5c+4d$

$$2a+4b+3c+8d$$
$$a+b-c-d$$
$$18a-3b+3c-4d$$
$$6b+5c+4d$$

Answer: $21a+8b+10c+7d$

Add: $a^2+3b-c+5d$, $3b+c$, a^2+3c, $-a^2+c-d$, $c-d$, and $4a^2-2b+c-3d$.

$$a^2+3b-c+5d$$
$$3b+c$$
$$a^2 \quad +3c$$
$$-a^2 \quad +c-d$$
$$c-d$$
$$4a^2-2b+c-3d$$

Answer: $5a^2+4b+6c$

Add: $2ab-3ac+4bx-3ay+3$, $ac+2ay-4$, $-ab-2ac-bx-ay-4$, $5ac+2$, and $ab+by$.

$$2ab-3ac+4bx-3ay+3$$
$$ac \quad +2ay-4$$
$$-ab-2ac-bx-ay-4$$
$$5ac \quad +2$$
$$ab \quad +ay$$

Answer: $2ab+ac+3bx-ay-3$

If in the last example $a=2$, $b=3$, $c=4$, $x=5$ and $y=6$, the sum would become:

$$12-24+60-36+3=75-60=\ \ 15$$
$$8+24-4=32-4=\ \ 28$$
$$-6-16-15-12-4=-53$$
$$40+2=\ \ 42$$
$$6+12=\ \ 18$$
$$\overline{\ \ 50\ \ }$$

Subtract: $3x^2-2xy+9$ from $5x^2-xy+ab-2$.

$$5x^2-xy+ab-2$$
$$3x^2-2xy \quad +9$$

Answer: $2x^2-xy+ab-11$

Subtract:

$9a^2+4ab+b^2$ from $a^2+2ab+b^2$

$$a^2+2ab+b^2$$
$$9a^2+4ab+b^2$$

Answer: $-8a^2-2ab$

Divide: $-x+y$ by -1.
Answer: $x-y$

Express $-x+y$ in another form.
Answer: $-(x-y)$.

The reader should practise multiplication in algebra and check the result by dividing the product by one of the two quantities which, multiplied together, produced it, to obtain the other quantity.

Thus: multiply $ax+3by$ by $4a+3b$.

$$\begin{array}{r} ax+3by \\ 4a+3b \\ \hline 4a^2x+12aby \qquad\qquad \\ +3abx+9b^2y \\ \hline \end{array}$$

Answer: $4a^2x+12aby+3abx+9b^2y$

We can now check this back:

$$ax+3by)4a^2x+12aby+3abx+9b^2y(4a+3b$$
$$\begin{array}{l} 4a^2x+12aby \\ \hline \qquad 3abx+9b^2y \\ \qquad 3abx+9b^2y \\ \hline \end{array}$$

or:

$$4a+3b)4a^2x+12aby+3abx+9b^2y(ax+3by$$
$$\begin{array}{l} 4a^2x \qquad +3abx \\ \hline \qquad 12aby+9b^2y \\ \qquad 12aby+9b^2y \\ \hline \end{array}$$

Simple Equations

Algebra is of the greatest use in expressing a problem in its simplest terms; it is a system of arithmetical shorthand, more graphic than words and enabling the relation of the quantities to one another to be seen at a glance. The problem is converted into *symbols*, or *symbolical expressions*.

Thus, the output of a machine may be stated as x, and of five machines of similar type as $5x$; or if the rate of output of a machine is increased by five times, its output would be $5x$.

Two numbers may differ by, say, 17. Let x denote the larger number and y the second.

Hence $x-y=17$.

A car travelling a distance of x miles at a speed of y miles an hour would take $\frac{x}{y}$ hours.

Now, in algebraic calculations certain symbols are assigned to certain quantities. Thus t=time, V and v =velocity, s=distance, or space, or sum; g=gravity =32.2ft. per sec./per sec. These letters convey what they stand for at a glance, because they are the initial letters of the quantities.

Any arithmetical or algebraic expression such as $x+y=9$, $3\times8=24$ is called an *equation*, since the terms each side of the = sign are *equal*, or *equated*. All expressions which are separated by the equality sign are therefore equations, whether the expressions are arithmetical or algebraic.

By means of algebraic equations we are able to find the value of the unknown quantities, and this process is known as *solving the equation*, the answer being the *root* or *solution*.

If the problem does not involve the power of any unknown quantity, it is termed a *simple equation*; if one or more of the unknown quantities are squared, the problem is a *quadratic equation*; if one or more unknown quantities are cubed, the problem is a *cubic equation*.

When the equation relates to an algebraic operation only, the expression is known as an *identity*. Thus $(a+b)^2=a^2+2ab+b^2$ is an identity, for we have evaluated the expression $(a+b)^2$, and reached a result beyond which it is impossible to proceed.

Continuing with simple equations, let us take the simple algebraic expression $5a+9=19$. In this expression it is clear that 5 times the unknown number plus $9=19$. It is apparent that a equals 2, and this simple example is sufficient to illustrate the process of solving an equation.

Now it is important to remember that the value of an equation is not altered by multiplying, dividing, subtracting, or adding to each side of the equation. Whatever is done to one side of the equation must be done to the other. We can, if it is convenient to solve the equation in that way, raise each side of the equation to the second or third power, or to the *nth* power, which is another way of saying that if you multiply, divide, subtract from, add to, or raise to a power the left-hand side of the equation, we must multiply, divide, subtract from, add to, or raise to the same power the right-hand side.

Although mentally we have found that the value of a in the above simple equation is 2, it would, in fact, be solved in the following way:

$$5a+9=19.$$

Now subtract 9 from both sides, thus:

$$(5a+9)-9=19-9.$$

Subtracting, $5a=10$.

Dividing throughout by the coefficient 5

$$a=2.$$

Both sides of the equation remain unchanged if all the signs on each side are changed, thus:

$$-5a-9=-19.$$

This merely means that we have multiplied the original equation by -1.

Another method of solving the equation would be to transpose the figure 9 from one side of the equation to the other, thus:

$$5a+9=19$$
$$5a=19-9$$

This boils down to the well-known algebraic rule:

All the unknown quantities are transposed to one side and all the known quantities to the other, dividing, if necessary, by the coefficient of the unknown quantity.

Here are some examples:

$$\begin{aligned} 3x+5&=20 \\ 3x&=20-5 \\ 3x&=15 \\ x&=5 \\ 2(x+4)&=24 \\ 2x+8&=24 \\ 2x&=24-8 \\ 2x&=16 \\ x&=8 \\ 3x^2-7&=41 \\ 3x^2&=48 \\ x^2&=16 \\ x&=\sqrt{16} \\ &=4 \\ (a+b)(a+b)&=25 \\ a^2+2ab+b^2&=25 \end{aligned}$$

This is an identity, and numerical values for a and b cannot be found (except by trial and error) unless we know the value of one of the unknowns.

$$\begin{aligned} 5x-7&=2x+2 \\ 5x-2x&=2+7 \\ 3x&=9 \\ x&=3 \end{aligned}$$

Note that, when transposing from one side to another, the signs are changed. Negative signs become positive and positive signs become negative.

Thus in the last example $+2x$ becomes $-2x$, and -7 becomes $+7$. This rule is most important.

$$\begin{aligned} 3a^2-10a&=8a+a^2 \\ 3a^2-a^2&=10a+8a \\ 2a^2&=18a \\ a^2&=9a \end{aligned}$$

Dividing by a $\quad a=9$

$$\frac{x}{3}+\frac{x}{9}=4$$

Get rid of the fractions by multiplying both sides of the equation by 9.

$$9\left(\frac{x}{3}\right)+9\left(\frac{x}{9}\right)=9\times4$$
$$\begin{aligned} 3x+x&=36 \\ 4x&=36 \\ x&=9 \end{aligned}$$

$$\tfrac{3}{5}\left(x+10\right)-\tfrac{2}{3}\left(x-2\right)=\frac{5x+5}{6}+2$$

Multiply both sides by 30 to eliminate the fractions:

$$\begin{aligned} 18(x+10)-20(x-2)&=25x+25+60 \\ 18x+180-20x+40&=25x+25+60 \\ 18x-45x&=-180-40+25+60 \\ -27x&=-135 \end{aligned}$$

Divide throughout by -27:

$$x=5$$

The reader will become facile at solving equations if he practises making up simple problems and expressing the conditions by symbols.

Here are some examples:

The difference between two numbers is 7. Their sum is 13. What are the numbers?

Let x = the larger number, and y the smaller.

$$\begin{aligned} \text{Then } x+y&=13 \\ x-y&=7 \\ \hline \text{Subtracting: } 2y&=6 \\ y&=3 \end{aligned}$$

Substituting this value in either of the above equations:

$$\begin{aligned} x+3&=13 \\ x&=13-3 \\ &=10 \\ \text{or } x-3&=7 \\ x&=7+3 \\ &=10 \end{aligned}$$

Problems

Find three numbers, such that the largest is equal to the sum of the other two; the ratio of the latter is as 2 to 3. If 10 be added to each number the largest number will be 5 more than half the sum of the other two numbers.

As the two smaller numbers are in the ratio of 2 to 3, let $3x$ and $2x$ represent them; $5x$ will therefore represent the largest number.

Add 10 to each of the numbers:

$$5x+10$$
$$3x+10$$
$$2x+10$$

Now:

$$\begin{aligned} 5x+10&=\tfrac{1}{2}(2x+3x+20)+5 \\ \therefore 5x+10&=\tfrac{1}{2}(5x+20)+5 \\ \text{Hence } \tfrac{5}{2}x&=5 \\ x&=2 \end{aligned}$$

The numbers are therefore 10, 6, and 4.

The result may be checked by substituting these values in the equation. Thus:

$$\begin{aligned} 10+10&=\tfrac{1}{2}(4+6+20)+5 \\ 20&=\tfrac{1}{2}(30)+5 \\ 20&=15+5 \end{aligned}$$

The sum of two numbers is as 2 to 3, and their sum is 30. Find the number.

Let $2x$ = one number

and $3x$ = the second number.

$$\begin{aligned} \text{Then } 3x+2x&=30 \\ 5x&=30 \\ x&=6 \end{aligned}$$

A stone dropped from a window takes 3 secs. to reach the ground. Find the height from which it was dropped. We must here remember that the velocity of a freely falling body is 32.2 ft. per sec./per sec.; and the relation between distance fallen and time taken is $s=\frac{1}{2}gt^2$, where s = distance in ft., t = time in secs., and $g=32.2$.

So:

$$\begin{aligned} s&=\tfrac{1}{2}\times 32.2\times 3^2 \\ &=16.1\times 9 \end{aligned}$$

Height of window $=144.9$ ft.

In what time will a stone drop a distance of 144.9 ft.?

$$\begin{aligned} 144.9&=\tfrac{1}{2}\times 32.2\times t^2 \\ t^2&=\frac{144.9}{16.1} \\ t&=\sqrt{8.9}=2.98 \text{ secs. approx.} \end{aligned}$$

By adding 4 to a number, and dividing the result by 5, the result is ¼th of the original number. What is the number?

$$\frac{x+4}{5}=\frac{x}{4}$$

Multiply each side by 20:

$$\begin{aligned} 4x+16&=5x \\ 5x-4x&=16 \\ x&=16 \end{aligned}$$

Pythagoras' rule for the length of the hypotenuse of a right-angled triangle is base^2+height^2=hypotenuse. The base of a right-angled triangle is 3ins. and the hypotenuse 5ins. What is its height?

$$\begin{aligned} a^2+b^2&=c^2 \\ 9+b^2&=25 \\ b^2&=25-9 \\ b&=\sqrt{16} \\ &=4 \end{aligned}$$

One number is one-fifth of another, and their sum is 30. What are the numbers?

Let x = the smaller number.

Then $5x$ = the larger number.

$$\begin{aligned} 5x+x&=30 \\ 6x&=30 \\ x&=5 \end{aligned}$$

The two numbers are thus 5 and 25.

The foregoing are simple equations, involving the use of one unknown quantity. It is, of course, impossible to lay down specific rules for every type of problem. The reader must learn the various tricks of calculation to enable him to solve a problem. For example, we have seen that the square of two quantities separated by a plus sign is the square of each quantity, plus twice the two quantities multiplied together. Put in the form of an equation:

$$(x+y)^2=x^2+2xy+y^2.$$

Here is an example of the use which may be made of this rule:

The square of the sum of two numbers is 81. The product of the numbers is 20; their sum is 9 and difference 1. What are the numbers? Although this is a quadratic equation, knowing the above rule we write:

$$\begin{aligned} x^2+y^2&=81 \\ 2xy&=40 \\ \hline x^2+2xy+y^2&=121 \end{aligned}$$

The factors of $x^2+2xy+y^2$ are:

$$(x+y)\ (x+y)$$

$$\begin{aligned} \text{and } x+y&=9 \\ \text{subtracting } x-y&=1 \\ \hline 2y&=8 \\ y&=4 \\ x&=5 \end{aligned}$$

Later on I shall explain how to solve quadratic equations, when the facts of the problem are not so fully given as in this example.

Here are some examples for practice:

$$\frac{11y-13}{25}+\frac{17y+4}{21}+\frac{19y+3}{7}=28\tfrac{1}{7}+\frac{5y-25\frac{1}{3}}{4}$$

Answer: 8.

Remember, it is always advantageous to clear the fractions.

Solve: $\dfrac{x-y}{x+y}+\dfrac{3a-x}{2a+x}=0.$

Answer: $x=\dfrac{-ay}{5a-2y}$

Solve: $\dfrac{a-b}{x-c}=\dfrac{a+b}{x+2c}$

Answer: $\dfrac{3ac-bc}{2b}$

Solve: $\dfrac{ax}{b}+b=\dfrac{bx}{a}+a$

Answer: $\dfrac{ab}{a+b}$

Solve: $\dfrac{1}{x-a}+\dfrac{1}{x-b}=\dfrac{2}{x}$

Answer: $\dfrac{2ab}{a+b}$

Solve: $\dfrac{x}{ab}+\dfrac{x}{bc}+\dfrac{x}{ac}=a+b+c.$

Answer: abc.

A man is older than his wife by 10 years, and 15 years ago the man was twice as old as his wife. What are their ages?

Answer: 25 and 35.

(To be continued.)

The S.W. Converter Two

Spare Parts Can be Used to Construct this Efficient S.W. Unit

AN efficient short-wave converter is one of those pieces of apparatus which should form part of every constructor's equipment.

It does not follow that it is necessary for one to be a most enthusiastic short-wave "fan" before one makes up and uses such gear. Even if the interest is only a passing one, or if short-wave reception is required only for one month a year, the apparatus takes up very little room, does not cost anything to keep, and is inexpensive to build.

With the great increase in news value of the world's S.W. stations, those many odd times when the medium waves have nothing tempting to offer need no longer be idle moments for the receiver, provided that one has an efficient S.W. converter or adapter ready to be put into action.

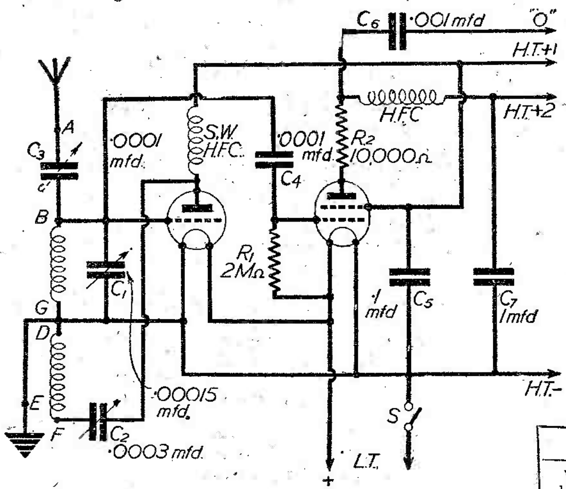


Fig. 1.—The circuit of the converter, showing how the S.G. valve is used as a detector-mixer.

Types of Units

There are two types of S.W. units which will enable use to be made of a normal broadcast receiver for the reception of the short waves. They are usually known as (a) an S.W. Converter, and (b) an S.W. Adapter. It is possible to combine both types in one unit; but that does not concern us at the moment.

The converter works on the superhet method, and is designed for use with any type of receiver employing one or more stages of high-frequency amplification—a superhet receiver being included. It possesses the following worth-while features: it has a good degree of selectivity—very essential nowadays on the short waves—and it forms, in conjunction with any good receiver, a very sensitive outfit.

The adapter, on the other hand, is the most simple arrangement possible, but as it only utilises the broadcast receiver from the detector stage to the output, it is, naturally, not so selective or sensitive, and the results obtained might not always be good. If you have been using an adapter and you are inclined to condemn short waves because of the results you did or did not get, I would say, have another try with the unit described below and then compare notes.

Some converters use a single triode valve as a combined detector and oscillator—two functions necessary in this type of unit—and although such an arrangement is cheap and simple, it is far from perfect in operation. A better method makes use of a heptode, or a heptode and a triode, but once again the constructor runs up against cost, and more valves for stock, so the heptode must be ruled out on that score.

An Alternative Circuit

An alternative system—which can be used without any loss of efficiency—is shown in Fig. 1, which is the circuit of the unit under discussion, and which makes use of a triode and an ordinary S.G. valve, both being likely occupants of the spares box.

The triode is used as an oscillator, the S.G. as a detector, and the combination lends itself to easy operation, good selectivity and sensitivity.

The tuning or grid condenser C_1 should have a capacity of .00015 mfds., while the reaction control C_2 has a value of .0003 mfds. The values are not too critical, provided the coil-winding details are adjusted to suit any variation. For example, if a .0002 mfd. reaction condenser is used, it may be necessary to add a turn or two to the reaction winding before a satisfactory effect is produced. If a larger tuning condenser is employed, fewer turns must be used for the grid coil, and so on, but don't go to the extreme and use, say, a .0005 mfd. condenser.

Coil Windings

The details for the coil windings are given with the illustration (Fig. 2), and it will be noted that there is nothing difficult about them. Should it happen that other two-circuit S.W. coils are available, there is no reason why they should not be used, so long as the values of C_1 and C_2 are selected to suit. It should be noted, at this stage, that the whole secret of the circuit depends on smooth and satisfactory reaction being obtained, otherwise the triode circuit will not be maintained in the required state of oscillation.

WINDINGS			
Wave-lengths	GRID, 22 S.W.G.	Distance X	Reaction 34 S.W.G. Enam. or Cotton Cov.
14-25M	3 Turns	½in.	4 Turns
24-40M	6 Turns	½in.	5 Turns
35-75M	10 Turns	⅜in.	8 Turns

Two high-frequency chokes are required, one wound for S.W. work, and the other a normal broadcast type.

The other components need no explanation as they are standard, but it is advisable to adhere to the values shown and use a triode valve of the H.L. type and a screened grid of the "straight" variety.

Operation

With the valves

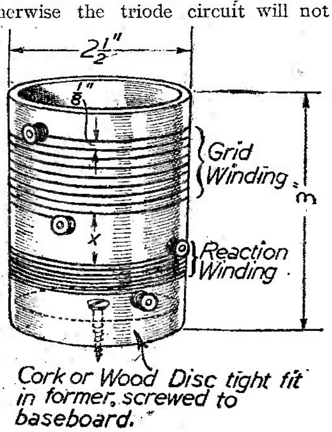
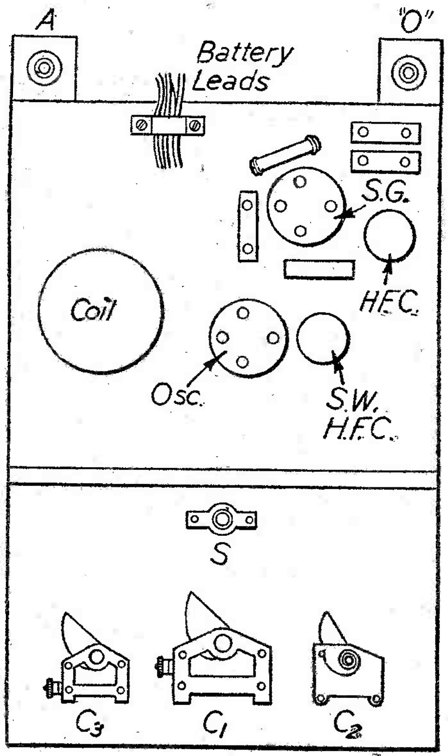


Fig. 2.—The simple constructional details of the coil are shown here.

and coil in position, the batteries all connected and switched on, connect the actual aerial to terminal A and the output (terminal O) to the aerial terminal of the broadcast receiver, after making sure that the receiver is switched over to the *long waves*. The broadcast receiver is then switched on and the volume or reaction control set to, say, just below maximum output, care being taken to see that the circuit is not oscillating or unstable.

The reaction condenser C2 of the converter is then adjusted until the circuit sounds alive or when a steady rushing—but not whistling—sound is produced, after



A suitable layout for the circuit shown in Fig. 1. Baseboard or chassis construction can be used.

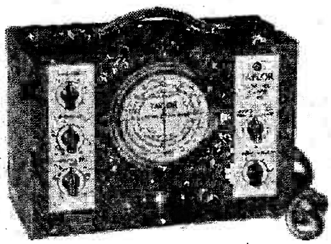
which the tuning condenser C1 can be rotated—very slowly—through its travel or until a station carrier is heard.

Tuning Adjustment

Be careful and patient with the tuning, as it is so easy to pass over transmissions on the short waves without being aware of their existence if the tuning is adjusted too quickly.

It will be found that it is possible, by adjusting the aerial series condenser and the H.T. feed, to find a setting of C2 which will hold good for all settings of C1 for the coil concerned, thus allowing one-dial tuning to be obtained. Once a station is received the volume can be adjusted by the reaction and/or volume controls of the broadcast receiver.

Provided the existing aerial is not longer than, say, 60ft. and a long lead-in is not used through the house, it will be quite satisfactory for use with the converter, though one that is well clear of all obstruction and having a good height will, naturally, be more efficient.



Comment, Chat and Criticism

Music and the Times

The Popularity of Beethoven. By Our Music Critic, Maurice Reeve

THIS war is so entirely different from the last one that it would make quite a difficult job to start enumerating all the points at which comparisons would fall to the ground. I would hazard that, the war itself apart, the greatest differences are to be seen in the temper of the people and in the revolutionary change it has effected in their everyday life.

To-day, there simply is no jingoism as such. This war seems to be utterly devoid of an atom of "atmosphere." Not a brass band is to be seen or heard, except on rare occasions, nor is a flag waving. Marching columns are so different in their formation that they have, of necessity, had to shed all their glamour. Also, there is no music-hall—comparable to the last war—or theatre, to arouse our patriotic fervour with nationalistic songs, displays and catches. I think that the anthems on the wireless are listened to by most people with a feeling bordering on either boredom or indifference.

No, compared to 1914, it isn't just there. War is just a horrible and vile necessity. Grim determination to see it through, plus disgust at having to soil our hands in it, are all it makes us feel.

Naturally this has had the most profound psychological reactions in the homes of the people. It all began, I think, at 11.15 a.m. on the morning of September 3rd, 1939, when the first air-raid warning of the second world war was sounded—a quarter of an hour after its commencement. Although the fears of the vast majority were not at that moment fulfilled, it drove the people, mentally speaking, into their shelters and dug-outs for the duration. Whether they knew it or not, their mentalities were made up for them then.

Queen's Hall Concerts

Don't mistake me on one point. That first frightening syren didn't kill the desire of people to go out and attend concerts or other resorts. On the contrary, the few concerts that have been held have, for the most part, been magnificently attended. Four Beethoven programmes at Queen's Hall were each sold out! But a fear was born at the back of one's mind, even if it was left there in most of us in despised oblivion, that whenever we sat down to a programme of any pretensions to seriousness we were liable to be called away from it by the dread summons of the approaching Heinkels, if not of the actual cargoes they carry.

Consequently the things we wish to listen to must be chosen by these overriding considerations. Needless to say, what we want is not always obtainable! But when it is, we just go out and grasp it.

It will be recalled that, when the war commenced, the Promenade Concerts were in the middle of a season well over their fortieth. Although the imminence of the aerial war—as most people believed—was doubtless the primary cause of their suspension, I think the character of the programmes had something to do with it as well. Audiences had been steadily dwindling during the days preceding the declaration of hostilities, and it was to an almost empty house that Sir Henry Wood announced that they would have to terminate.

Concert-going Public

In normal times and with normal frames of mind and mood, few programmes are as skilfully framed to meet and satisfy the demands of the concert-going public as are those heard at the Promenade Concerts. The skill with which they ranged from a Brandenburg to bolero or from Peer Gynt to Sibelius, were astonishing. The specialist as well as the casual music lover each had his wishes catered for, and only the most unreasonable were heard to grumble.

Changing Tastes

Why, therefore, did music lovers fail to support them when catastrophe loomed ahead and when the solace of sweet music might have been considered more necessary than ever? Conceding that the times we lived in were the chief governing factor, I also feel that, whilst, of necessity, the programmes remained static, the people's minds, and with it their tastes, were rapidly changing. For the fact remains that, even during the air raids on London in the latter half of the last world war, these famous concerts never missed one single performance during the five seasons of them which it embraced. And they were always splendidly attended. Furthermore, the Monday night Wagner programme was given throughout the war, and it was invariably the best patronised of the week.

This would seem to show that to-day, people are much more contemplative and introspective; they like to think while they are being regaled with great music. A concert is far from the thing it was then, something one got excited about, dressed up for, and perhaps combined with a dinner as well. To-day we go to hear music just with our minds and our thoughts and divorced from all the pre-war trappings and etceteras, which brings me to the perennial question: What is the magic of this man Beethoven, which completely filled Queen's Hall on four consecutive concerts during a war which the civil population is bearing more heavily than almost any other section of the people, and when even cinemas are seldom by any means full?

Beethoven's Struggle Against Tyranny

To a greater extent than any man who ever lived, greater even than Shakespeare or Hugo, Beethoven stands for freedom. His whole life, right from its very beginning, was a struggle against every conceivable form of tyranny and oppression. It began with the tyranny of a dissolute and drunken father which was followed by that of reactionary music masters. Then came the prejudices and weaknesses of aristocrats—with one or two honourable exceptions like Count Waldstein—whose patronage he had to seek.

But the greatest of all the tyrannies he fought and, for Beethoven the artist, the greatest of all his victories was musical reaction. Throughout his life he fought for what he knew to be right and what he knew music needed if it was to survive and develop into the greatest of the arts. Whilst one foot was firmly planted in all that was best from the past—Palestrina, Scarlatti, Bach, Handel, Haydn and Mozart, the other went out in search of the new world. "The man who freed music," is the apt title of yet another study of the master recently published in America. His complete triumph over all these forces of darkness and oppression are proved by the wonderful stream of music which poured out from scores of pens during the nineteenth century and all of which was in some way or another influenced by Beethoven. It was also to be seen in the presence of those four audiences packing Queen's Hall, not one member of which hadn't heard every work performed at least fifty times before. But was it not ever thus? No matter how fashionable other composers may be at times, the Beethoven Symphonies and Concertos are, year in and year out, the greatest money spinners in the concert world.

Beethoven's one fault was that he was a German! But I have no doubt that his finest qualities came from his Dutch ancestry—he was only the third generation of a Dutchman, van Beethoven, who emigrated to Germany and settled in Bonn to seek a living at music. Always note that the master's name is van, and never von Beethoven.

Open to Discussion

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

"P.W." in India

WE have received the following interesting airgraph from a reader in India :—

Sir,—Although I had been a regular reader of " P.W." for some years, the Sept. No. was the last issue I was able to get in the U.K., my particular newsagent's supply having been cut down by one half, and earlier placed orders naturally received preference. It was with great surprise, therefore, that in the bazaar bookshop of a village near here, I saw on display the good old " P.W." for Oct. and Nov. '41, and in its new and handier format, the Dec. and the March issue. If I had been confronted with an UNDERGROUND sign, I wouldn't have been much more surprised. Their long journey has enhanced their prices somewhat (the 6d. ones cost 9 as. and the 9d. ones 12 as.) but they are still good value. Bouquet for you! And for the "Experimenters" (p. 20 of the Dec. issue) a small raspberry for erroneously stating that "the expression 10^6 means ten multiplied by itself SIX times." (My capitals.) Probably I have been forestalled by readers nearer home, but not having the Jan. or Feb. Nos., I don't know. As I still have a little space left, I'm sure priority should be given to an honourable mention for Thermion, whose rather sarcastic pen generally produces an amusing page. Best wishes for " P.W." in the future.—J. B. SYMONDS (Begumpet, Secunderabad, India).

[*The Experimenters are duly abashed for making this elementary slip.*—ED.]

Station WCW

SIR,—Readers may be interested to know of a fairly new U.S.A. short-wave station which has been operating on 18.9 metres in the evening. It is station WCW, and is owned by " Press Wireless," New York. News is given in many languages, including English. Volume is usually about R8, and signals are very clear and well maintained. Announcements in English are given every fifteen minutes, the usual dialogue being " News in English every hour on the hour ! "

I would be very grateful if any other readers could help me in definitely establishing the identity of a station which I picked up on the night of September 10th, 1941, about 10 p.m. G.M.T. It appeared to be located in Rio de Janeiro and the call-sign sounded like PBQ. It was on the 25m. band, and there was an interval signal comprising three different notes in quick succession.—JOHN W. MACVEY (Forestfield).

An L.F. Amplifier

SIR,—I append a description of an L.F. amplifier I have constructed from data collected in " P.W." There is nothing unorthodox in the design, but it may be of interest to other constructors. The first amplifier valve is a Cossor 41 MH, followed by two Cossor 41 MPs in class A push-pull.

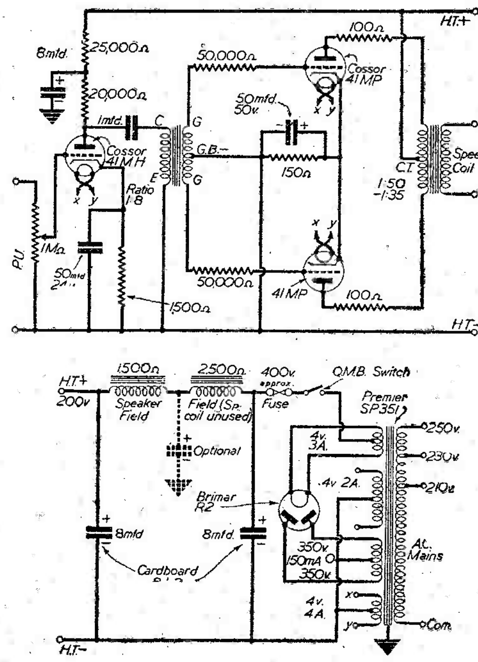
All the components, except the 8 μF L.F. decoupling condenser, are new, the only snags being the input and output transformers. I had to compromise, with a 1 to 8 input transformer, but quality does not seem to have suffered to any degree.

The output transformer is supposed to be an 8-watt job, the actual ratio being unknown, but it must be near to the correct one (1 : 50), as it matches up admirably. A .5 megohm volume control was used in the first place, but this did not give enough attenuation, so it was replaced with one of value 1 megohm.

As the rectifier is only running on approximately half load, two speakers were used for smoothing and voltage dropping. An 8 μF electrolytic smoothing condenser was placed between the two fields, but offered no advantage, no hum being present at all. As the amplifier valves are indirectly heated, a Q.M.B. toggle-switch has been placed in the rectifier heater centre-top (H.T.+) so as to allow the valves to attain their working temperatures, before H.T. is applied across the condensers.

The power pack was built up as a separate unit, being mounted on an extra heavy gauge chassis, owing to the size and weight of the Premier mains transformer (model SP 351) which is a robust job. The speech speaker was mounted on a 3ft. square board, and gave everything expected of it, the baffle making bass notes audible, which hitherto simply didn't exist.

The whole job is to be mounted in a large gramophone cabinet, which will first be strengthened with heavy boarding. Incidentally, although no fuses are shown



Circuit diagram of J. E. Woodward's A.C. push-pull amplifier

these will be incorporated in the circuit, before finally installing in the cabinet.—J. E. WOODWARD (Wolverhampton).

Australian S.W. Transmissions

SIR,—Recently several of the Australian short-wave stations have changed their schedules, and are now " on the air " at the following times : VLQ6 (Sydney), 31.32 m., 08.55–09.25, beamed on British Isles ; VLG6 (Melbourne), 19.59 m., 08.55–09.25 (British Isles) ; VLQ (Sydney), 31.20 m., 10.25–11.25 (Oceania—in French) ; VLQ6 (Sydney), 31.32 m., 17.00–17.45 (Western States of North America) ; VLW2 (Perth), 31.38 m., 17.00–17.45 (Western States of North America) ; VLQ6 (Sydney), 31.32 m., 18.00–18.20 (for Australian troops overseas) ; VLG6 (Melbourne), 19.59 m., 06.25–07.00 (Western States of North America). Radio Saigon has returned to its old wave length of 25.47 m., and can be heard at 13.15–13.45, 17.30–18.00. Cairo is testing on 49.32 m. iu the evenings, and news is broadcast at 21.00. Chungking is using XGOA 30.86 m. for its afternoon broadcasts and the 50 m. wavelength at night. All times given are D.B.S.T.—S. R. SMITH (Crewe).

S.W. Listening

SIR,—I am interested in S.W. listening, and use a commercial S.W. two and a 6-valve superhet, with an inverted " L," and a vertical aerial, respectively.

Could you please put me in touch with another person about my own age (19) who is interested in short-wave reception with a view to exchanging logs?

The station WCBX referred to in your May issue on the 16 m. band has now been replaced by WCRC, which also operates on the 19 m. band. WLW is also operating on the 19 m. band from 4 p.m. D.B.S.T.

Could you please identify a station on the 25 m. band with a call-sign (indistinct) HJD or HJB, received at 23.30 hours D.B.S.T.?—E. E. HARTWELL (Southall).

[*The transmission you heard on the 25 m. band is evidently from one of the stations in the Republic of Colombia.*—ED.]

Eliminators and Class B

SIR,—The remarks by Mr. S. W. Manktelow, in his letter published in the June issue, about eliminators with Class B and Q.P.P. output circuits, are quite interesting, but open, I think, to question.

The Cossor 240B has a maximum anode current swing of 50 mA.s; it seems only natural that to secure perfect reproduction the anode voltage must be maintained reasonably constant over the wide current variation, i.e., from 4 mA.s to 50 mA.s. The resistance of an L.F. choke, such as that used in a smoothing circuit, might be anything between 400 ohms and 1,000 ohms. Taking a value of 750 ohms as being representative, and assuming that the choke is in a smoothing circuit common to the H.T. feed to the other valves, a voltage drop of at least 37.5 volts will be produced by the choke alone, when the maximum current for the Class B valve is drawn. If the output from the eliminator is 120 volts—on normal load—it will be reduced to 82.5 volts under the above conditions, and this would not be conducive to the perfect reproduction which S. W. M. claims.—P. SEXSTONE (Greenwich).

Back Numbers Wanted

SIR,—I shall be grateful if any reader will oblige with copies of PRACTICAL WIRELESS for December, 1941, and January, 1942, as I have been unable to obtain these anywhere. I will, of course, refund postage and cost of journals.—JAMES BRODERICK (18, Lenthall Avenue, Grays, Essex).

G. L. Binsley, 17, Buxton Road, Perry Common, Erdington, Birmingham, 23, is anxious to get in touch with any reader who has a spare copy of " Amateur Wireless " No. 646 (October 27th, 1934) for sale. This issue contains instructions for building the " 150 Mile Crystal Set."

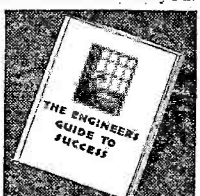
L. Hadley, 133, Wood Street, Kidderminster, Worcs., will be greatly obliged if any reader who has finished with his copy of the April, 1942, issue of PRACTICAL WIRELESS, and wishes to dispose of it, would send his name and address. A postal order for the cost of the journal, including postage, will be gladly sent.

E. M. Kelsey, Dormer Cottage, Brackendale Road, Camberley, will be glad if anyone who has a copy of the May issue of PRACTICAL WIRELESS to spare would kindly forward it to him. Postage will be refunded.

Books Received

CORRECTION

THE price of the " Radio Handbook Supplement," which was reviewed in the June issue, was given as 2s. This is incorrect, the price being 2s. 6d., or 2s. 9d. post paid.



Replies to Queries

Condenser Connections

"I have an R.I. radio receiver, which has destroyed two rectifying valves in a short period. I think the condenser block is at fault, and deciding to replace it, I am now at a loss as to where the leads go. The condenser is a dry electrolytic type and fitted with four leads, a red, black, blue and green. I noted where three of them went, but the fourth—the green one—has beaten me, as it came adrift and I presume is responsible for the trouble. The leads are marked: Red Com. Pos., Black Neg. 8 Mfd., Blue Neg. 12 Mfd., and Green Neg. 4 Mfd."—H. J. N. (Greenford).

YOU do not state the type of circuit the receiver uses or the make of the condenser block you are trying to fit, therefore it is rather difficult for us to give any information about the connections, especially as we cannot trace a condenser having the markings mentioned. It is unusual—unless some special circuit is in use—for a condenser block to have a common positive lead. It is more usual for the negative to be common, and the various positive connections to be made by means of separate leads.

Speaker Energising

"I have an old energised speaker, designed for a 6-volt accumulator energising. I am building a mains set, and I wondered if this would be good enough to put in the H.T. positive lead with the necessary series resistance to drop only 6 volts across the field. Can you advise me regarding this point?"—H. B. (Crewe).

THE field is probably of the type requiring .5 or 1 amp. field current and, therefore, you could not use it in the manner you suggest. The H.T. current is only of the order of .06 amp. or so and consequently, apart from the fact that the field would not be properly energised, the winding would not be large enough to provide normal H.T. smoothing.

Meter Correction

"In measuring A.C. with a single meter plus metal rectifier I understand there is a correction needed. What is the exact amount of this correction? Does it depend upon the resistance of the meter? My meter is 100 ohms and reads 1 milliamp full scale. I have a special 1 mA rectifier for use with it."—R. F. (S.E.15).

THE correction needed is due to the fact that the meter will give a deflection proportional to the mean value of the current passing through it, whereas in the case of an A.C. sinusoidal quantity, the measurement required is the R.M.S. (root-mean-square) value, which is greater than the mean value and bears a constant ratio to it of 1.11. Therefore, your 1 mA meter will read 1.11 mA, R.M.S. A.C., and the increase in the reading is actually 11 per cent.

S.W. H.F. Choke

"Could you give me an idea what inductance I should need for a short-wave choke to use in a set designed to cover from about 5 to 70 or 80 metres? I thought a former about 1in. in diameter would be suitable as I have a paxolin former of that size available."—J. K. (Leigh-on-Sea).

AN inductance of 170 to 180 μH would be satisfactory, and 100 turns of 26 or 28 enamelled wire close wound would give you a suitable inductance value. If you require a rather high degree of efficiency we would suggest that you split the winding into, say, five sections, each separated by about ⅛in.

Unavoidable Hum

"I have built a battery receiver to one of your designs. Every part is as specified and the set is wired in accordance with your blueprint, and the only departure from your specification is in the valves, of which I have used three of my own which are practically identical in characteristics. I have fitted the set in the top part of a radiogram cabinet and the eliminator is on the lower shelf behind the M.C. speaker. There is a loud hum all the time and I have moved the eliminator away from the speaker without effect. Is it possible to explain the cause of this hum and how to get rid of it?—D. T. R. (Birmingham).

THE trouble is no doubt due to the eliminator, and this point may be confirmed in the simplest manner by removing the eliminator and using a dry battery for the H.T. supply. If the noise ceases you will know that the mains unit is causing the trouble and that it is not due to earth induction or some other source. If it persists, try a new earth, and also move the lead-in wire and speaker leads in case they are picking up the hum from mains supply wires inside the walls or beneath the floor. If the hum ceases when the mains unit is removed, you will have to modify the circuit, by fitting more complete decoupling or by earthing the containing case of the eliminator. This should be in an iron box, or the position so modified that the internal transformer and choke do not introduce coupling with any of the inductive components of the receiver.

> **RULES**
>
> 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.
> (5) Grant interviews to querists.
>
> A stamped, addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.
>
> Requests for Blueprints must not be enclosed with queries, as they are dealt with by a separate department.
>
> **Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.** The Coupon on page iii of cover must be enclosed with every query.

Output Chokes

"I am in some doubt regarding the type of choke needed for an output circuit to feed an extension speaker. In looking at some old catalogues there appears to be a number of chokes all having different ratings, and I should like to know what characteristics I must look for in this particular case."—C. F. (Bognor Regis).

IN the output circuit you need a high inductance with a low D.C. resistance. You will find that choke ratings are in henries with a certain D.C. flowing. The greater the current the lower the inductance. A good all-round value would be 30 henries at the current passed by your output valve. The D.C. resistance should be as low as possible to avoid a serious voltage drop and thus to enable the valve to obtain as much H.T. as possible.

Transformer Ratios

"I have only recently started in the radio game and am confused by the fact that I see L.F. transformers available from 3 to 1 up to 9 to 1 in ratio. How is one to determine which ratio should be used in a given circuit? Are there any special rules to adopt regarding overloading, etc., or is it possible to use any type and take steps to avoid overloading?"—L. T. (Hove).

THE ordinary L.F. transformer is generally only available in ratios from 1.75 to 1 up to 5 to 1. The latter ratio would give the highest step-up and consequently would be used when a minimum number of L.F. stages is in use. Where the highest quality is desirable, you would use the lowest ratio, and in this respect the Ferranti 1.75 to 1 transformer is claimed to give results equivalent to an ordinary resistance-capacity coupled stage, with greater gain. The higher ratios, such as 8 and 9 to 1, are generally for push-pull circuits of the Q.P.P. type, and must, therefore, be used in these particular circuits.

Accumulator Rating

"I have an accumulator which is marked '70 A.H. on slow discharge and 42 A.H. at 100 hour rate.' Can you explain the meaning of this or give me the date of any articles dealing with the subject?"—I. P. R. (Watford).

ACCUMULATORS often bear a similar marking, although the wording adopted is often varied. Thus you may find a cell marked at so-many ampere hours at ignition rate and so-many continuous. In the case of the cell in question the slow-discharge period is rated at 1,000 hours, and it means that if the accumulator is put on discharge over a period of 1,000 hours a current of .7 amps would be given continuously for that period. On the other hand, if discharged over a period of only 100 hours the current given would be .42 amps. It is thus possible from these figures to obtain a rough idea of the hours of service you will be able to obtain from the accumulator with your receiver, the total current drain being, of course, the total consumption of all the valves you are using.

Classified Advertisements

ADVERTISEMENTS are accepted at 2s. per line or part of a line. Minimum 4s. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

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WE regret that, owing to all our employees having joined H.M. forces, we are unable to accept orders for cabinets except to callers. Limited stock only. We have a large stock of radio components.—H. L. Smith & Co., Ltd., 289, Edgware Road, London, W.2. Tel.: Pad. 5891.

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RECEIVERS AND COMPONENTS

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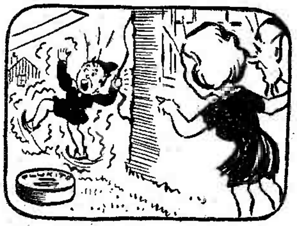

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Cried OO, "Well, for goodness' sake,
What's making young OI jump and quake?"
(For when OI, and FLUXITE,
Put the old aerial right,
He grabbed a live wire by mistake.)

See that FLUXITE is always by you—in the house—garage—workshop — wherever speedy soldering is needed. Used for 30 years in government works and by leading engineers and manufacturers. Of Ironmongers —in tins, 4d., 8d., 1/4 and 2/8.

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B.I. TUBULAR CONDENSERS. .02 mfd., .001 mfd., .002 mfd., .0001 mfd., .0002 mfd., .0003 mfd., 0005 mfd. All 350 v. wkg. **6d.** each, **5/-** doz.; .005 mfd. 450 v. wkg. **7d.** each, **6/-** doz.

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(Continued at top of page 371.)

RECEIVERS AND COMPONENTS

(Continued from page 370.)

RESISTANCES. Special offer of wire end 1 watt type, 7,000 ohms, 12,000 ohms, 500 ohms, 100 ohms, **3/6** doz.; 1.5 meg. **3/-** doz.

ERIE RESISTANCES. All values, ½ and ¼ watt **6d.** each, 1 watt **10d.** each, 2 watt **1/2** each, 3 watt, **2/-** each.

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THE HOUSE FOR QUALITY COMPONENTS AT LOW PRICES.

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MAINS DROPPERS. .2 amp., suitable for Lissen, Pye, etc. Brand new, **3/9** each. Also .3 amp. for Decca, Ferranti, Maestro, brand new, **5/6** each.

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PENTODE Output Speaker transformers, brand new, reduced price, **5/-** each.

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(Continued top of col. 3.)

F.H. WILSON

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TWO-GANG .0005 mfd. variable condensers, small standard type with trimmers, new, boxed, **4/-** each.

THREE-GANG .0005 mfd. variable condensers, standard type, **4/6** each.

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B.I. Tubular Condensers, N.I. 0.0001, 0.0002, 0.0003, 0.0005, 0.005, 0.01, 0.05, **5d.** each.

T.C.C. Tubular Condensers, 0.00015, 0.01, 0.05, **5d.** each; 0.1, **7d.** each; .25, **11d.** each; 0.5, **1/3** each.

T.C.C. Tubular Electrolytic, 25 mfd. 25 v., **1/6** each; 50 mfd. 25 v., **1/9** each; 25 mfd. 50 v., **1/9** each; 50 mfd. 12 v., **1/6** each; 2 mfd. 250 v. working, **1/6** each.

VOLUME controls, 100,000 ohms and 2,000 ohms centralab midget type, **3/-** each.

SHORT and medium wave band coil, in aluminium can, with small ceramic trimmer, new, **2/-** each.

PHILIPS Three Waveband Oscillator Coil, 3 air space trimmers, circuit, **3/-** each.

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RECEIVERS AND COMPONENTS

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TELEVISION EQUIPMENT.

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TUBULAR condensers, .1 mfd. 6,000 v D.C., **9/6** each.

(Continued top of page 372.)

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	28.8.38	PW93
Two-valve : Blueprint, 1s.		
The Signet Two (D & I F)	24.9.38	PW76
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Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	—	PW39
Hall Mark Cadet (D, LF, Pen (RC))	—	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	—	PW62
The Centaur Three (SG, D, P)	—	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	—	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	—	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen)	—	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	—	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)		PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	—	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)		PW92
Four-valve : Blueprints, 1s. each.		
Beta Universal Four (SG, D, LF, Cl.B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	—	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)		PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)		PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D (Pen))	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each		
£5 Superhet (Three-valve)	—	PW40
F. J. Camm's 2-valve Superhet	—	PW52
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	—	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model / Push Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
Simple S.W. One-valver		PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	—	PW68
PORTABLES		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	—	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G. 3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	—	WM327
Economy Pentode Three (SG, D Pen)	—	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	—	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	Oct. '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
Self-contained Four (SG, D, LF, Cl. B)	—	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
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